nasscom

Gamechangers
2023-24

nasscom

# AI GAMECHANGERS 2023-24

## AMPLIFYING INDIA'S AI ADOPTION STORIES

Strategic Partner
Meta

Innovation Partner
NTT DATA

Silver Partner
Cigniti

Knowledge Partner
KPMG

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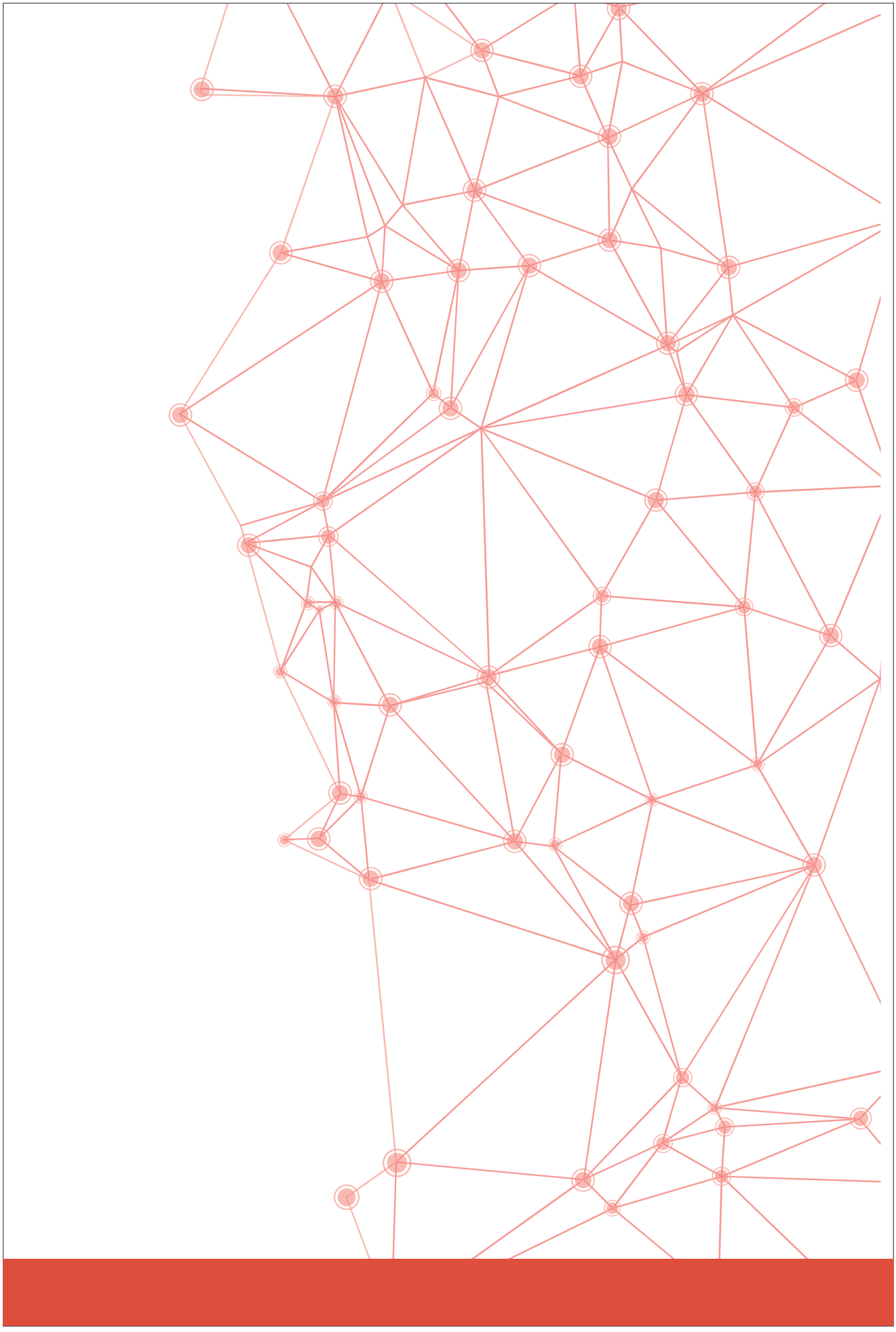


# PREFACE

**Debjani Ghosh**
**President - nasscom**

We are living in a very interesting moment in time today, AI is a truly transformative general-purpose technology with the potential to influence economies and society. While excitement around AI continues and will persist, companies and governments are increasingly shifting focus to the application of AI.

From healthcare to agriculture, from finance to education, companies and startups are integrating and building AI to enhance efficiencies and create new opportunities. India with its inherent strengths in talent, technology, and the development and scale of inclusive technology is well-positioned to lead the era of applied AI with human-centricity at its heart.

The third edition of the Nasscom AI Gamechangers compendium showcases select use cases that are being built from India. At Nasscom, we believe in the power of collaboration and the importance of fostering an ecosystem where innovation thrives. I hope this compendium will be helpful in your AI journey and help contribute to the vision of India's leadership in applied AI.

## Akhilesh Tuteja

**Partner and Global Cyber Security Leader, Head Clients & Markets, KPMG India**

The Nasscom AI Gamechangers Awards is a great platform to celebrate the remarkable achievements of AI innovators, it is a testament to the AI ecosystem that Nasscom has been actively building. AI is advancing at a rapid rate with applications across the sectors of healthcare, agriculture, education, finance, public infrastructure, transportation, entertainment and so many more.

Not only is the vibrant AI ecosystem boosting economic growth it is also shaping industries, transforming lives, solving social challenges, and increasing business productivity. Supported by robust government initiatives in India, the future is bright for this generation of tech entrepreneurs with their pioneering spirit and the courage to drive the future of AI. As a part of the steering committee, I have had the opportunity to engage with the brightest minds, experience the ingenuity of their solutions and their undeniable passion for solving problems with AI.

## Sangeeta Gupta

**Senior Vice President,**
**nasscom**

The journey of AI is one of continuous learning and evolution. It requires staying abreast with all the technological shifts, the risks and regulatory environment, understanding of use cases that will enable businesses to stay ahead and more importantly building an AI strategy across the organisation.

At Nasscom our focus is to share best practices, expert talks, benchmark adoption and showcase innovate solutions that are being built and use cases that are being deployed. The Nasscom AI Gamechangers in its 3rd edition has received a phenomenal response and this compendium is a selection of some of the best use cases across sectors that are being deployed by enterprises and start-ups. I hope you enjoy reading these use cases and explore opportunities to partner with these organisations for your AI journey.

## Ankit Bose

**Head of AI, nasscom**

Welcome to The AI Gamechangers, a compendium celebrating India's groundbreaking work in AI innovation. This collection showcases how Indian startups and enterprises are transforming lives and industries through the power of artificial intelligence.

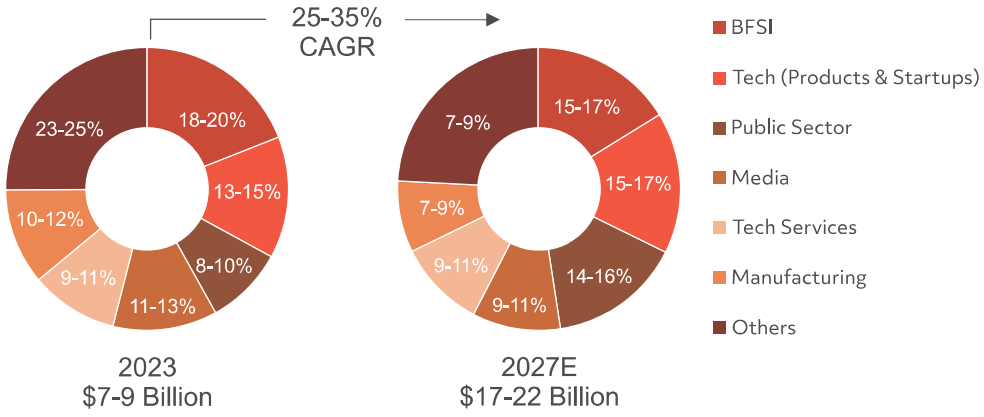
Explore stories that highlight AI's transformative potential across diverse sectors. From pioneering healthcare diagnostics and personalized education platforms to precision agriculture empowering farmers and revolutionizing financial services, these innovations are making a profound impact. Discover the passion and determination behind each breakthrough, learn best practices, and gain insights into the challenges overcome and strategies that led to success. Our featured innovators blend technical brilliance with ethical, human-centric development, setting new global standards for responsible AI adoption.

At nasscom, we proudly spotlight these gamechangers. This compendium serves as both a tribute to their remarkable achievements and a guiding light for aspiring innovators. It underscores India's growing influence in the global AI landscape and demonstrates our commitment to fostering a thriving AI ecosystem.

As you immerse yourself in these narratives, let them ignite your imagination and spark new ideas. Allow their visionary success to fuel your innovative spirit, propelling India's leadership in applied AI to new heights. Together, we can harness AI's power to create a more sustainable, equitable, and prosperous future for all.

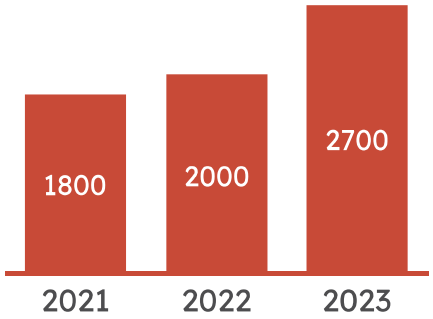
# AI LANDSCAPE IN INDIA

## AI market size forecast in India (2023-2027)




**Source:** BCG + nasscom AI powered Tech Services: A Roadmap for future ready firms and AI's role in turbocharging the industry

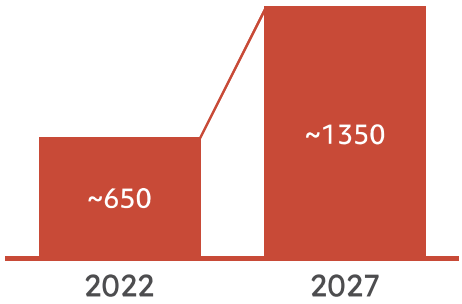
## AI startups in India




**Source:** nasscom Deeptech report

## AI installed talent in India

(no. of people, '000s)




**Source:** nasscom Skills report

**2.45/4**

Maturity level of AI Adoption in India.

**Source:** nasscom AI Adoption Index

**$1.2 Billion**

India AI Mission announced by Government of India

**Source:** Government of India

**49%**

Share of AI patents in India

**Source:** nasscom Patents report

AI Gamechangers aims to recognize and reward innovative use cases that solve important problems across various sectors and industries leveraging Artificial Intelligent technologies. This third edition of the program received ~500 AI use cases from multiple stakeholders such as enterprises, start-ups, government bodies, academic institutes, and NGOs. The program culminates into a ceremony wherein the winners from different applicant categories are awarded for their impactful implementation of AI use-cases.

**9 SECTORS**

- Agriculture
- BFSI
- CPG & Retail
- Energy & Utilities
- Healthcare & Pharma
- Manufacturing – including Automotive
- Technology - IT & ITES
- Telecom Media & Entertainment
- Transport & Logistics

**3 THEMES**

- Research
- Responsible AI
- Government Showcase

**The use cases have been classified as**

Gamechangers | Challengers | Exemplars | Innovators

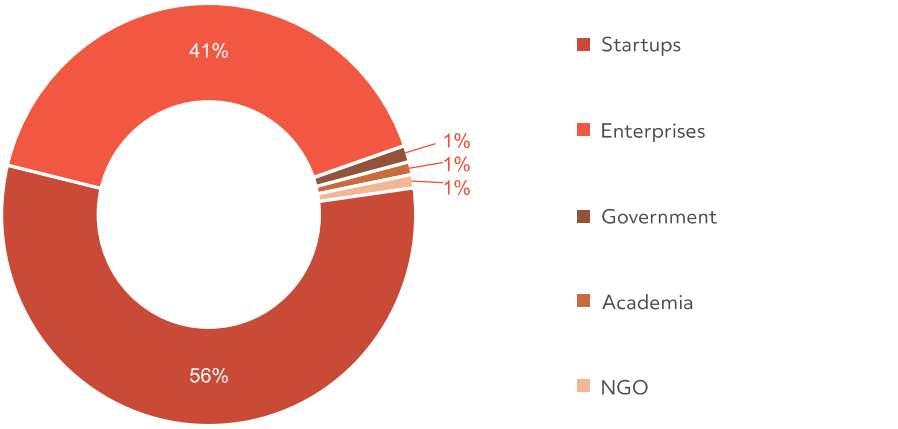
We have defined Gamechangers as the winners, Challengers as the first runner-up and Innovators as the second runner-up. Impactful government use-cases have been categorized as Exemplars.

The first three have been covered as featured stories, while the Innovator use case details have been tabulated at the end. Moreover, one 'Special Mentions' have also been featured.

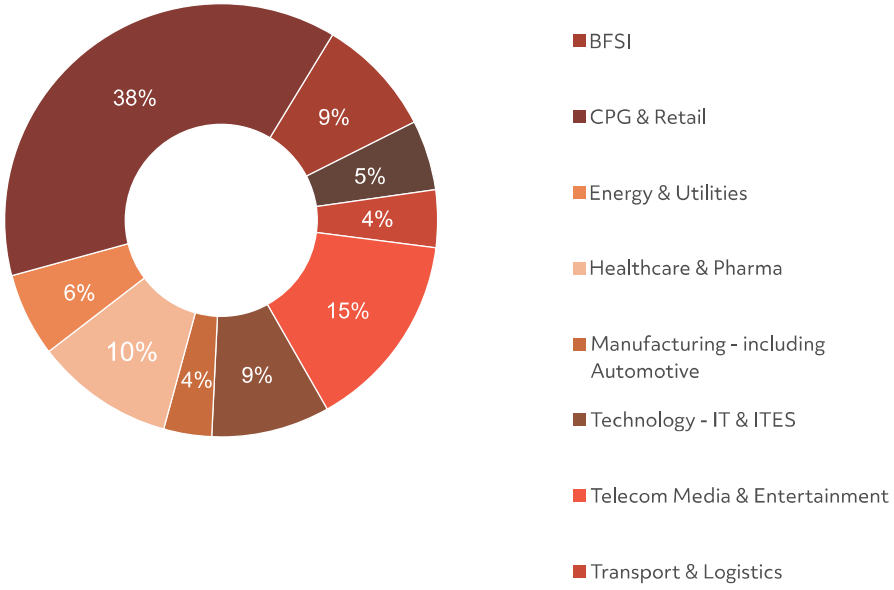
The AI Gamechangers compendium offers a sneak peek into the thriving Indian AI ecosystem. The collection will serve as a ready reckoner to know the pulse of India's AI adoption in 2023-24. We hope this compendium will inspire, motivate, and ignite more invention and innovation in AI as a multiplier for our fast-growing digital economy.

# AI GAMECHANGERS APPLICATION SNAPSHOT

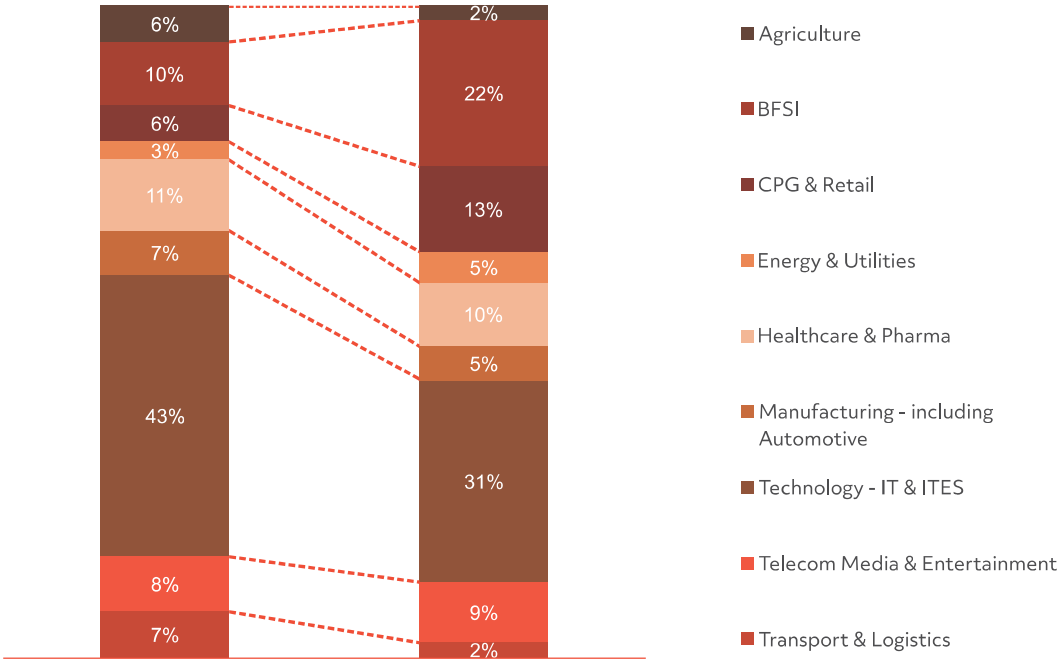
**AI Gamechangers Application Snapshot**



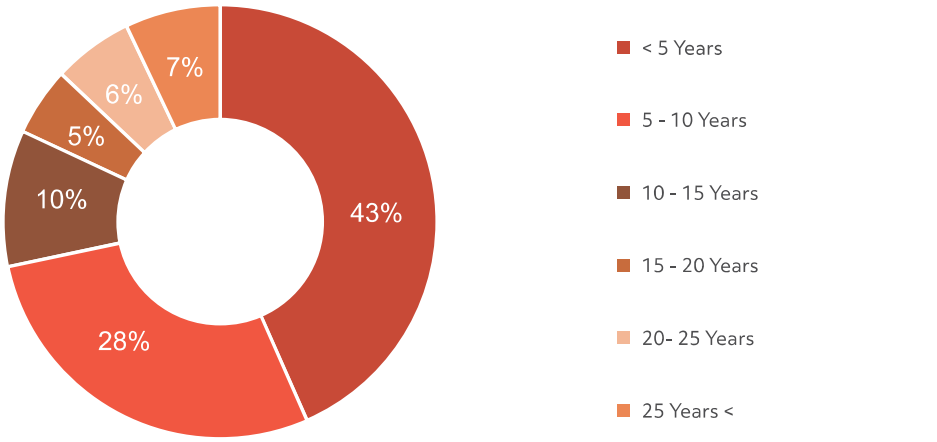

**Percentage breakup of applications by sectors**



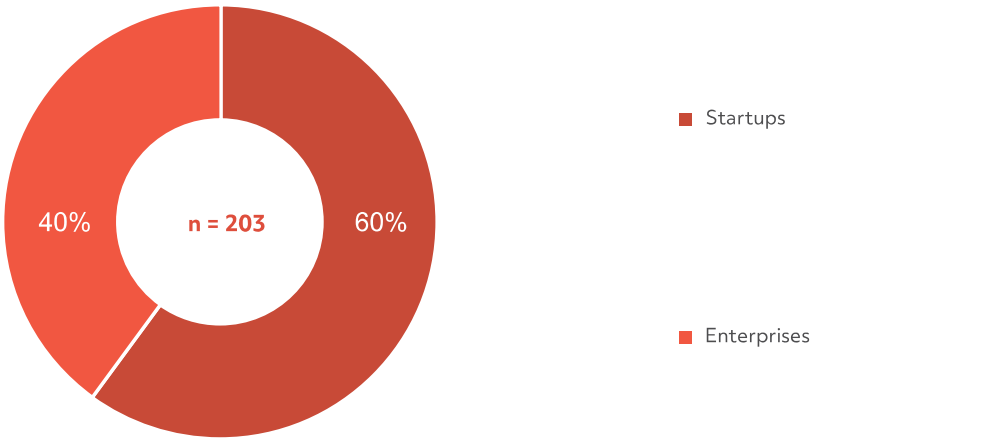
**Percentage breakup of applications by Entity vs Sector**



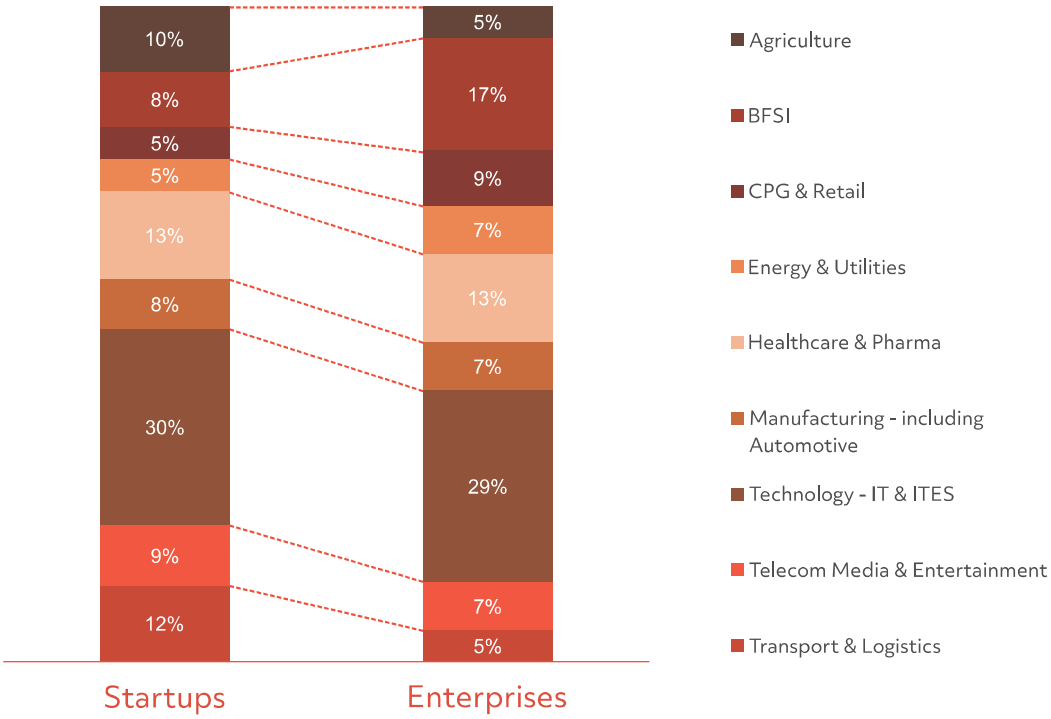

**Percentage breakup of applications by age of Organization**



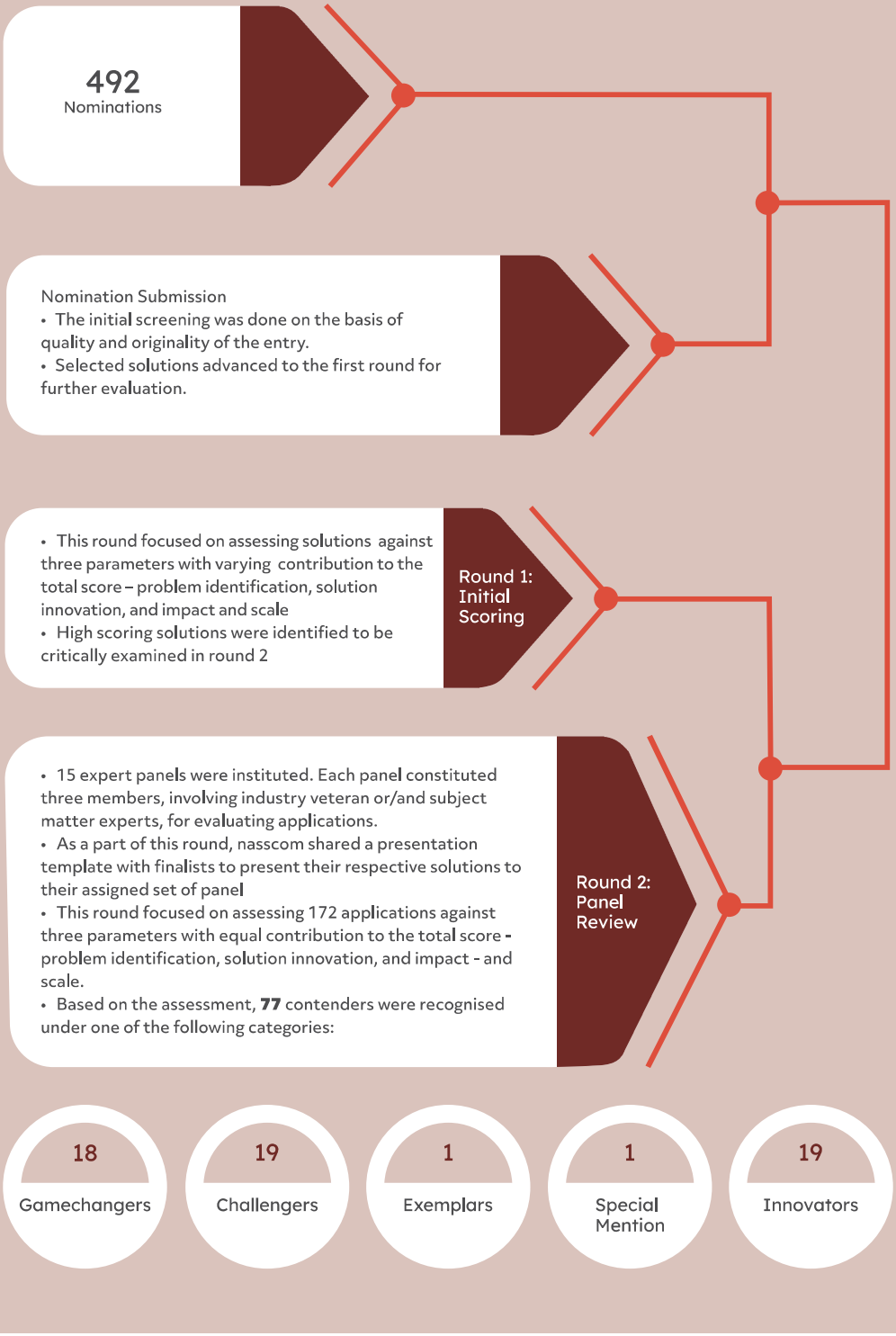
**Percentage breakup of Shortlisted by entity**




**Percentage breakup of Shortlisted by Entity vs Sector**



## Screening framework



# TECHNOLOGY, IT & BPM

TECHNOLOGY - IT & BPM
GAMECHANGER

**Entropik**

# ENTROPIK : AI-POWERED HUMAN INSIGHTS


***Industry:*** *Technology, Media & Telecommunications, Retail & CPG*
***Business Function:*** *Customer Service, Marketing & Sales*
***Beneficiary:*** *Brands like - Grab, Lazaada, KFC, Aditya Birla and many more*
***Technology used:*** *Generative AI, NLP, Emotion AI*

### Entropik: Pioneering Enterprise AI

A trailblazing enterprise AI company that has created an advanced Insights AI technology stack that powers its products, Decode and Qatalyst. This stack consists of:

- Emotion AI (Facial Coding and Voice AI)
- Behavior AI (Eye-Gaze and Mouse Tracking)
- Generative AI (Co-pilot feature)

Specialising in consumer and user research, Entropik uniquely offers standalone tech solutions via API/SDK integrations. Serving 150+ global clients across industries like Telecom, BFSI, Media, CPG, FMCG, Entertainment, Fintech, and E-commerce, Entropik stands out as the sole company covering both consumer and user research comprehensively.

### Problem Identification

Failing to grasp consumer emotions and behaviours can prevent businesses from tailoring strategies that resonate with their target audience.

**Importance of Solving the Problem**

Understanding consumer emotions and behaviours is critical for effective marketing and product development decision-making. These insights directly impact purchasing choices, brand loyalty, and overall customer satisfaction.

Solving this problem unlocks the potential for businesses to make informed, emotionally intelligent decisions, enhancing customer engagement, satisfaction, and overall market success.

### Solution Overview: Leveraging AI for Comprehensive Insights

Entropik's solution leverages advanced AI technologies to address the identified problem

effectively. By integrating Emotion AI, Behavior AI, and Gen AI, the platform provides a holistic understanding of user behaviour and emotional responses. Unlike traditional analytics focusing on historical data patterns, AI-driven approach captures real-time and nuanced insights. This dynamic capability identifies trends and interprets the underlying emotional context, offering a more comprehensive and actionable solution. AI plays a pivotal role in decoding intricate human behaviours that traditional analytics alone would not sufficiently capture, ensuring a nuanced and impactful problem resolution.

### Dataset Complexity: Volume, Data Type, and Sources

Entropik's dataset is characterised by high volume and diverse data types. It includes vast quantities of structured and unstructured data, encompassing user interactions, emotional responses, and behavioural patterns. Sources range from digital platforms and sensors to user-generated content, creating a rich and multifaceted dataset crucial for comprehensive analysis.

### Data Solution and Implementation Challenges

Entropik's data solution encountered challenges with data silos, availability, and security. Overcoming these hurdles involved implementing robust data integration strategies to ensure seamless accessibility. They established stringent security measures to safeguard data integrity, including encryption and access controls. Processing challenges were addressed through optimised algorithms, significantly enhancing efficiency. Continuous monitoring and proactive measures mitigate potential issues, ensuring a resilient and effective data solution.

### Role of AI in Solving Identified Problems

**Problem Statements:**

- Biased, inaccurate market research insights
- Slow time to obtain research data
- Siloed data and information
- High research cost and time

**Solutions:**

- Emotion AI, Behavior AI, and GenAI technologies remove guesswork and biased data by identifying customer needs and interaction preferences
- Achieve 6X Faster Turnaround Time with remote user testing and real-time dashboard capabilities

- Perform comprehensive analysis and obtain rapid research insights within the workspace using GenAI
- AI in user and consumer research reduces GTM (Go-To-Market) time and speeds up processes, reducing costs

### Risk & Governance and Competitive Landscape

**Emotion AI and Behavior AI:**

- Adapting to multimodal emotion and behaviour measurements at scale (e.g., OpenAI, Claude)
- Handling high-volume data collection & aggregation across demographics and geographies to ensure data accuracy
- Custom-developing solutions for data labelling, cleansing, and training

**Generative AI:**

- Ensuring security and processing integrity
- Addressing data sensitivity among customers and industries with heavy data restrictions
- Developing and utilising Language Model (LLM) options per customer requirements

**Competitive Landscape:**

- Providing a holistic view of Emotion, Behavior, and Gen AI in a unified user and consumer research platform
- Only global vendor with multimodal LLM capabilities (integrations with Open AI, Claude, and other open-source models)
- Offering custom in-house models with data hosting capability within Entropik Cloud to address security concerns
- Holding proprietary tech solutions patented with the Indian PTO
- Remaining vendor-agnostic with flexibility for customers to select technologies based on data sensitivity


## Impact & Scale

Entropik's solution has achieved remarkable scale, processing vast datasets with millions of user interactions daily. This has accelerated research across diverse domains such as Quant, Qual, Diaries, Media, and Shopper insights. Businesses using their AI-driven platform experience six times faster data collection, enabling comprehensive and timely consumer behaviour and emotional response analyses. This scalability and impact underscore the commitment to delivering transformative human insights and revolutionising decision-making processes for their clients.

***Key Facts:***

- Trusted by over 150+ brands across various industry verticals
- Platform leads to cost optimisation and operational efficiency, driving revenue optimisation
- Major brands they have worked with include Tata AIA, Tata AIG, ICICI, Aditya Birla, Lazada, TikTok, and P&G

***Impact on Major Brands:***

- 22% increase in website leads and check-outs due to improved user experience
- Improved the stopping power of marketing creatives by 33%
- >30% reduction in insights budget due to decreased go-to-market time

**Future Scalability**

- Scaling from processing 900,000 unique faces today to over 9,000,000 faces per day
- Optimizing qualitative and quantitative research processes in a unified platform
- Uniting past and ongoing research data to eliminate idle data silos

TECHNOLOGY - IT & BPM
CHALLENGER

Samsung

SAMSUNG


# SAMSUNG R&D INSTITUTE INDIA: BREAKING LANGUAGE BARRIERS "LIVE TRANSLATE": CONNECT WITH PEOPLE, PLACES AND CULTURES ANY TIME, IN ANY LANGUAGE

***Industry:*** *Technology, Media & Telecommunications*
***Business Function:*** *Software & Applications*
***Beneficiary:*** *OEM Smart Phone/Feature Phone and landline users*
***Technologies used:*** *NLP, Automatic Speech Recognition (ASR), Neural Machine Translation (NMT), Text to Speech (TTS)*

**Samsung R&D Institute India-Bangalore (SRI-B)**

Samsung R&D Institute India-Bangalore (SRI-B), the largest R&D centre outside South Korea, is a key innovation hub for Samsung.It develops cutting-edge technologies in Modem, Multimedia, On-Device AI, IoT, and Services, enhancing user experiences globally and locally.

SRI-B's dual mission includes creating USPs for global flagship devices and addressing Indian consumers' needs. It aims to build an AI-infused patent portfolio in 5G, Multimedia, On-Device AI, IoT, and Services, positioning itself as Samsung's Asian IP hub.

**Breaking Language Barriers with Samsung Galaxy S24**

Communication over phone calls often encounters language barriers in various scenarios, such as business, tourism, and multicultural events. The Samsung Galaxy S24 series addresses this with its on-device Live Translate and Interpreter features, which work without Wi-Fi or the Internet.

**Key Use-Cases and Beneficiaries:**

- **Telecom and Technology:** Benefiting OEM smartphone/feature phone and landline users communicating with Samsung Galaxy S24 users
- **Live Translate:** Translates conversations in real-time during phone calls. For example, it enables a Hindi-speaking S24 user to communicate with an English-speaking caller seamlessly
- **Medical Consultation:** Connects users with doctors and specialists globally, overcoming language boundaries
- **Business Expansion:** Helps Indian users communicate with clients and partners worldwide

- **Interpreter:** Adds in-person translation without calls. For instance, a user in Thailand can speak Hindi to a cab driver who understands Thai

**AI-Powered Live Translate Solution**

**Importance of Solving Language Barriers**

Reducing communication barriers is essential for enabling people to interact freely and effectively.

The solution leverages three Language AI components: Automatic Speech Recognition (ASR), Neural Machine Translation (NMT), and Text-to-Speech (TTS) for seamless communication, fostering collaboration and cooperation.

The Live Translate solution facilitates seamless communication in users' preferred languages - provides real-time translation during phone calls, creating a smooth user experience. It ensures privacy and security by operating entirely on-device, aligning with the principles of Responsible AI.

**Data Solution and Implementation Challenges**

**Data Solution Overview:**

Developing the Live Translation feature involved handling a complex dataset across three primary data types: Language, Conversational, and Telephonic. Each type presented unique challenges:

**Data Complexity:**

- **Language Data:** Required thousands of hours covering name entities (local and foreign), homophones, homonyms, short and long sentences, numerals, and multiple dialects. This ensured the solution could handle the intricacies of language
- **Conversational Data:** Needed extensive training on open domain and diverse themes, with thousands of hours of data to support real-time, free-flowing conversations on any topic
- **Telephonic Data:** This was more complex due to real-time phone call scenarios. It included a vast volume of data from various situations, such as different sampling rates (wide and narrow band), Bluetooth data, room conversation data, and noise data

**Data Availability and Cleaning:**

- Ensuring the data was consumable was challenging. The pipeline was designed to clean the data meticulously for effective training.

To address data challenges, an in-house data pipeline was developed with two main components:

Data Sourcing:

Channels data from various sources, incl. purchased data, simulation data, open-source data, and seed data from native and foreign speakers. The Bhasini dataset was used for Hindi translation

**Data Pre-processing:**

**Cleans the data to make it suitable for training**

**On-Device Processing:**

To enable this feature on the device, AI models were compressed using techniques like knowledge distillation to reduce their size, ensuring efficient execution on the device

**Competitive Advantage:**

The features deployed on the Galaxy S24 are the first in the market to offer on-device live translation, setting it apart from existing solutions

## Achieved Scale and Impact of Live Translation Solution

The Live Translation feature, integrated into Galaxy S24 smartphones, positively impacts millions of daily phone call interactions involving Samsung Galaxy S24 users.

***Implementation and Impact:***

- **Customer Impact:** It benefits Galaxy S24 users and those communicating with them, incl. international travellers who can use the Interpreter feature without needing an internet connection
- **Social Impact:** The solution fosters collaboration and cooperation by reducing language barriers and bringing people together
- **Environmental Impact:** The Language AI solution's on-device deployment eliminates the need for servers, contributing to environmental sustainability

**Future Scalability and Limitations of Live Translation**

**Current Operation:**

The Galaxy S24 is the first to feature these Galaxy AI capabilities. The Live Translation solution operates as follows:

User 1 makes or receives a call with enabled Live Translation (English to Hindi)

- *ASR: Converts English speech to text*
- *Machine Translation: Translates English text to Hindi*
- *TTS: Converts Hindi text to speech*

*User 2 hears the call in Hindi*

- User 2 responds in Hindi
- *ASR: Converts Hindi speech to text*
- *Machine Translation: Translates Hindi text to English*
- *TTS: Converts English text to speech*
- *User 1 hears the response in English*

**Future Scalability:**

**Model Optimization:** Efforts are underway to optimise neural models for low-end CPU/GPU devices

**Expansion:** Positive user feedback is driving the expansion of Galaxy AI features to more Samsung devices and improving language coverage

TECHNOLOGY - IT & BPM
INNOVATOR

PWC India

# PWC INDIA: CYBER SECURE GEN AI

***Industry:*** *Technology, Media & Telecommunications, CPG & Retail, BFSI, Healthcare & Pharma, Manufacturing & Industrial Automotive, Energy and Utilities, Transport and Logistics*
***Business Functions Catered:*** *Customer Service, Marketing & Sales, HR, Software & Applications, Operations, Business Intelligence, Sovereign Functions of Govt. of India (State-run functions)*
***Beneficiary:*** *In-house solution of PwC India*
***Technologies Used:*** *Generative AI, Computer Vision, Cybersecurity*

### Gen AI Security: A Revolutionary Solution

As organisations increasingly integrate Gen AI and LLM applications for tasks ranging from automation to decision-making, new cyber threats have emerged. These threats necessitate robust safeguards to prevent malicious attacks.

### Advanced Security System

This solution offers a modular security stack to protect connected applications, systems, and sensitive data across the input, data, connected apps, and output layers. It uniquely addresses "hallucinations," where AI models generate misleading or false information, ensuring reliability and accuracy.

### Conceptualisation and Implementation

PwC India saw the security challenges in Gen AI and formed a technocrat team to innovate solutions. Their journey, from initial ideas to rigorous prototype testing, led to developing a security system that reliably identifies and prevents hallucinations, acting as a Gen AI guardian.

### Commercial Development

PwC's advanced security system addresses the challenges of deploying LLM applications across sectors. This modular stack mitigates vulnerabilities at every layer, reinforcing the reliability of AI models. The system exemplifies PwC's commitment to innovative, client-centric solutions.

**Deployment**

After receiving DORM approvals, PwC India deployed the Cyber Secure Gen AI system internally. A patent application in the USA is underway, with plans to extend this advanced security solution to clients across various sectors by January

**Securing the Future with Gen AI Protection**

As businesses embrace Gen AI and LLM applications, they face unprecedented cyber threats. These advanced technologies revolutionise operations but expose organisations to significant risks, compromising applications, systems, and sensitive data.

A robust security system is essential to navigate these threats. PwC's modular security solution protects across five strategic layers, safeguarding against data breaches, unauthorised access, and cyber-attacks. It ensures the accuracy and reliability of AI models by preventing "hallucinations," where AI generates false information.

This advanced security system is more than a shield; it transforms the landscape of AI implementation. Providing a secure and trustworthy environment allows organisations to innovate confidently and make infallible decisions. This solution fortifies the future, blending innovation with invincibility, and ensures businesses can thrive without fear.

The innovation revolutionises the security of Gen AI and LLM applications, providing a robust defence against emerging cyber threats. This advanced security system employs a modular security stack, targeting critical layers of input, data, connected apps, and output. Fortifying these layers ensures the protection of connected applications, systems, and sensitive data.

This security system empowers organisations to adopt advanced technologies confidently by addressing the inherent risks of LLM applications. It establishes a secure foundation for digital innovation, fostering trust and resilience in the face of evolving cyber threats.

**Pioneering AI Security: Overcoming Challenges**

PwC India led the development of advanced security systems for LLM applications, facing the challenge of understanding and mitigating risks in emerging AI technology. This required continuous learning and adaptation to stay ahead.

With clients across diverse sectors, PwC India needed a flexible and scalable solution to meet various industry requirements. Harmonising these needs was a significant challenge the team overcame by creating a versatile security system.

A significant hurdle was identifying and preventing 'hallucinations' in AI models. PwC India invested heavily in research to develop a solution that ensures AI-generated information is accurate and reliable.

Another challenge was navigating complex and evolving regulations on AI and data security. Ensuring the security system complied with regional and global standards required meticulous attention and legal collaboration.

Introducing a groundbreaking security system required educating users and overcoming resistance to change. PwC India focused on fostering understanding and acceptance of the system's benefits and functionalities.

Despite these challenges, PwC India's resilience and commitment to excellence led to the successful development of a pioneering AI security solution, reinforcing its position as a leader in technology and security.

**Transformative Impact of PwC India's AI Security Solution**

- **Market Context:** The global Gen AI market, valued at US$ 10.14 bn. in 2022, is expected to grow at a CAGR of 35.6% from 2023 to 2030. The increasing demand for AI applications and the need to modernise workflows is driving this growth. According to IBM's Global AI Adoption Index 2022, over 53% of IT professionals have accelerated AI roll-outs in response to the pandemic
- **Cost Efficiency and Risk Mitigation:** PwC India's security solution addresses vulnerabilities in LLM applications, reducing the economic impact of cyber attacks. This results in significant cost savings from preventing data breaches, downtime, and reputational damage

- **Enhanced Operational Efficiency:** The modular security stack minimises disruptions from security incidents, improving productivity and operational efficiency. This contributes to economic growth and competitiveness
- **Fostering Innovation and Investment:** With robust security, businesses are more likely to invest in innovative AI technologies. PwC India's solution provides a secure foundation for technological exploration, fostering innovation and attracting investment
- **Global Market Access:** Strong security systems enhance client and partner confidence, enabling global market access. PwC India's expertise in securing LLM applications positions businesses for international collaboration and economic expansion
- **Job Creation and Skill Development:** The adoption of advanced technologies increases the demand for skilled professionals in cybersecurity and AI. PwC India's initiative promotes job creation and skill development in these crucial fields
- **Regulatory Compliance and Reputation Enhancement:** Meeting and exceeding regulatory standards builds trust and enhances business reputations. PwC India's solution ensures compliance and opens doors to new partnerships and opportunities
- **Resilient Supply Chains:** Strengthening security layers protects supply chains from disruptions, ensuring economic stability and seamless operations
- **Revenue Optimisation:** The solution prevents cyber threats, ensuring uninterrupted operation of LLM applications. This enhances decision-making and operational effectiveness, contributing to revenue optimisation
- **Operational Efficiency:** The comprehensive defence mechanism across multiple layers allows organisations to operate without cyber threat fears. This reduces the need for remediation efforts and optimises resource allocation
- **Customer Experience:** The security solution enhances customer trust and satisfaction by ensuring the reliability and accuracy of LLM applications and preventing hallucinations. The absence of disruptions leads to a seamless user experience

### Expanding Horizons: The Scalable Potential of AI Security Solutions

#### Current Trends and Future Prospects

With the rising adoption of LLM applications, the demand for robust cybersecurity measures is set to grow significantly. PwC India's modular and layered security system is ideally positioned to scale alongside this increasing integration of AI into organisational workflows. This solution ensures a secure and reliable technological landscape, meeting the evolving cybersecurity needs of businesses leveraging LLM applications.

TECHNOLOGY - IT & BPM
GAMECHANGER

**Valiance**

# VALIANCE: HUMAN-ANIMAL CONFLICT MITIGATION SYSTEM

***Industry:*** *Retail & CPG, BFSI, Healthcare & Pharma, Agriculture, Manufacturing & Industrial Automotive, Energy and Utilities, AI for Social Good*
***Business Function:*** *Business Intelligence, Sovereign Functions of Govt. of India (State-run functions)*
***Beneficiary:*** *Forests, Tiger Reserves, National Parks, all areas prone to wild animal attacks*
***Technologies used:*** *NLP, Computer Vision*

**Valiance: Leading DeepTech Innovators**

Valiance leads profound tech innovation, tackling real-world problems with AI, Computer Vision, Edge Analytics, Remote Sensing, and Machine Learning.
Their expertise drives advancements in Healthcare, Smart Policing, and Human-Animal Conflict Management, enhancing safety and health standards through cutting-edge technology.

**Identifying the Problem**

Valiance's groundbreaking Human-Animal Conflict Mitigation System leverages AI and computer vision to address rising human-wildlife conflicts, especially with elephants and tigers. The system identifies potential animal encroachments and tracks individual tigers, noting behavioural changes that indicate increased risks to humans or livestock.

**Need to Resolve Human-Animal Conflicts**

With 80% of the world's wild tigers and 75% of the population in villages in India, human-animal conflicts cause significant loss of life and livestock, resulting in compensation costs amounting to hundreds of crores. Practical solutions are crucial to preserving lives and the economic well-being of communities. The urgency to mitigate these conflicts is critical for the safety of both wildlife and human communities.

**Leveraging AI for Solutions**

Valiance's "Wildlife Eye" uses AI to protect human

communities and promote sustainable coexistence with wildlife.

**Virtual Wall Technology:** Integrates lights, hooters, cameras, and AI algorithms for real-time detection and predictive capabilities

**Predictive Analytics for Wildlife Behaviour:** Tracks and monitors individual animals like tigers, leopards, and bears, identifying behavioural changes that signal increased risk to humans or livestock

**Tracing Jungle Violations:** AI-powered cameras detect and alert on movements from 6:00 pm to 6:00 am, ensuring vigilant monitoring and preservation of jungle integrity

**Real-time Monitoring and Alerts:** Smart cameras with internet capabilities monitor animal movements and send immediate alerts to local authorities and communities within 3 seconds, helping prevent potential conflicts or attacks

**Behaviour Prediction:** AI predicts potentially dangerous situations by analysing individual animal behaviour, enabling pre-emptive actions to avoid conflicts

**Near-Zero Error Rate:** AI algorithms achieve high accuracy, even in low-light conditions, ensuring reliable detection and minimising false alarms

**Complexity of Managing High-Volume Image Data**

Each advanced sensor-equipped camera generates substantial image data, capturing 172,800 images daily at over 100 GB per camera. With a minimum of six cameras per village, daily data exceeds 600 GB, necessitating robust storage and efficient data transfer solutions due to limited network bandwidth.

**Data Solution Implementation and Challenges**

**Data Transmission Optimization:** Initially transmitting 121 GB per day per camera, edge devices were introduced to communicate only when objects were detected, reducing data to 2-3 GB per day per camera

**Limited Internet Connectivity:** Locations with robust Internet access were identified through thorough surveys, and strategic camera placement was managed with field tests

Robust Model for Low-Light Areas: The models were optimised to identify nocturnal animals in low-light conditions, ensuring night time accuracy

Availability of Electricity: Solar panels and 200 Ah batteries were used to power LED lights and cameras in areas lacking conventional electricity, ensuring continuous operation

Security Challenges:

- External IP instances were concealed to prevent unauthorised access, using cloud proxies for instance access
- Network firewall rules were integrated to restrict access, and email security was enhanced
- SSL encryption limited external database access, resolved by configuring the cloud project and using cloud proxy middleware
- Pre-signed URLs for data transmission were secured

Data Processing Challenges:

- Transition to Serverless Compute System: Managed request handling, compute loads, and performance optimisation with dynamic resource allocation

Handling Real-time Data: Proactive measures, incl. SQL query optimisation, prevented database overload, ensuring smooth data processing

- Scalability and Peak Load Handling: Utilized cloud-native autoscaling to handle sudden peak loads, ensuring seamless scalability and resource availability
- Cloud-Native Architecture: Leveraged managed services and serverless computing for agility, cost-effectiveness, scalability, fault tolerance, and operational efficiency

Governance Mechanism:

- Tailored models for day and night scenarios to ensure accurate wildlife identification
- Combined models addressed diverse scenarios using natural light patterns
- Rigorous evaluation and iterative refinement guaranteed peak performance
- Adaptive optimisation enabled continuous improvement

- Transparency and accountability were prioritised in model development and deployment

Physical Security Challenges:

- Barbed wires were installed around smart cameras for perimeter security
- Cameras captured photos of individuals approaching the installation, providing real-time monitoring
- Hooters were activated upon detecting suspicious activity, alerting nearby personnel
- Instant notifications were sent to officials upon unauthorised activity detection, enabling swift response

### Impact and Scalability of the Solution

*Zero-Casualties in Sitarampeth: Over the past seven months, the solution has triggered over 175 alerts, ensured the safety of locals and wildlife and demonstrated its effectiveness in preventing human-animal conflicts*

*Revenue Optimization: The solution's costs are modest compared to the substantial compensation costs for human lives lost (₹20-25 lakhs per victim). It has saved numerous lives, underscoring its value in mitigating human-animal conflicts*

*Operational Efficiency: It provides real-time alerts within 3 seconds of detecting tigers, leopards, bears, or elephants, surpassing previous statistical-focused camera systems*

*Customer Experience: Since the implementation of the Human-Animal Conflict Mitigation System (HACMS), there have been no recorded human or livestock losses to wild animal attacks, enhancing community safety*

*Portability: Mobile app, available on iOS and Android, is easily adaptable for diverse client needs. Containerised backend deployment ensures flexibility across cloud or on-premises servers*

*Environment, Social Impact & Governance: This solution preserves lives and safeguards community economic well-being from substantial compensation costs due to human-animal conflicts.*

### Scalability

- Implemented in 4 Indian tiger reserves
- Valiance has secured orders to cover nine villages in the TATR Buffer Area, Maharashtra
- Over the next six months, expansion plans aim to encompass 30 villages

The goal is to reach 100 villages in the next 12 months and expand to ~500 villages within 24 months. This solution is poised for international expansion, with discussions underway with global wildlife parks and reserves.

TECHNOLOGY - IT & BPM
CHALLENGER

Apto.AI

# APTO.AI: DOWNLOADABLE CODE GENERATION PLATFORM

***Industry:*** *Retail & CPG, BFSI, Healthcare & Pharma, Manufacturing & Industrial Automotive, Technology, Media & Telecommunications, Energy and Utilities, Transport and Logistics*
***Business Function:*** *Customer Service; Marketing & Sales, HR, Software & Applications, Operations, Business Intelligence, Sovereign Functions of Govt. of India (State-run functions)*
***Beneficiary:*** *Petrochemicals, Insurance, IT Services*
***Technologies used:*** *Generative AI, NLP, Computer Vision*

**Apto.ai: The World's First AI Full Stack Software Engineer**

Apto.ai is the world's first AI full-stack software engineer that writes code like a full-stack engineer for backend (Java Spring), web (ReactJS), and mobile native (ReactNative for both web and Android). It also writes database code, incl. MySQL, Oracle, SQL Server, Postgres, and MongoDB. Additionally, Apto.ai tests the code for users, version controls the code, deploys it on any environment (AWS, Google Cloud, Azure, or on-premises), checks code vulnerabilities, documents the code, and allows users to download the code and walk away. Apto.ai features an in-house AI engine that suggests development steps and assists in generating databases, reports, and various no-code plugins like document implementation and OCR.

**Problem Identification:**

- Java developers are expensive and in short supply
- Java developers take 12-18 months to train
- Apto.ai platform allows anyone to create code intuitively without knowing code or having a software engineering background

**Addressing the Challenges of Software Development**

**Challenges Addressed:**

- Difficulties in meeting business requirements on time and within budget
- Lack of flexibility; insufficient qualified staff

- Prolonged app update times
- Poor customer experience; poor quality
- High costs

**Importance of Solving This Problem**

Client feedback indicates that it takes less than two weeks to get a user to 90-95% of the capabilities of a trained Java developer.

**Leveraging AI to Revolutionize Software Development**

Apto.ai significantly reduces development time and costs by 70-80%, enabling businesses to become more agile and eliminating tech development as a roadblock. Its AI and Gen AI platforms facilitate creation of end-to-end enterprise-level applications for users. The AI engine generates production-ready code without bugs, ensuring the code is readable and editable in Java Spring, ReactJS, and ReactNative. This approach minimises errors typically introduced by developers.

Additionally, the platform automatically manages database modelling from the UI interface, preventing loose connections in table relationships. Apto.ai reduces the workload for testing and code review teams by automatically documenting the generated code. Furthermore, the AI engine handles auto-deployment, ensuring the deployment process occurs without downtime.

## Achieved Scale and Impact of Apto.ai

***Security and Financial Success***

- Successfully passed rigorous VAPT penetration testing, ensuring generated code is completely secure
- Achieved a $2 million turnover last year within three years

***Key Features***

- Platform and industry agnostic
- Ability to export code, giving users ownership of their apps and code
- Automated SDLC process
- Single-click cloud deployment
- Reduced development costs and time by 65%-75%
- Accelerated time to market and fuelled innovation

**Client Success Stories**

**Leading Petrochemical Enterprise**

- **Background:** The client needed an application to launch a marketing campaign
- **Scoping:** Initially planned for a team of 15 resources and four months of development
- **Apto.ai Solution:** Developed and deployed the application across the web, Android, and iOS in three business days, with no additional resources needed for load balancing or DevOps

**Results:**

- Achieved 35,000 Android app downloads daily, handled over 500,000 transactions
- Generated revenue exceeding $500,000
- Saved 60 person-months of effort (~$120,000) and delivered 30X ROI

**Leading Insurance Firm:**

Background: The client required a document management system
Scoping: Initially planned for a team of 12 resources and eight months of development
Apto.ai Solution: Developed the Document Management System in 8 weeks with just two resources, incorporating multiple third-party APIs

**Results:**

- The CMS handles over 5,000 documents daily without extra support
- Reduced estimated development time from 8 months to 8 weeks and resource requirement from 12 to 2, resulting in a 75% reduction in development costs

**Empowering Non-Coders:**

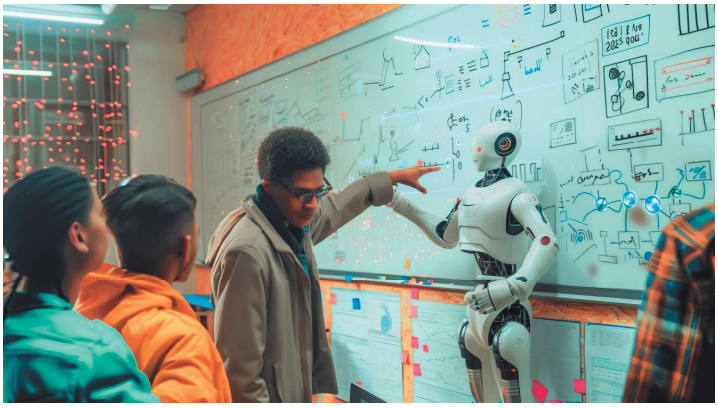
The platform empowers non-coders, transforming them into skilled coders –coding knowledge no longer required. They can now bring their dream apps to life quickly and independently without relying on external developers or alternative platforms.

**Unveiling Potential Scale in the Low-Code/No-Code Industry**

- According to Everest Group, Apto.ai ranks 25th in the Low-Code/No-Code Industry
- Achieved 7th position in No-Code Application Development and 1st rank in Auto Code Generation

TECHNOLOGY - IT & BPM
INNOVATOR

**Stempedia**



# STEMPEDIA: 21ST-CENTURY SKILLS LEARNING PLATFORM

***Industry:*** *Education*
***Business Function:*** *Marketing & Sales, Software & Applications, Operations*
***Beneficiary:*** *STEMpedia*
***Technologies used:*** *AR/VR, Generative AI, NLP, Computer Vision*

### EmpoweringEducation with Advanced STEM Tools

STEMpedia, an innovative tech-education platform, provides AI, coding, robotics, ML, and XR/VR courses for K-12 students and educators. Their suite of AI tools, including PictoBlox, Quarky, Evive, and Wizbot, transforms complex subjects into engaging learning experiences, fostering skills in software development, IoT, robotics, and AI through interactive projects. The AI and Robotics Lab at STEMpedia offers a comprehensive educational environment, equipping students with structured curricula and practical activity books to tackle future technological challenges effectively.

### Key Challenges in STEM Education

1. **Complexity of AI and Robotics:** Understanding AI, machine learning, and robotics is challenging without simplified educational tools
2. **Access and Inclusion:** Students from underprivileged communities lack advanced educational resources, limiting their exposure to STEM fields
3. **Resource Limitations:** Many schools in developing nations face constraints such as inadequate funding and technological infrastructure, hindering STEM education
4. **Skill Gap:** Despite increasing demand for AI and technology skills, many students lack adequate training during their foundational education

**Importance of Addressing the Problem**

Addressing this issue is critical as skills like AI, coding, and robotics are now essential in today's rapidly evolving, technology-driven world. Proficiency in these areas is necessary, not optional, for future success. Early exposure enhances students' employability, critical thinking, problem-solving, and creativity. Closing this educational gap enables the next generation to actively shape future technological advancements, preparing them for a digital and automated future.

**Role of AI in Transforming STEM Education**

By integrating AI into its educational tools and programs, STEMpedia addresses immediate challenges in STEM and AI education while preparing future workforces with critical technological skills:

1. **Simplifying Complex Concepts:** AI-driven platforms like PictoBlox make AI, coding, and robotics accessible and engaging through storytelling, gamification, and a visual programming interface

2. **Enhancing Accessibility:** Versatile and affordable tools like Quarky and Wizbot ensure students from underrepresented communities and resource-limited environments access high-quality STEM education

3. **Bridging Educational Gaps:** Initiatives like STEM, AI, and Robotics labs in over 100 schools provide structured curricula and state-of-the-art resources to urban and rural schools, levelling the educational playing field

4. **Fostering Inclusion and Diversity:** Promote gender diversity in STEM careers

5. **STEM and Robotics Impact Program:** With 50+ impact programs globally, STEMpedia provides AI and Robotics education kits, learning materials, and trainer training to reach children in countries like the US, India, Ghana, Nigeria, and Kenya

**Complexity of Dataset for AI and Robotics Education**

STEMpedia's dataset is essential for developing AI and Robotics curriculum and improving PictoBlox and Quarky. It includes various data types—textual, visual, and sensor data from robotics projects—crucial for training adaptable AI models that cater to diverse student needs.

This comprehensive dataset not only supports versatile AI development but also enhances the relevance and engagement of educational resources across various learning levels and ages.

**Risks and Challenges**

**Challenges:**

1. **Infrastructure:** Inadequate infrastructure in under-resourced schools can hinder the implementation of STEMpedia's educational kits and platforms

2. **Data Availability:** Ethically sourcing and utilising vast datasets for AI-driven educational tools poses significant challenges

3. **Accessibility:** Overcoming geographical, economic, and technological barriers to ensure equitable access to educational solutions, particularly for under-represented communities

4. **Security:** Ensuring stringent measures to protect student data privacy and security in the digital learning environment

5. **Processing Power:** Meeting the high processing demands of advanced AI functionalities, especially in schools in developing countries

**Governance:**

STEMpedia ensures the integrity of the AI model through audits and updates. Continuous monitoring refines content and methods based on performance metrics.

**Competitive Advantage:**

STEMpedia has inclusive, hands-on learning, storytelling, and gamification. Tailored initiatives and teacher support enhance STEM education's effectiveness and inclusivity.

**Solution Implementation and Impact**

1. **Revenue Optimization:** Operating in 90+ countries, PictoBlox boosts revenue through subscriptions, kit sales, and partnerships. Its 180k+ monthly active users drive demand, expanding its outreach to 2000+ schools and impacting 1M+ students

2. **Cost Optimization:** Automation and AI diagnostics enhance scalability and reduce operational costs

3. **Operational Efficiency:** Streamlined deployment and cloud-based management optimise content distribution and user progress tracking, supported by agile decision-making through data analytics

4. **Customer Experience:** Enhanced interactive learning and personalised paths elevate satisfaction, catering to diverse interests and skill levels

5. **Educational Impact:** Demonstrated improvements in STEM literacy and problem-solving skills, validated by success in competitions like Codeavour involving 167+ ATL schools and 5900+ students

6. **Teacher Training Program:** Over 15,000 teachers have been equipped with ICT, AI, and Robotics skills through STEMpedia's curriculum and hands-on experience with Evive and IoT kits, enhancing their ability to deliver 21st-century education

7. **Environment:** PictoBlox fosters environmental consciousness by enabling students to innovate solutions for waste management and energy conservation

8. **Social Impact:** Codeavour has inspired over 3 million students globally, resulting in 8500+ inventions addressing community-specific issues, showcasing STEM education's transformative power in social change

9. **Financial Impact:** STEMpedia's expansion into new markets and increased adoption rates significantly contribute to revenue growth

**Responsible AI:**

1. **Unbiasedness/Fairness:** Algorithmic adjustments minimise bias in educational content delivery

2. **Data Privacy and Security:** Strict adherence to data protection regulations ensures secure handling and transparent usage of user data

3. **Explainability:** AI models in educational tools prioritise interpretability, ensuring clarity in outputs and decisions for educators and students

**Future Scalability and Growth**

STEMpedia's solutions are designed for scalable deployment across new regions and educational systems using cloud-based infrastructures and modular content. However, success hinges on local infrastructure quality and continuous updates for ongoing relevance. Anticipating significant growth, Codeavour, STEMpedia's global AI and Robotics competition, continues to attract widespread participation, underscoring increasing interest in STEM education facilitated by STEMpedia.

TECHNOLOGY - IT & BPM
INNOVATOR

**Fundamento (Skiller Talent Pvt. Ltd.)**

# FUNDAMENTO: REDEFINING THE FUTURE OF CONTACT CENTRES

***Industry:*** *BFSI, Technology, Media & Telecommunications, Travel*
***Business Function:*** *Customer Service*
***Beneficiaries:*** *Enterprises with large customer contact centres intelecommunications, travel and BFSI sectors*
***Technology used:*** *Generative AI, AIOps, NLP, Graph Technology*

## Automating Enterprise Contact Centers Using AI

Redefine the future of contact centres with the most humanised AI-powered virtual agent that can slash operational costs by up to 60%. Fundamento is an AI-powered automation solution for enterprise contact centres. Its AI virtual agent enhances operations, saving time and money while improving accuracy. Fundamento partners with companies to boost their P&L efficiency through increased scale, reduced costs and builds customer loyalty and brand reputation by enhancing key metrics without needing agent training. It ensures quick, error-free problem resolution and provides agents with up-to-date information, leading to better query resolution and consistent quality experiences.

### Why this AI technology?

Fundamento understands that investing in customer-facing teams is vital for business, but high attrition and long ramp times hinder RoI. Training agents is complex, so Fundamentohas developed AI-powered tools to support them efficiently. Yara, Fundamento's Agent Assist platform, is a comprehensive knowledge base. Fundamento created an AI stack with Agent Assist and Virtual Agent to cut costs further, processing unstructured data from SOPs and call recordings to enhance Yara's capabilities.
Running enterprise contact centres is expensive and inefficient, with <2% of agent interactions currently automated, leading to several challenges:

- **High Operational Costs:** Enabling agents is costly, and poor performance affects key metrics
- **Talent Scarcity:** High-pressure environments cause burnout and turnover

- **Lack of Standardization:** Inconsistent handling of cases across teams causes inefficiencies
- **Capacity Constraints:** High call volumes during peak periods strain resources
- **Long Average Handle Time (AHT):** AHT can exceed 6-8 minutes due to agent response delays and poor knowledge sharing
- **Untapped Tech Potential:** Agents spend time on repetitive tasks that could be automated
- **Input data:** Unstructured call recordings, SOP documents & PDFs, annotated images
- **Volume of Data:** Very high volume ranging from 15 GB to 5TB of data, depending on the complexity of dispositions. Formats: mp3, wav, pdf, doc, docx, jpeg, png, CSV, xls
- **Incomplete Data:** Telephonic conversations often do not cover all possible scenarios, leading to incomplete scenarios and data extraction.
This leads to the need for a manual audit
Fundamento leverages AI to address these end-to-end problems, achieving cost-effective business outcomes for enterprise contact centres.

### AI-powered solution

#### Agent Assist

- **Processing Unstructured Data:** Fundamento's AI Labs efficiently process unstructured data, creating structured, easy-to-use information for training models. This involves translating, transcribing, distinguishing customer voices from agents, and generating intent
- **Industry-Specific Models:** It recognises the uniqueness of each contact centre and develops tailored AI models. By combining structured data with semantic search algorithms, they create industry-specific solutions
- **Intuitive Virtual Assistance:** The Agent Assist platform integrates live listening and real-time data fetching from knowledge bases. AI algorithms and LLM ensures accurate responses to customer queries. It also guides agents on appropriate language based on the situation
- **Intelligent AI Workflows:** Traditional workflows are enhanced with AI, making interactions more intelligent and actionable in real-time conversations. The platform automatically delivers follow-up information during calls and captures & pushes information to the CRM in real-time. It also allows seamless call revisits or customer transfers without losing context

#### Virtual Agent

Fundamento's Virtual Agent offers near-human AI bots that reduce operating costs by up to 60%, handling upstream interactions while agents tackle complex issues.

- **100% SLA:** Ensures no customer is unattended with 24x7 availability and multimodal capabilities
- **Zero Latency:** Eliminates wait times
- **Sentiment Analysis:** Monitors sentiment, detects emotions, and provides empathetic handling with contextual handovers to agents
- **Multilingual:** Supports accurate transcription and translation in real-time across 250+ language

### Achieved scale and impact of the solution

- **Reduce After-Call Work:** Fundamento automates repetitive post-call tasks, boosting agent productivity and reducing costs
- **Automation:** Fundamento automates 50% of daily calls without agent intervention
- **Revenue Optimization:** Reduces contact centre costs by up to 60%
- **Average Handle Time (AHT):** AHT is reduced by 40% as agents resolve issues quickly with relevant questions
- **Ramp Time:** With readily available information, ramp time decreases by 70%, allowing agents to perform efficiently
- **Handle High-Volume Events:** During peak call periods, Fundamento manages 100% of customer calls, maintaining SLA

**With IndiaMart, Fundamento achieved the following:**

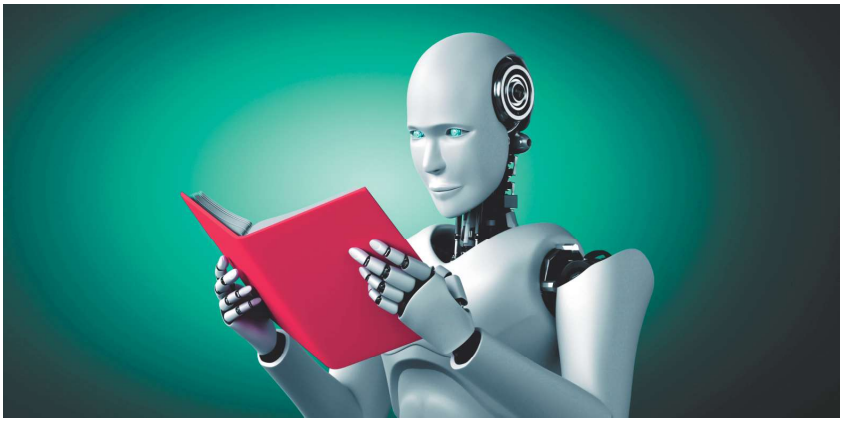
- **Cost Reduction:** Saved >$150k annually in contact center costs
- **100% SLA:** Improved SLA from 70% during high call volumes to 100%
- **Reduced AHT:** Cut Average Handle Time by 60%, from 8-10 minutes to <4 minutes
- **Improved CSAT:** Increased satisfactory calls from <20% to >50% on average

# TELECOM, MEDIA AND ENTERTAINMENT

TELECOM, MEDIA & ENTERTAINMENT
GAMECHANGER

Integra

# INTEGRA: ENGLISH LANGUAGE ASSESSMENT AND GUIDED EDITING - iNLP



***Industry:*** *Telecom, Media & Entertainment*
***Business function:*** *Operations, Content, Editorial and Production Services*
***Beneficiary:*** *Publishing industry*
***Technology used:*** *NLP*

Integra is a leading end-to-end technology and content solutions provider specialising in enhancing speed to market with higher quality at a lower cost. With over 2,300 employees across four delivery centres in India, the USA, and the UK, Integra excels in AI and ML solutions. Their expertise includes consultancy, automation, generative AI, custom model development, and AI acceleration.

**Transforming Editorial Processes with AI Innovation**

- **Understanding Customer Pain Points:** Identified manuscript editing and assessment inefficiencies within the publishing industry, impacting competitiveness and profitability
- **iNLP Development:** Developed iNLP to revolutionise the editorial process, making it faster, more accurate, and cost-effective
- **Hiring AI Specialists:** A team of AI specialists and subject matter experts to turn this vision into reality
- **Proof of Concept:** Developed a prototype to validate iNLP's effectiveness in addressing customer pain points
- **Iterative Refinement:** Continuous refinement through feedback ensured iNLP evolved into a mature, market-ready product
- **Launch and Implementation:** Before the full-scale launch, iNLP underwent rigorous testing with select customers, exceeding market expectations
- **Establishment of AI Center of Excellence (CoE):** Dedicated AI CoE continues to innovate and deliver practical AI applications
- **AI Accelerator Deployment:** Launched Quixl, an AI accelerator empowering businesses with advanced AI features for rapid market adaptation and scalable growth

**Challenges Faced by a Leading Journal Publisher**

A prominent journal publisher encountered the following challenges:

**TAT Reduction (Turnaround Time):**

- **Editorial Inefficiencies:** Delays in manuscript assessment, causing bottlenecks and impacting overall TAT
- **Publication Delays:** Resulting in author dissatisfaction and the risk of manuscript withdrawals, affecting publication cycle time

**Quality Gain:**

- **Resource-Intensive Screening:** Extensive resources dedicated to article screening, especially for language quality assessment
- Elevated Editorial Costs: High editing requirements for poorly written articles, compromising the quality of outputs

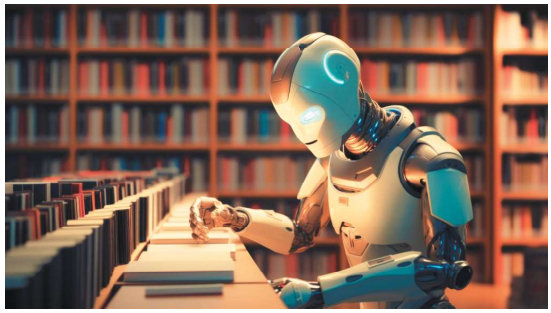
**Cost Gain:**

- **Financial Pressure:** Increased burden due to digital and technological shifts in the publishing landscape
- **Risk of Lost Business:** Inefficiencies potentially lead to losing authors to competitors, impacting revenue

### Importance of Addressing the Selected Problem

- **Operational Cost Optimization:** Enhancing financial robustness by addressing inefficiencies and high costs in the publishing process
- **Stakeholder Engagement and Retention:** Efficient and punctual publication processes are essential for maintaining author and researcher loyalty
- **Editorial Process Efficiency:** Streamlining the editorial workflow to prevent content loss and safeguard the publisher's reputation
- **Research Quality and Standards:** Elevating published research standards through compelling language and presentation norms

- **Academic Contribution and Impact:** Delivering clear, well-edited, and timely research findings that benefit the wider academic community and contribute to knowledge dissemination
- **Supporting Academic Research Integrity:** Upholding the integrity and progress of academic research in an increasingly digital and competitive scholarly landscape



### AI-Powered Revolution in Academic Publishing

iNLP transforms academic publishing with advanced AI technology, offering tools for authors and editorial staff. It enhances audience engagement through optimal research presentation and inclusive language, automating tasks like text analysis and contextual recommendations to boost productivity in publishing.

**AI's Role in Enhancing iNLP's Capabilities:**

- Efficient Manuscript Assessment: AI algorithms swiftly assess language quality, reducing manuscript review time
- **In-depth Language Analysis:** iNLP's AI evaluates style and flow, going beyond grammar for a comprehensive assessment
- **Guided Editing Process:** AI-driven guidance streamlines copyediting, enhancing efficiency and effectiveness

### Complexity of Dataset for Language Editing

The project's success in language editing relied on an exceptionally complex and diverse dataset:

**1. Volume and Diversity:**
Over 12 million records covering a wide spectrum of language complexities and textual elements

**2. Dual-Source Data Collection:**

- **In-House Expertise:** Curated and cleaned by experienced in-house copyeditors for foundational accuracy
- **Freelance Specialists:** Additional data from freelance copyeditors with domain-specific expertise, enriching dataset diversity
- **Synthetic Data Integration:** Strategic use of synthetic data to fill gaps in natural language variations, enhancing dataset comprehensiveness

**3. Rigorous Quality Control:**

- Validation and augmentation by a dedicated team of copyeditors to ensure the highest data quality

- Inclusion of nuanced language elements to make the dataset more representative of real-world linguistic structures

**4. Balanced Dataset:**

The latest research in natural language processing was applied to ensure data balance, reduce biases, and enhance model effectiveness across various editing scenarios

### Overcoming Challenges in AI Implementation

Implementing AI-led technology posed several challenges, including:

- **Data Availability:** Insufficient access to required data due to existing format limitations
- **Data Quality:** Conflicting and duplicating records skewed initial training dataset results
- **Technical Expertise:** Lack of in-house skills and resources for successful AI implementation
- **Cost:** High expenses associated with AI adoption, incl. hardware, software, and development resources

### Strategies to Overcome Challenges:

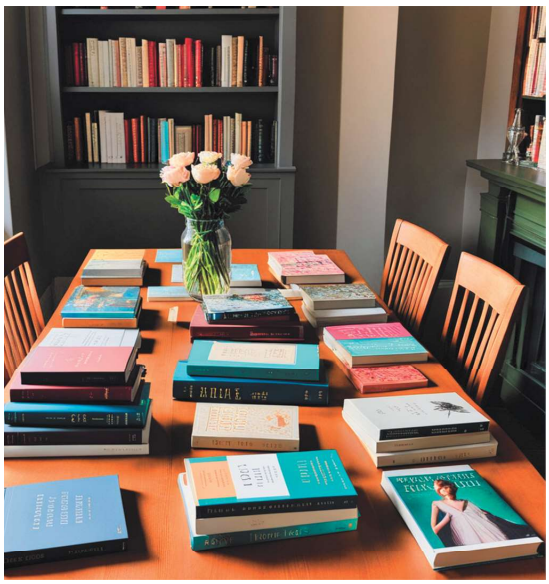
- **Data Availability:** Data augmentation and synthetic data generation techniques ensure a steady supply of high-quality data
- **Data Quality:** Implementing data cleansing filters and involving copyeditors to validate and certify datasets used in model training
- **Dedicated AI CoE:** Establishing a 10-member team within a dedicated AI Centre of Excellence to focus on AI-related use cases, ensuring a clear roadmap and focus for AI initiatives
- **Use Case-based Approach:** Concentrating AI adoption efforts on specific use cases to expedite implementation and achieve measurable results sooner

### Scale and Impact of iNLP Solution

iNLP solution has achieved significant scale and impact, addressing editorial challenges with impressive qualitative and quantitative results:

**Impact on Clients:**

- **Operational Efficiency:** Reduced manuscript assessment time from 60 days to minutes, streamlining the publication process
- **Cost Savings:** Up to 40% reduction in copyediting costs



- **Revenue Optimization:** Increased manuscript acceptance rate by 20%, boosting publisher revenue
- **Editorial Turnaround Time:** Reduced by 50%, accelerating the publication process
- **Proof Delivery to Authors:** Reduced from 7 to 2 days, leading to more articles published and increased revenue
- **Customer Experience:** Improved author satisfaction with faster response times
- **Author Satisfaction:** Improved through faster response times, benefiting primary clients
- **Article Quality:** Noticeable improvement, enhancing the prestige and reliability of publications

**Impact on Integra:**

Market Positioning and Competitive Advantage:

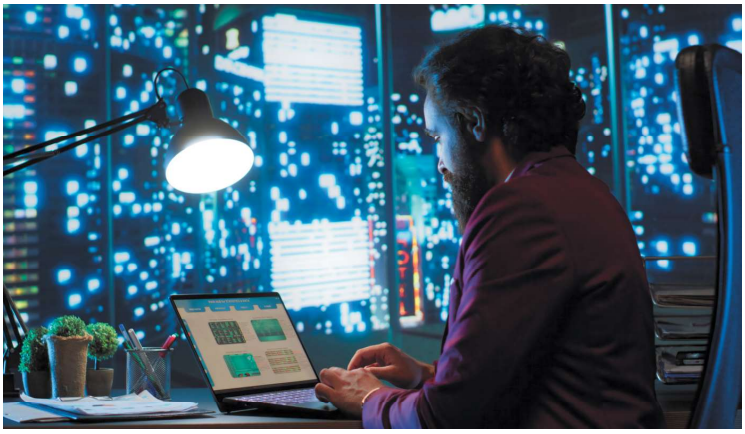
- *Distinct competitive edge in the market*
- *Unique offering that is generating new revenue streams*

Revenue Growth and Business Model Innovation:

- *Increasing demand and recommendations from publishers*
- *Non-linear revenue growth without significant additional investment*

TELECOM, MEDIA & ENTERTAINMENT
CHALLENGER

Thomson Reuters



# THOMSON REUTERS: OPEN ARENA – ENTERPRISE PLAYGROUND TO EXPLORE GEN AI

***Industry:*** *Technology, Media & Telecommunications*
***Business Function:*** *Customer Service, Marketing & Sales, HR, Software & Applications, Operations, Business Intelligence*
***Beneficiaries:*** *Customer Service agents, Developers, Journalists, HR*
***Technologies Used:*** *Generative AI, NLP, AIOps*

Thomson Reuters, a technology company rooted in content, boasts a century-long legacy of curating and classifying data.

### Evolution Towards AI Solutions

Their journey into adopting and developing AI technology is evident in their range of specialised information-enabled software and tools. These cater to legal, tax, accounting, trade, and compliance professionals, complemented by the globally renowned Reuters news service.

### Addressing Enterprise Needs with GenAI Solutions

The challenge involves creating a robust and secure framework for enterprises to effectively harness and explore GenAI capabilities, subsequently integrating them into product features. Potential users include Thomson Reuters' customer base and internal support functions such as customer support, HR, and journalists.

### Significance of Solving the Chosen Problem

In response to the rapid advancements in AI technology, the focus has been on integrating AI into employee workflows and product features within the organisation. This necessitated addressing challenges such as data security and democratising AI skills through a well-designed framework for secure implementation. A secure AI playground

plays a crucial role by allowing safe experimentation with cutting-edge AI technologies like LLMs, fostering employee innovation and collaboration. This initiative accelerated the adoption of generative AI across Thomson Reuters, leading to significant improvements.

By end-2023, Gen AI had been integrated into three essential legal products, enhancing productivity by transforming legal professionals' operations.

### Leveraging AI Solutions to Address Complex Challenges

The organisation is leveraging AI proficiency to introduce and cultivate diverse experiences, emphasising state-of-the-art Gen AI capabilities. This strategic approach goes beyond conventional analytics, targeting intricate challenges that demand advanced AI solutions for resolution.

### Complexity of Dataset Utilisation

The organisation utilised an extensive in-house dataset comprising diverse data types and sources, incl. data from application usage, to enhance user experiences and deploy production applications. Overcoming the complexity involved developing connectors to various in-house data repositories.

### Overcoming Data Solution Challenges

Implementing the data solution posed various challenges, particularly in accessing data from the playground and its applications. Creating new connectors to existing data stores was essential to facilitate this access. Understanding the data involved leveraging data catalogues and tools for annotating and grading AI solution outcomes. During implementation, challenges arose in effectively utilising data within RAG approaches. To address this, they employed advanced data processing techniques. Another significant hurdle was creating a dataset tailored for fine-tuning LLMs to align with specific organisational use cases and experiences. This was overcome by applying customised data processing techniques, ensuring effective resolution of these issues.

### Risk & Governance and Competitive Landscape

Accessibility to data from the playground and its applications posed a challenge, addressed by developing innovative connectors for existing data stores. It was understanding the data involved utilising data catalogues and tools for annotating and grading AI outcomes. They encountered data-related hurdles when they implemented the solution, notably difficulties in leveraging data within RAG approaches, Overcoming this involved deploying advanced data processing techniques and creating a dataset tailored for fine-tuning LLMs aligned with specific organisational use cases, which required bespoke data processing methods, effectively resolving these challenges. RAG chains were established as reusable assets for rapid information retrieval across AI solutions.

### Governance Mechanism

To ensure responsible AI integration, the solution incorporates robust notification systems, comprehensive documentation, and dedicated resources for answers. They maintained secure frameworks to develop and deploy systems, prioritising security and privacy. Human-in-loop and human-feedback frameworks are integral to fostering Responsible AI principles. Thomson Reuters promotes user awareness through campaigns and upskill training initiatives, operationalising Responsible AI throughout this solution.

### Scale and Impact of the Implemented Solution

- 5,000+ active users
- 125 customer support agents rely on the app for timely &effective customer query responses
- 200 journalists utilise it for their editorial activities
- Customer support agents have enhanced their article search efficiency by over 50%
- Journalists complete editorial tasks in <70% of the time compared to manual methods
- Impact measurable across revenue optimisation, operational efficiency, UX metrics

### Potential Scale Based on Current Trends and Scenarios

The solution is poised to scale extensively, becoming the primary platform for experimenting with the latest capabilities across the organisation. Enhancing current platform capabilities and accelerating the transition from experimentation to production aims to bring innovative results to fruition rapidly. Additionally, continuously adopting new techniques will improve the solution, making it adaptable to external needs.

TELECOM, MEDIA & ENTERTAINMENT
GAMECHANGER

Justbaat.AI

# JUSTBAAT.AI: TEXT TO VIDEO - ENABLING USERS TO CREATE STUDIO QUALITY VIDEOS WITH TEXT

***Industry:*** *Technology, Media & Telecommunications; Retail & CPG*
***Business Function:*** *Marketing & Sales*
***Beneficiary:*** *Video Editors, text editors, creators, media houses, e-commerce merchants and more*
***Technologies used:*** *Generative AI*

**Justbaat Mediatech Private Limited**

Justbaat.ai is a video creation and automation platform allowing publishers and brands to produce engaging videos with text. Their custom AI model lets media houses create studio-quality videos, automating 95% of the process and producing AI anchors.

**Importance of Solving This Problem**

Users watch 60 minutes daily, making video the best communication format. Content is becoming hyper-local, and AI videos can justify the RoI of quality content.

**Problem Description**

Aims to enable anyone to create engaging, studio-quality videos without physical infrastructure.
Text to Video for Media Publishers:

- Justbaat.ai brings AI to newsrooms, powering most AI anchors in the country
- Users engage more with video than text
- Justbaat.ai automates video creation from text
- Enhances reach, engagement, and monetisation for publishers
- Creates over 2000 minutes of video content daily

**Brand Mascots:**

- Justbaat.ai is developing brand mascots for companies like Paytm, Diageo, and Flipkart
- Facilitates better communication between brands and users
- Multi-language automated video creation expands reach

**Video Personalization:**

- Collaborate with talent management and agencies to help influencers create personalised videos
- Justbaat.ai is developing an influencer engagement platform
- Partnered with political parties to create AI avatars of prominent politicians

### AI-Powered Solution for Video Creation

Our end-to-end video creation leverages AI through an AI Co-pilot that performs:


### Role of AI in Solving the Identified Problem

- **Avatar Creation:** Utilizes advanced machine learning algorithms custom-trained with our database
- **Text-to-Speech:** Custom-trained models with over a million words for Indian languages, leading in text-to-speech technology for these languages
- **Video Automation:** Primarily driven by machine learning

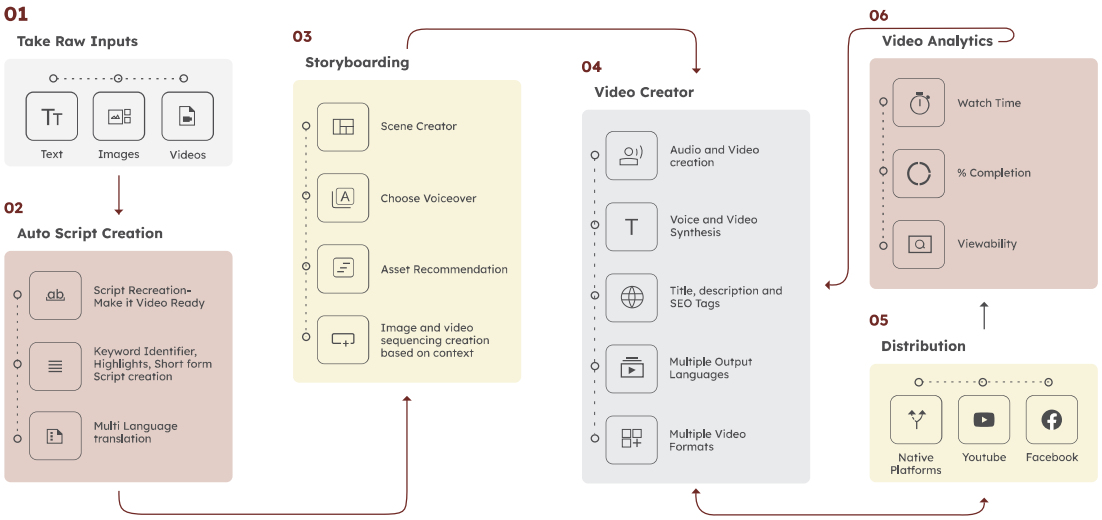
### Technical description of the proposed solution

Oriya, Bhojpuri, Bundeli, and Bodo. Obtaining data and developing these languages was a considerable challenge, which they overcame through extensive data collection and custom training.

### Risk, Governance, and Competitive Landscape

Challenges faced during development included:

- **Infrastructure:** Limited GPU availability and high costs
- **Ecosystem:** The Indian ecosystem lacks research support and has few India-specific open-source resources
- **Capital Availability:** Initially, few investors were willing to invest in AI-based solutions




### Dataset Complexity

Justbaat.ai's AI model, Heartbeat, is trained on over 2,000 hours of custom data sourced from media houses (their clients).

### Data Solution and Implementation Challenges

They enable hyper-local video creation, but most TTS platforms support only significant languages. Justbaat.ai has added nine local languages, incl.

### What Makes Justbaat.ai Different

**Business Model:** Justbaat.ai is the growth partner for clients. Their solution has zero upfront cost and works on a revenue-sharing model with publisher partners.

**Access to Unlimited Data:** Their market presence allows them to custom-train and optimise models for specific use cases in the publishing and media industry.

**Achieved Scale and Overall Impact**

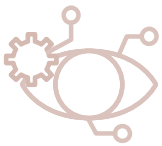
12% of content is created using Justbaat AI. Media creators are saving time and money and have increased their reach. Video content is now being created in many more languages, which was impossible earlier.

**Potential Scale as per Current Trends & Scenarios**

Justbaat.ai aims to reach 2,000+ minutes of daily content by the end of 2024 and 10,000 minutes by the end of 2025.

**Impact Metrics**

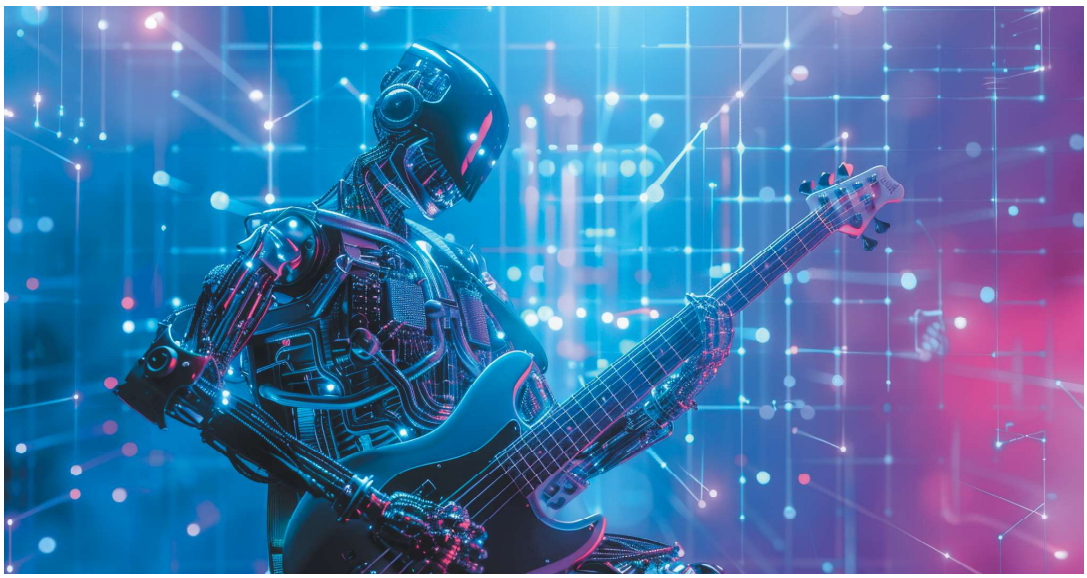
- USD 550K - Month-over-month gross revenue contributed by Justbaat.ai to publisher partners
- Creates 400 minutes of daily video content, 20% growth month-over-month
- Enables the creation of 100+ studio-quality videos per day by one person
- Users can watch content in video format in their local language-enhancing customer experience



TELECOM, MEDIA & ENTERTAINMENT

CHALLENGER

**Beatoven.AI**



# BEATOVEN.AI: AI POWERED ROYALTY FREE MUSIC

***Industry:*** *Telecom, Media & Entertainment*
***Business Function:*** *Software & Applications*
***Beneficiary:*** *Video content creators, Game developers, Podcast creators, Music producers*
***Technologies used:*** *Generative AI, Computer Vision, NLP, AIOps*

Beatoven.ai is an AI-powered music creation platform that helps content creators compose original background music for their videos, games, and podcasts. The platform allows creators to create custom royalty-free music and license it for their content

**Problem Identification**

Content creators for videos, podcasts, and games frequently struggle to find, edit, and license royalty-free background music. Incorrectly licensed music leads to copyright infringement issues, wasting significant time searching stock music libraries for suitable tracks. It aims to bridge the gap between cumbersome, static stock music libraries and costly, time-consuming music producers. Copyright takedowns on content platforms pose a significant challenge, causing creators and studios billions in losses.

**Approach**

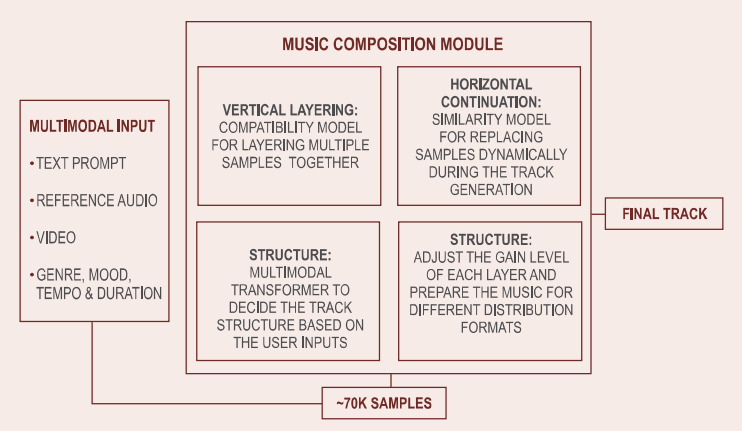
Machine learning creates original music from a curated database of 100,000 samples. The tool lets users compose and license soundtracks tailored to their needs, eliminating the need for extensive

searching, editing, and licensing.
Unlike stock music libraries like Epidemic Sound, Artist, and Musicbed, the Beatoven.ai platform simplifies music creation, enabling users to generate and customise soundtracks.

### Solution

**Advanced Music Composition and Customization System**

Users select four parameters—mood, genre, tempo, and duration—to generate an original soundtrack, which they can further refine using customisation features. The platform also uses Reinforcement Learning from Human Feedback (RLHF) for user feedback.
Alternatively, users can upload a video, and the system automatically extracts these parameters to compose music, or they can input free-flowing text.




- **Transparency:** Diagnostic models trace sound inputs, enabling analytics and future revenue sharing
- **Portability:** Accessible via web browser on any desktop, laptop, or mobile device

**Technology includes**:

- A fusion network of three Convolutional Neural Networks for video analysis
- In-house developed contrastive learning algorithms for compatibility and similarity in soundtracks
- Hidden Markov Models for Music Structure
- The Wave-U-Net model for mixing and mastering

### Implementation Challenges

The scarcity of available music data due to strict industry regulations posed a significant challenge. Major copyrights are controlled by Sony, Universal, and Warner, making data procurement difficult. Label and tag data were sourced independently, a time-consuming and costly process.
**Data:** They source their data to avoid copyright infringement, which is both expensive and labour-intensive.
**Compute:** Training large models requires substantial GPU resources, which are costly and difficult to access at scale.

### Impact and Achievements

*Cost Optimization: 90% cheaper than acquiring licensed music tracks*
*Operational Efficiency: Reduced soundtrack acquisition time from 2-3 days to 2-3 minutes*
*User Growth and Engagement:*

- *800,000 registered users in the first year*
- *Over 2 million songs created*
- *200,000+ music downloads*

*Inclusivity: Diverse genres support global artists, including folk and classical musicians*

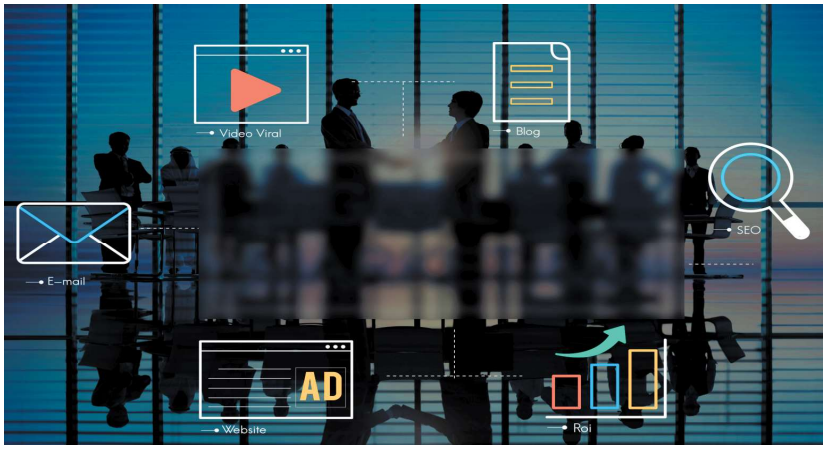
### Projected Growth and Future Plans

In the next 6-24 months, Beatoven.ai anticipates reaching 4-5 million registered users with 200-400K monthly active users (MAUs). The company also plans to explore multi-modal music generation, with a six-month roadmap already in place.

TELECOM, MEDIA & ENTERTAINMENT
INNOVATOR

LeapX

# LEAPX: DEMOCRATISE DIGITAL MARKETING FOR SMBs




***Industry:*** *Technology, Media & Telecommunications*
***Business Function:*** *Marketing & Sales, Business Intelligence*
***Technologies Used:*** *GenAI, Computer Vision, Graph Technology, NLP, AIOps*

LeapX offers an advanced generative AI copilot to democratise digital marketing for SMBs globally. Their platform enables users without marketing experience to easily create and launch effective digital ads tailored to their industry. This technology empowers SMBs to enhance their online presence across various sectors, simplifying and improving digital advertising with AI.

### LeapX's AI Technology Journey

In 2023, technological advancements in generative AI transformed the landscape, democratising access to expertise. LeapX leads this change, simplifying advertising and amplifying impact for SMBs by providing enterprise-grade knowledge. LeapX has developed a sophisticated AI platform enabling SMBs to compete with large enterprises. Launched to customer acclaim, the platform effectively fosters business growth. Success lies in identifying precise use cases with measurable outcomes and addressing critical needs in an underserved market.

### Transforming Axiom Landbase with AI Technology

Axiom Landbase, a leading Gurugram real estate brokerage, aimed to grow from 70 to 500 team members and become a top housing developer, facing operational and marketing challenges in a competitive market. LeapX's platform streamlined their lead ad campaigns from three days and six team members to a five-minute task, boosting marketing precision and revenue.

A 10X increase in conversion rates empowered Axiom to compete with larger firms, showcasing the transformative power of technology. Now equipped with data-driven insights, Axiom is poised to achieve ambitious expansion goals in a competitive industry.

### Addressing Digital Marketing Challenges for SMBs

SMBs face significant challenges in achieving online visibility due to the complexity of digital marketing, which includes over 500 ad formats and 5,000

targeting options. This complexity is a substantial barrier, especially for SMBs with limited budgets and no direct access to digital marketing professionals.
The issue is particularly severe in India: 300,000 marketing professionals serve over 70 million businesses, leaving 95% of Indian SMBs unable to effectively use digital marketing. This shortage of expertise and resources threatens these businesses with obscurity and failure in the digital-first marketplace. Bridging this gap is crucial for enabling SMBs to thrive and compete.

### Importance of Solving the Digital Marketing Gap for SMBs

Addressing the digital marketing gap for SMBs is crucial due to their significant economic impact. They contribute around 30% to India's GDP and employ over 120 million people. With over 70 million businesses striving for visibility in a digital-first market, most lack the means to compete online, risking obscurity and failure. Equipping SMBs with digital marketing tools is vital for their survival, ensuring they continue to drive economic growth and employment. This effort fosters a more inclusive and vibrant economy in the digital age.

### AI-Driven Digital Marketing Solution for SMBs

LeapX's solution for SMBs' digital marketing challenges is an innovative platform that enables anyone to launch high-performance ads like a professional. They have automated the entire digital marketing process using AI, making complex tasks simple and user-friendly.

The platform analyses vast amounts of data, predicts trends, & offers recommendations that typically require extensive experience. It identifies effective targeting parameters & ad formats, optimises real-time campaigns, & ensures superior marketing results without needing specialised staff. This comprehensive solution includes campaign creation, audience targeting, performance analysis, and optimisation - all streamlined by AI. By automating these tasks, the platform reduces the time, cost, and complexity of executing effective digital marketing strategies.

Ultimately, their platform democratises SMBs' access to advanced digital marketing, allowing them to compete with larger enterprises and secure their place in the digital economy.

### Complexity of the Dataset

The dataset integrates terabytes of structured and unstructured data from various sources, incl. ad performance metrics, user demographics, social media interactions, and market trends. It encompasses numerical data, text inputs, customer feedback sourced from significant ad platforms like Google, Facebook, and LinkedIn, web analytics, CRM systems, and external market research. This extensive and diverse dataset enables their AI to automate marketing processes, optimise campaigns, and generate targeted content by analysing millions of data points across different dimensions of digital marketing.

### AI-Driven Data Solution for Digital Marketing

Their data solution leverages AI for digital marketing, addressing challenges like managing vast data volumes, ensuring data quality, integrating diverse platforms, and enabling real-time optimisation. They overcame these challenges with scalable cloud processing, automated data normalisation, microservices for seamless API integration, and adaptive machine learning for dynamic campaign adjustments. This approach handles structured and unstructured data, integrates with platforms like Google, Facebook, and LinkedIn, and optimises decisions in a fast-paced marketing environment, empowering SMBs with advanced, AI-driven marketing strategies.

### Achieved Scale and Overall Impact

*Implementing the AI-driven platform has delivered transformative results for SMBs across various industries, revolutionising digital marketing and driving significant business growth:*

- *Operational Efficiency: SMBs have reduced the time to launch lead ad campaigns from days to under 5 minutes, streamlining operations and freeing up resources for strategic initiatives*
- *Enhanced Campaign Performance: AI-optimised campaigns have improved targeting, leading to better lead quality and increased revenue*

- ***Conversion Rate Improvement:*** *SMBs have achieved up to 10X improvement in conversion rates, helping them exceed growth targets even with limited sales resources*
- ***Competitive Edge:*** *The platform empowers SMBs to compete with larger firms by making data-driven decisions, streamlining marketing efforts, and optimising real-time campaigns*
- ***Strategic Business Transformation:*** *Supports SMBs in scaling operations, entering new markets, and transitioning to new business models, boosting market visibility and operational efficiency*
- ***Revenue Optimisation:*** *The platform targets and optimises ad spend, leading to higher ROI, increased conversions, and improved marketing-driven revenue*
- ***Customer Experience:*** *AI enhances customer understanding, allowing for personalised marketing messages that increase engagement, satisfaction, and brand loyalty*
- ***Economic Empowerment:*** *By levelling the playing field, the platform enables SMBs to compete effectively, fostering economic diversity, innovation, and resilience*
- ***Job Creation:*** *As SMBs grow, they create more jobs, contributing to community development and reducing unemployment rates*
- ***Global Reach:*** *Helps SMBs extend their reach globally, promoting cultural exchange and international networking*

**Potential Scale in Digital Advertising**

Global digital advertising spending totals US$400 bn, with SMBs contributing around US$160 bn (40% share). The potential for AI-driven solutions is particularly promising in rapidly expanding markets like India, where SMB ad spend is growing at a 30% CAGR.

# MANUFACTURING

MANUFACTURING
GAMECHANGER

Infosys

Infosys topaz

# INFOSYS: AUTONOMOUS VEHICLER SOLUTION FOR SAFE TRANSPORTATION


***Industry:*** *Manufacturing & Industrial Automotive*
***Business Function:*** *Software & Applications*
***Beneficiary:*** *Retail, Manufacturing, Hospitality, and Logistics*
***Technologies used:*** *Autonomous Technologies*

**Infosys: Leading Digital Transformation with AI and Cloud Technologies**

Infosys, a global leader in digital services and consulting, supports client's digital transformation journeys using cloud and AI technologies. Infosys delivers scalable, agile digital solutions, fostering continuous improvement and skill transfer through its innovation ecosystem. The company is committed to governance, environmental sustainability, and inclusivity.

**Autonomous Mobility Solution: Enhancing Safety, Efficiency, and Productivity**

**Problem Statement:**

The client aims to pioneer autonomous mobility, ensuring safe transportation within controlled environments. The platform requires real-time object sensing and synchronisation to control steering and braking systems. This involves developing and integrating hardware and software for precise autonomous navigation.

**Business Challenges:**

- Manual logistics operations leading to low productivity, efficiency, and safety
- Underutilization of high-cost mobility assets
- Scarcity of skilled operators
- Safety liabilities with contract operators
- Reduce/eliminate manual operations for logistics in controlled environments

**Importance of Solving Autonomous Mobility Challenges**

The Infosys Autonomous System Platform delivers tailored, unmanned transportation solutions that are crucial for the digital transformation of industries. It autonomously transports people and cargo in controlled environments, addressing critical mobility needs in Retail, Manufacturing, Hospitality, and Logistics.

These sectors demand low-speed, fixed-route, high-availability transport, traditionally serviced by manually operated vehicles. As industries embrace Industry 4.0, there is a pressing need for greater automation, efficiency, and scalability. Reducing human intervention enhances operational performance and analytics, making autonomous systems essential for modern industry operations.

**Proposed Solution: Infosys Autonomous System Platform: AI-Driven Autonomous Mobility**

Infosys proposes an Autonomous System Platform integrated with their patented Drive-by-Wire technology for client-specific electric vehicles. Key features include:

- **Drive-by-Wire Technology:** Auto steering, braking, and throttle integrated with navigation
- **Advanced Detection Systems:** Long-range and short-range obstacle detection using 2D/3D LiDAR and cameras
- **AI and Deep Learning:** For lanes, curbs, and obstacles detection and ensuring precise, safe, and optimised navigation
- **Safety and Reliability:** Health monitoring, emergency stop procedures, and system redundancies with human override
- **Navigation and Path Planning:** AI-driven algorithms for precise localisation, mapping, and route computation
- **Versatile Implementation:** Suitable for new and existing environments, combining real-time and historical data for route safety
- **Security:** Encrypted communication and cybersecurity features

**Complexity of Dataset for Autonomous System**

The dataset used by the Infosys Autonomous System is complex and high-volume, encompassing diverse traffic conditions, environments, and times of day. Key elements include:

- **Data Sources:** Various sensors and camera systems
- **Data Types:** Traffic conditions, environmental variations, and traffic density
- **Volume:** Extensive data collection for comprehensive analysis

The platform's architecture includes sensors, infrastructure, computing and networking, hardware/software interface, and applications for precise autonomous navigation.

**Data Solution and Implementation Challenges**

**Challenges:**

Lack of Modular Autonomous Systems: For effective unmanned navigation

- **Solution:** Developed intelligent, modular navigation systems utilising vision and sensor technologies for safe and efficient movement of people and materials

High Cost of Human-Intensive Operations: Dependence on human labour for logistics and transportation

- **Solution:** Implemented autonomous systems to reduce human dependency, enhancing efficiency in critical logistics and hazardous environments

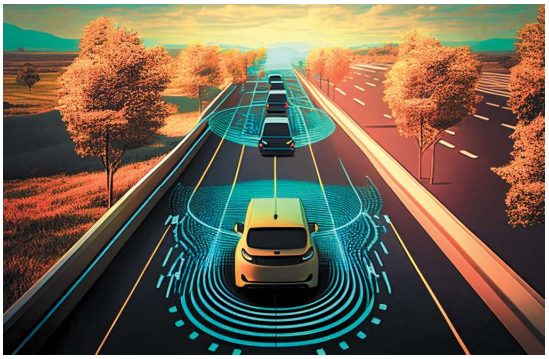
Absence of Remote Fleet Management: Inability to remotely manage and optimise mobility platforms

- **Solution:** Created an end-to-end fleet management system for remote control and optimisation of autonomous systems

**Data Challenges:**

Sensitivity and Real-Time Assessment: Ensuring data security, accessibility, and timely processing

- **Solution:** Established robust security layers and optimised response times for seamless data transmission and integration within the technology stack, ensuring effective real-time navigation



**Achievements and Impact of Infosys Autonomous System Platform**

*Infosys successfully delivered three product variants: Autonomous Buggy, Autonomous Mobile Robot (AMR) (1 Ton and 5 Tons), and the Autonomous Vehicle Research platform (AVR), with more derivatives in development. These achievements have significant business implications:*

- *New Business Line: Created a new revenue stream in the autonomous mobility space within E&RD*
- *Revenue Potential: Established a promising pipeline in the emerging autonomous mobility market*
- *Fleet Management: The solution optimises AMR utilisation and availability, ensuring efficient path movements and extended battery life*

***Key Features:***

- *Accountability: Customer-specific environment data is collected and processed by Infosys for precise path planning and navigation*
- *MLOps Practices: Adherence to standard MLOps practices for data modelling, image processing, AI model development, deployment, and retention*
- *Human Touchpoints: Manual override functionality for safety and redundancy, allowing flexible use between manual and autonomous modes*
- *Security: Encryption at various levels to eliminate vulnerabilities*
- *Robustness: Additional time for the heartbeat module to ensure system reliability*
- *Explainability: The platform has a comprehensive user interface with all safety warnings for safer autonomous navigation*
- *Drift: The platform can optimise planning, localisation, and path planning to ensure smooth autonomous navigation*
- *Privacy: No customer data is captured and recorded apart from user credentials*

***Collaborations:***

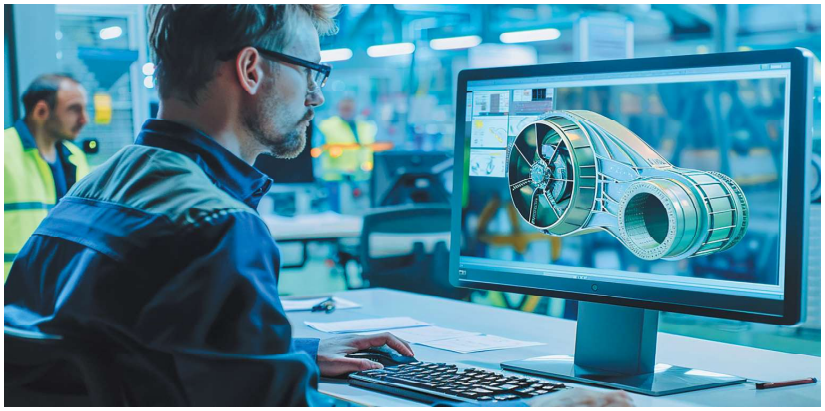
- *Partnered with Maini Group and Bangalore International Airport Ltd. to enhance the platform's development and deployment*

**Potential Scale and Future Goals**

The aim is to achieve SAE Level 4.0 Autonomy, enabling fully autonomous operations in controlled environments.

MANUFACTURING
CHALLENGER

**L&T Technologies Services**



# L&T TECHNOLOGY SERVICES: AI-BASED FRAMEWORK FOR ASSET HEALTH MONITORING

***Industry:*** *Manufacturing & Industrial Automotive, CPG & Retail, Energy and Utilities, Transport and Logistics*
***Business Function:*** *Operations*
***Beneficiary:*** *Transportation OEM, Petrochemical Company, FMCG Company, Industrial Products OEM*
***Technologies used:*** *NLP, ML Algorithms, Document and Image Processing*

## L&T Technology Services: Engineering and AI Excellence

L&T Technology Services Limited (LTTS) is a leading provider of Engineering and R&D services, catering to 69 Fortune 500 companies and 57 top ER&D firms. Specialising in AI technologies such as machine learning, deep learning, and predictive analytics, LTTS enhances operational efficiency and delivers actionable insights across various industries. Their AI-driven solutions like AiKno® for industrial optimisation, Chest-rAi™ for healthcare imaging, and AnnotAI® for automotive data annotation, developed in collaboration with AWS and NVIDIA, showcase their innovation prowess. With a portfolio encompassing over 30 AI solutions and 55 patents, LTTS transforms raw data into strategic intelligence, fostering growth and inspiring new possibilities for its global clientele.

### Tackling Unscheduled Asset Downtime in Asset-Intensive Industries

LTTS addresses the critical issue of unscheduled asset downtime in industries like Oil & Gas (O&G) and Consumer Packaged Goods (CPG), which rely on consistent asset performance. Outdated processes and legacy systems increase downtime, impacting productivity and financial health.
Key challenges include:

- **Legacy Systems:** Outdated equipment lacks modern sensors and efficient data utilisation, leading to reactive maintenance
- **System Complexity:** The intricate nature of industrial assets makes root cause analysis difficult

without advanced diagnostic tools

- **Data Silos:** Fragmented data across departments hampers a holistic view of asset health and performance
- **Lack of Scalability:** Legacy systems struggle to adapt to growing business needs

### Importance of Solving Unscheduled Asset Downtime

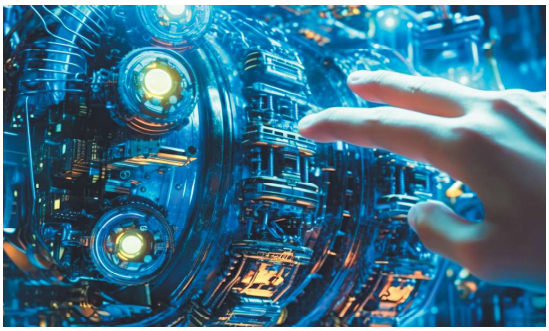
Unscheduled asset downtime in industries critically affects operational efficiency, costs, and productivity. Key reasons to address this issue include:

- **Increased Costs:** Unexpected repairs or replacements incur significant expenses, often with premium pricing for expedited parts and labour
- **Lost Productivity:** Non-operational assets lead to substantial financial losses due to halted production
- **Supply Chain Disruptions:** Downtime delays deliveries, eroding customer trust and damaging market reputation
- **Safety Risks:** Unexpected failures pose safety hazards, especially in critical systems, jeopardising worker safety
- **Resource Misallocation:** Crisis management during downtime disrupts scheduled maintenance, leading to further issues
- **Quality Impact:** Operational interruptions can compromise product or service quality, causing quality control issues

Addressing unscheduled downtime through predictive maintenance and enhanced training is crucial for maintaining competitiveness, ensuring safety, and upholding reliable production schedules.

### AI-Driven Solution

LTTS addresses unscheduled asset downtime with its AI-integrated Asset Health Framework (AHF). This real-time, cloud-native platform analyses key asset health parameters to provide predictive insights and proactive decision-making.



**Key AI Components**

- **Anomaly Detection:** Machine learning algorithms detect real-time anomalies, learning from historical data to identify potential failures
- **Failure Prediction:** AI analyses operational data to predict asset failures, identifying trends missed by human analysts
- **Process Optimization:** AI models continuously optimise processes, enhancing efficiency and reducing downtime
- **Customizable Data Pipeline:** Modular AI-driven pipelines cater to domain-specific needs, ensuring high data quality
- **Real-time Alerts:** AI integration enables immediate alerts and notifications for deviations or failures

By leveraging AI, the AHF monitors assets, predicts problems, offers prescriptive solutions, and adapts to industry-specific needs, providing a significant competitive edge.

### Dataset Complexity

The dataset comprises 4 GB of data with 750 dimensions, including text, images, and manuals, making it highly complex and multi-faceted.

### Overcoming Data Challenges in AHF Implementation

LTTS faced several data-related challenges while developing the Asset Health Framework (AHF):

**Data Quality and Availability:**

Ensuring high-quality, relevant data was crucial for practical AI model training. This was addressed through partnerships with data providers and a robust data governance framework.

**Testing Challenges:**

Data access issues during volume and robustness testing were resolved by securing industry-specific test data from domain experts, ensuring the AI system's stability under varying conditions.

**Initial Model Building:**

The initial stages required ample, domain-specific data. Collaboration with data providers and comprehensive data governance helped gather and maintain relevant data.

**Data Security:**

The "Secure AI" framework was implemented to protect sensitive information and ensure compliance

with data protection regulations, which are crucial for industries dealing with clinical or personal health information.

These measures ensured the AHF's effectiveness and reliability, transforming asset management in asset-intensive industries.

### Scale and Impact of LTTS' Asset Health Framework (AHF)

***Quantitative Impact***

- *10-20% decrease in equipment downtime*
- *5-15% increase in productivity*
- *2-10% lower maintenance costs*

***Qualitative Impact***

- *Enhances asset reliability and performance, predicting issues before they occur*
- *Streamlines and optimises maintenance schedules, preventing unnecessary wear and tear*
- *Improves workplace safety by minimising the risk of equipment failures*
- *Optimizes resource use, reduces waste, and lowers environmental footprint*
- *Decision Support - Provides critical insights for informed asset management and strategic decisions*

***Environmental Impact***

- *Resource Efficiency: Promotes targeted maintenance, reducing large-scale repairs and waste*
- *Lower Carbon Footprint: Cloud-based solution minimises physical infrastructure reliance*

*The AHF's real-time data processing and granular health assessments empower companies to strategically schedule maintenance, avoid costly outages, and achieve operational excellence.*

### Future Potential of LTTS' Asset Health Framework (AHF)

LTTS is advancing AHF with Gen AI features and prompt engineering to enhance personalisation and interaction for maintenance personnel.

**Customer Adoption**

- **Current Use:** Several customers have adopted AHF, incl. a petrochemical major implementing it across global plants
- **Future Deployment:** 8-9 more customers are expected to deploy AHF in production within 12 to 18 months, as they are in advanced stages of customisation and pre-production

MANUFACTURING INNOVATOR

Baker Hughes

# BAKER HUGHES: RAISE - ROBOTICS AND ARTIFICIAL INTELLIGENCE FOR SAFE ENERGY INSPECTION

***Industry:*** *Manufacturing & Industrial Automotive, Energy and Utilities*
***Business Function:*** *Business Intelligence, Operations, Software & Applications, Customer Service*
***Beneficiary:*** *Oil & Gas companies, Gas distribution companies in India*
***Technologies used:*** *AIOps, Computer Vision, NLP, Graph Technology*

## Baker Hughes' AI and Digital Transformation in India

Baker Hughes is a global energy technology leader offering innovative energy and industrial solutions. It designs, manufactures, and services technologies to enhance energy safety, cleanliness, and efficiency. Baker Hughes provides a diverse portfolio of integrated equipment and services that improve productivity and customer outcomes. Committed to reducing carbon intensity, it deploys low-carbon technologies to help customers achieve environmental goals. AI aids in monitoring, tracking, and improving efficiency to meet emission targets.
Baker Hughes is critical in advancing India as a global manufacturing and digital technology hub. The BAKER HUGHESC3 team enhances AI capabilities through an R&D centre specialising in 3D printing, material process engineering, and X-ray machines.

### Optimising Energy Infrastructure with Robotic Solutions

The energy industry faces challenges in optimising infrastructure management, mainly due to the risks and costs associated with human inspections in hazardous environments. Traditional methods also contribute significantly to carbon emissions, particularly when travelling to remote locations. To tackle these challenges, the project aims to

enhance robotic inspection capabilities by reducing risks, lowering costs, and minimising environmental impact. Advanced computer vision and AI techniques will empower robots to autonomously detect issues such as leaks, corrosion, and equipment malfunctions.

Current autonomous inspection methods must be improved, as structured and labelled data is required to train AI models. This project proposes integrating cutting-edge computer vision and AI to fine-tune deep learning models with relevant data, reducing the need for manual labelling. Leveraging Baker Hughes' expertise will be crucial for adapting these techniques to the complexities of energy assets.

**Significance of the Chosen Problem**

Human-led inspections in remote energy locations are costly and environmentally impactful:

- Field Service Engineers (FSEs) incur high daily rates and travel expenses
- Limited on-site time increases costs and logistical challenges

Industrial inspection robots offer a cost-effective solution and excel in challenging environments:

**Industrial inspection robots offer a cost-effective solution and excel in challenging environments:**

- Operate autonomously with lower monthly costs
- Have a more extended on-site presence and enhanced accuracy through AI
- Significantly reduce the carbon footprint by minimising worker transportation
- Autonomously detect gas leaks, enhancing safety and environmental protection
- Allow continuous equipment monitoring without shutdowns
- Enable predictive maintenance to optimise energy use
- Extend component life, further reducing emissions

**Solution Overview with AI Integration**

The proposed solution leverages advanced computer vision (CV) and artificial intelligence (AI) within a robotic platform to revolutionise energy

sector inspections. The goal is to enable robots to detect leaks, corrosion, and equipment malfunctions, reducing accident risks and environmental harm. CV identifies anomalies like leakages and overheating, while AI handles complex image classification and feature extraction. Techniques include thermal and RGB cameras, microphones, and deep learning models fine-tuned for energy industry inspections.

The solution also integrates data collection and analysis into a comprehensive monitoring platform. Predictive models help anticipate risks, plan robot missions, and prevent environmental hazards. Continuous data collection and analysis create a digital twin for real-time production plant status, enabling predictive maintenance and anomaly detection through AI algorithms.

**Dataset Complexity: Volume, Type, and Sources**

Each inspection plugin is developed using a testing facility's diverse datasets from RGB cameras, thermal cameras, audio recordings, and lidar cloud points. Hundreds of images ensure accuracy and repeatability. Initial training in analytics is followed by on-site fine-tuning to align the prediction model with the plant's physical characteristics, enhancing inspection capabilities.

**Data Solution Implementation and Overcoming Challenges**

1. **Environmental Complexity:** High-installed elements hindered robotic movement and reachability

2. **Environmental Mutability:** Daily variations due to other operations affected inspection reliability

3. **Weather Conditions:** Lighting, humidity, and temperature impacted system performance

Solutions included acquiring extensive datasets under various conditions, using high-dexterity robotic platforms, and modifying inspection plant designs.

**Critical Aspects of the Solution**

1. **Advanced Technology Integration:** Utilizes advanced computer vision (CV) and AI within a robotic platform

2. **Comprehensive Monitoring:** Integrates data collection and analysis into a monitoring platform using machine learning operations (MLOps) for predictive risk identification

3. **Risk Reduction and Cost Efficiency:** Autonomous robotic inspections reduce human risk, lower costs, and minimise environmental impact

**Challenges and Governance**

1. **Integration Complexity:** Ensuring seamless communication between components requires careful design

2. **Scalability and Adaptability:** Must accommodate evolving infrastructure and monitoring needs

3. **Governance Model:** Robust oversight ensures AI model reliability and adherence to standards

**Collaborative Advantage**

Collaboration with various Baker Hughes teams helped leverage their domain knowledge and expertise. The project is driven by an interdisciplinary team, which has a strong R&D tradition in turbomachinery, field service operations, digital technology, robotics, and AI.

**Achieved Scale and Impact of the Solution**

Routine inspections are essential for quality control and safety. Robotic inspections revolutionise infrastructure management, offering cost savings and CO2 reduction. Human inspections in remote or hazardous locations are resource-intensive, involving high transportation, permits, safety equipment, and logistical costs.

Currently piloted at Baker Hughes' test sites and external facilities, robotic solutions aim to minimise human intervention, improve detection accuracy and speed, and enhance data collection for predictive maintenance. Early issue detection reduces downtime and costly repairs, while autonomous gas leakage detection prevents harmful emissions. Robotic inspections significantly lower the carbon footprint by reducing the need for human travel.

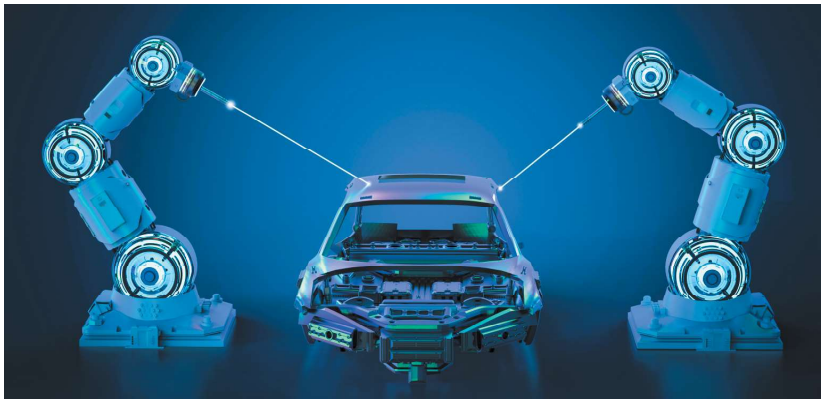
**Expanding Robotic Inspection Technologies**

Over the next 24 months, Baker Hughes plans to test and deploy autonomous robotic inspections in various environments, incl. hydrogen storage plants, CSP blocks, CAES power blocks, and CCUS systems.

The proposed AI-driven robotics can be adapted for other industries and applications, such as defect detection and quality control in manufacturing lines.

MANUFACTURING
GAMECHANGER

**CamCom Technologies**



# CAMCOM CV: MICRO-LEVEL DEFECT INSPECTIONS FOR AUTOMOTIVE OEMS

***Industry:*** *Manufacturing & Industrial Automotive*
***Business Functions:*** *Operations*
***Beneficiary:*** *Automotive manufacturing (OEM)*
***Technology used:*** *Computer Vision*

## Revolutionizing Defect and Damage Assessment with Computer Vision

CamCom is an award-winning, industry-agnostic Computer Vision (CV) platform specialising in defect and damage assessment and anomaly identification on metal, plastic, or glass surfaces. Renowned as pioneers in integrating CV and related technologies into visual inspection processes, CamCom's platform is in production with leading players within the automotive ecosystem. It offers solutions that create visual audit trails of vehicles from end-of-line to end-of-life, significantly enhancing operational efficiency.

### Transforming Visual Inspections with AI

CamCom's AI solution eliminates subjectivity of traditional manual methods, future-proofs the process, and maintains current throughput levels. Acting as the ultimate control tower, this solution creates a comprehensive visual track and trace audit trail throughout the product lifecycle in the automotive sector. Additionally, CamCom ensures contactless solutions, enabling partners to maintain business continuity seamlessly.

### Addressing Manufacturing Defects with Precision AI

CamCom tackles the critical problem of manual defect detection in manufacturing lines, which is prone to human error and can lead to costly product recalls. Traditional inspection processes are labour-intensive, subjective, slow, error-prone, and inconsistent, resulting in defective product seepage. Identifying micro-level defects is essential for maintaining brand reputation and achieving significant cost savings by avoiding recalls.

CamCom's solution identifies micro defects up to 50 microns during production with an accuracy of 99.97%.

**Leveraging AI for Precision in Defect Detection for Automotive Inspections**

CamCom's AI-powered visual inspection platform offers real-time micro-level defect detection for automotive end-of-line inspections, including reflective surfaces. The solution integrates easily with existing workflows using bespoke retrofit rigs for automated conveyor systems.
CamCom pioneered the Computer Vision and Deflectometry (pattern recognition) analysis powered by deep learning models, for OEM end-of-line defect assessments. Extensive R&D has produced a retrofit platform that efficiently addresses complex visual inspections.

**Complexity of the Database:**
High-Volume Image Analysis for Automotive Defect Detection: CamCom processes 150 million images annually, utilising data annotation and pattern recognition to identify defects. The data includes up to 52 types of automotive part identification and paint defect detection. These images are sourced from machine vision cameras operating in controlled environments, ensuring precision and accuracy in defect detection.

**Data Solutions: Implementation Challenges and Overcoming Strategies**

CamCom has conducted significant R&D to tailor the platform for varying assembly line speeds and high-volume image processing.
CamCom's AI-powered rigs, including highly reflective surfaces, are designed for paint defect inspections and are deployed on customer sites using the proprietary AI platform.

**Achievements and Impact of the Solution**

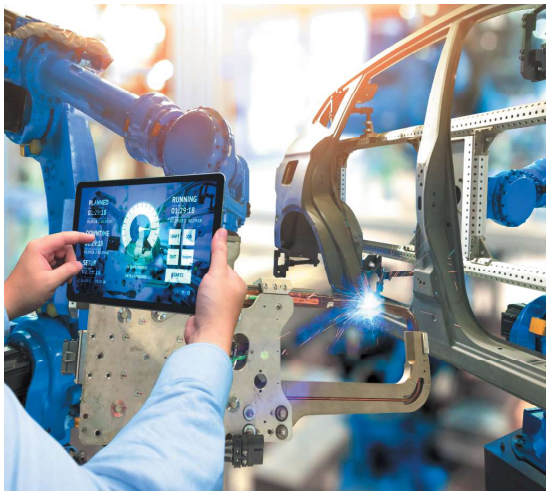
- *99.97% defect detection accuracy in a controlled environment*
- *The AI platform is trained to classify 90% of Pareto defects (Top 8 defects)*
- *Retrofit rigs matching the speed of the assembly line - inspection time reduced to 20 seconds (Operational efficiency)*
- *False positives observed in one vehicle out of 1,000+ scanned for defect identification*
- *False negatives of <1%*
- *600% increase in productivity*
- *Defect detection time reduced to 20 seconds*
- *~50% more defects detected per vehicle compared to manual inspection*
- *Minimum chances of recall (Revenue optimisation)*
- *Defect-free products ensure higher gratification for the automotive dealer fraternity and, in turn, the end-consumer (Customer experience)*

**Potential Achievements Based on Current Trends**

The solution is applicable across OEM and component manufacturing sectors, and industry-agnostic, accessible to all markets, entirely "Made in India," and designed for factories of all sizes, including the MSME sector.

**Impact of CamCom AI on Environment, Social Impact, and Governance**

The solution aligns with the UN SDG Goal 8.2 - "Achieve higher levels of economic productivity through diversification, technological upgrading, and innovation, incl. through a focus on high-value added and labour-intensive sectors."



MANUFACTURING
CHALLENGER

**Skylark Labs India Private Ltd.**

# SKYLARK LABS: MOBILE FOD DETECTION FOR MILITARY AIR STATIONS

***Industry:*** *Technology, Media, Manufacturing & Telecommunications*
***Business Functions:*** *Software & Applications*
***Beneficiary:*** *Indian Naval Air Stations*
***Technology used:*** *Generative AI, NLP, Computer Vision, AIOps*

## Skylark Labs: Pioneers in AI Threat Detection

Skylark Labs specialises in self-learning AI to enhance safety by identifying and neutralising real-time threats. Their advanced solutions use data from cameras, radars, and satellites to detect hazards across various conditions. By integrating diverse data sources, they offer tactical and strategic solutions for defence and commercial sectors, providing comprehensive situational awareness. Skylark's commitment to sophisticated algorithms and sensor data integration enables effective, real-time risk management that adapts to evolving security needs.

**Problem Statement and Importance to Resolve**

Foreign Object Debris (FOD) encompasses various materials, including tools, metal parts, and natural debris, and poses significant threats to aircraft operations.

**Impact on Military Operations:**

- FOD is a critical concern in military settings due to aircraft deployments' fast-paced and high-stakes nature
- Even small objects can cause substantial damage to jet engines, leading to costly repairs and potential aircraft downtime

**Consequences of FOD:**

- **Operational Efficiency:** A single piece of debris can ground aircraft, directly impacting military readiness
- **Safety Risks:** Increases risk of accidents and injuries during take-offs and landings
- **Maintenance Costs:** Addressing damage caused by FOD increases maintenance efforts and significantly burdens military budgets

**Importance of Efficient Removal:**

- Efficient and timely FOD removal is crucial for maintaining the safety and readiness of military aircraft

- Proper FOD management can substantially reduce preventable maintenance costs, enhancing overall mission capability

**Skylark Labs' Advanced FOD Detection System for Military Airfields**

**AI-Driven Detection:**

- Integrates high-resolution cameras and advanced algorithms to detect a variety of FOD, from small metal parts to wildlife

**Real-Time Analysis and Precision:**

- Provides instant and accurate identification of FOD, minimising false alarms and enhancing response times

**Self-Learning and Adaptation:**

- Learned from scans to improve detection algorithms and operate effectively in diverse weather conditions

**Solution Innovation: AI-Enabled Mobile FOD Detection System**

- **Imaging Technology:** Uses thermal and PTZ cameras for surveillance
- **AI and Machine Learning:** Employs algorithms for real-time analysis and accuracy improvement
- **Data Processing Infrastructure:** Includes robust servers for handling high-volume data
- **Software Platform:** Custom software integrates AI with imaging data for monitoring and analysis
- **Connectivity and Integration:** Ensures real-time data transfer and system integration
- **Mobile Deployment:** Designed for mobility across airstrip areas

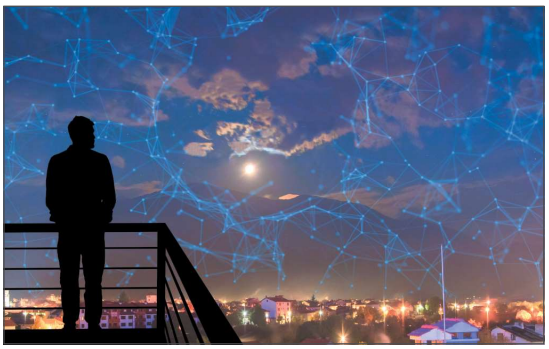
**Additional Features:**

- **Automated FOD Detection:** DebriSense generates real-time alerts in critical areas
- **FOD Source Tracking:** Identifies FOD sources and documents aircraft movements
- **FOD Reporting System:** Provides GPS data, images, and video archives for analysis and reporting

**Dataset Complexity of Skylark's FOD Detection System**

Skylark Labs' Mobile FOD Detection System handles a complex dataset characterised by:

- **High Volume:** Continuous video feeds from high-resolution thermal and PTZ cameras covering extensive runway and taxiway areas



- **Diverse Data Types:** Includes RGB imagery, thermal imagery, radar data, and metadata on weather conditions and operational schedules
- **Multiple Data Sources:** Data from mobile units equipped with cameras, existing air station infrastructure, and environmental sensors

**Overcoming Data Challenges in Skylark's FOD Detection System**

- **Data Silos:** Integrated isolated data from cameras and sensors into a unified system
- **Data Availability:** Ensured real-time access for immediate analysis in a mobile setup
- **Data Security:** Implemented stringent protocols to protect sensitive military data
- **Processing:** Utilized high-capacity servers and efficient algorithms to handle large volumes of data in real-time

Scale and Impact on Key Performance Metrics

***Scale:***

*Implemented across various Indian Naval Air Stations, covering extensive runway and taxiway areas, handling large-scale, real-time data inputs.*

***Impact:***

- ***Financial:*** *Potential savings of $4-$13 billion annually in repairs*
- ***Safety:*** *Significantly reduced FOD-related accidents and operational disruptions*
- ***Efficiency:*** *Minimized delays, enhanced operational readiness, and reduced maintenance costs*
- ***Revenue Optimization:*** *Achieved substantial cost savings in maintenance and repairs for military airfields*
- ***Operational:*** *Automated detection reduces workforce and inspection time*

- *Operational Efficiency: By reducing FOD-related delays and maintaining continuous operations*
- *Customer Experience: Improved safety and reliability for military air stations, creating a secure environment*
- *Safety Standards: Reduced risk of accidents and equipment damage*

***Technical Merit:***

- *High Accuracy: Excels in identifying diverse FOD types*
- *Adaptability: Maintains accuracy in varied conditions (e.g., low light, rain, fog)*
- *Learning: Continuously improves detection capabilities*
- *Integration: Seamlessly integrates with existing systems*
- *Localization: Pinpoints FOD locations for efficient debris management*

**Potential Scale for Skylark Labs' Mobile FOD Detection System**

In the next 6 to 24 months, Skylark Labs' Mobile FOD Detection System could significantly expand its scale. It can potentially be deployed in more military airfields domestically and internationally. There is also potential for adaptation to civilian airports.

**Impact of Skylark's AI on Environment, Social Impact & Governance**

**Environmental:** Reduced environmental damage from aircraft accidents and debris; lower carbon emissions from military vehicles and aircraft during ground operations

**Social Impact:** Enhances military personnel and equipment safety, contributing to social welfare. Data-driven insights improve governance and operational practices within military installations

**Governance:** Implements advanced safety and operational efficiency technology, aligning with responsible governance practices. Demonstrates commitment to continuous improvement and high safety standards.

MANUFACTURING INNOVATOR

Qpi.AI

# QPIAI: ENVIRONMENT COMPLIANCE AT A MEGA CITY CONSTRUCTION SITE

**Industry:** Smart City Construction
**Business Function:** Environmental compliance team of the Smart City
**Beneficiary:** Smart City Construction Companies, Environment Compliance at Construction Site (ESG) and Construction Quality Monitoring (Operations - Quality Assurance & Excellence)
**Technologies used:** Computer Vision, AIOps

## QpiAI's Solutions for Enterprise Applications

QpiAI integrates AI and quantum solutions to deliver advanced computing and automation to enterprises. Their flagship platform, QpiAI Pro, features a patented Model Discovery engine that supports large-scale AI innovation, collaboration, and deployment across data centres, clouds, and edge environments. This award-winning AutoML and MLOps platform, launched in 2020, is used by Fortune 500 companies to create and deploy AI solutions in diverse domains. Additionally, QpiAI's quantum-inspired software, QpiAI-Opt, addresses large-scale industrial optimisation challenges in logistics, supply chain, finance, pharma, automotive, and manufacturing sectors.

### AI Solutions for Environmental Compliance in Construction

The application of AI in identifying and reporting environmental damage has had a profound impact on the Environmental Compliance and Operational Excellence teams. This collaborative initiative with the Mega City Construction team, harnessing data from drones, cameras, sensors, and satellite imagery, has resulted in the implementation of over 15 AI solutions. These solutions offer near real-time feedback to site contractors on SOP violations, thereby ensuring minimal environmental damage. The platform's effectiveness is further reinforced by the imposition of fines for repeated violations, enhancing its value proposition.

**Importance of Solving Environmental Impact in Construction**

The urgency to address environmental impact in mega-scale construction at pristine sites cannot be overstated. The preservation of these fragile ecosystems, with a particular emphasis on the protection of endangered flora and coral reefs, is a matter of utmost importance.

### AI-Powered Environmental Compliance for Mega City Construction

To address environmental compliance at a mega city construction site, AI models leverage drone imagery, satellite imagery, fixed-point cameras, and sensors to monitor and detect SOP violations. A unified command centre oversees construction activities, providing near real-time identification of deviations. Deep learning models, continuously trained on diverse data, ensure precise detections and scalability.

Critical AI applications include:

- Monitoring and change detection of trees
- Litter detection near coral reefs
- Equipment maintenance checks
- Dust cloud and plume emissions detection
- Hazardous material storage compliance

### Dataset Complexity for Environmental Compliance Models

The dataset integrates multiple sources, incl. drone and satellite imagery, fixed-point cameras, and sensors. Each use case involves ~50,000 drone images and 120,000 fixed-point camera images. After segregation, models are trained on datasets ranging from 500 to 1,000 photos.

### Overcoming Challenges in AI-Driven Environmental Compliance

Data Availability: Initially limited; solved by generating synthetic datasets and utilising proprietary AutoML for fast, accurate model tuning.

Infrastructure: Limited GPU availability required training low-footprint, high-accuracy models for specific domains. These models are deployable on resource-constrained devices and fine-tuned independently. All data remained within the Enterprise Data Center.

Model Re-training: Automated pipelines for model tuning, automated annotations, transfer learning, rigorous validation, and Docker-based deployment addressed frequent fine-tuning.

Robust models were developed using synthetic data generation, AutoML, and a version-controlled system for use case definitions, annotated datasets, trained models, and inference code, ensuring transparency and change tracking.

### Achieved Scale and Impact of AI Solutions

*QpiAI's AI models are now operational, providing near real-time inference. Leveraging the QpiAI Enterprise platform, the solutions offer significant benefits:*

- *Efficiency Gains: 5X faster iteration and 2X smaller teams during data analysis and model iteration; 4X reduction in model failure incidents; 5Xmore rapid iteration and 4X smaller teams during model re-training and deployment*
- *Operational Benefits: 15+ deployed AI use cases enhance cost optimisation through fines for SOP violations and improve efficiency with a unified command centre*
- *Responsible AI: Automated pipelines ensure reduced bias, data security (data remains within the enterprise data centre), and explainable AI through Grad-CAM, LRP, and heatmaps for performance improvement*

### Future Scalability of the AI Platform

The AI models are adapted to specific use case domains, enabling scalable training and deployment for various scenarios. Despite challenges like poor initial data quality and concept drift, the team has successfully created and deployed AI solutions for 15 use cases, potentially scaling to 50+ new use cases within 12 months.

These models enhance operational efficiency, ensuring contractors follow SOPs and minimise environmental damage. The engagement promises significant ROI by reducing environmental compliance violations and supporting sustainable development for mega-city operations. Continuous improvement is expected with better data availability and automated MLOps capabilities.

# TRANSPORT AND LOGISTICS

TRANSPORT & LOGISTICS
GAMECHANGER

Maersk

MAERSK

# MAERSK: CX AGENT ASSIST

***Industry:*** *Transport and Logistics*
***Business Function:*** *Customer Experience*
***Beneficiary:*** *Customer Relationship Management (CRM) Platform*
***Technologies used:*** *Generative AI, NLP, AIOps*

## Maersk: Connecting Trade and Innovating Technology Globally

A.P. Moller-Maersk is an integrated container logistics company with a vision to 'Connect and simplify trade to help customers grow and thrive.' The Innovation, Data Science & Artificial Intelligence (IDA) CoE, founded in India in 2019 and part of the Maersk Technology Centre, focuses on AI and Operations Research (OR) initiatives for revenue optimisation and operational efficiency. The IDA has so far contributed to 31 patents for Maersk.

**Objective:**

Optimize operational efficiencies, reduce response times, elevate overall quality of customer interactions

### Identifying the Core Problem

- Email is a vital communication tool at Maersk, facilitating operations and collaboration
- Maersk receives ~45 million queries (cases) annually for Ocean, with 32 million through email
- Each of Maersk's 15k+ customer support executives (CX Agents) spends an average of 40 minutes per case
- On average, agents spend 22 minutes investigating across multiple systems and 9 minutes in response to emails
- Despite training and complex systems, delayed responses to the high volume of emails affect service quality
- These inefficiencies hinder visibility into customers' supply chains and limit cross-sell opportunities

**Solution Overview: Leveraging AI to address the identified problem**

To address these challenges, Maersk developed a cutting-edge solution leveraging Gen AI to revolutionise customer query, dispute resolution and enhance overall CX.

- **Gen AI Capabilities:** Utilizes machine learning and natural language processing to automate and optimise query resolution, ensuring faster response times, greater accuracy, and improved customer satisfaction
- **Data Transformation:** Consolidates and transforms transactional and pricing data for each booking/invoice. Customer emails and calls are recorded as "cases" in Salesforce CRM (SFDC), with documented case types, sub-types, and reasons
- **Data Cleaning:** Parallel data cleaning and transformation include CX Agent responses using NLTK for text data processing
- **Embedding and Clustering:** Extracts OpenAI ADA Embeddings for QnA pairs and identifies unique QnA pairs using HDBSCAN clustering. Facebook AI Similarity Search (FAISS) creates a vector database at the sub-type level for real-time, appropriate responses based on historical agent replies
- **Recommendation De-duplication:** Implements techniques based on similarity and agent actions to ensure unique and inclusive recommendations

- **Complaint/Dispute Identification:** Uses recorded cases and types to identify complaints/disputes (e.g., incorrect rates, unrecognised free time) and validates them with transformed transactional and pricing data. Responds to customers with the most appropriate replies from the vector database, communicating acceptance or rejection

**Risk & Governance and Competitive Landscape**

Maersk's problem was unique, and there were no readily available solutions. While some tools identify automation opportunities, Maersk realised that focusing on every step within the workflow was crucial for building an accurate and adaptable solution. Therefore, they collaborated with the CX teams to develop their solution. Below are the challenges they faced and their model governance strategy.

**Challenges:**

- **Accuracy of Auto-Resolutions:** Achieving 100% accuracy was critical, as any errors in backend validation and responses would lead to customer dissatisfaction. Maersk enhanced its NLP and validation code to improve accuracy, accounting for variations in workflows across countries and products. They rigorously tested the workflow with 200k cases
- **Scalability of NLP and Gen AI:** The solution globally required high computing GPUs and handling many tokens per minute from the Gen AI API (GPT-3.5 and ADA embeddings). This was resolved through discussions with Microsoft teams
- **Solution Adoption:** Achieving 100% accuracy was essential for adoption. Governance and feedback sessions with CX agents helped refine email response recommendations and educate agents on using them effectively

**Model Governance:**

- The auto-resolution workflow is governed and validated daily to achieve 100% accuracy. A validator/checker queue within the CRM system flags cases with more named entities, low sub-type classification probability, or negative sentiment. Agents manually review these cases, flagging any inaccuracies
- A PowerBI dashboard tracks the use of email response recommendations by CX agents at the ticket sub-type level. Based on this usage and new custom responses, Maersk has set up an incremental learning pipeline to fine-tune the model, improving recall and precision of recommendations
- **Scale:** The Maersk team created a single API for Salesforce to share case details, manage queuing, and split between auto resolutions and email response recommendations. The architecture accounts for single-point failures from Microsoft GPT APIs for GPT-3.5 Turbo and ADA text embeddings and efficiently handles peak case volumes across countries
- **Responsible AI:** The NLP/Gen AI models were evaluated for bias, and no disparities were found. Artifacts and results are shared with the AI ethics team to address potential bias and disparities

continually. The solution ensures data security by preventing unauthorised access to data and insights

- Maersk has an AI ethics and legal team aligned with a governance structure ensuring fair and legal AI use and preventing social or economic injustice. The AI team and product owners openly discuss concerns with this team, identifying legal/ethical risks and taking corrective measures. Maersk follows clear policies, protocols, and procedures for ethical data sourcing. Monthly audits ensure unbiased AI models. Explainable models are used to understand system workings, with human-in-the-loop architectures to evaluate fairness. The AI models are scrutinised for misuse potential, with robust systems to withstand adversarial attacks

**Potential Scale and Impact of The Solution**

The solution enhances efficiency by enabling agents to deliver highly customised responses with precise information like names, codes, IDs, URLs, dates, and ETA. This ensures accurate interactions and helps new agents understand email context for appropriate responses. It improves user experience, customisation, and scalability, driving operational efficiency and customer satisfaction.
Designed for 15K CX agents, the global solution streamlines case resolution and transforms ocean business operations, impacting 32 million cases annually. They plan to extend its impact to other Maersk products, such as landside transport, further solidifying its transformative potential.

**Impact on Key Performance Metrics**

***Operational Excellence:***

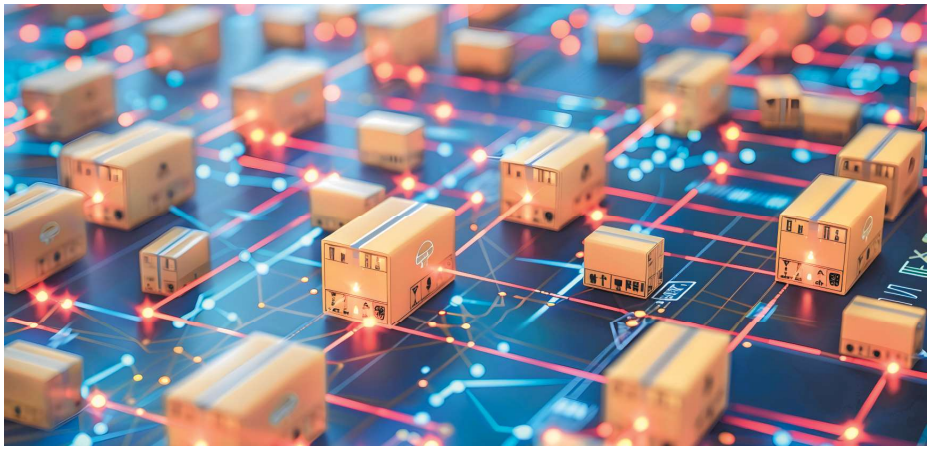
- *15K CX agents use the tool, saving 10-12 minutes per disputed case by avoiding validation from multiple systems*
- *Agents save 3 minutes per case by not having to comprehend customer issues from emails thoroughly*
- *The solution saves 7 minutes per case by automating reply typing TAT for dispute/complaint cases was reduced by 21 minutes and 9 minutes for other cases, saving 300K hours of manual effort, equivalent to man-hours of 200 full-time employees annually.*

***Customer Experience:***
*Post-2023 rollout, NPS rating up by +0.27*

***Revenue Optimization:***
*Decreased revenue leakage from $1.2M to $0.8M in specific geographies*

TRANSPORT & LOGISTICS
CHALLENGER

**DHL Information Service**



# DHL INFORMATION SERVICES: SMART ECO-PACK

***Industry:*** *Transport & Logistics*
***Business Function:*** *Operations, Software & Applications*
***Beneficiary:*** *DHL Global – Customer solution innovation*
***Technologies used:*** *AIOps*

### Innovative IT Solutions for Seamless Global Supply Chains

DHL IT Services provides top-tier IT solutions and infrastructure, ensuring smooth international supply chains. The company leverages robotics and automation to digitalise routine tasks and utilise big data and machine learning to combat cybercrime in global trade.

### The Importance of Addressing Packaging Optimization

The Carton Optimization Project is crucial for sustainability, cost efficiency, operational commitment to excellence and responsible business practices. Optimised packaging can reduce wasted space by up to 50%, cutting extra truckloads and unnecessary transportation and significantly lowering carbon emissions.

**Objective:**

The Carton Optimization Project aims to optimize packaging in logistics and supply chains while addressing key issues:

- **Suboptimal Space Utilization:** Traditional packaging wastes space, increasing shipping costs and carbon footprint
- **Environmental Impact:** Excess packaging creates waste and higher emissions. DHL aims to reduce its ecological footprint with more innovative packaging
- **Cost Inefficiencies:** Inefficient packaging raises costs. The project seeks to cut costs without compromising safety

• **Operational Streamlining:** Inconsistent packaging causes bottlenecks and delays. AI-driven optimisation standardises and streamlines operations

**Solution Overview:**

**Data-Driven Analysis**

• Aggregates historical shipment data (product dimensions, weight, packaging materials)

• AI algorithms analyse patterns and trends for optimal packaging requirements Machine Learning Models

• Trained on historical data to predict optimal carton sizes and configurations

• Models continuously learn and improve with more data

**Predictive Analytics**

• Forecasts optimal packaging solutions based on real-time demand and seasonal variations

• Proactively adjusts strategies to meet changing requirements Algorithmic Optimization

• Analyses item dimensions and characteristics (fragility, stacking capabilities)

• Recommends efficient carton sizes to minimise wasted space and ensure item safety

**Continuous Improvement**

• Regularly assesses model performance, incorporating feedback for enhanced accuracy

• Ensures the system remains adaptive to evolving logistics challenges Integration with Operational Systems

• Seamlessly integrates with DHL's operational systems for real-time application

• Streamlines the packaging process, reducing manual intervention and ensuring consistency

**User-Friendly Interface**

• Provides an interface for logistics personnel to review and approve carton optimisations

• Ensures a collaborative and user-centric approach Sustainability Metrics


• Tracks reductions in packaging materials, waste, and carbon emissions.

• Provide insights for DHL's sustainability reporting

**Data Solution Implementation and Overcoming Challenges**

Iterative refinement and continuous improvement kept the solution adaptive to evolving logistics complexities. The solution efficiently handles high volumes of transactions, optimising carton configurations for many shipments across various industries. Collaboration with data experts, stakeholders, and end-users was crucial in overcoming challenges and achieving a robust data-driven solution.

**Achievements and Impact of the Carton Optimization Solution**

• ***Cost Savings:*** Significantly reduced wasted space and additional shipments, resulting in substantial cost savings for DHL and its clients

• ***Environmental Sustainability:*** Reduced packaging materials, waste, and carbon emissions indicate DHL's commitment to ecological sustainability

• ***Customer Satisfaction:*** Improved operational efficiency, faster delivery times, and reduced shipping costs

• ***Industry Leadership:*** The successful implementation of AI positions DHL as a leader in logistics innovation

• ***Global Reach:*** The solution operates in numerous countries and regions and seamlessly integrates into DHL's global logistics network

• ***Diverse Product Portfolio:*** Manages a wide range of products, from small parcels to large shipments, covering diverse industries, product types, packaging requirements

• ***Real-time Adaptability:*** Operates in real-time, dynamically adapting to demand fluctuations, changes in logistics patterns, and evolving product portfolios, ensuring continuous optimisation

• ***Scaling Globally:*** The project will scale globally, reaching new markets and increasing shipment volumes optimised for cartons

TRANSPORT & LOGISTICS
INNOVATOR

**Capgemini Technology Services India Limited**

# CAPGEMINI: AI IN COMPLIANCE AUDITING

***Industry:*** *Transport and Logistics*
***Business Function:*** *Operations*
***Beneficiary:*** *Network Rail, UK (Rail infrastructure management organisation)*
***Technology used:*** *NLP*

## Capgemini: Transforming Businesses with Technology

Capgemini is a global leader in helping companies transform and manage their business through technology. Guided by a purpose of using technology to unleash human energy for a sustainable future, Capgemini is a diverse organization with 360,000 team members across 50+ countries. With over 55 years of industry expertise, Capgemini addresses all business needs, from strategy and design to operations, leveraging advancements in cloud, data, AI, connectivity, software, digital engineering, and platforms.

For the UK's largest rail infrastructure management company, Capgemini developed an AI-powered web tool to analyse safety-critical communication call recordings, enhancing rail operations and safety compliance.

### Specifics of the Problem Identified

- Network Rail aimed to test AI feasibility for automating and analysing track possession request calls to determine employee training needs
- Prioritized safety, reliability, and efficiency
- Managed 5,000+ calls between maintenance workers and signallers for trackside maintenance
- Conducting random audits by the operational team on these calls to verify compliance with safety standards

Sought to use AI for auditing compliance of every call to improve compliance with safety-critical communication (SCC) standards.

- AI tool tested random calls, measuring adherence to SCC standards
- Used tech frameworks like AI, cloud computing, and SQL databases
- AI tool enabled 100% call audits, significantly reducing analysis time

### Importance of Solving This Problem

- Enhances rail safety by auditing critical communication calls
- Improves trackside operations through better compliance
- Ensures effective communication between track workers and signallers

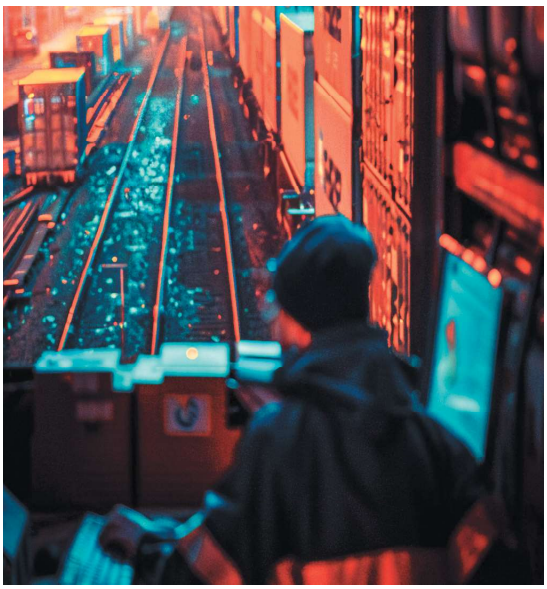
**Capgemini's AI-Based Solution**

Data is essential for insight, but it must be reliable and usable. Capgemini's full-service portfolio leverages AI and Generative AI (GenAI) and helps clients harness data's transformative power. The solution included the design of a custom speech-to-text model using OpenAI Whisper. The solution:

- Audited calls and assessed compliance
- Improved critical communication and identified employee training needs
- Enhanced adherence of Safety Critical Communication standards
- Implemented a custom NLP algorithm to analyze calls on Clarity, Completeness, Compliance, and Focus
- Promoted continuous improvement and a safer working environment

**Data Solution and Implementation Challenges**

- Recordings were business-critical and restricted to the UK, necessitating a secure local network
- Used Whisper Foundation model for client deployment
- Trained a custom STT model with 200 call recordings, averaging 6 minutes each, totalling 20 hours
- Training data provided by Network Rail; AI model trained within the client's environment due to data confidentiality
- Enhanced call transcripts with a custom neural network



**Risk & Governance and Competitive Landscape Challenges**

**Limited Data Availability:** Insufficient training audio data for the custom speech-to-text model

**Data Quality:** Railway-specific terms and abbreviations caused incorrect spellings and grammar in text outputs

**Background Noise:** High noise levels in some recordings affected transcription accuracy

**SCC Manual Alignment:** Difficulty in training a generic model due to misalignment with the SCC Manual

**Governance**

- Milestone-based project planning pre-agreed with the client
- Discovery workshops to set expectations and finalize the tech stack
- Regular sync-ups with client and internal teams to monitor progress
- Feedback mechanism to improve the solution promptly
- Collaboration with Network Rail's technical teams to enhance the STT model with specific terms

**Highlights**

- **Contextualized Problem Solving:** Accurately converted technical terms into grammatically correct transcripts of safety-critical conversations
- **Custom Fine-Tuned NLP:** Performed call quality audits and identified missing information
- **Client Adaptation:** Tailored to client-specific communication structures for accurate call audits

**Impact of AI Implementation**

- **Actionable Insights:** AI-driven analysis provided Network Rail with guidelines for using AI to analyse critical communications
- **Training Cost Savings:** Personalized training recommendations reduced enterprises' training costs
- **Operational Efficiency:** Improved adherence to Safety Critical Communication Standards led to clear communication, effective trackside maintenance, and enhanced rail safety
- **Automated Audits:** Achieved 100% automated call quality audits, improving safety compliance
- **MVP Trial:** The solution, trailed as a minimum viable product, demonstrated AI feasibility for SCC call audits
- **Efficiency Gains:** Saved 300 hours per month and achieved 85% accuracy in call quality audits

- **Future Plans:** Discussing scaling the solution in Control Period 7 over the next five years
- **Responsible AI:** Ensured reliability in AI outputs to maintain operational efficiency and safety

### Future Scalability of AI Solution

#### Future Potential

- **Scalable Industrial Solution:** Plans to develop a scalable solution for analysing safety-critical communications in the travel and transport sectors
- **Guidelines and Framework:** Provide industry guidelines and a responsible AI framework for implementing AI in safety-critical communications

#### Future of Solution

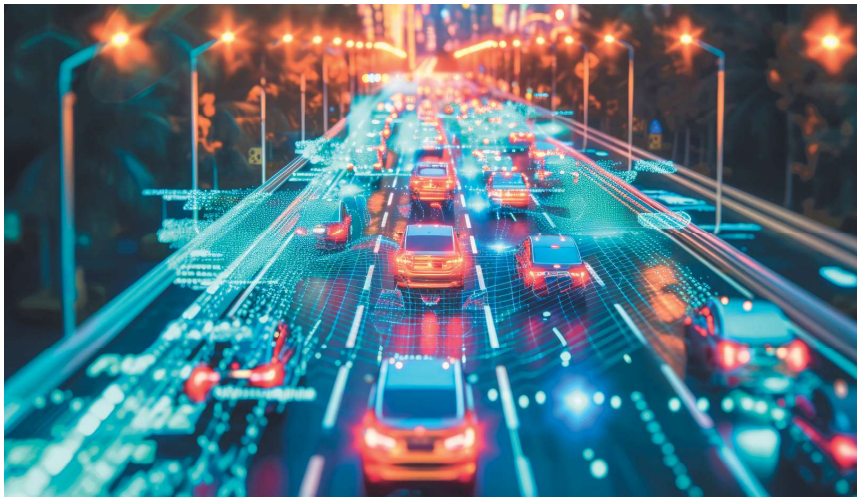
- **Portability:** Web-based platform, easily portable for other clients
- **Improved Accuracy:** Enhanced custom STT and NLP models for more accurate outputs
- **Cross-Functionality:** Applicable to various railway

safety-critical calls, beyond just track workers and signallers

- **Cross-Industry Application:** Relevant for other sectors like airport operations and warehouse communications
- **Flexible Tech Stack:** The solution is platform-independent, open-source, and easy to scale

TRANSPORT & LOGISTICS
GAMECHANGER

**AI Unika Technologies Pvt. Ltd.**



# AIUNIKA TECHNOLOGIES: AI-POWERED ROAD INFRASTRUCTURE MONITORING SYSTEM

***Industry:*** *Transport and Logistics*
***Business Function:*** *HR, Marketing & Sales, Software & Applications, Operations, Business Intelligence, and Customer Service*
***Beneficiary:*** *Public Sector Infrastructure Projects*
***Technologies used:*** *Generative AI, Computer Vision, AIOps*

## AI Unika Technologies: Enhancing Road Safety

AI Unika Technologies addresses critical challenges in the public sector, with specialization in road safety.
Their flagship product is an innovative AI-based road construction and quality monitoring system that is designed to tackle key issues in infrastructure projects, with a focus on optimizing costs, expediting timelines, and facilitating streamlined issue identification.

**Why Solving This Problem is Critical?**

Bad road conditions could lead to problems of road safety, impact infrastructure quality, and cause inconvenience to the public.

**AI-Driven Transformation:**

AI Unika Technologies leverages AI to address inefficiencies in traditional public-sector road construction and infrastructure projects.

- **Road Defects Identification:** AI algorithms detect and identify road defects for proactive maintenance and safety
- **Road Assets Monitoring:** Real-time AI monitoring manages road assets for efficient resource allocation
- **Road Conditions Assessment:** AI models assess road conditions, enhancing maintenance and improvement strategies
- **Road Features Identification:** AI-powered image recognition identifies and categorises road features, aiding infrastructure understanding

### AI-Enhanced Solution

1. Data Analysis: AI algorithms analyse data from sensors, 3600 cameras, and maps to accurately assess road conditions and detect issues like potholes and cracks

2. Predictive Maintenance: AI predicts road defects and deterioration using historical data and real-time monitoring, enabling proactive maintenance to prevent costly repairs and ensure safety

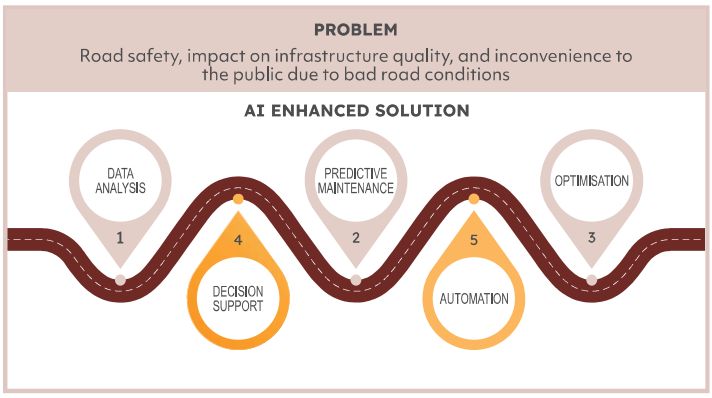
3. Optimisation: AI optimises route planning for autonomous vehicles and logistics, identifying pothole-free routes and reducing travel time, fuel consumption, and vehicle wear

4. Decision Support: AI systems provide road authorities and urban planners with actionable insights and recommendations, helping them prioritise maintenance and resource allocation

5. Automation: AI automates inspection and monitoring, reducing manual intervention and enabling continuous road condition surveillance for faster defect detection and response

### Process and Comprehensive Road Dataset for AI Analysis

- Volume: The dataset generated from video recordings is converted into images, resulting in a substantial volume of image data
- Data Type: Primarily image data extracted from videos; each frame is input for AI model analysis
- Variety: Captures diverse road-related information, incl. conditions, defects, features, and assets, enabling comprehensive analysis
- Data Sources: Videos recorded via the application capture real-time road infrastructure, enriching the dataset and improving accuracy




- Complexity: The dataset's dynamic nature and high frame rate conversion creates complexity, requiring robust AI models to handle the diverse and voluminous data effectively

### Data Solution

The solution collects, processes, and analyses images from video recordings to monitor road conditions, defects, features, and assets. The data trains and tests AI models, and results are mapped to represent road infrastructure visually

### Scalability, Profitability & Limitations:

- Scalability: Easily grows with cloud resources, integrates with GIS systems, and collects data via mobile app or 360-degree camera
- Portability: Cost-effective for global governments and firms
- Limitations: Cloud computing constraints like downtime and data quality risks

### Challenges and Implementation

**Challenges Faced:**

1. Data Volume and Processing
2. Data Silos
3. Data Security
4. Data Accessibility
5. Data Availability
6. Model Training Challenges

**Overcoming Challenges:**

- Iterative Development: Regular reviews and refinements address evolving challenges
- Collaboration: Engaging stakeholders provide insights and feedback for effective solutions
- Continuous Monitoring: Robust systems identify and address potential challenges in real time

**Impact and Key Performance Metrics**

***Revenue Optimization:***

- *Timely defect resolution minimises unexpected costs, enhancing budget efficiency*

***Operational Efficiency:***

- *Real-time monitoring and automated defect detection streamline operations*
- *Accelerated decision-making improves resource allocation and project timelines*

***Customer Experience:***

- *Reduced disruptions and improved road safety enhance public satisfaction*
- *Positive feedback from stakeholders on efficient road maintenance*
- *Maintains high-quality roads, improving daily life for citizens*

***Improved Safety:***

- *Quicker defect resolution reduces accident risks*
- *Enhances road safety by promptly addressing defects*

***Reduced Environmental Impact:***

- *Optimizes resource use and construction practices, minimising disruptions and waste*

*Efficient Resource Allocation:*

- *AI-driven insights enable effective resource use and project prioritisation*

***Transparent Monitoring:***

- *Real-time reporting enhances governance transparency for stakeholders*

TRANSPORT & LOGISTICS
CHALLENGER

**RoadVision AI Private Limited**

# ROADVISION AI: AI-POWERED ROAD INFRASTRUCTURE MANAGEMENT

***Industry:*** *Transport & Logistics*
***Business Function:*** *Infrastructure management*
***Beneficiary:*** *Private entities, central and state government authorities & municipal corporations*
***Technologies used:*** *Computer Vision*

## RoadVision AI: Revolutionizing Road Infrastructure Management

RoadVision AI is a technology startup that leverages the power of artificial intelligence, digital twins, and GIS technology to transform road infrastructure management. It empowers road authorities, infrastructure entities, and communities worldwide to improve road safety, enhance transportation efficiency, and promote sustainable development.

### Why Solving This Problem is Critical?

Inefficient and inaccurate road maintenance can cause frequent road deterioration. This is the leading cause of traffic congestion and transport delays that result in significant economic losses. In addition, deteriorated roads are one of the crucial reasons for road accidents resulting in injuries and deaths.

### Beneficiaries of AI-Powered Road Management

RoadVision AI collaborated with several intelligent cities and municipal corporations in India, incl. Jalandhar, Raipur, and Vizag, and they are currently piloting with additional smart cities and state highway authorities.

### Challenges in Road Infrastructure Management

Road infrastructure maintenance is inefficient. Entities still rely on manual surveys, spreadsheets, and traditional judgments. Hardware-based inspections are faster, but missed issues are not

directly encountered. Scanner vans (NSVs) with sensors like LiDAR, radar, thermal cameras, and GPS are effective but costly and require special training. Identifying road conditions from NSV video feeds remains manual and error-prone. Manual data processing and lack of analysis hinder effective, data-driven decision-making.

**RoadVision AI: Advanced Road Infrastructure Management**

- RoadVision AI uses AI, Digital Twins, and GIS-powered Enterprise-SaaS for efficient road infrastructure management
- Automated data collection through a smartphone-based GIS application, compatible with data from dashcams, drones, NSVs, etc.
- Analysis of survey data using AI to identify road defects, markings, signs, assets, and other relevant information, adapting to unique datasets
- Presentation of processed data on a web-based GIS platform with intuitive dashboards, colour-coded segments, business intelligence tools, and downloadable reports for effective decision-making, survey management, budgeting, activity assignments, progress tracking, and collaboration

**Building RoadVision AI: Overcoming Challenges and Enhancing Road Management**

Developing RoadVision AI faced challenges with training data for Indian road conditions. Due to insufficient open-source data, the company collected >10,000 km of high-quality road data in-house. Ensuring a continuous flow of high-quality data for real-time analysis while maintaining security and efficiency was crucial.
Their system uses this comprehensive dataset to understand diverse road conditions, enhances health assessment, and provides detailed insights for road authorities. This aids informed decision-making and supports good governance practices. Compared to traditional surveying methods, this AI platform automates data processing and analysis, saving time and cost while improving efficiency and accuracy.

**Challenges in Implementing RoadVision AI**

Implementing RoadVision AI involved managing vast and varied data. During development, a critical focus was on ensuring a continuous flow of high-quality data for real-time analysis while maintaining security and efficiency.

**RoadVision AI: Transforming Road Management**

RoadVision AI improves road management by replacing manual surveys with advanced technology, ensuring efficient maintenance spending. Its Road Asset Management System (RAMS) detects issues early, extending road lifespan and preventing costly repairs. RoadVision AI promotes collaboration between private companies and the government for enhanced road care.
By leveraging modern technology and supporting global goals for safer, sustainable transport, RoadVision AI contributes to environmental preservation and facilitates informed decision-making, leading to healthier roads and improved overall infrastructure.

**Impact on Key Performance Metrics**

*75% improvement in operational efficiency - manual road surveys typically take a month; these are now completed within a week*

Impact of RoadVision AI on Environment, Social Impact, and Governance

***Environment:*** *Optimising maintenance and preventing costly repairs through early detection of issues*

Social Impact

- ***Improved Road Safety:*** *RoadVision AI prioritises road safety, leading to safer transportation environments with fewer accidents*
- ***Community Collaboration:*** *The solution engages with local communities, addressing real-world needs and fostering a positive social impact*

TRANSPORT & LOGISTICS
INNOVATOR

**Dave AI**

# DAVE AI: NEXAVERSE: GRAND VITARA LAUNCH CAMPAIGN

***Industry:*** *Transport and Logistics*
***Business Function:*** *Marketing & Sales; Customer Experience*
***Beneficiary:*** *Maruti Suzuki India Limited*
***Technologies used:*** *AR/VR, NLP, Computer Vision, Speech & NLP, 3D Visualization*

**Objective:** Establish brand positioning for a yet-to-be manufactured care model / launch, promote, and sell a commercially launched product (car) for bookings with limited physical inventory

## Dave AI: Humanizing Digital Conversations

Dave AI humanises digital interactions using conversational and visual AI. Integrating diverse AI models and vector databases creates immersive, human-like encounters that drive revenue and enhance customer discovery. Dave AI's Virtual Sales Avatar bridges offline salesperson-assisted experiences and online self-assisted discovery, offering natural interactions, real-time hyper-personalized recommendations, and combining Speech, NLP, 3D Visualization, and real-time recommendations. This platform's Empathetic AI and Adaptive Learning Algorithms boost revenue growth and enhance customer journeys in sectors like Automotive, BFSI, and Lifestyle Retail.

## Identifying the Challenge

**Maruti Suzuki's Grand Vitara Pre-Launch Strategy:**

Maruti Suzuki was confronted with a significant challenge: Launching the Grand Vitara, a new car model, that had yet to be produced. They aimed to generate a buzz among young, tech-savvy customers. To overcome this, the NEXAverse metaverse platform was developed, a unique solution that offered a virtual showroom experience. This platform allowed customers to experience and book the Grand Vitara within the virtual environment, making the process convenient and engaging. The result was a successful pre-launch campaign that effectively generated interest and excitement.

## Importance of Solving the Problem

Considering market dynamics and customer preferences, addressing this problem became vital for a successful Grand Vitara launch.

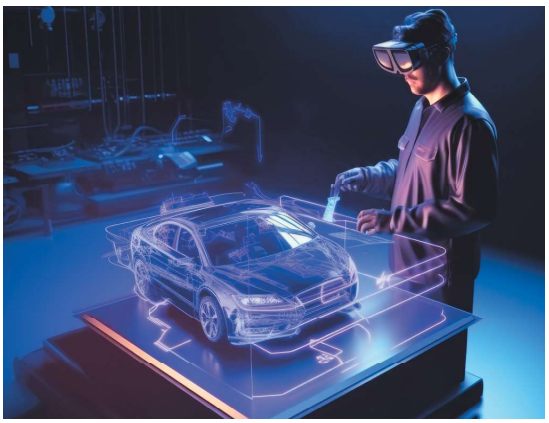
- **Pre-launch Engagement:** Generating early interest in a new car not yet in production was crucial to capturing potential customers' attention
- **Target Audience:** Young, tech-savvy customers prefer digital experiences
- **Booking Process:** Allowing direct booking within the virtual platform enhances convenience and accelerates the sales cycle
- **Brand Awareness and Engagement:** Building a solid brand presence and engaging customers pre-launch, fosters anticipation and positive perception
- **Technology Adoption:** Developing the NEXAverse platform showcases Maruti Suzuki's commitment to innovation and digital adaptation

**Leveraging AI to Address the Challenge**

- **Personalised Recommendations:** Algorithms analyse user behaviour and preferences, tailoring recommendations and interactions to enhance engagement and satisfaction
- **Brand Avatar:** The AI-driven avatar guides users through the platform, helping them explore the Grand Vitara and make informed purchase decisions, improving user experience and brand connection
- **Data Analysis and Insights:** DaveAI's algorithms provide insights into user behaviour and trends, informing Maruti Suzuki's marketing strategies, product offerings, and optimisation
- **Automated Customer Support:** The virtual assistant offers automated support, addressing inquiries, resolving issues, and assisting with bookings, ensuring 24/7 customer satisfaction and quick response times
- **Enhanced Marketing Campaigns:** Customer data analysis enables effective audience segmentation and personalised marketing, maximising impact and efficiently attracting potential customers
- **High-Quality Visualization on Low GPU Devices:** AI optimises visual quality for devices with low or no GPU, ensuring scalability and achieving desired RoI

**AI Governance**

- **Data Privacy and Protection:** Prioritized user data privacy with robust encryption, anonymisation, and access controls to safeguard sensitive information
- **Fairness and Bias Mitigation:** Mitigated bias in AI algorithms through bias assessments on training data, decision-making processes, and user interactions
- **Transparency and Accountability:** Ensured transparency in AI operations and established accountability mechanisms like audit trails and compliance frameworks
- **User Empowerment and Control:** This feature gave users control over their data and interactions, allowing them to manage privacy settings and opt out of data collection
- **Ethical Use of AI:** Adhered to ethical standards in AI development, ensuring responsible and ethical use to enhance user experiences without causing harm or discrimination



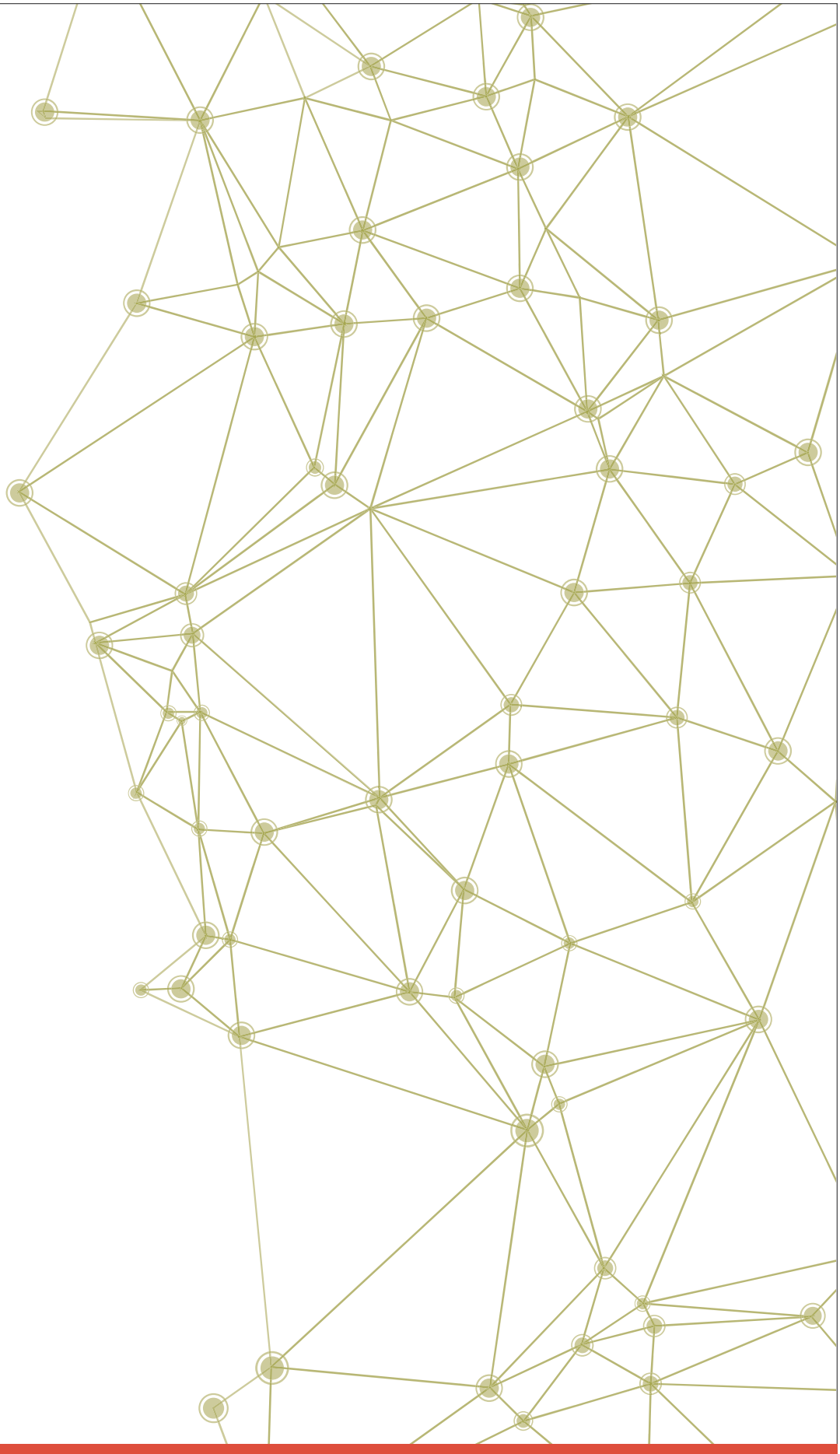
**Solution Innovation**

**Approach**

- Use AI (Conversational and Visual) to bridge the online/offline gap with a virtual store featuring life-like product visualisation and a virtual sales avatar, mimicking the physical sales process. This involves a Hybrid AI Stack (Conversational + Visual + Edge)
- Replicate the offline car discovery process in a virtual showroom with AI Sales Avatars. The showroom provides a near-life-like experience accessible in showrooms, at events, and on the website
- **Virtual Sales Avatar:** An AI salesperson trained on the car's features, integrated with enterprise data, to guide users and encourage positive purchase decisions
- **VR Virtual Showroom:** Personalized scenes based on user persona and discovery stage
- **Usage:** 75,000 users accessed the platform; 92,000 interactions recorded; 84,000 sessions logged

**Impact Metrics**

- *>50% Improvement in Engagement*
- *>25% Improvement in Lead Qualification*
- *>30% Improvement in Upsell/Cross Sell – Product Mix Optimization*
- *21% of bookings came from platform users*
- *54% KPI-centric queries, indicating practical user guidance towards purchase decisions*
- Revenue Optimization: *Achieved an 18% conversion rate, surpassing the target by 80%*



# ENERGY AND UTILITIES

ENERGY & UTILITIES
GAMECHANGER

Adani Green Energy Ltd.

adani Renewables

# ADANI GREEN ENERGY: ADVANCED LONG-TERM RESOURCE FORECASTING APPLICATION

***Industry:*** *Energy and Utilities*
***Business Function:*** *Business Intelligence, Operations*
***Beneficiary:*** *Financial Institutions& RE Investors, Internal users (Business Development, Resource Assessment and O&M)*
***Technologies used:*** *AIOps*

Adani Green Energy Limited (AGEL) is a crucial influencer in India's renewable energy sector. With a robust portfolio of 20,434 MW across solar and wind projects, AGEL is a driving force in the industry. Backed by long-term PPAs with government entities, AGEL operates in 12 states with 54 projects running and 12 more under construction, actively shaping India's renewable energy agenda.

**Challenges in Renewable Resource Forecasting**

India aims to achieve 500 GW of renewable energy capacity by 2030, comprising 50% of its energy needs. Rapid solar, wind, and hybrid plant installation is crucial to meet this goal. However, the variable nature of renewable resources, driven by dynamic weather patterns and exacerbated by climate change, poses significant challenges. Fluctuations in solar radiation and wind patterns impact generation targets (P50), affecting project viability and hindering infrastructure development. Accurate resource forecasts, critical from project conception to operations, are essential for feasibility assessments, regulatory compliance, bid pricing, and cash flow projections.

Globally, resource projections based on historical averages often underestimate year-to-year variations, leading to financial implications such as reduced equity IRR. These uncertainties jeopardise project financing and impede India's renewable energy expansion to meet ambitious 2030 targets.

**Importance of Addressing Resource Projection Challenges**

Globally, resources are projected based on the historical averages of solar radiation and wind speeds over the past 15-20 years. These averages are then used to estimate the production yield for the lifespan of a plant (the next 25 years). This approach assumes that the long-term historical averages of these resources will remain consistent over the plant's 20–25-year lifespan. However, this assumption has led to year-on-year deviations in solar and wind resources.

A mere 1% drop in irradiation or wind speed can lead to a significant 0.4%-0.6% drop in equity IRR for solar/wind portfolios across lifecycle, underscoring the importance of precision in the forecasts. In addition to this, year on year variation in weather lead to inaccurate resource estimation from 6% in case of Solar & 12 % for wind resources, thus affecting yearly cash flow.

The need to address these inaccuracies is not just crucial, but it's a matter of enhancing the reliability of renewable energy forecasts and ensuring sustainable energy planning and development. The potential impact of actions in this regard is immense.

**AI-Powered Forecasting Solution for Renewable Energy**

An AI-driven approach integrates data from SCADA systems and satellite sources via OPC to the cloud to enhance wind speed and solar irradiation forecasts. Wind speed predictions are refined by vertically extrapolating data to hub heights using empirical formulas. Machine learning models leverage local meteorological station data and satellite inputs, optimising data distribution via a pre-analytics engine. These models predict conditions at specific locations through hyperparameter tuning, generating forecasts for hourly (1-year horizon) and monthly aggregated (25-year horizon) values using a post-analytics engine for further refinement.

**Complexity of Dataset: Volume, Type, and Sources**

The dataset for the application includes:

1. Historical plant data (solar irradiation and wind speeds at hub height) with 10-minute logs spanning 5 to 6 years

2. Historical satellite data from 2005 covering global solar irradiation, wind speed, El-Nino events (ENSO Index), NDVI data, Aerosol Optical Depth (AOD), Sea Surface Temperature, and IPCC scenarios

3. Local weather station data managed by various national weather organisations

These data points exceeded 3 TB in size and are incrementally updated over time, posing significant volume and variety challenges.

**Data Solution Implementation and Challenges**

Implementing the data solution involved addressing challenges such as average sensor data quality, outliers, and data stuck issues, managed through pre-processing techniques in the pre-analytics phase. Monthly satellite data extraction and storage in ample cloud storage posed another hurdle due to file size and time-consuming information extraction. Data segmentation into quadrants based on coordinates and coordination overlap features was implemented to optimise processing. Initially, algorithm runtimes were lengthy, requiring up to 6 hours per location. Refinements reduced this to 2 hours per run, with ongoing research focused on further efficiency improvements.

**Scale and Impact of the Solution**

*Financial Stability: The solution supports accurate revenue budgeting year-on-year, enhancing financial stability. It enables precise financial planning for new plants with 96% to 98% accuracy over 25 years.*

*Environmental Contribution: By accurately predicting energy supply from wind and solar sources, the solution optimises renewable energy use, reducing reliance on fossil fuels and mitigating climate change.*

*Social and Economic Impact: Ensuring the viability of renewable energy projects attracts investments, creates jobs, and fosters socio-economic development, particularly in rural areas.*

***Governance and Responsibility:***

*Adhering to responsible AI principles ensures fairness, reliability, privacy, security, transparency, and accountability, aligning with regulatory standards and building stakeholder trust.*

***Operational Efficiency and Innovation:***

*The application enhances resource allocation, efficiency, and customer satisfaction. It sets industry standards with Machine Learning for forecasting, Agile practices for deployment, and GCP Dataflow for backend processing, driving sustainability in the renewable energy sector.*

**Potential Scale and Impact**

The application improves solar and wind resource annual forecasting accuracy to 98% and 96% respectively, for the next 1 to 25 years. This precision significantly reduces revenue gaps caused by resource estimation errors, projected to be up to ₹1,400 crores annually for a 25GW portfolio. It supports efficient resource allocation, new plant financial planning, and operational asset revenue budgeting.

**Scalability and Infrastructure:**

Hosted on GoogleCloud Platform, the application scales dynamically to handle multiple solar and wind

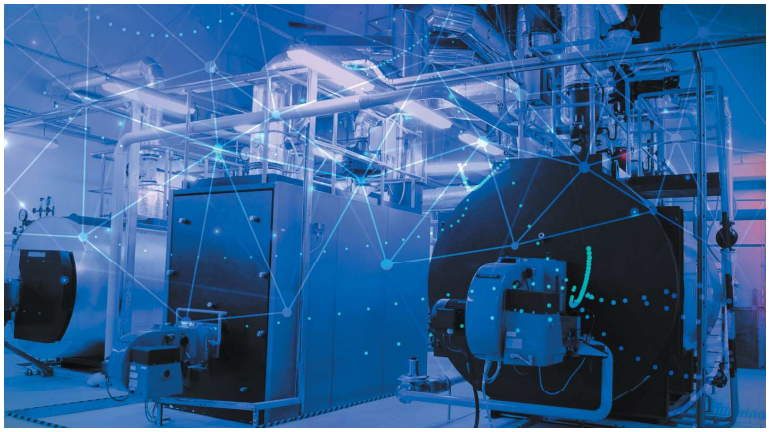
projects simultaneously, ensuring high availability and operational reliability without downtime.

**Global Reach:**

Leveraging weather and site-specific data, the application provides forecasts for international locations, including pioneering installations like the Khavda Hybrid Plant (Gujarat), Jaisalmer (Rajasthan), and Sri Lanka, as well as AGEL's operational portfolio of 10GW.

ENERGY & UTILITIES
CHALLENGER

**Thermax Ltd**



# THERMAX EDGE LIVE ®: ENTERPRISE ASSET PERFORMANCE ENHANCEMENT SOLUTION

***Industry:*** *Energy and Utilities, CPG & Retail, Healthcare & Pharma, Manufacturing & Industrial Automotive*
***Business Function:*** *Customer Service, Operations, Business Intelligence*
***Beneficiary:*** *Industries such as Power, Food & Beverages, Sugar, Paper and Packaging, Agro chemicals, Speciality Chemicals, Metal and Mining, Textile, Pharmaceutical, Cement Plants, Tyre & Rubber, and CPG*
***Technologies used:*** *Cybersecurity, AIOps, AI & ML, IIoT, OT & OT Security*

## Driving Digital Innovation in Energy Solutions

Thermax Limited leads in energy and environment solutions, offering a comprehensive portfolio that includes clean air, energy, and water technologies. With 14 manufacturing facilities worldwide and 37 subsidiaries, Thermax excels in audit, consulting, and maintenance, bolstered by digital expertise.

Their Digital Transformation Journey began over a decade ago, resulting in Thermax EDGE Live, a platform enabling real-time monitoring and optimisation of power plants and industrial assets like boilers and chillers. Transitioning from first principle to machine learning models, Thermax leverages advanced analytics to enhance operational efficiency and offer actionable insights, extending their impact to renewables and bio-CNG solutions.

### Enhancing Industrial Performance with EDGE Live

Thermax EDGE Live integrates Industry 4.0 principles with AI/ML technology, leveraging Thermax's expertise in Energy Transition. Recognising the need for centralised asset management and analytics, Thermax collaborates closely with clients to address critical challenges:

1. Detailed diagnostics and predictive analytics to prevent failures and downtime
2. Optimizing energy consumption and reducing carbon footprint
3. Knowledge management through automated reports, alerts, and best practice recommendations

Specific use cases of EDGE Live include timely detection of tube leakage in the Air-Pre Heater, optimising Biofuels for better calorific value, optimising the soot blower cycle, improving the steam-to-fuel ratio, and reducing CO2 emissions. Thermax EDGE Live® empowers customers with actionable insights, enabling effective navigation of challenges and attainment of business goals.

**Harnessing AI for Enhanced Operational Efficiency**

EDGE Live employs advanced AI techniques to enhance asset health monitoring. Utilising unsupervised learning, Thermax identifies abnormalities, supported by fault tree analysis, to pinpoint root causes and recommend solutions.

| CUSTOMER PERSONA | CHALLENGES |
|---|---|
| Plant Manager | • Reduced profitability due to inefficient equipment and plant operations<br>• Increased energy consumption leads to higher costs |
| Production Manager | • Frequent breakdowns of critical equipment, such as tube leakages, affect production |
| Maintenance Manager | • Remote site locations are causing delays in responding to breakdowns<br>• Limited visibility into the health status of assets |
| Sustainability Manager | • Limited affordable solutions for carbon footprint reduction and energy optimisation |

**Addressing Critical Industrial Challenges**

Industrial customers prioritise sustainability through energy-efficient operations, effective knowledge management, and proactive maintenance to enhance plant uptime. These initiatives drive cost reduction and sustain competitive advantages while ensuring compliance with environmental regulations.

For instance, preventing boiler tube leakage, a common issue in process industries is crucial for uninterrupted operations. Thermax EDGE Live employs unsupervised learning to analyse real-time data and predict such failures, highlighting the interconnected nature of these challenges and their impact on plant resilience and success.

Additionally, supervised learning in EDGE Live monitors sensor data, aligning actual outcomes with desired benchmarks to deliver actionable insights. Furthermore, leveraging pattern recognition, clustering, and regression algorithms, EDGE Live analyses critical plant metrics such as temperature, pressure, and fuel flow. This analysis optimises plant operations in real-time, improving efficiency and effectively reducing fuel consumption.

**Use Case: Cluster Analysis optimises soot-blowing cycles in the boiler.**

### Managing Complex Data in EDGE Live

Thermax EDGE Live efficiently handles diverse data complexities. It manages a large volume of sensor data, currently processing >1 million data streams in real-time from nearly 100,000 sensors with below 1-second latency. Leveraging Kubernetes for scalability and microservices for orchestration, EDGE Live ensures high reliability with over 99.5% SLA, supporting up to 5 years of data storage. Data types include parameters like temperature, pressure, and vibration, encompassing numerical values, Boolean data, timestamps, and offline lab reports. Sources range from sensors and DCS to PLCs and third-party clouds, ensuring comprehensive data integration for robust industrial insights.

### Implementing EDGE Live Data Solution and Overcoming Challenges

Thermax's EDGE Live solution captures data from Industrial assets via EDGE Gateway, securely transmitting it to the cloud. The raw data undergoes processing in the raw zone, involving cleansing, data rebuilding, normalisation, and enrichment. EDGE Live handles real-time and historical structured and unstructured data using machine learning algorithms, delivering insights through a dashboard. Real-time interaction between plant operations teams and Thermax's EDGE Live Operations Centre enhances operational intelligence.

### Challenges Faced and Solutions Implemented:

1. Operational Technology (OT): Implementing at MSME sites lacking DCS/PLC connectivity required a cost-effective hardware solution to capture live data, overcoming initial data availability challenges
2. Data Silos: Addressed accessibility issues by centralising disparate data silos into a unified data store for streamlined processing and visualisation across geographic locations
3. Data Security: Ensured robust data security through access controls, firewalls, disaster recovery mechanisms, data masking, and encryption protocols, incl. recommending firewall installations at customer premises
4. Data Processing: Managed initial data processing challenges by implementing auto-scaling cloud infrastructure to efficiently handle varying volumes and velocities of data flow

### Achieving Scale and Impact with EDGE Live

***Deployment and Asset Monitoring:***

*EDGE Live is operational at over 200 sites, monitoring 50+ asset classes, incl. Power Plants, Boilers and heaters, and Air Pollution Control equipment. The platform incorporates 200+ fault trees and 25+ predictive models to enhance operational efficiency.*

***Quantified Impact:***

*EDGE Live has achieved significant results, incl. reducing auxiliary power in power plants by 454 MW/year and saving 4000 tons/year of fossil fuels. It has improved steam-to-fuel ratio by up to 2% and reduced CO2 emissions by 5%. Additionally, the platform has avoided 300 hours of unplanned downtime and lowered operating expenses by 2%.*

***Customer Benefits:***

*The platform supports revenue optimisation by preventing unplanned downtime and improving production throughput. It enhances operational efficiency with reduced auxiliary power consumption and improved fuel efficiency. Early alerts and recommendations enable quicker customer service responses and shorter service lead times.*

***Environmental and Social Impact:***

*EDGE Live contributes to environmental sustainability by optimising energy consumption, leading to reduced carbon emissions. It promotes preventive maintenance through early failure detection, ensuring safer plant operations and accident prevention.*

*EDGE Live optimises fuel consumption, reduces carbon emissions, enhances operational efficiency and customer service, aligns with global sustainability goals, and fosters a safer industrial environment.*

### Scaling EDGE Live Globally

Thermax anticipates expanding EDGE Live to over 500 sites worldwide within the next two years, aiming to onboard over 8,000 assets and monitor over 200,000 input tags. Thermax has established operations centres with a dedicated customer success team to facilitate this growth. These teams ensure seamless monitoring and aim to enhance customer satisfaction by leveraging industrial asset analysis to deliver valuable insights.

ENERGY & UTILITIES
INNOVATOR

**Johnson Controls (India) Pvt. Ltd.**

# JOHNSONS CONTROL INTERNATIONAL: AI WORKER SAFETY SOLUTION

***Industry:*** *Energy and Utilities, Oil & Gas, Construction*
***Business Function:*** *HSE (Health, Safety & Environment) within an Oil & Gas company*
***Beneficiary:*** *HSE (Health, Safety & Environment) departments in Oil & Gas, Energy, and Construction industries*
***Technologies used:*** *Computer Vision*

## Johnson Controls: Pioneers in Smart Building Solutions

Johnson Controls, a global leader in smart buildings, has enhanced building environments for nearly 140 years. Utilising award-winning digital technologies and AI-driven solutions, they provide deep insights into building health, sustainability, and performance, ushering in an era of autonomous buildings.

Their comprehensive OpenBlue suite delivers future-ready solutions for healthcare, education, data centres, airports, stadiums, hotels, manufacturing, and more. AI is central to Johnson Controls' digital offerings, which are deployed both at the edge and in the cloud and tailored to customer preferences.

### Addressing Workplace Safety Challenges in Heavy Industries

Workplace injuries and accidents significantly impact business operations in Oil and gas, Construction, and other heavy industries. A primary challenge for Health, Safety, and environment (HSE) teams is the lack of visibility into near-miss incidents and unsafe acts. These sites' vast and remote nature makes daily, comprehensive inspections impractical, leading to potential safety gaps and preventable accidents.

Current manual observation methods fail to identify hazards and pose logistical challenges proactively. The AI Worker Safety Digital Solution addresses these issues by automating HSE monitoring, enhancing productivity, and reducing accidents.

Incidents result in substantial direct and indirect costs, affecting the company's finances, productivity, and reputation.

**Importance of Solving Workplace Safety in Oil & Gas**

Ensuring safety in high-risk Oil & Gas environments is critical. Protecting the workforce is a top priority for companies, driven by strict government regulations and workplace injuries' severe financial and reputational impact. The top causes of injuries include overexertion, falls, and contact with equipment.

Due to the nature of these locations, real-time data analysis and instant response are essential. Implementing Visual AI at the Edge offers 24/7 automated monitoring, proactively identifying hazardous conditions and enhancing safety compliance.

### AI's Role in Enhancing Safety

Manual safety inspections in Oil & Gas are insufficient and logistically challenging. AI and real-time video monitoring offer a solution by providing continuous, automated oversight.

**AI Capabilities**

- Analyses video for safety violations
- Monitors multiple scenarios and alerts for violations
- Ensures consistent, accurate monitoring

**Solution Description**

- Live CCTV video feeds are processed by computer vision software
- A deep learning AI model on the edge analyses the video for safety rule violations
- The system generates alerts, notifications, and logs of violations
- This information allows users to take immediate preventive action

### Dataset Complexity and Development

This project spans multiple years, utilising diverse training data from client sites to ensure robust model performance on rare classes. Months of video recordings under various conditions were converted into ~100,000 image batches for filtering and labelling. Continuous data acquisition and pre-processing improved model accuracy. Data augmentation, incl. gaming-engine-based synthetic images and conventional techniques like copy-paste augmentation with mask segmentation increased dataset diversity and size.

### Challenges, Governance, and Competitive Edge

**Risk & Governance**

1. Ensuring cameras are strategically placed to monitor relevant activities
2. Gathering extensive test data from challenging Oil & Gas sites
3. Relying on customer-provided data, as public datasets are unavailable, and managing logistical challenges during data collection
4. Manually labelling images for model training while maintaining high-quality standards, which can be complicated with external consultants
5. Deploying AI models on-site due to lack of internet connectivity at remote work sites for security reasons
6. Monitoring model performance remotely by running it for a week, then reviewing and improving it in extended cycles

**Governance Mechanism:**

Observability is crucial for AI model performance, and it is achieved through remote monitoring or offline logs based on customer architecture preferences.

**Key Competitive Advantage:**

This solution uses an edge-based AI deployment, unlike others that rely on cloud computing.
The AI model is deployed on a slight footprint edge compute box, enabling on-premise implementation.

## Impact and Scale

***Award:*** *Winner of the 2024 Artificial Intelligence Excellence Awards by Business Intelligence Group (BIG) - US*

***Implementation:*** *Deployed across 10+ sites with over 100 cameras*

***Key Benefits:***

- *Proactive hazard identification*
- *Regulatory compliance record maintenance*
- *Increased HSE team productivity*
- *Efficient contractor management*

***Detection Scenarios:***

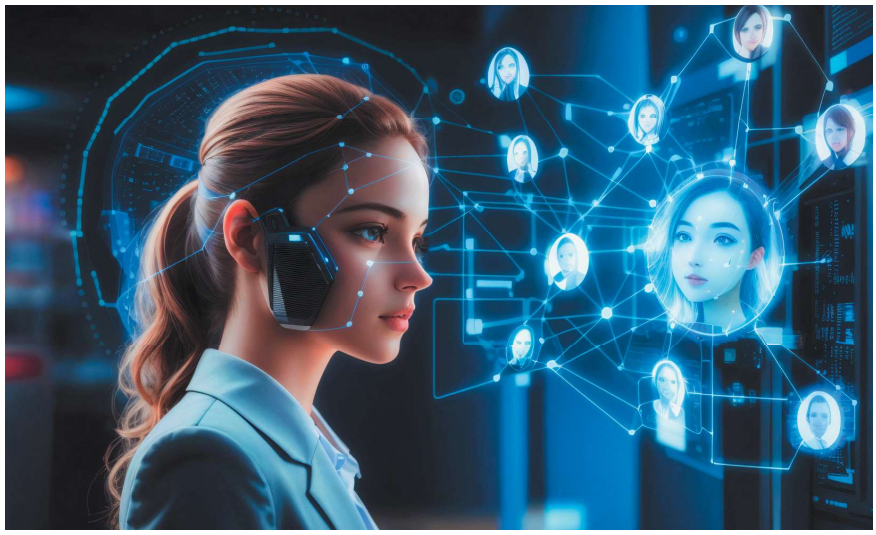
- *Safety gear compliance (PPE monitoring)*
- *Exposure to heavy equipment (e.g., dumpers, cranes)*
- *Work at height hazards*
- *Motor driving violations (e.g., no seat belt, cell phone use)*

**Potential Scale**

Potential to deploy over 1,000 cameras across multiple market segments.

ENERGY & UTILITIES
INNOVATOR

## Schneider Electric India



# SCHNEIDER ELECTRIC INDIA: CUSTOMER CARE CENTER (CCC) KNOWLEDGE BOT

***Industry:*** *Energy & Utilities*
***Business Function:*** *Customer Service, Marketing & Sales*
***Beneficiary:*** *Customer Care Center (CCC) Technical Agents, Customer Support teams under Global Marketing function; also End Customers*
***Technologies used:*** *NLP, AIOps, Generative AI/Large Language Models*

### Pioneering a Sustainable and Digital Future with AI

Schneider Electric is committed to solving real-world challenges to create a sustainable, digitised, new electric future. With over 20 years of machine learning and AI expertise, Schneider Electric has developed 15 AI-enabled solutions and over 20 internal AI applications. They manage over 4 million EcoStruxure™ assets globally, supported by three AI hubs and a team of 250+ AI and data experts.

**Problem Identification:**

**Enhancing Customer Support Efficiency with AI**

Schneider Electric's Customer Centre agents handle >2 million tech support cases annually through various channels like email, phone, and live chat. They use an elastic search tool aggregating 3.5+ million documents, incl. FAQs, historical cases, and product manuals.

**Pain Points:**

- **Information Search & Response Generation:** Traditional search methods failed to accurately pinpoint required information. Agents had to manually read through documents to find answers, slowing response times
- **Content Management:** Curating and managing FAQ documents from sources like product manuals was time-consuming. In addition, these documents needed to be available in 8+ languages, leading to inefficiencies

As a result, agents spent over 35% of their time searching for information.

**Reasons for Addressing the Problem**

**Opportunity for Massive Productivity Gains:**

- Agents spend nearly 100,000 hours annually resolving ~2 million technical cases
- The proposed solution could increase efficiency by around 35%

**Business Criticality:**

- Enhance customer experience by speeding up case resolution time
- Align with Schneider Electric's core value of "Customer First"

### AI-Driven Solution Overview

Generative AI (Large Language Model/GPT) based conversational assistant on the CRM console helps Customer Care tech agents find precise answers from various relevant knowledge sources tailored to the agent's language and attributes.

**Key Features of the AI-Powered Solution:**

1. Advanced Document Snippet Search:
Utilizes 'Semantic Similarity' techniques on Indexed Embeddings in the Vector Search database

2. Query Refinement:
Leverages GPT/Azure OpenAI to refine queries based on session transcripts and conversation context

3. Dynamic Response Generation:
Generates precise responses using the context and predefined prompts based on specific attributes

4. Classification & Intent Detection:
Uses LLM to classify queries and enhance response relevance

5. Personalization:
Achieves dynamic language understanding, translation, prioritised search, and access control with LLM
These components form an 'Advanced Retrieval Augmented Generation' system.

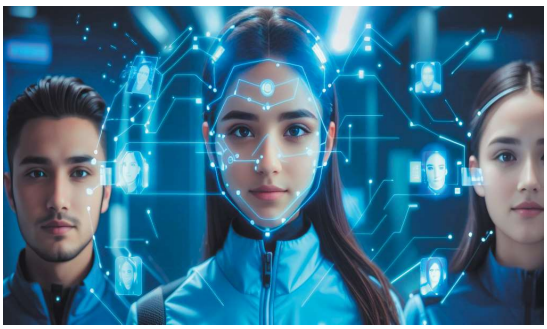
### Dataset Complexity Analysis

**Documents Volume Supported:**

- Current: <500,000
- Future Plan: >3 million

**Data Sources:**

- Salesforce, Enterprise Data Lake, Enterprise Web Pages



**File and Data Types Supported:**

- Current: Text from web pages, PDFs, docs, JSON via Enterprise APIs
- Future Plan: Images, tables, Excel files, etc.

### Data Solution Implementation and Challenges Overcome

Data solution involves:

1. Building data connectors to multiple sources

2. Parsing data from various document types mentioned above

3. Extracting images and tables from documents (In-progress)

4. Handling documents in multiple languages

5. Addressing incorrect meta-tags added in the source, necessitating additional checks and updates

6. Managing access control based on target user-persona and CCC tech teams on the Indexed and Vectorized data during the search

These efforts ensure robust data integration, parsing, extraction, and management across diverse document types and languages, enhancing accessibility and reliability for users and technical teams.

**Challenges and Competitive Landscape**

1. Data Pipeline Complexity:

- Ingesting documents from multiple sources and custom processing for optimal retrieval accuracy

2. Large Volume of Documents:

- Handling many documents, incl. data in tables and images and multiple unique scenarios

3. Reliable Process and Ground-Truth System:

- Implementing a reliable process and ground-truth system for offline evaluation to predictably improve accuracy from multiple experiments

4. Inline Evaluation:

- Performing reliable inline evaluation to determine routing rules based on specific metrics, effectively utilising LLM memory vs RAG vs fallback responses

5. Conversational Experience in Multiple Languages:

- Need for conversational experience in multiple languages, complicating the dynamic translation process due to the predominance of English in source knowledge

**Risks:**

Risks of providing inaccurate responses and hallucinations are low

## Scale and Impact of the Solution

***Achieved Scale:***

*1. Number of Requests Served:*

- *~3,500 prompts from CCC technical agents were served on average in the first quarter*

*2. Potential Time Saved:*

- *~1,000 hours: Estimated time saved for agents*

***Impact Metrics:***

*Operational Efficiency:*

- *35% higher productivity of technical agents globally, covering ~2 million customer cases annually*

*Customer Satisfaction:*

- *Global Net Promoter Score (NPS) tracked to measure the improvement*
- *Improved customer satisfaction due to faster response resolution*

*Employee Engagement:*

- *Enhanced employee engagement through more efficient workflows*

**Potential Scale and Future Scalability**

**Current Trend & Scenarios:**

Annual Requests Served/ Equivalent Number of Cases Supported: ~500,000+ customer cases annually

**Future Scalability:**

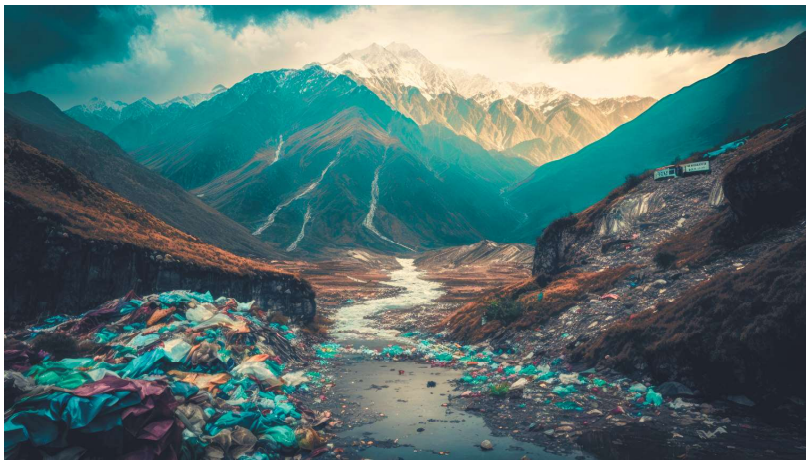
1. Monthly Requests Served (Expected): ~50,000 requests monthly

2. Monthly Potential Time Saved (of Agents): 10,000+ hours

ENERGY & UTILITIES
GAMECHANGER

Recykal

# RECYKAL: DIGITAL DEPOSIT REFUND SYSTEM, dDRS



***Industry:*** *Energy and Utilities, Sustainability Tech, Technology, Media & Telecommunications*
***Business Function:*** *Environmental Services*
***Beneficiary:*** *Individuals participating in the dDRS program, waste pickers, and the broader community impacted by sustainable waste management practices.*
***Technologies used:*** *Computer Vision, Cybersecurity, AIOps, Machine Learning, and Explainable AI*

### Recykal: Leading India's Circular Economy

Recykal, a Hyderabad-based tech startup, drives India's circular economy with innovative sustainability solutions. Their Circular Economy Marketplace connects recyclers nationwide, supporting brands like Pepsi and P&G in achieving ESG goals.
Their digital Deposit Refund Scheme (dDRS), piloted in Kedarnath and recognised with the Digital India Award, incentivises responsible packaging disposal. Integrating AI, Recykal enhances efficiency in waste management through QR code distribution and AI-enabled Reverse Vending Machines in dDRS, solidifying their role in sustainable waste solutions.

### Addressing Plastic Pollution with Recykal's dDRS

Recykal's digital Deposit Refund System (dDRS) addresses plastic pollution and improper disposal, particularly in ecologically sensitive areas like the Himalayas. Plastic bottle littering poses a severe environmental threat. Through dDRS, Recykal aims to revolutionise waste disposal with a refundable deposit system, encouraging responsible consumer behaviour and active recycling participation.

**Significance of Addressing Plastic Pollution**

The issue targeted by Recykal - plastic pollution and irresponsible waste disposal - is critical due to its profound environmental impact. Widespread littering of plastic bottles threatens ecosystems, contaminates water bodies, and disrupts natural habitats. Ineffective waste management exacerbates this crisis. Recykal addresses these challenges with its digital Deposit Refund System (dDRS), aiming to revolutionise waste management, mitigate plastic pollution, and promote a cleaner environment through incentivised responsible disposal practices.

### Innovative AI Integration in Recykal's dDRS

Recykal's digital Deposit Refund System (dDRS) integrates advanced Artificial Intelligence (AI) into its Reverse Vending Machines (RVMs). These AI-equipped machines streamline recycling by instantly identifying and categorising returned plastic bottles with QR codes. Users receive deposit refunds swiftly via UPI directly into their bank accounts, ensuring efficiency and accuracy. This AI integration enhances user experience, transparency, and accessibility in recycling, promoting responsible waste disposal practices.

### Complexities of Recykal's AI Dataset

Recykal's AI model utilises a diverse dataset with significant complexities:

Volume and Data Type: The dataset includes five categories of FMCG Post-Consumer Recyclables (PCRs), such as PET, Aluminum cans, Glass bottles, Tetra packs, and Multilayered plastic (MLPs). It comprises nearly 1 million in-house captured images for model training, primarily varied visual characteristics of recyclables ranging from 100 ml to 2000 ml.

Data Sources: The dataset is sourced from multiple channels. ~60% comes from local Kabadiwalas and Recyclers listed on Recykal's Marketplace. Another 20% is sourced from local retailers in Hyderabad, 12% from Goa, and 8% from Recykal's employees.

**Complexities Addressed:**

- Planning: Demographic surveys and assumptions shaped the dataset to reflect market realities
- Sourcing: Utilisation of Recykal's Marketplace, local retailers, and employee contributions addressed sourcing challenges
- Redundancy: A dedicated program was developed to eliminate redundancy during data annotation
- Condition Considerations: Despite 55% of PCRs being in original condition, measures were implemented to account for dirty, damaged, and unlabelled items during data capture

This comprehensive dataset underpins developing an effective AI model for accurately identifying and classifying post-consumer recyclables in practical scenarios.

### Recykal's Data Solution and Implementation Challenges

Recykal's data solution addresses the complexities of integrating, securing, and processing diverse datasets of FMCG Post-Consumer Recyclables. The dataset encompasses PET, Aluminum cans, Glass bottles, Tetra packs, and MLPs in various sizes and colours sourced from multiple regions.

**Challenges & Solutions**

Data Silos
Challenge: Disparate data sources
Solution: Integrated data from diverse sources into a unified dataset

Data Availability
Challenge: Limited availability for specific subtypes
Solution: Employed semi-supervised learning with a combination of labelled and unlabelled data. Implemented active learning for crucial instances

Data Accessibility
Challenge: Ensuring accessibility for model training
Solution: Collaborated with local recyclers and retailers andsourced data inclusively from Recykal's Marketplace

Data Security
Challenge: Ensuring data confidentiality and integrity
Solution: Implemented encryption protocols and secure communication channels and followed Indian data protection regulations with regular security audits

Data Processing
Challenge: Processing a large volume of diverse images
Solution: Applied data augmentation techniques, optimised processing pipelines, and utilised transfer learning for efficient feature extraction

This holistic approach ensures dataset integrity, security, and accessibility, overcoming challenges associated with diverse data sources and processing complexities.

### Impact of Recykal's dDRS Solution

***Achieved Scale***

- *Geographic Expansion: Successfully implemented across multiple states, extending impact nationwide in waste management transformation*
- *Operational Reach: Strategically deployed RVMs in urban centres and ecologically sensitive areas, facilitating efficient recyclable collection and sorting*
- *Increasing Bottle Collection: Initiated with 7.5 lakh bottles, collection surged to 13 lakh bottles, reflecting growing acceptance of responsible waste disposal*

***Overall Impact***

- *Environmental Conservation: Prevented 13 lakh plastic bottles from polluting water bodies and conserved 15 square kilometres of landfill space. Recycled efforts saved over 400 metric tons of coal and reduced carbon emissions by preventing 65 metric tons of CO2 equivalent*
- *Job Creation: Created approximately 15 jobs through RVM expansion, contributing to local employment growth*

***Qualitative Impact***

- *Behavioural Shift: Fostered positive consumer behaviour towards recycling, driven by RVM convenience and dDRS incentives*
- *Community Engagement: Increased recognition and adoption of sustainable waste management practices among individuals, local businesses, and government entities*

***Revenue Optimization***

- *Consumer Participation: Increased participation through dDRS implementation*
- *Operational Efficiency: AI in RVMs reduced sorting efforts by >70%, enhancing efficiency and lowering operational costs by 40%*

***Customer Experience***

- *Satisfaction: >95% satisfaction rate with streamlined dDRS process and reliable RVM uptime of 95%*

***Behavioural Change***

- *Environmental Responsibility: Financial incentives encourage responsible waste disposal, supporting behavioural change*

***Economic Opportunities***

- *Livelihood Support: Deposit refunds create economic opportunities for waste pickers, contributing to their livelihoods*

***Collaboration with Authorities***

- *Government Collaboration: Partnered with district administrations to combat plastic pollution and promote responsible waste management*

*Recykal's dDRS solution achieves a multifaceted impact on environmental conservation, social responsibility, and collaborative governance practices.*

### Potential Scale of Recykal's Operations

Uttarakhand Expansion: Expanding operations across Uttarakhand could potentially channel ~30,000 metric tonnes of PET bottles, considering the average weight of 20 grams per bottle.

Pan-India Expansion (6 to 24 Months): With pan-India expansion plans within 6 to 24 months, Recykal anticipates channelising up to 40 lakh metric tonnes of PET bottles.

ENERGY & UTILITIES
CHALLENGER

**Corrosion Intel**

# CORROSION INTEL: AI-BASED CORROSION MONITORING AND PREDICTION SOFTWARE

***Industry:*** *Energy and Utilities, Manufacturing & Industrial Automotive, Transport & Logistics, Oil & Gas, Chemicals, Shipping and Defence*
***Business Function:*** *Software & Applications, Operations, Sovereign Functions of Govt. of India (State-run functions), Maintenance*
***Beneficiary:*** *Industries like Oil & Gas, Automotive, Shipping, Logistics, Chemicals, Energy and Utilities, and Defence*
***Technologies used:*** *Generative AI, Computer Vision, AI-ML, Digital Twin*

## Revolutionizing Industrial Asset Management with AI Corrosion Solutions

Corrosion Intel pioneers AI-driven solutions for industrial asset management with its Corrosion Monitoring and Prediction System. Addressing sectors like oil and gas, chemical, shipping, and defence, Corrosion Intel leads this initiative in India with collaborations from Maharatna companies like Indian Oil Corporation Limited (IOCL) and a pilot commitment from Bharat Petroleum Corporation Limited (BPCL). Unlike traditional solutions, real-time monitoring technology prevents equipment damage, offering critical insights into asset health.

### Challenges in Corrosion Management

Corrosion Intel addresses the critical challenge of corrosion across diverse industrial sectors, incl. defence, oil and gas, chemicals, and shipping. Corrosion threatens asset integrity and safety and results in significant financial losses and environmental risks globally.

The lack of real-time monitoring systems leaves assets vulnerable despite numerous mitigation options. Corrosion Intel's solution fills this crucial gap, providing timely insights into asset health and performance.

Specific issues include:

- Global economic losses due to corrosion are estimated at US$ 25 trillion annually

- Inadequate monitoring and mitigation technologies accelerate infrastructure deterioration, impacting operational efficiency and lifespan
- Poses significant costs and risks to sectors like oil & gas, shipping, chemicals, manufacturing
- Current corrosion management practices are often imprecise and time-intensive, leading to inefficiencies in maintenance
- There is a growing demand for innovative solutions offering real-time monitoring, predictive analytics, and actionable insights to optimise maintenance strategies and reduce downtime

**Importance of Resolving Corrosion Challenges**

Effective corrosion prevention and management are crucial across industries like oil and gas, shipping, chemicals, and manufacturing, where corrosion leads to asset deterioration, operational disruptions, and substantial financial losses. Globally, corrosion-related costs amount to USD 25 trillion annually, with India alone facing costs estimated at 3-4% of GDP*.

Industries urgently require solutions offering real-time monitoring, predictive analytics, and actionable insights to optimise maintenance and minimise downtime. Current corrosion management methods often lack precision and are time-consuming, necessitating innovative approaches.

Corrosion Intel's AI-driven technology addresses these challenges by providing accurate corrosion predictions, facilitating proactive decision-making and aligning with industry needs to reduce losses, ensure regulatory compliance, and enhance asset integrity.

*Source: CORCON Institute of Corrosion

### AI-Powered Solutions for Corrosion Monitoring

Corrosion Intel innovates corrosion monitoring across diverse sectors by leveraging advanced AI technologies tailored to specific industry challenges. In oil and chemical storage tanks, the system adapts AI to continuously learn from tank conditions, fluid properties, chemical reactions, and historical data.

This approach delivers real-time predictions and preventative insights beyond traditional analytics. The AI-driven solution dynamically monitors material integrity and fluid properties for pipelines, providing accurate predictions in challenging environments where conventional methods are inadequate. Corrosion Intel integrates AI with existing Impressed Current Cathodic Protection (ICCP) systems in the shipping sector, enhancing predictive capabilities over time for real-time insights that surpass traditional analytics.

AI models learn from unique conditions in defence, offering precise corrosion forecasts that overcome standard analytical limitations.

### Complexity of Dataset: Volume, Data Types, and Sources

The dataset used is extensive, incorporating a large volume of information from diverse origins. Continuous monitoring produces a steady flow of real-time data, contributing significantly to its overall size. Data types vary, incl. sensor readings and operational parameters, which are crucial for capturing the temporal aspect of corrosion progression.

Sensor networks deployed on assets supply detailed insights into environmental conditions, while integration with operational systems enriches the dataset with information on asset usage. External data sources, such as weather conditions, further enhance its breadth and depth.

### Data Solution Implementation Challenges and Competitive Landscape

**Challenges Faced:**

- Ensuring data availability and accessibility
- Managing the complexity of the dataset and breaking down data silos
- Integrating diverse data sources effectively

- Scaling infrastructure and processing power to handle large volumes of data
- Developing accurate predictive models while balancing computational efficiency
- Continuously monitoring and updating models to maintain relevance and accuracy

**Governance Framework:**

Includes continuously tracking and monitoring model performance, data quality, and compliance adherence. This involves regular audits, version control, comprehensive documentation, and transparent stakeholder communication. Corrosion Intel's approach involves robust data integration strategies to unify data sources, ensuring real-time availability and connectivity. Security concerns are addressed through encryption, access controls, and rigorous monitoring protocols.

## Scale and Impact of AI-Based Corrosion Monitoring

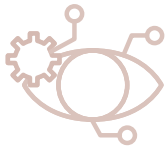
*Currently deployed with IOCL and piloted with BPCL for distillation units, the system leverages sensors and AI capabilities to monitor entire assets, such as oil storage tanks and pipelines.*

***Key Achievements and Impact:***

- *Revenue Optimization: By providing predictive insights, Corrosion Intel minimises downtime and maintenance costs, optimising revenue streams. For example, scheduled maintenance in oil and chemical storage reduces revenue loss from unplanned shutdowns*
- *Operational Efficiency: Enhances operational efficiency by predicting pipeline corrosion, allowing targeted maintenance interventions and resource optimisation*
- *Customer Experience: Improved operational reliability, particularly in shipping, ensures timely deliveries and enhances customer satisfaction by avoiding unexpected maintenance issues*
- *Environmental and Safety Impact: Preventing corrosion-related incidents contributes to a safer work environment and reduces environmental harm from leaks or spills, aligning with sustainability goals*
- *Social Impact: Enhanced safety measures protect workers and communities from potential industrial accidents, promoting overall well-being*
- *Governance: Provides decision-makers with critical insights into asset health, ensuring regulatory compliance and responsible asset management*

### Future Scalability and Expansion Plans

Corrosion Intel aims to scale significantly in the near future. Initially, the focus is on expanding coverage to encompass the entire asset base of current clients and integrating our technology with all existing terminal companies nationwide. Subsequently, the plan includes expanding into other sectors, such as chemicals, shipping, and defence, broadening our impact across diverse industries.



ENERGY & UTILITIES
INNOVATOR

**Gotisheel Technologies LLP**

# GOTISHEEL TECHNOLOGIES LLP: AI BASED SMART GATE SYSTEM


**Industry:** Energy & Utilities
**Business Function:** Software & Applications
**Beneficiary:** Oil & Gas sector
**Technologies used:** Computer Vision

### Innovative Solutions for Safety and Compliance Automation

Gotisheel Technologies LLP, a software technology startup, specialises in Software Product Development utilising AI/ML, Computer Vision, and Full-stack technologies for Workforce Management and Safety/Security Solutions. The company offers AI-based solutions for automating safety and security compliance, primarily targeting the Oil and Gas industries. Originally established as a travel technology startup, Gotisheel Technologies pivoted to focus on AI post-COVID-19, securing its first customer, HPCL Mangalore. Since then, the company has successfully implemented solutions for several other oil and gas companies.

### Addressing Safety and Efficiency in Hazardous Environments

Employees face significant dangers in hazardous working environments, exposing organisations to potential damages and fines. The pressing need of the hour is a smart gate system that goes beyond traditional access control to ensure safe and secure entry. Manual checks of safety compliance and reliance on paper-based gate pass systems are inefficient, prone to errors, and resource-intensive.

### Significance of AI in Oil and Gas Safety

Ensuring safety and security is paramount in the oil and gas industry. AI-based technologies are crucial for effectively monitoring and safeguarding both workers and environments.

### AI-Enhanced Smart Gate System for Safety Compliance

Gotisheel Technologies has developed an AI-enabled Smart Gate System designed to enforce safety protocols for all personnel and vehicles entering premises, ensuring compliance with

organisational standards. Leveraging computer vision technology, the system verifies authorised individuals and vehicles, checking for Personal Protective Equipment (PPE) and alcohol presence before granting access.

**Technical Solution**

For Workers

- Face recognition
- Alcohol detection
- PPE verification
- Safety training validation
- Gate system integration
- Integration with ERP/HRMS
- Audio-visual display with announcements

For Vehicles & Crews

- Automatic Number Plate Recognition (ANPR)
- Driver and helper facial recognition against database
- PPE and alcohol checks for drivers and helpers
- Integration with boom barriers
- ERP/TAS integration
- Audio-visual display with announcements

**Dataset Complexity and Environmental Variability**

The complexity of the dataset used for PPE detection varies significantly due to diverse environmental conditions and lighting effects specific to customer environments. This variability impacts the model's performance and requires robust adaptation strategies to ensure accurate detection under varying circumstances.

**Data Solution Implementation Challenges and Competitive Landscape**

Challenges Faced

- Remote accessibility for data collection and model fine-tuning post-deployment
- Handling data and environmental variations, incl. lighting conditions and different types of surroundings and footwear
- High computational resources required for model training
- Limited availability of APIs for integrating hardware components

Governance Mechanism:

To address data privacy concerns, models are deployed locally within the customer's environment, operating on segregated networks with restricted internet access. This setup ensures data remains secure by preventing external data exchanges.

Competitive Advantage

- While numerous products exist, Gotisheel' solution incorporates additional safety monitoring layers (e.g., PPE, alcohol detection, and safety training) - particularly beneficial for high-risk industries such as Oil &Gas and Underground Mines
- The solution not only enforces compliance at entry gates but also simplifies monitoring for CISF/security personnel, reducing the need for manual checks
- The modular and customisable nature of their solution facilitates seamless integration into larger, bespoke systems

The company places significant emphasis on retraining models using field data from customer sites, particularly for challenging aspects like safety boot detection under various lighting conditions. Automated data collection for refining AI models ensures ongoing enhancements even after deployment.

**Achieved Scale and Impact of Solutions**

*Gotisheel Technologies has successfully implemented and customised its smart gate systems across several high-profile installations, demonstrating significant operational improvements and safety enhancements.*

- *The HPCL MLIF, Asia's largest LPG terminal, has benefited from two years of operational efficiency since adopting the system, now under an annual maintenance contract. This transformation has automated terminal operations, enhancing safety and operational efficiency*
- *Similarly, the Numaligarh Refinery Marketing Terminal now relies on Gotisheel's smart gate and*

*seamless tanker loading operations and setting new standards in terminal automation.*

- *In March 2024, Gotisheel launched its smart gate system at Mahanadi Coalfields Limited (Orissa), a subsidiary of Coal India Limited. This system will pioneer safety measures for underground mine workers with integrated alcohol detection capabilities*

***Key achievements include:***

- *Automated entry and exit processes, reducing clerical tasks for security personnel*
- *Streamlined driver and helper verification via AI-based facial recognition*
- *Enhanced safety compliance through mandatory PPE checks at entry points*
- *Environmental benefits by eliminating roadside truck parking, reducing accidents and congestion*
- *Social impact through improved safety standards for blue-collar workers*

*These implementations underscore Gotisheel's commitment to innovation in safety and operational efficiency across industrial sectors.*

**Growth Potential in Current Trends and Scenarios**

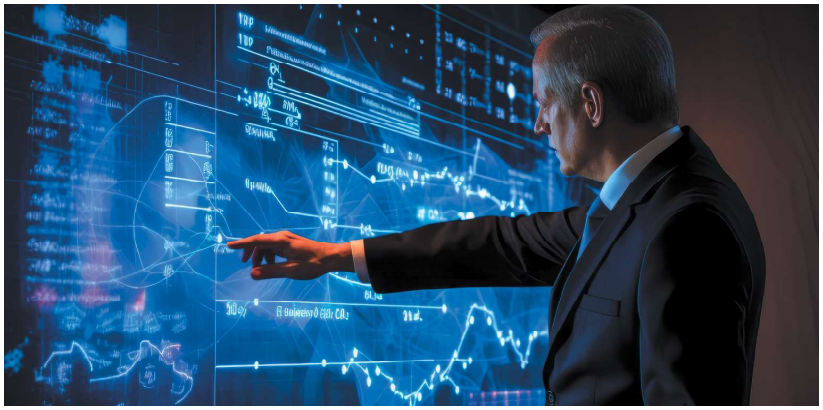
- Potential revenue growth: Projected at ₹1.5 crores for 2023-24
- Expected to increase to ₹3-4 crores over the next 2-3 years
- Opportunities in India's Oil and Gas sector, esp. in the untapped markets of North East India, incl. prominent players like Indian Oil Corporation Ltd. and Oil India

# BFSI

BFSI
GAMECHANGER

**Fidelity Business Services India Pvt Ltd**

# INNOVATION & AI POWERING FIDELITY'S CLIENT-RELATIONSHIP MANAGEMENT



***Industry:*** *BFSI*
***Business Function:*** *Business Intelligence, Customer Service, Marketing & Sales*
***Beneficiary:*** *Head of Relationship Management, Segment Heads, Relationship Managers of Workplace Investing Business Unit in Fidelity Investments*
***Technologies used:*** *AIOps*

### Fidelity Investments: Empowering Financial Confidence and Growth

Fidelity Investments supports over 40 million individuals with financial goals, manages employee benefits for nearly 23,000 businesses, and aids over 3,600 advisory firms with innovative investment and technology solutions. The Analytics, Research, and Data team employs advanced analytics, market research, decision sciences, and investment research to deliver strategic solutions across Fidelity's businesses, earning numerous awards for innovation and excellence.

### Enhancing B2B Client Relationship Management and Reducing Attrition

Fidelity aims to redefine and enhance its relationship management with B2B clients by revamping the existing service model. They focus on proactively identifying at-risk clients likely to discontinue their relationship with Fidelity. Key aspects include early detection, identifying risk factors, predictive analytics, and implementing retention strategies.

**Importance of Solving Client Relationship Challenges and Attrition**

Addressing Fidelity's client relationship management issues is critical due to several factors:

1. Challenges in Service Metrics

- Existing clients' asset growth and participant's strain relationship management (RM) metrics
- Clients may need re-segmentation, e.g., dedicated vs pooled RM
- Advisor relationships have growing demands
- Geographical optimisation is necessary as clients expand to multiple sites
- Post-pandemic market factors particularly impact smaller clients, necessitating pre-emptive risk mitigation

2. Client Attrition Prediction

- Revenue Protection: Identifying at-risk clients helps address concerns proactively, safeguarding revenue
- Cost Savings: Retaining clients is more cost-effective than acquiring new ones, reducing onboarding and implementation expenses
- Client Experience: Early detection of potential churn improves satisfaction and loyalty by addressing issues promptly

**AI-Driven Solution for Client Relationship Management and Attrition**

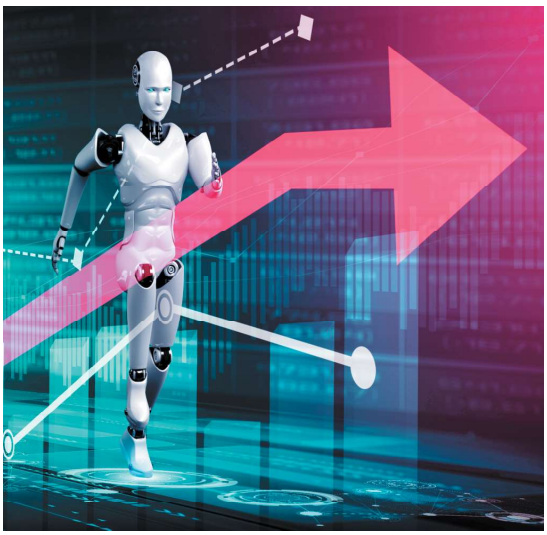
Fidelity leverages advanced AI to revamp its service model and predict client attrition with high accuracy. The solution encompasses:

1. Data Collection and Integration

- Aggregating diverse datasets (client interactions, demographics, transaction history, engagement metrics) to build a robust AI foundation

2. Feature Engineering

- Extracting relevant patterns and signals to identify key attrition indicators and new client segments



3. Machine Learning Models

- Utilising algorithms like decision trees, random forests, and gradient boosting to analyse historical data and predict client attrition
- Implementing Partition Around Medoids (PAM) clustering to identify natural client asset segments based on asset value, advisor presence, multi-product use, and geographical territories

4. Deep Learning Techniques

- Incorporating neural networks to detect intricate data relationships and subtle patterns beyond conventional methods

5. Continuous Learning and Adaptation

- Designing the AI model for ongoing learning to adapt to evolving client behaviour, ensuring dynamic business environment relevance

6. Explainability and Interpretability

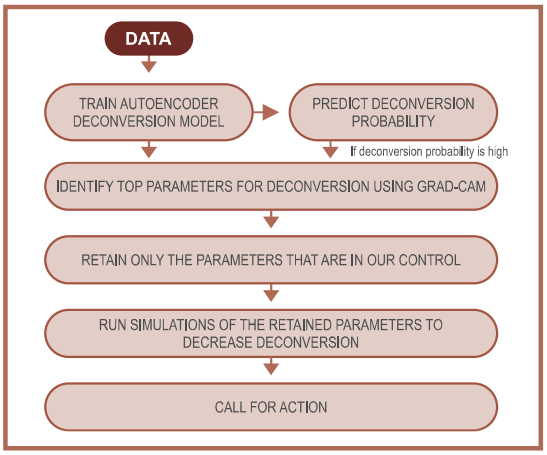
- Prioritising transparency by providing insights into prediction factors, fostering business understanding and trust in the model's recommendations

7. Integration with Business Processes

- Seamlessly embedding the solution into existing processes to enable targeted retention strategies, personalised communication, and proactive measures

This AI-driven approach predicts potential client attrition and empowers Fidelity's Relationship Management team to take strategic actions, reducing churn and enhancing long-term client satisfaction.

### Technical Description of the Proposed Solution




**Dataset Complexity**

The dataset used is complex, encompassing less than a million entries monthly. It includes time series, cross-sectional, and unstructured data sourced from a News API and internal databases.

### Data Solution and Implementation Challenges

**Challenges**

Real-Time Data: Ensuring data concurrency was a significant challenge

PII Data Usage: Implementing strong guardrails for sourcing and using clients' PII dataExternal Data Sourcing: Seamlessly integrating competitor data from external sources

**Governance**

Data Storage: Stored in the Enterprise Analytics Platform within the Enterprise Data Lake, making it readily consumable by AI models

Compliance: Conforms to North American and European standards, adhering to GDPR norms

Review Boards: Technical and Ethical Review Boards assess AI techniques and data usage and test for bias, discrimination, performance, and deployment

**Uniqueness of Solution**

Methodology: A convoluted autoencoder is used instead of traditional classification algorithms for attrition prediction

Algorithm Output: Gives higher weight to business consumer input and hypotheses over standard ML algorithms.

News Integration: Generates human-like summaries with accurate event recognition from news data

### Achieved Scale and Impact

*1. Segment Formation and Client Alignment:*

- *A new client segment was formed, and a new head was hired based on recommendations*
- *Clients were migrated to appropriate segments, ensuring they received the right services and were aligned with the right relationship managers*
- *Successful implementation improved business metrics, including increased NPS, higher multi-product uptake, and reduced miles per MD for each book*

*2. Client Attrition Prediction*

- *The model effectively analysed vast datasets to identify potential churn patterns, reducing client attrition*
- *It fostered a proactive and personalised engagement approach with at-risk clients, enhancing client satisfaction and loyalty*
- *The solution preserved existing client relationships and improved overall client experience*

*3. Revenue Protection and Cost Savings*

- *Proactively addressing at-risk clients' concerns reduced the likelihood of losing revenue*
- *Focusing on client retention minimised the costs associated with acquiring new clients*

*4. Client Experience Improvement*

- *Early identification of potential churn allowed for timely issue resolution and enhanced client satisfaction*
- *The model fostered long-term loyalty and improved overall client experience*

*5. ESG Risk Assessment*

- *The Relationship Management systems can now assess and quantify ESG-related risks, ensuring sustainable practices throughout the ecosystem*

### Potential Scalability of Service Model and Attrition Prediction

The service model optimisation and client attrition prediction model have immense scalability potential. By forecasting potential client departures, the model enables proactive retention strategies, personalised engagement, and pre-emptive interventions, thereby preserving client relationships and enhancing satisfaction. This scalable approach supports sustainable growth by maintaining a loyal client base. Its adaptability to diverse datasets and business environments further amplifies its value, making it an essential tool for enterprises aiming to optimise client retention on a large scale.

BFSI

CHALLENGER

## NatWest Digital Services India Private Limited

# NATWEST WALL E'S ODYSSEY: NAVIGATEOPS

***Industry:*** *BFSI*
***Business Function:*** *Operations, Customer Service, Business Intelligence*
***Beneficiary:*** *C&I Operations India, NatWest*
***Technologies used:*** *NLP, Computer Vision, AIOps, Generative AI*

### NatWest Group: Leading Banking Innovation

NatWest Group is a relationship bank for a digital world dedicated to enhancing financial confidence for 19 million customers across the UK and Ireland. As the UK's most prominent business and commercial bank, it offers various services through brands like NatWest, Royal Bank of Scotland, Ulster Bank, and Coutts. NatWest is transforming into a data-driven institution by prioritising innovation and providing AI training to 450 operational users. The bank's AI journey, featuring the WALL E platform, leverages machine learning and deep learning to optimise processes and address bottlenecks. This strategic approach ensures regulatory compliance, efficiency, and enhanced customer experiences, aligning the 300-year-old bank with modern expectations.

### NatWest's Digital Transformation Challenge

NatWest, aiming to be the premier digital relationship bank, faces challenges due to its 300-year history, which creates friction between technology and customer experience.
Their goal was to expedite the resolution of 18,000 colleague queries per year and reduce this by 50%. The team sought to enhance customer experiences, strengthen controls, and reduce costs by identifying bottlenecks and providing tailored solutions

**Importance of Solving Operational Challenges at NatWest**

Eliminating service friction is crucial for NatWest to become a leading digital bank. The bank's operations handle 18,000 annual issues, generating 1 TB of data from over 20 applications in post-trade services. Simply increasing staff did not improve customer service and often made it worse. Traditional transformation methods were slow and aggravated customer issues. Reducing technology debt lagged behind customer experience needs.

The goal was to implement process automation, foster a data-driven problem-solving culture, and modernise banking operations for a fast-paced world, thereby resolving significant pain points and enhancing customer service.

### AI-Powered Solution: NatWest WALL E Platform

The NatWest WALL E platform, NavigateOps, serves as a dynamic organisational flow map, similar to Google Maps, pinpointing operation bottlenecks. It processes telemetry and business events from over 20 critical post-trade applications using machine learning and deep learning models such as random forests, neural networks, gradient boosting, naive Bayes, and LLM.

These models enable correlation studies, bottleneck detection, pattern recognition, issue clustering, text summarisation, standard deviation analysis, NLP, and OCR. IT operations and business units leverage these tools for root cause analysis, anomaly detection, performance analysis, event correlation, workload distribution, process mining, and pattern prediction.

Unlike simple analytics, this AI-based solution redefines measures, actions, and solutions for deep-rooted problems. Additionally, GenAI was used to develop advanced solutions like the confirmation negotiator, which assists in negotiations with counterparties during breaks.

### Complexity of NatWest's Data

NatWest handles complex data, including 5 million structured records daily from audit and transaction tables, JSON, and XML. It also processes 30 GB of semi-structured data daily from file logs and application telemetry, along with 5,000 unstructured items such as emails and scanned files.

### Data Solution Implementation and Challenges

The WALL E platform was developed to analyse and optimise banking operations. Significant challenges included integrating telemetry and business events from over 20 critical applications, managing large datasets (1 TB), and employing machine learning and deep learning models for complex tasks.

To overcome these, the team engaged in meticulous planning, acquired skilled talent, and built robust infrastructure. They implemented advanced algorithms and fostered seamless collaboration between IT and business units. Continuous monitoring and refinement were essential for handling the scale. Strategic planning, technological expertise, and adaptability were vital to successfully implementing the data solution.

### Achieved Scale and Impact of NatWest's AI Solution

*WALL E has significantly improved operational efficiency:*

- *30% reduction in operation effort due to auto-suggested reconciliation matches*
- *50% reduction in operational issues resulting in savings in technology run costs to the tune of ₹5 crores annually*
- *99% accuracy in regulatory reporting, ranking NatWest among the top three banks in DTCC inter-ranking*
- *Elimination of overtime in settlement and confirmation technology operations*
- *Revenue optimisation*

***Operational Efficiency***

- *Improved productivity by standardising processes and reducing service issue resolution time*
- *Auto-recovery for repeated service queries standardised processes and time, leading to more efficient issue resolution*
- *Mean time to recovery decreased by 65%*
- *Service query resolution time decreased by 83%*
- *Similar improvements were seen in settlements, confirmations, regulatory reporting, and reconciliations*

**Potential Scale and Future Impact**

The AI-enabled digital enterprise initiative at NatWest shows significant scaling potential. In 2023-24, the bank fully embraced AI to transform work processes, eliminate manual tasks, enhance experiences, reduce risk, and foster growth. Initially, 450 operational users are undergoing training in process mining and AI/ML data analytics to optimise processes in commercial and institutional banking. Implementing insights from the WALL E platform and AI/ML is projected to improve colleague experience by 30%, increasing capacity for new customer onboarding. Over 80 use cases have been identified for critical processes such as customer

onboarding, payment query handling, and overdraft and deposit processing, highlighting the scalability potential in revolutionising various banking operations.

BFSI
INNOVATOR

NSEIT Ltd.

# NSEIT LIMITED: USE CASE - ANOMALY DETECTION FOR A LEADING STOCK EXCHANGE

***Industry:*** *BFSI*
***Business Function:*** *Operations, Business Intelligence*
***Beneficiary:*** *Stock Exchange*
***Technologies used:*** *Artificial Intelligence, Machine Learning*

## NSEIT Limited: Leading Tech Solutions in Capital Markets

NSEIT Limited excels in Application Modernisation, Business Transformation, Data Analytics, Infrastructure & Cloud Services, and Cybersecurity. With over 20 years of expertise, they are a preferred global partner for digital advancement.

Their AI/ML/Data Science services enhance decision-making and automate tasks, using deep learning, computer vision, and NLP for real-time data analysis. Their AI/ML-driven anomaly detection system for a leading stock exchange adapts to market changes, enhancing surveillance and resolving anomalies proactively.

### Dynamic Anomaly Detection for a Major Stock Exchange

A significant stock exchange client relied on a static rule-based system for monitoring trading activities, which proved inadequate for the dynamic nature of trading behaviour. They required a predictive anomaly detection system to enhance surveillance operations under fluctuating market conditions.

**Key Objectives:**

- **Market Integrity:** Detect and prevent manipulative trading practices to maintain investor trust and market fairness
- **Investor Protection:** Safeguard investors from unfair practices, fostering a healthy investment environment
- **Regulatory Compliance:** Ensure adherence to SEBI guidelines for algorithmic trading activities
- **National Importance:** Support India's goal to

become a global financial hub by fostering trust and transparency

- **Global Reach:** Develop explainable and replicable solutions to meet international standards, reflecting NSEIT's expertise in the capital market industry

**Importance of Dynamic Anomaly Detection for Stock Exchanges**

Fraudulent activities can damage an organisation's reputation, disrupt its systems, and lead to customer losses. Detecting anomalies is crucial for a leading stock exchange handling vast amounts of trading data daily.

### Role of AI in Dynamic Anomaly Detection

NSEIT created an advanced AI/ML-based anomaly detection system for a major stock exchange, utilising its capital markets and technology expertise. The new AI/ML system boosts surveillance efficiency by expanding anomaly detection capabilities and minimising false positives.

#### Key Features

- **Predictive Capabilities:** Predicts and adapts to changes in trading behaviours and market sentiments
- **Interactive Dashboard:** Summarises outlier data for five use cases, enabling detailed analysis and prompt action by the surveillance team
- **Big Data Handling:** Processes over 10 billion messages daily, ensuring swift and accurate anomaly detection

#### Development Steps

1. **Data Pre-processing and Cleansing:** Ensured data quality and consistency
2. **Data Enrichment and Attribute Computation:** Computed additional attributes for deeper analysis
3. **Exploratory Data Analysis and Selection:** Identified 20 key influencers, incl. trade ratio and value
4. **ML Algorithm:** Developed an ML model incorporating the identified influencers
5. **Model Training and Implementation:** Trained and implemented the model for real-time or batch anomaly detection

#### Solution Features

- Near real-time, predictive anomaly detection
- Integration of real-time and historical data for contextual understanding
- Broader scope for detecting breaches, enhancing investigative control
- Reduced false positives through machine learning in market surveillance
- Optimised costs due to reduced manual intervention
- Improved user experience and faster results
- Immediate alerts for anomalous behaviour, providing dynamic insights

### Dataset Complexity in Anomaly Detection

The anomaly detection system manages a complex dataset, handling over 3 TB of data and processing 7 billion messages daily. It processes daily Equity


and F&O order and trade data in near real-time with a 2-3 hour lag for model learning. Monthly raw data totals about 56 TB, reduced to 5 GB per month and 60 GB per year post-processing.

### Risk Management and Market Challenges

Challenges of the static system included

- Inability to adapt to dynamic member behaviour and market changes
- Generating false positives requires manual intervention, increasing effort, cost, and time
- Reactive nature, as it relied on outdated rules
- Limited to running once a day

The new dynamic system needed to:

- Identify potential high-frequency traders
- Detect market abuse practices and capture multi-leg reversal cases
- Detect algorithmically induced price crashes

**Processing large volumes of trade order data in real time presents several challenges:**

- Regulatory Constraints: Operating in a highly regulated environment, storing trade data in public cloud infrastructure is prohibited. Thus, an on-premise solution was necessary, requiring high-performing, scalable infrastructure
- Data Volume and Performance: Handling billions of trade order records in real-time demanded careful model selection and the correct set of influencers to balance accuracy and performance
- Data Consistency: Ensuring data integrity without altering the sequence or meaning of fields over time
- Imbalanced Data: Anomalous events are rare compared to regular trading activity, complicating detection
- Adaptability: The system must adapt to evolving market conditions and trading strategies
- Labelling Anomalies: Reliance on human expertise for labelling affects overall accuracy in unsupervised or semi-supervised settings
- Anomaly Detection Trade-Offs: Balancing false positives and false negatives

## Impact Metrics, Responsible AI, and Scalability

***Impact Metrics***

*NSEIT's solution allows clients to identify outliers in algorithmic and non-algorithmic trading, enhancing surveillance in regulated environments while upholding responsible AI principles.*

***Key Results***

*Reduced Investigation Time: Faster identification of suspicious activities with minimal latency reduces false positives and allows analysts to focus on genuine anomalies.*

- *Actionable Insights: Real-time alerts and explainable visualisations enable efficient verification of suspicious activities, incl.*
- *Misclassified Trading: Detecting non-algorithmic traders behaving like algorithmic traders and vice versa.*
- *Algo Drift Detection: Identifying algorithm behaviour deviations over time.*
- *Strategy Violations: Ensuring clients adhere to registered trading strategy parameters.*

*Improved User Experience: Streamlined workflows prioritise genuine anomalies, enhancing analyst efficiency.*

- *Market Integrity: Consistent investigation and action against offenders.*

***Scalable Framework***

*The framework is designed for scalability, enabling replication across other exchanges with consistent performance. It includes data selection, cleaning, feature engineering, and model building*

***Modes Developed***

*1. Non-Algo Members: Detect if non-algorithmic members use automation techniques*

*2. Overall Algo Members: Check if algorithmic trading behaviour mimics non-algorithmic trading clients*

*3. Deviant Algo Member: Analyse algo ID behaviour over time for deviations*

*4. Algo Strategy: Verify if clients adhere to defined strategy parameters& trading strategies*

*5. Intra-Day Algo: Real-time analysis of algorithmic members*

### Achieving Scale in Anomaly Detection

**Domain Objectives**

- Identify potential high-frequency traders and assess their market impact
- Detect market abuse in equity stock options and multi-leg reversal cases
- Predict and prevent algorithmically induced price crashes

BFSI
GAMECHANGER

**Saarthi.AI**

Saarthi .ai

# SAARTHI.AI: AI SaaS FOR AUTONOMOUS LENDING OPERATIONS

***Industry:*** *BFSI*
***Business Function:*** *Operations, Business Intelligence, Software & Applications, Analytics*
***Beneficiary:*** *Banks, NBFCs, FinTechs*
***Technologies used:*** *AIOps, NLP*

## Transforming Customer Communication in BFSI with AI

Saarthi.ai transforms customer communication in BFSI, incl. FinTechs and Banks, with tailored AI technologies. The platform integrates behavioural, generative, and conversational AI to enhance interactions. Supporting 13 Indian languages, its speech and language technology ensures universal accessibility.

PRAVID automates the digital lending journey from lead qualification to debt collections, offering to upsell/cross-sell opportunities. It serves as a unified AI workplace for lending teams, integrating seamlessly into borrower communication processes. MAIA, Saarthi.ai's AI-human hybrid, ensures affordable, transparent, and effective interactions.

Saarthi.ai prioritises ethics and empathy, fostering meaningful lender-borrower relationships. Their AI journey is focussed on overcoming India's linguistic diversity with a native technology framework.

### Addressing Challenges in BFSI Digital Lending

Costs:

- High costs associated with traditional approaches and legacy systems
- Excessive operational costs

Inefficient Operations:

- Dependency on manual communication processes leading to inefficiencies and delays
- Difficulty in scaling operations smoothly and effectively
- Delays and inefficiencies in debt collection
- Ineffective conversion of leads into active customers

Technology:

- Disconnected and disjointed technology systems
- Challenges in managing and utilising data for strategic decision-making

- Inadequate tools and insights for managing risks effectively

Consumers:

- Inability to personalise services and communications to meet individual customer needs
- Constraints in communicating effectively across diverse linguistic landscapes
- Lack of understanding and analysis of customer behaviour

Their products, Pravid and MAIA, offer comprehensive solutions to these challenges.

**Significance of Addressing Inefficient Debt Collection in Indian Digital Lending**

Efficiently addressing costly and ineffective human-led debt collection and recovery processes in India's digital lending sector is critical. Challenges like India's linguistic diversity complicate traditional methods like tele-calling and field collections, leading to costly and opaque processes. The lack of personalised communication further diminishes customer satisfaction and trust while evolving RBI guidelines complicate compliance. Addressing these issues is vital for sustaining growth, fostering financial inclusion, and bolstering consumer trust in India's changing economic landscape.

**Significance of Addressing Inefficient Debt Collection in Indian Digital Lending**

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**AI-Powered Solution for Digital Lending**

PRAVID platform automates the digital lending journey from lead qualification and KYC to debt collections, feedback, and upsell/cross-sell strategies. It serves as a unified AI workspace for lending teams in Banks, FinTechs, NBFCs, and others, seamlessly integrating AI into borrower communication processes. MAIA, the AI-human hybrid, ensures affordable, transparent, and effective interactions.

**Key AI components driving these AI assistants include:**

1. Automatic Speech Recognition (ASR): Explicitly tailored for the banking domain, this system utilises a blend of Hidden Markov Models (HMMs) and Deep Learning techniques trained on 160 hours of Hindi domain data. This ensures high accuracy in understanding customer queries and requests during voice agent interactions

2. Natural Language Understanding (NLU): Designed to identify banking-specific signals and Named Entities (NER), the NLU system employs a BERT-based signal identification and classification model. It also uses rule-based engines to extract entities like payment dates and loan amounts

accurately, enhancing personalised customer responses

3. Text-to-Speech (TTS): It generates human-like responses tailored to caller parameters such as user base and geographical region, enhancing customer engagement and satisfaction

**Complexity of Dataset: Volume, Data Type, and Sources**

The dataset used is extensive and diverse in volume, comprising corpora meticulously crafted by the linguistics team. This data integrates socio-linguistic parameters and insights from customer behaviour across banking, telecom, customer service, and eCommerce domains.

Data types encompass both text and audio formats across 11 Indian languages, spanning millions of conversations handled by agents. Sources include collection AI, self-service interactions, onboarding processes in banking, telecom data, customer service interactions on e-commerce platforms.

**Implementing Multilingual Data Solutions:**

**Challenges and Solutions**

1. Domain Understanding: Understanding specific domain nuances was challenging. Saarthi.ai collaborated with domain experts to gain deep insights and tailor data generation accordingly

2. Knowledge Transfer: Transferring domain knowledge to the multilingual data generation team posed challenges due to language barriers and cultural differences. They mitigated this by ensuring linguists are proficient in target languages and are culturally sensitive

3. Scaling Languages: Scaling across multiple languages increased complexity in maintaining consistency and accuracy. This was addressed through stringent quality control and advanced natural language processing techniques

4. Comprehensive Spoken Language Understanding: Capturing spoken language nuances, incl. colloquialisms and slang, was challenging. The company this with rigorous testing and advanced speech recognition technologies

5. User Acceptance Testing (UAT): Ensuring user-friendliness and meeting end-user expectations is critical. The company involves end-users in UAT to gather feedback and continuously improve the model through batch user output analysis

**Scale and Impact of Saarthi.ai**

*Scale: Saarthi.ai engages with over 700,000 unique customers daily through omnichannel, multilingual communication campaigns. On voice channels alone, it initiates over 3.5 million attempts daily.*

*Impact: In India's dynamic lending sector, Saarthi.ai plays a pivotal role:*

- *Creating a Safe Space: Upholding borrower dignity by fostering open discussions on financial needs without judgment*
- *Ethical Integrity: Ensuring compliance through regulated and auditable communication processes, eradicating unethical practices*
- *Unlocking Credit for Bharat: Democratising financial access with inclusive and assistive AI interfaces*
- *Robust Compliance: Deploying enterprise AI certified with SOC2, ISO 9001, ISO 27001, ISO 27017, and ISO 27018 for data protection and operational excellence*

***Business KPIs:***

*1. 5X cost efficiency compared to traditional methods*

*2. 25% reduction in collection cycles*

*3. Up to 10% lower default rates*

*4. 87-97%collection rates with AI*

*Results Since September 2021:*

- *$1+ billion collected across secured and unsecured products*
- *Connecting >20 million borrowers across socio-economic strata*
- *95% client retention and high user satisfaction*
- *Realising over $10 million in cost savings*

*Social Impact:*

- *Bridging language barriers via multilingual communication*
- *Promoting financial literacy*

**Scaling Potential and Expansion Strategy**

- Client Acquisition: Expand by onboarding additional banks and enhancing revenue by automating cross-selling and lead qualification processes
- Geographic Expansion: Venture into new markets such as the US, MENA, and SEA to broaden global presence
- Use Case Diversification: Introduce alternative credit scoring for NTC users and diversify into industries like insurance and government
- Innovation: Launch a Communication AI developer platform to foster innovation and collaboration in AI-driven customer communication solutions

BFSI
CHALLENGER

**VuNet System Private Limited**

# VUNET: USE CASE NAME - AI/ML PLATFORM WITH BUSINESS CENTRIC OBSERVABILITY

***Industry:*** *BFSI, CPG & Retail, Technology, Media & Telecommunications, Manufacturing & Industrial Automotive, FinTech and Payment Gateways*
***Business Function:*** *Customer Service, Software & Applications, Operations, Business Intelligence*
***Beneficiary:*** *Banks, Payment Gateways, Data Centre Hosting Providers, and Asset Management Firms*
***Technologies used:*** *Generative AI, AIOps, NLP*

**VuNet's Advanced Observability Platform**

VuNet's Business-Centric Observability Platform leverages AI to enhance user transactions in BFSI, FinTech, and other sectors. It reduces failure rates and strengthens digital infrastructure, promoting operational excellence. Partnering with ICICI, RBL Bank, and Indian Bank, VuNet manages over 20 billion transactions and US$900 billion in assets monthly.

**Addressing the Gap in IT and Business Performance Monitoring**

Traditional IT monitoring often overlooks the impact of technical metrics on business performance. For instance, delays in payment workflows or batch process failures can severely affect business outcomes, but many organisations lack the tools to measure these impacts. IT incidents can immediately and significantly impact business results, given the critical role of IT systems in value creation.

Business-centric observability addresses this gap by correlating IT metrics with business KPIs and customer experience, offering actionable insights. For example, identifying that 3,000 users couldn't upload documents due to latency during onboarding highlights the severity of such incidents.

**Importance of Addressing the Selected Problem**

Traditional IT monitoring tools excel at tracking system health and performance metrics like CPU usage and network latency. However, they often fail to link these metrics to business outcomes, posing several challenges. These include a lack of business context, hindering understanding of technical issues' impact on business processes. Moreover, these tools operate reactively, alerting teams after issues arise. This exacerbates communication silos between IT and business units, complicating collaboration and alignment of objectives.

### Leveraging AI for Enhanced Transaction Monitoring

VuNet's platform monitors 20 billion transactions valued at US$900 billion, enhancing customer engagement, growth, and operational efficiency for banks, payment gateways, and MSPs. By integrating diverse data sources into a unified pipeline for real-time processing, it cleans, validates, and enriches data to predict and prevent transaction failures.

AI-powered VuNet facilitates anomaly detection and accelerated root cause analysis, improving IT response times. Supporting various real-time payment methods like UPI, IMPS, Swift, ACH, and RuPay, it offers configurable vuBlocks for sector-specific adaptation. VuSmartMaps provides tailored user transaction views, enhancing end-to-end visibility and operational insights. Unlike traditional tools, VuNet integrates domain-specific insights with MLOps, enabling flexible deployment of pre-built and custom ML models.

### Technical Overview of vuSmartMaps Platform

vuSmartMaps is an integrated enterprise AI/ML platform with MLOps capabilities featuring:

**Data Acquisition:** Utilises agents and agentless methods for collecting logs, metrics, and traces, employing tools like Logstash, Fluentd, and Telegraf.

**Data Processing/Pipeline:** Real-time processing and ContextStreams for semantic and syntax data extraction, with Kafka and Redis for queueing and data forwarding to multiple destinations.

**Data Cleaning:** Implements Great Expectations for real-time data validation and cleaning.

**Data Scheduling:** Uses Airflow and scheduling algorithms to move data across databases (NoSQL to TSDB) for summarisation and ML model building.

**Data Storage:** Employs HyperScale Data Store capable of managing petabytes of data.

**ML Models:** Executes real-time ML models via prebuilt Python modules, handling high-scale transactions (30K-50K events per second).

**MLOps Modelling:** Infrastructure layer facilitating data movement, automated quality checks, and scalable training, execution, and retraining of ML models.

**Alerts:** Features advanced AI/ML-driven alert logic for real-time correlation and precise alerts on transaction and infrastructure issues.

**Dashboarding and Reporting:** Provide dashboards and storyboarded KPIs, metrics, and enriched data for detailed issue analysis.

**GenAI:** Includes VED, an AI Assistant for incident identification and accelerated root cause recommendations, significantly faster than traditional methods.

### Dataset Complexity and Scalability

The platform seamlessly scales to monitor >12 billion transactions monthly, valued at over US$900 billion. It handles 40TB of logs and metrics daily, processing 1 million events per second. Data sources include diverse formats like non-standard logs and time series data from network, server, and application infrastructures. It excels in real-time auto-recognition of data syntax and semantics, which is crucial for computing session states per transaction. Optimisations ensure efficient tracking of session data, vital for quick issue resolution and transaction acceleration across primary and downstream API interactions.

### Data Solution Implementation Challenges and Solutions

1. **Data Acquisition:** Deploying agents securely and non-intrusively on servers/applications for real-time log/metric collection. Agents are optimised for efficiency and undergo rigorous security validations

2. **Data Processing:** Ensuring data availability within customer networks often requires adjusting firewall rules. Vunet educates customers on best practices to enhance data quality

3. Data Contextualisation: Using vuBlocks, data adapters interpret diverse logs, capturing session information, semantics, and syntax for precise analysis
4. Data Storage: Managing high-volume data ingestion and ensuring compliance with storage requirements beyond seven days. Customise virtual machine data storage capacities to meet client specifications

**Scale and Impact of vuSmartMaps Solution**

- *vuSmartMaps operates at a large scale, monitoring 20 billion transactions monthly, valued at over $900 billion. It processes 40 Terabytes of logs daily from 90,000 nodes, utilising 450+ data adapters across 25,000+ branches. Continuous AI model training through MLOps ensures accuracy and relevance, preventing data and concept drift*

*The platform has significantly impacted various customers:*

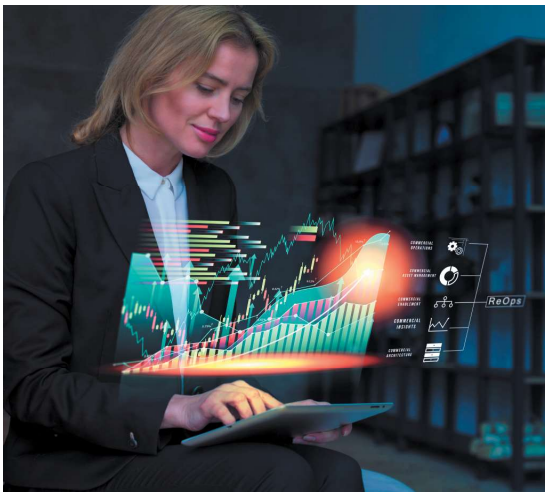
- *Reduced technical decline by ~60% for a leading payment processor and resulted in ₹270 crores annual revenue optimization*
- *For ICICI Bank's UPI application, vuSmartMaps' AI models increased annual transaction volumes by ₹725 crores, saved 6,500 hours in annual root cause analysis, and enhanced the daily experience for 4,000 end users*

*Overall, vuSmartMaps benefits over 25 customers in banking, payment gateways, and fintech sectors, improving digital infrastructure performance, increasing revenue through optimised transactions, and reducing costs through quicker issue resolution.*

Integration with major cloud providers-Azure, AWS, and GCP-will improve data management for swift deployment. Containerisation and microservices architecture will further enable scalability. Automated log analytics utilising NLP and AI will enhance operational efficiency and insight accuracy.

**Scaling Potential and Future Developments**

vuSmartMaps, in collaboration with a leading payment regulator, manages 12 billion daily transactions, aiming to reduce technical declines from 3% to below 0.5%. This initiative seeks to mitigate 360 million failed transactions valued at approximately ₹360 billion.




To sustain declines below 1%, banks and processors require advanced solutions offering unified visibility and domain-centric AI KPIs for proactive insights. This approach accelerates failure detection, analysis, revenue enhancement, and operational cost reduction, surpassing traditional monitoring systems.

Over the next six months, vuSmartMaps plans to introduce new KPIs like the Current Health Index (CHI) for real-time monitoring and Dynamic-threshold-based Enterprise Anomaly Detection to minimise false alerts. Enhancements to existing KPIs will provide faster, more precise insights supported by robust MLOps capabilities.

BFSI
INNOVATOR

**Artivatic Datalabs Pvt Ltd**

# ARTIVATIC'S AUSIS PLATFORM

***Industry:*** *BFSI*
***Business Function:*** *Software & Applications*
***Beneficiary:*** *Life and Health Insurance, Customer Onboarding, Underwriting, Fraud Control functions*
***Technologies used:*** *Generative AI, Computer Vision, NLP*

**Artivatic.ai: AI-Powered Insurance Solutions**

Artivatic.ai is an AI and ML-based platform offering APIs for product configuration, smart underwriting, risk assessment, fraud detection, document processing, customer/agent onboarding, sales, analytics, third-party data intelligence, and claims automation. It aids insurance companies in digital transformation, product development, infrastructure building, and data-driven decision-making.

**Challenges in Traditional Underwriting Platforms**

Many insurance companies face issues with their existing underwriting platforms and rule engines, which lack scalability, user-friendliness, and automation. These systems are not integrated solutions and rely heavily on manual processes, failing to leverage past experiences or external data sources for underwriting decisions. Automated decision-making is absent, and configuring underwriting rules is limited, complex, technology-intensive, and time-consuming.

**AUSIS: AI-Driven Underwriting Solution**

AUSIS is an intelligent engine that uses AI and ML to streamline life and health insurance underwriting processes. It processes diverse data and documents to bridge data gaps, enabling informed decisions in retail and group sectors. The platform features data-driven medical risk scoring, integrates with built-in rule engines and reinsurance rules, and automates multiple underwriting tasks. AUSIS enhances legacy systems and provides a complete,

**Importance of AI in Solving Underwriting Challenges**

AI offers essential solutions to address these issues. AI provides powerful tools to overcome traditional underwriting limitations, enhancing efficiency, accuracy, and adaptability, thus benefiting both insurers and policyholders. Key reasons for the growing importance of AI in insurance underwriting include enhanced data analysis, improved efficiency and speed, combatting fraud and adverse selection, adapting to evolving risks, and addressing bias and fairness concerns.

modern solution for STP (straight-through processing) and NSTP (non-straight-through processing), ensuring seamless, efficient, data-driven, customer-centric, and automated underwriting.

### Complexity of the AUSIS Dataset

The dataset used in AUSIS is complex due to its volume, data types, and diverse sources.

**Volume:**

Large and Growing: The dataset includes financial information, medical records, driving history, property details, wearable data, and social media activity. This diversity and continuous addition of data points result in a large and ever-expanding dataset.

**Data Type:**

Highly Heterogeneous: The dataset consists of structured and unstructured data. Structured data includes numerical information from financial records and sensor readings, while unstructured data includes text documents like medical reports and social media posts. This variety requires advanced data processing and analysis techniques.

Data Sources: AUSIS uses data from multiple sources – Internal, external, emerging and Third-Party Providers.

**Additional Complexity Factors**

- Data Quality and Bias: Ensuring accuracy and fairness of risk assessments involves addressing data quality and potential biases
- Data Privacy and Security: Compliance with stringent regulations and user privacy concerns requires secure data handling and anonymisation techniques
- Real-Time Updates: Incorporating real-time data streams, such as from wearables, adds another layer of complexity

### AUSIS Data Solution and Implementation Challenges

Data Processing and Analysis: AUSIS ensures data quality and consistency through cleaning and pre-processing. Feature engineering transforms raw data into relevant features for analysis. Machine learning algorithms generate risk profiles, detect fraud, and personalise pricing.

**Challenges**

- **Data Integration and Standardisation:** Combining diverse data sources with varying formats
- **Data Quality and Bias:** Addressing missing values, errors, and biases
- **Privacy and Security:** Comply with regulations and protect user privacy
- **Explainability and Fairness:** Ensuring transparency and fairness in AI-driven decisions
- **Performance and Scalability:** Managing large datasets efficiently while maintaining accuracy

**Solutions**

- **Data Governance and Quality Management:** Processes to ensure data quality and consistency
- **Data Anonymisation and Privacy-Preserving Techniques:** Protecting user privacy during data analysis
- **Explainable AI (XAI):** Providing explanations for AI decisions to assess fairness and address biases
- **Cloud-based infrastructure and Scalable Algorithms:** Facilitating efficient processing and model training with large datasets
- **Continuous Monitoring and Improvement:** Iterative refinement of data pipelines and models for optimal performance

**Features**

- **Data Processing:** Handles large datasets for numerous clients, demonstrating scalability in data processing and analysis
- **Deep Understanding:** Models recognise over 1,500 insurance-specific data attributes
- **Data Enrichment:** Data is cleansed and enriched for accuracy and insights using sources such as the IIB, Bureau, environmental data, and more

- **Pre-Trained Models:** Trained on 5+ million new business data points and 500,000 claims
- **Domain Expertise:** It is supported by in-depth domain and data engineering expertise
- **Explainable AI:** Provides attribute-level insights and detailed risk scores for underwriting decisions
- **Regulatory Compliance:** Automates compliance checks and integrates regulatory updates, aiding efficient compliance management

### AUSIS: Achieved Scale and Overall Impact

***Overall Impact***

- ***Adoption:*** *Actively used by over five life insurance companies, indicating broad industry acceptance*
- ***Global Reach:*** *In active pilot phase in the Middle East, Southeast Asia, and India*
- ***Industry Transformation:*** *Contributes to a more efficient and data-driven insurance industry by promoting AI adoption in underwriting*
- ***Proven Results:*** *Clients have reported improved STP ratios, reduced early claims, and enhanced underwriter productivity*
- ***Brand Differentiation:*** *Using cutting-edge AI technology attracts tech-savvy customers and provides a competitive edge*
- ***Data-Driven Insights:*** *AI analysis offers valuable insights for product development, marketing strategies, and risk management*

***Revenue Optimisation:***

- ***Reduced Underwriting Costs:*** *Automation and AI-driven decisions lead to faster processing and lower labour costs*
- ***Improved Risk Selection:*** *Accurate risk assessments allow competitive pricing, attracting better risks and potentially increasing premiums*
- ***Reduced Fraud Losses:*** *Enhanced fraud detection saves insurers significant money*

***Operational Efficiency:***

- ***Faster Turnaround Times:*** *Claims up to 90% faster policy issuance, with significant underwriter productivity improvement*
- ***Reduced Processing Costs:*** *Reports 60% reductions in processing costs, improving operational efficiency*
- ***Accuracy Improvements:*** *The platform achieves up to 80% enhanced fraud detection and a 30% reduction in risk, improving risk assessment accuracy*
- ***Streamlined Workflows:*** *Automates tasks, simplifies underwriting processes, and reduces errors*

***Customer Experience:***

- *Improved customer satisfaction through quicker underwriting*
- *Utilises individual data to suggest relevant insurance products and personalise pricing*
- *Streamlined processes and data transparency enhance customer trust*

***ESG Contributions***

- ***Environmental Impact:*** *Reduced paper usage and better climate risk assessment*
- ***Social Impact:*** *Promotes financial inclusion and supports data-driven social initiatives*
- ***Governance:*** *Enhances compliance, transparency, and data privacy*

### Future Potential of AUSIS

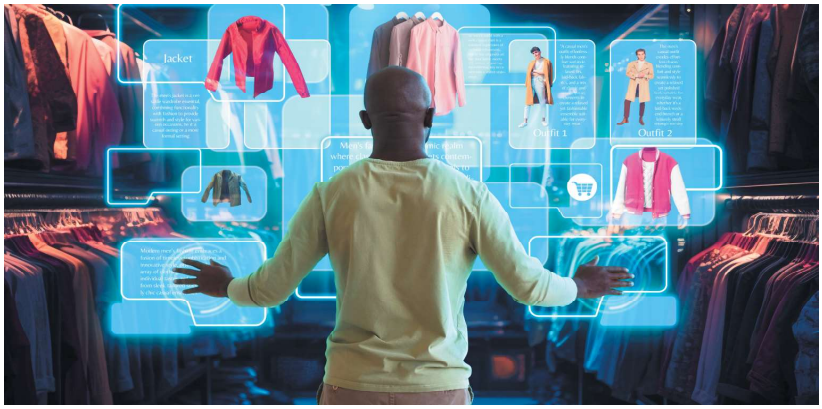
- Expand geographically into new markets, especially emerging economies
- Target new insurance segments like cyber risk and climate change
- Collaborations with reinsurers, insurtech startups, and technology providers could further enhance its reach
- Influence industry standards, democratise insurance by increasing accessibility, and shift underwriters' roles to focus on complex cases

# CPG AND RETAIL

CPG & RETAIL
GAMECHANGER

Lululemon

# LULULEMON: FORECAST ALLOCATION & REPLENISHMENT ENGINE




***Industry:*** *CPG & Retail*
***Business Function:*** *Operations*
***Beneficiary:*** *Product planning and assortment team, Global merchandise team, Regional assortment planning team*
***Technologies used:*** *AIOps*

## Lululemon's Data-Driven Strategy

Lululemon is a global retail company specialising in premium athleisure products for men and women. It operates through eCommerce and offline stores. The company is adopting data-driven decision-making and AI across various areas, incl. product planning, assortment, and demand forecasting. This approach enhances accuracy, efficiency, and adaptability to changing market trends.

## Lululemon's AI Adoption Journey

Lululemon's journey in adopting AI technology involves tailored strategies and overcoming unique challenges specific to its retail and business model:

- Assessment of Needs and Objectives
- Data Collection and Preparation
- Skillset and Talent Acquisition
- Technology Selection
- Pilot Projects and Prototyping
- Integration with Existing Systems
- AI Implementation
- Continuous Improvement and Optimization
- Ethical Considerations and Compliance
- Scaling and Expansion
- Collaboration and Communication

## Forecasting Challenges at Lululemon

**Forecasting was challenging for Lululemon due to several factors:**

**Manual Planning:** Hundreds of planners manually managed assortment planning for nearly 800 global stores and around 100,000 products using MS Excel.

**Human Bias:** Manual processes introduced human biases, leading to suboptimal outcomes.

**Scale of Operations:** In FY2024, ~60,000 new products are expected to be introduced globally, and 100 new stores are expected to open.

**Data Sparsity:** Sparse data at the forecast hierarchy (Product * Store * Day/Week) complicated forecasting.

**Ineffective Traditional Models:** Traditional time series models provided subpar results.

### Addressing Lululemon's Assortment Planning and Supply Chain Challenges

**Uncertainty in Consumer Behaviour:** Consumer preferences and behaviour shift due to trends, economic conditions, and external events.

**Market Dynamics:** Competition, technological advancements, and regulatory changes influence market conditions.

**Seasonal Variations:** Seasonal demand fluctuations led to overstocking or understocking, increasing holding costs or causing missed sales opportunities.

**Supply Chain:** Manual procurement, production planning, inventory management, and distribution processes resulted in high costs and operational difficulties as the company expanded.

**Inventory Management:** Overstocking causes capital to be tied up in unsold inventory while understocking leads to stockouts, lost sales, and dissatisfied customers.

**Production Planning:** Accurate production schedules were needed to meet anticipated demand.

**Financial Planning:** Effective resource allocation and informed investment, marketing, and budgeting decisions were crucial.

**Market Competition:** Anticipating and meeting customer demand provided a competitive advantage.

**Customer Satisfaction:** Promptly meeting customer demand improved customer satisfaction, experience, and loyalty.

**Importance of Solving Lululemon's Planning Problem**

Solving this problem is crucial for Lululemon because it impacts product planning, purchase order placement (done at least a year in advance), and store-level product replenishment. Improving this process benefits the Product Assortment & Planning team, enhancing overall supply chain management.

### IAI-Driven Solution for Lululemon's Planning Challenges

**Lululemon employs AI to tackle planning challenges through several essential methods:**

Firstly, AI conducts precise demand forecasting by analysing historical data, customer behaviour, and market trends, optimising inventory levels and reducing stockouts.

Secondly, AI aids in product planning and assortment optimisation by identifying popular products aligned with customer preferences and market trends.

Thirdly, AI-driven tools automate data analysis and decision-making, freeing resources for strategic tasks and boosting operational efficiency.

Lastly, the AI system continuously learns and adjusts to market changes, empowering Lululemon to quickly adapt to evolving customer preferences and industry trends.

### Dataset Complexity

Lululemon's dataset is complex, with a daily volume of 2 GB and approximately 100 million predictions made to date, incl. 170,000 daily predictions. The data, stored in a data warehouse, is structured relational data.

### Data Solution and Implementation Challenges

Lululemon implemented a data solution that involved several challenges and strategies:

**Challenges:**

- **Domain Knowledge:** Required to use normalised data effectively
- **Stakeholder Involvement:** Multiple stakeholders increased the likelihood of changes from upstream to downstream processes

- **Batch Orchestration:** Needed to consider Airflow-based batch orchestration

**Solutions:**

- **Expert Consultation:** Engaged in discussions with SMEs and validated decisions with business experts
- **Data Quality:** Implemented data quality checks within the code using assertions and leveraged data quality tools
- **Team Communication:** Ensured transparent communication between teams, facilitated by product managers

### Achieved Scale and Impact of Lululemon's AI Solution

***Lululemon's AI solution has achieved significant scale and impact across multiple dimensions:***

- *Scalability: The system effectively handles planning for ~27,000 products and 800 stores, demonstrating adaptability as the business grows. Over 4,000 experimentations were conducted during peak periods without downtime, showing robust performance.*
- *Operational Efficiency: By aligning resource allocation with demand, the solution optimises resource utilisation, minimises waste, and enhances operational efficiency.*
- *Reduced Errors: Automation has significantly reduced human errors in calculations, data entry, and decision-making. Stockouts at the store level have decreased by 63%, leading to more accurate planning and order fulfilment.*
- *Revenue Optimisation: Accurate demand forecasts align supply with expected demand, minimising holding costs while ensuring product availability, thereby maximising revenue.*
- *Improved Inventory Management: Automation has optimised inventory levels, reducing overstock and stockouts. The lead time from the distribution centre to the store has been cut from 5 to 2 days, resulting in cost savings and improved customer satisfaction.*

- *Resource Optimisation: Planners can now focus on strategic supply chain management tasks, such as trend analysis and forecasting, while routine tasks are automated.*
- *Enhanced Visibility: Automated systems provide real-time visibility into the supply chain, allowing planners to track product movement and identify potential bottlenecks.*
- *Adaptability to Market: The system allows for rapid adjustments to market fluctuations, customer demands, and unexpected events, ensuring a flexible and agile supply chain*
- *Customer Experience: Ensuring product availability where and when needed leads to an improved customer experience.*
- *Environmental Impact: Algorithms and infrastructure are optimised to minimise energy consumption across the value chain.*
- *Societal Impact: The solution has led to significant operational savings and person-hours saved, allowing more investment in customer relationships and community engagement. Community engagement goals are fully met each quarter, with all hours forecasted, scheduled, and actualised in Dayforce.*

CPG & RETAIL
CHALLENGER

Fractal Analytics

# FRACTAL ANALYTICS: PRICE PACK ARCHITECTURE

***Industry:*** *CPG & Retail*
***Business Function:*** *Marketing & Sales*
***Beneficiary:*** *Global CPG company in pet, confectionary, food and beverages and personal care*
***Technologies used:*** *AIOps, Supervised Learning*

**Global AI & Advanced Analytics Solutions**

Fractal Analytics is a global AI and analytics firm serving Fortune 500 clients. It offers services and software for the full lifecycle of AI solutions, from ideation to insights.

Fractal's key businesses include:

- Crux Intelligence: AI-driven business intelligence
- Eugenie.ai: AI for sustainability
- Senseforth.ai: Conversational AI for sales and customer service
- Qure.ai: Healthcare AI for detecting tuberculosis and lung cancer

They serve industries such as BFSI, Healthcare & Life Sciences, TMT, CPG & Retail, using a user-centric approach, integrating data and behavioural science, and scalable AI solutions.

**H2: Challenges in Price Pack Architecture (PPA) for CPG Brands**

Price Pack Architecture (PPA) is crucial for CPG brands as it affects market presence, profitability, and shopper loyalty. PPA involves creating a well-structured product assortment, pricing, and packaging to meet diverse consumer demands across various channels and retailers.

**Key Challenges:**

**Siloed Decision-Making:** Pricing, product assortment, and innovations are often handled by separate teams, leading to strategies that don't fully address market needs.

**Reliance on Heuristics:** Many decisions are based on traditional methods or past experiences rather than data and AI-driven insights, resulting in suboptimal outcomes.

**Lack of Digitization:** The decision-making process is often manual, relying on documents, spreadsheets, and presentations, which hampers collaboration and speed

**Global Ecosystem Enablement:** Unlocking the full potential of PPA requires moving beyond developed markets and enabling all markets to leverage AI for decision-making, a persistent challenge

### Importance of Solving Price Pack Architecture (PPA) Issues

Addressing PPA challenges is vital for brands for several reasons:

**Winning with Consumers:** Effective PPA aligns with consumer preferences, enhancing shopper loyalty and boosting profitability by 2-5%

**Competitive Edge:** Improved PPA provides agility and foresight, enabling brands to navigate market shifts and secure durable competitive advantage, with potential share gains of 50-100 basis points

**Digital Transformation:** AI in PPA revolutionises decision-making, streamlines operations, and advances digital empowerment, leading to 30-50% productivity gains

### AI-Driven Solution for Price Pack Architecture (PPA)

**Fractal's solution for PPA integrates AI at every stage:**

**Data Foundation:** AI automates data validation, configuration, and standardisation across global markets, ensuring a solid foundation for accurate modelling

**Model Workbench:** AI forms homogeneous product groups, identifies competitors, automates feature engineering, and executes a four-step modelling process. This process isolates sales-impacting factors (e.g., seasonality, promotions), examines

product size changes, forecasts sales for new products, and captures demand transference between products

**Consumption Platform:** Beyond analysis, this platform simulates multiple what-if scenarios and optimises pricing and product strategies using GenAI-driven recommendations. For example, it might suggest introducing a specific pack size at a certain price point based on predictive insights

**Always-on Operations:** The platform includes model tracking, performance dashboards, drift detection algorithms, and automated retraining workflows, ensuring models stay up-to-date and aligned with market dynamics

This AI-driven approach transforms traditional PPA analytics into a dynamic, integrated, and predictive solution.

### Complexity of Dataset in Price Pack Architecture (PPA)

**Data Sources and Types:** Fractal's PPA solution integrates syndicated data from Nielsen and IRI, POS data, internal financial records, advertising expenditure, and product attributes like segment, brand, flavour, and pack size. It also incorporates market-specific holiday data from Google Calendar.

**Data Granularity:** The solution adapts to monthly and weekly data updates, providing detailed retailer-level insights and broader channel or regional aggregates.

**Volume and Scalability:** Designed for over 50 global markets, with 7+ markets currently operational, the solution handles up to 3 years of historical data per market. Data volumes range from 10 million to 1 billion rows, accommodating extensive analytics and strategic insights.

### Data Solution Design and Implementation Challenges

Fractal developed a robust data foundation for its Price Pack Architecture (PPA) solution, covering data ingestion, transformation, storage, a unified data model, and data views. This infrastructure supports downstream platforms and reports through an operationalised DevOps process, scalable across the top 50 CPG markets.

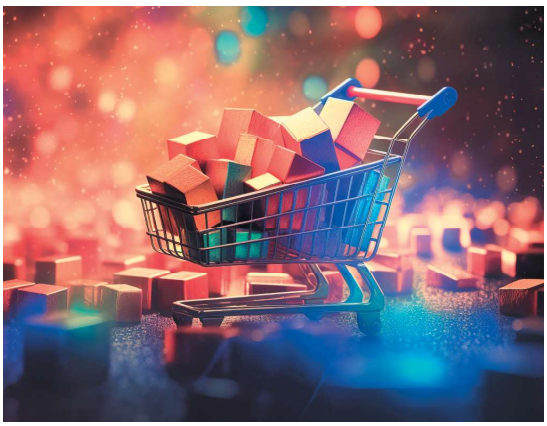
**Key Features:**

**Unified Data Model:**

- During pilot phases, challenges like repeated localisations and global changes were addressed
- Introduced a PPA Global model for standardised market data, adaptable for local exceptions
- Benefits: 50% faster market onboarding, 45% fewer code changes, and 20% reduced data requirements

**Data Transformations:**

- Market-specific transformations add derived columns based on granularity, pricing tactics, and market size



- Azure ML-based feature store integration offers flexibility in creating transformed variables
- Examples include splitting weekly prices, mapping competition, product classification, and handling missing data

**Data Mapping (External Sales to Internal Financials):**

- Aligning external sales data (e.g., IRI, Nielsen) with internal financials posed challenges
- AI facilitated mapping through product descriptions, ensuring a comprehensive view of market performance relative to financial data

### Scale and Impact of PPA Solution

*Fractal's Price Pack Architecture (PPA) solution has significantly transformed revenue management for a Fortune 100 CPG giant, demonstrating substantial scale and impact across various business dimensions:*

- ***Margin Impact:*** *Delivered over $100 million impact, driven by enhanced strategic decision-making capabilities*
- ***Operational Efficiency and Speed:*** *Reduced deployment time from 20 to 4 weeks, achieving 70-80% operational efficiency gains*
- ***User Adoption and Leadership Endorsement:*** *Praised for its user-friendly interface and data-driven platform, the solution enjoys high adoption rates and satisfaction. It has garnered endorsements from over 25 senior executives globally, including the Chief Growth Officer*
- ***Market Demand and Scalability:*** *Currently operational in 5+ markets, with plans to expand to the top 50 markets within 12-24 months. Its modular design allows easy scalability and customisation to meet diverse market needs*

*Looking ahead, future enhancements will include innovation and renovation modules, leveraging additional data sources like social chatter and supply chain networks to recommend sustainable, socially impactful products*

### Scaling Plan for Future Growth

Fractal's upcoming scaling plans align with current trends and scenarios:

**Next 6 Months:** Expand into 4-5 additional markets and modularise the solution for staged deployment in smaller markets. Complete Proof of Concepts (POCs) with two new Top 20 CPG clients.

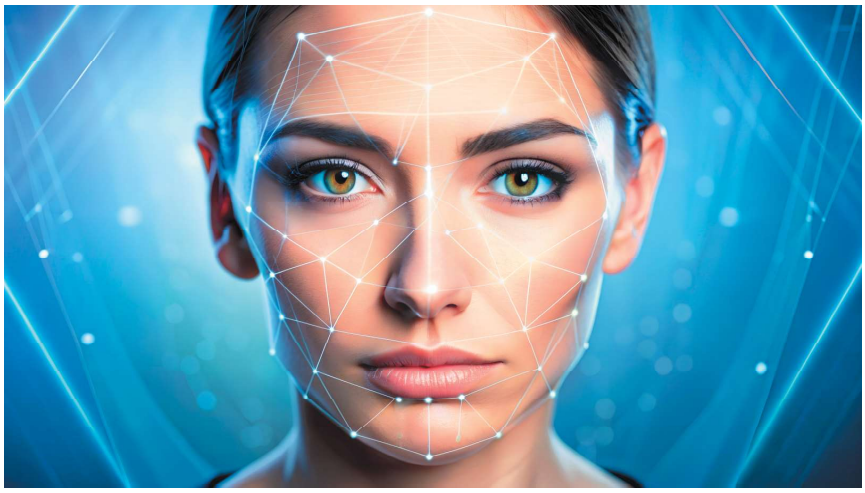
**Next 12 Months:** Scale into 10+ additional markets and enhance product portfolio coverage by modelling seasonal products and optimising capabilities with Gen AI-powered intelligence.

**Next 24 Months:** Scale to cover the top 50 markets for the client and extend the solution to other market categories, ensuring comprehensive market penetration and growth.

CPG & RETAIL
CHALLENGER

Hindustan Unilever

# HINDUSTAN UNILEVER: LEVERAGING AI IN BEAUTY-TECH AND SOCIAL COMMERCE ACROSS BEAUTY BRANDS



***Industry:*** *CPG & Retail*
***Business Function:*** *Marketing & Sales*
***Beneficiary:*** *Consumers across Beauty & Personal Care*
***Technologies used:*** *AR/VR, Computer Vision, NLP, Generative AI*

## HUL's AI-powered Innovation in Beauty-Tech and Social Commerce

Hindustan Unilever Limited (HUL) leverages AI to enhance its six major beauty brands. Advanced AI algorithms provide personalised skincare recommendations and virtual try-ons, boosting customer engagement and satisfaction. AI-powered chatbots and predictive analytics enable real-time interactions and smooth transactions on social commerce platforms like WhatsApp, Instagram, and Facebook, setting new standards in personalised beauty experiences and driving brand growth.

HUL prioritises ethical AI, data privacy, security, and consent in the beauty sector, reaching millions of consumers digitally.

### Addressing Key Consumer Engagement Challenges

HUL seeks to solve issues like low consumer engagement, lack of data for analysis, high bounce rates, short average time spent, weak brand loyalty, poor conversion rate optimisation (CRO), and low return on ad spend.

Engaging consumers with an immersive product experience drives organic engagement and consumer delight, enhances brand loyalty and reduces product

### Leveraging AI to Enhance Consumer Engagement

HUL addresses consumer engagement challenges with an AI-driven solution comprising diagnostic

tools and immersive experiences integrated via a customisable platform. This AI capability employs imaging, sensors, and data analysis to assess skin health metrics, incl. moisture, oiliness, pigmentation, wrinkles, pore size, and UV damage. These tools are available on brand websites, retailer partner sites, and in-store experiences.

HUL's "build once, deploy in multiple brands/ channels" model lowers the total cost of ownership and speeds up market readiness. In social commerce, AI-driven chatbots provide instant consumer interaction, offering personalised product suggestions for skin, hair, and makeup, improving engagement and purchasing behaviour insights.

This comprehensive AI approach delivers personalised recommendations, virtual try-ons (VTOs), and AR/VR experiences, catering to evolving needs of consumers and saving them time, effort, & money.

### AI-Driven Personalised Beauty Solutions

In the digital era, consumers seek personalised skincare and make-up solutions. HUL's AI-powered skin analysers on beauty websites use advanced algorithms to assess skin conditions, providing insights on hydration, pigmentation, texture, and elasticity. This technology generates tailored skincare routines based on high-resolution images or user inputs, revolutionising online shopping.

The DefineU solution offers AR-based make-up tutorials for complex techniques like contouring and highlighting, using AI for shape analysis. In social commerce, HUL combines social media and eCommerce to enhance engagement, drive sales, and boost brand loyalty. Users interacting on Instagram receive DMs from AI bots, offering virtual try-ons and personalised recommendations, leading to direct purchases or visits to HUL's DTC platform.

### Complexity of the Dataset

The AR-based beauty analyser is trained on millions of images, while the chat interfaces are trained on >100,000 articles and products.

### Data Solution and Implementation Challenges

HUL implemented a robust data solution that focused on consumer consent management, data security, ethical AI, and multi-platform integration.

#### Challenges and Solutions

Data Flow from Multiple Partners: Managed integration complexities by customising the global application for local markets.

Continuous Evolution: Adapted to emerging trends through regular reviews and updates.

#### Governance

Performance Review: Weekly brand and tech meetings to analyse performance and trends

Platform Resilience: Weekly platform reviews to ensure 100% uptime and compliance

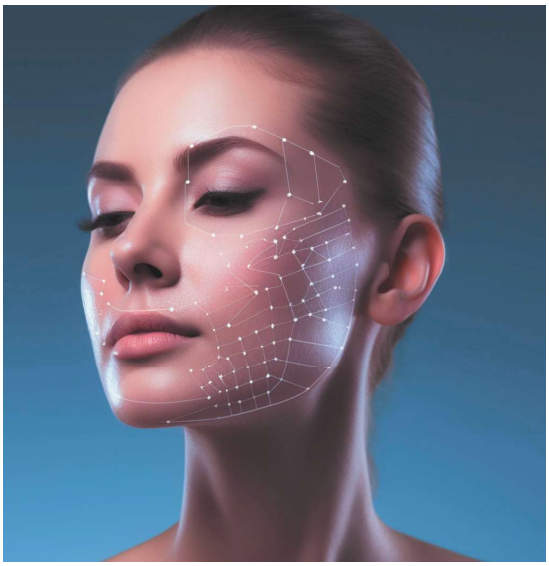
Change Requests: Fortnightly meetings with the product support team

Innovation: Monthly sessions with product innovation team to stay ahead of market trends

#### Efficacy

Dedicated Teams: A beauty and social squad focused on process innovation, ensuring these features are integral to the customer journey.

Audience Engagement: Promoted applications to a broader audience, gathering regular feedback for continuous improvement.



### Achieved Scale and Impact of HUL's AI Solution

*HUL engaged 4 million consumers, achieving a 30% increase in conversion rates.*

#### *Consumer Benefits*

- *Product Matching: Helps users find suitable products quickly*
- *Empowerment: Enhances understanding of their skin, hair, and make-up*
- *Convenience: Provides an in-store experience at home*

***Brand Benefits***

- *Order Conversion: Optimises conversion rates Consumer Equity: Strengthens brand equity*
- *Engagement: Improves engagement metrics*

***Business Benefits***

- *ROAS: Increases return on ad spend through hyper-personalisation*
- *Customer LTV: Boosts lifetime value by creating new selling moments*
- *Consistency: Ensures consistent execution across the brand footprint*

**Projected Scale and Revenue Growth**

Based on current trends, HUL anticipates engaging 10 million consumers and generating ₹1 billion in revenue.

CPG & RETAIL
INNOVATOR

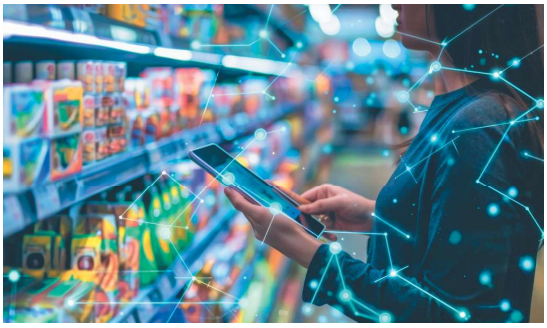
Anko GCC

# ANKO GCC: AI-ENABLED PRICING RECOMMENDATION ENGINE

***Industry:*** *CPG & Retail*
***Business Function:*** *Marketing & Sales*
***Beneficiary:*** *Kmart Merchandise team - Buyers and Planners*
***Technology used:*** *NLP, Optimization*

## Anko GCC: Optimizing Operations and Enhancing Customer Experience with AI

Anko, the global capability centre for Australia's Kmart and Target, uses advanced analytics, machine learning, and AI to improve customer experiences and optimise operations.



## Optimal Pricing Challenge and the Importance of Solving It

To maintain market leadership and maximize profits, Kmart aims to determine the best product prices using a scalable price recommender and real-time competitor pricing intelligence. With AUD 10.6 billion in revenue (FY2023), accurate pricing is crucial. The solution should:

- Suggest optimal prices considering store inventory
- Incorporate real-time competitive pricing intelligence
- Factor in price elasticities, product affinities, cannibalization, and business rules
- Allow users to override optimized prices and assess the impact on revenue and margins

### Role of AI in Pricing Optimization

**Predictive Analytics: General Linear Models (GLMs)**

- Utilises a suite of linear models to predict units sold based on price and product attributes
- Calculates price elasticity for each product for easy business consumption

**Competitive Intelligence: Web-Scraping and Product Matching**

- Scrapes data for 150,000 competitor products daily for daily price tracking
- Accurately identifies top competitor products to inform pricing decisions

**Optimisation: Optimization Engine**

- Combines price elasticities (GLMs) and competitor pricing intelligence to recommend optimal prices
- Maximizes profits while adhering to various business constraints


**Engineering: ML Platform**

- Deploys top-tier ML infrastructure to scale the product across all GM categories
- Provides a web interface for easy access to price elasticities and optimal prices

### Complexity of Dataset

The dataset used is complex in terms of volume, data type, and data sources:

- Volume: Anko scrapes data for 150,000 competitor products daily. Product matching with Kmart products involves multiple joins/cross-joins, resulting in massive datasets
- Data Type: Includes text, numeric, image data sourced from competitors' websites
- Data Sources: For the price recommender, the data source is the internal Kmart data warehouse, consisting of numeric and text data

### Data Challenges and Governance

**Data Challenges:**

- Web-scraped competitor data often requires extensive cleaning due to changes in webpage layouts, necessitating code and pipeline modifications
- Sparse availability of price change data posed challenges for building regression models to calculate price elasticity

**Governance:**

- Models are refreshed monthly to review performance in terms of model fit and statistical significance of price features
- Feedback from business users on price elasticity and recommendations is incorporated to enhance models

**Benefits of AI Solutions**

- Previous manual processes led to subjectivity and lack of standardisation. The current solution provides accurate price recommendations at scale
- The model's workings and product functionality are transparent to users, allowing it to understand why a specific price was recommended
- The suite lists the latest competitor products, their prices, and optimal prices for all General Merchandise products. This improves decision-making and saves significant time for business teams
- Transparent price recommendations help business teams understand price changes and secure leadership approval before finalising prices

### Implementing the Data Solution

To mitigate the challenges, the team implemented proactive checks and data validation scripts to promptly identify and address issues caused by changes in competitor web pages. After data collection, they rigorously tested the data using multiple test cases to ensure accuracy and readiness for downstream processes.

Another significant challenge was the limited availability of price change data needed for predictive modelling. To overcome this, the team utilised various modelling techniques and explored data techniques such as oversampling to improve the effectiveness of their predictive models.

### Achieved Scale and Impact

***Operational Efficiency:***

- *2% improvement in POS as objective, transparent price recommendations increased business adoption*
- *Automated, accurate pricing recommendations saved significant time for business teams*

***Customer Experience:***

- *Maintained Kmart's EDLP position, allowing customers to enjoy high-quality products at the lowest prices*

***Revenue Optimization:***

- *The pricing engine ensures agility, providing the right price for the right products at the right time and enhancing customer experience and profitability*

### Potential Scale and Future Impact

Kmart plans to integrate the apparel departments into the pricing suite within 12 months.

CPG & RETAIL
GAMECHANGER

Vodex

# VODEX: PRE-SALES CONVERSATIONS

***Industry:*** *CPG & Retail, BFSI, Healthcare & Pharma*
***Business Function:*** *Marketing & Sales*
***Beneficiary:*** *Fintech, Insurance Tech, BFSI, Energy companies and SMBs*
***Technologies used:*** *Generative AI, NLP*

### Vodex: Revolutionising Outbound Sales with AI

Vodex is a B2B SaaS platform that automates outbound sales and marketing using proprietary Generative AI technology. It aims to create AI-powered virtual sales agents for natural, human-like conversations and an automated end-to-end sales process. Focused on the US market, Vodex has seen a 40X growth in the last 11 months, demonstrating strong adoption.

### Opportunities in Sales Automation for CPG and Retail

Vodex aims to automate sales engagement for businesses using Gen AI, focusing on pre-sales automation.

#### Enhanced Customer Engagement

Managing large volumes of consumer data to offer personalised experiences is technically challenging. AI algorithms analyse extensive consumer data to identify patterns, preferences, and past experience enabling personalised interactions at scale and predicting future behaviours for proactive and relevant engagement.

#### Increased Sales and Revenue

The retail sector faces challenges such as ineffective lead generation, qualification, and nurturing processes and poorly timed upselling and cross-selling. Gen AI improves lead qualification by analysing behavioural data, automating sales calls, and dynamically suggesting up-sell and cross-sell opportunities to maximise revenue.

#### Increased Customer Retention

Regular, personalised feedback requests and suggestions can boost retention, a task AI can manage effectively. AI anticipates customer needs and uses automated calls to assist. It personalises feedback requests and adapts reward programs to customer preferences, enhancing retention.

### Importance of Solving Sales Automation

With a decade of experience in NLP-driven systems, they identified a significant market need across organisations of all sizes. Recognising this challenge within their own company, they saw the potential and value in addressing it.

### Dataset Complexity and Training

The TTS model was trained on 55,000 hours of data compiled from various open sources, followed by internal data cleaning. For LLM fine-tuning, in-house curated data was augmented with LLM. Additionally, a reinforcement learning framework was employed for automatic model training.

### Data Solution and Implementation Challenges

Vodex faced numerous challenges, incl. hallucinations, implementing guardrails, latency, ultra-realistic TTS voice generation, vocoder integration, dataset refinement, model fine-tuning, and voice cloning architecture. Over 18 months, these issues were resolved mainly in-house, with ongoing efficiency optimisation.

#### Development and Production Challenges

- **Infrastructure:** Strong computing power is required for AI processing
- **Data Availability:** Sourcing sufficient quality data was complex
- **Accessibility:** Ensuring the solution's universal usability
- **Security:** Prioritised safeguarding customer data
- **Processing:** Needed fine-tuning for fast, accurate AI responses

#### Model Governance Mechanisms

- **Continuous Monitoring:** Ongoing performance checks
- **Regular Updates:** Frequent AI improvements
- **Audit Trails:** Maintained records for accountability

- **Feedback Loops:** User feedback and reinforcement learning enhance AI decisions

#### Advantages Over Existing Solutions

**Personalisation:** Better understanding of customer needs

- **Quicker Response:** Faster problem-solving
- **Learning Ability:** Continuous improvement and learning

**User-Friendly:** Easier interaction for users

### Achievements and Impact of Vodex

- *40% lower costs in pre-sales and sales*
- *~90% time saved for businesses*

*Revenue: Reached US$1 mn. ARR within 11 months of its January 2023 launch*

*Customer Experience: As a no-code solution, it is easy to use and provides immediate value*

### Responsible AI in Vodex

- **Unbiasedness/Fairness:** Utilises state-of-the-art open-source LLMs with guardrails to ensure fairness.
- **Data Privacy and Security:** Implements end-to-end encryption and adheres to strict privacy laws.
- **Adaptability:** Continuously improves AI to align with new ethical guidelines and user needs.
- Vodex includes guardrails to monitor AI impact, prevent misuse, block illegal activities, and continuously enhance safety measures.

### Future Scalability and Potential Growth

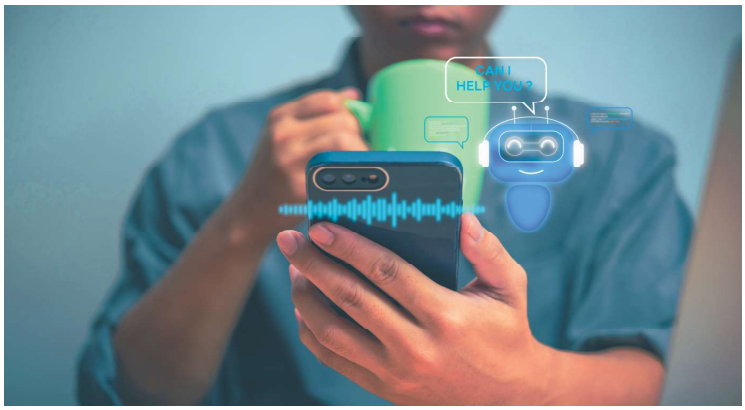
The current target market for Vodex is valued at nearly US$100 bn., within the global sales market worth US$1 tn. As the product expands into new geographies, its potential market size will grow significantly.

**Scalability:** Vodex handles 40 million TPD and continuously enhances this capacity

**Portability:** Developing on-premise deployment solutions for enterprises to broaden accessibility.

CPG & RETAIL
CHALLENGER

UL AI




# ULAI - EMPOWERING GLOBAL ECOMMERCE

***Industry:*** *Retail & CPG, Healthcare & Pharm, Manufacturing & Industrial Automotive*
***Business Function:*** *Customer Service, Marketing & Sales, Software & Applications, Operations, Business Intelligence*
***Beneficiary:*** *Online Businesses, Consumers, Customer Service teams*
***Technologies used:*** *Generative AI, AIOps*

## ulai: Transforming Conversational Commerce

ulai is an AI-powered platform that enhances eCommerce with personalised recommendations, seamless transactions, and post-purchase support. It engages customers in real-time, human-like conversations to boost sales and reduce cart abandonment. Supporting multilingual and voice interactions, Ulai makes online shopping accessible globally.

### Initial Adoption and Future Prospects

Early adopters such as Evlogia and Highway Delight have embraced Ulai. Evlogia, serving tens of thousands of customers globally through its extensive distributor network, and Highway Delight, with over a million users, have benefitted from ulai's conversational commerce platform.

ulai anticipates further adoption by Gamatics, Hobnob, and Bubblenutwash. These entities are poised to leverage ulai's multilingual, voice-enabled, and personalised solutions. As ulai continues to expand its presence in the market, more customers and entities are expected to join its user base.

### Importance of Addressing E-commerce Challenges

**User-Friendly Interaction:** ~80% of users encounter difficulties with device touch and typing interactions. ulai's voice-enabled interface simplifies the user experience, catering to diverse needs and enhancing accessibility, particularly for seniors and those with limited tech proficiency

**Customer Engagement and Satisfaction:** 80% of users prefer personalised assistance, crucial for fostering satisfaction and loyalty. ulai's focus on tailored support enhances customer experiences, driving engagement and facilitating successful transactions

**Language Barriers:** With ~90% of the global population lacking proficiency in English, ulai's multilingual capabilities break down language barriers, ensuring accessibility for a diverse audience

Addressing these challenges is essential for creating a more inclusive, user-friendly, and customer-centric eCommerce environment. ulai meets evolving consumer expectations and enables businesses to tap into a broader, more diverse customer base, unlocking new growth opportunities.

**Leveraging AI for Enhanced E-commerce Solutions**

ulai employs AI within its conversational commerce framework to address critical challenges in e-commerce. Here's how ulai leverages AI to tackle these issues:

Multilingual Conversational Interface: ulai's AI-driven chatbot facilitates seamless communication in multiple languages, ensuring context-aware interactions that mimic human conversation. Voice-Enabled Interaction: Using AI-powered NL), ulai enables voice-based queries, catering to users who find touch and typing interactions challenging.

Personalised Assistance: ulai's AI analyses user behaviour and preferences to offer tailored recommendations and support, enhancing the shopping experience through machine learning algorithms.

Contextual Memory: ulai's AI retains contextual information across interactions, delivering human-like responses and improving post-purchase support.

By integrating AI, ulai enhances real-time interactions, adapts to user preferences dynamically, and ensures nuanced contextual understanding. It surpasses the capabilities of traditional analytics in delivering personalised, immediate, and engaging e-commerce experiences.

**Complexity of ulai's Dataset**

**Volume**

Large-Scale: ulai handles extensive data, incl. user interactions, preferences, purchase histories, and contextual information across multiple channels

Real-Time Data: Includes real-time interactions, adding complexity to its management and processing

**Data Type**

Multimodal Data: Encompasses text, voice, and potentially visual data, necessitating advanced processing techniques

Unstructured Data: Conversations generate unstructured text and voice inputs, requiring sophisticated NLP to understand and respond appropriately

Data Sources

Omni-Channel Data: Data comes from various platforms, incl. websites, mobile apps, messaging apps, and social media, requiring integration and harmonisation

External Integrations: Integration with external systems further increases dataset complexity

**Data Solution Implementation Challenges and Strategies**

Scalability: They employed horizontal scaling and cloud-based solutions, optimising queries to manage increased user interactions effectively

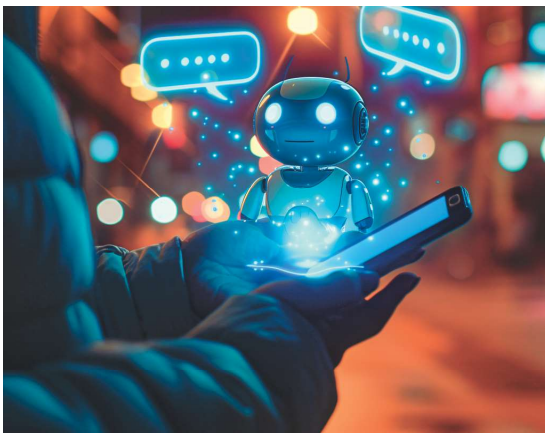
Data Quality and Cleaning: Implementing data cleaning pipelines and regular audits ensured data integrity and accuracy, maintaining high standards through systematic cleaning processes

Integration Complexity: Building flexible APIs and middleware solutions streamlined integration with diverse channels and external systems, enhancing overall system cohesion

User Engagement Analytics:· Implementing sophisticated analytics tools and continuously refining metrics improved tracking and enhanced user engagement across their platform

Training NLP Models: Continuous model training with relevant datasets and staying updated with NLP advancements improved NLP capabilities, which is crucial for understanding user inputs accurately

ulai successfully implemented a robust data solution through these strategic solutions, ensuring scalability, data quality, seamless integration, advanced analytics, and enhanced NLP capabilities in its conversational commerce platform



**Impact on Key Performance Metrics**

***Revenue Optimization***

*Enhanced Sales: Personalized recommendations and brilliant discounts based on user behaviour enhance conversion rates and sales revenue*

*Subscription Model: A subscription-based revenue approach combined with sales commissions diversifies revenue streams*

*Reduced Cart Abandonment: Streamlined checkout processes and contextual assistance help reduce cart abandonment rates, ensuring more successful transactions*

***Operational Efficiency***

- *Automated Customer Interactions: AI-driven automation reduces manual tasks, enhancing operational efficiency*

*Real-Time Insights: ulai's analytical dashboard provides immediate insights for agile decision-making*

*Customisable Solutions: Tailored platforms meet enterprise needs, enhancing operational efficiency*

***Customer Experience***

*Personalised Assistance: Understanding user preferences leads to engaging and satisfactory customer interactions*

*24/7 Availability: Round-the-clock support enhances customer satisfaction and experience*

*Contextual Memory: Retaining conversation context improves interaction quality and brand perception*

**Potential Scale in Current Market Trends**

ulai is poised to achieve substantial scale given the prevailing trends in conversational commerce:

- Global Market Growth
- Demand for AI Solutions
- Diverse Industry Applicability
- Voice and Multimodal Interaction Trends
- Omnichannel Integration
- Data-Driven Insights
- Subscription Model and Revenue Streams
- Customisation for Enterprise Solutions

With these factors in play, ulai stands poised to achieve significant scale by leveraging current market trends, its early success with prominent clients, and a strategic approach to meeting evolving market demands in conversational commerce.

CPG & RETAIL
INNOVATOR

DotEYE Labs

# DOTEYE LABS: ADVANCED CCTV ANALYTICS FOR ACTIONABLE INSIGHTS

***Industry:*** *CPG & Retail*
***Business Function:*** *Software & Applications*
***Beneficiary:*** *Hustlehub office spaces*
***Technologies Used:*** *Computer Vision*

dotEYE Labs specialises in advanced video analytics for retailers, using computer vision to enhance marketing through detailed offline retargeting metrics. Their comprehensive tech stack offers integrated solutions, enabling deep insights into customer behaviour and preferences.

The process begins with identifying AI solutions for specific retail challenges, followed by rigorous research and acquiring technical expertise. Developing prototypes and securing funding are crucial for scaling AI solutions while navigating data challenges to ensure ethical and effective implementation.

### Addressing Data Gaps in Offline Store Marketing

dotEYE Labs aims to address data deficiencies in offline store marketing through pixel data analytics. Offline stores need more data-driven marketing strategies, leading to missed opportunities and suboptimal store optimisation. They need help with accurate customer retargeting and effectively capturing local sales potential.

**Significance of the Selected Problem**

Solving it enhances sales through targeted promotions to customers.

### AI-Powered Solution for Customer Behaviour Mapping in Retail

dotEYE Labs' solution leverages AI to map customer behaviour precisely, using CCTV video footage. The process involves batch processing of CCTV images with an adaptive bridging algorithm. The system uses SSD with an OG algorithm to identify and track

human figures, distinguishing between new and returning visitors.

**Key features of the solution include:**

- **Demographic Analysis:** Predicting age and gender provides valuable insights into the demographic makeup of store visitors
- **Microservice Architecture:** AI models, such as SSD with OG, are deployed as microservices - ensures scalability and facilitates seamless integration of new models
- **Artifact Management:** Integrated artifact management ensures efficient handling of model versions and datasets, which is essential for maintaining and expanding AI operations

### Advanced Retail Analytics Solution

dotEYE Labs' video analytics solution represents a significant advancement in retail technology, combining advanced algorithms, a robust software architecture, and ongoing research and development to establish leadership in the field. This solution provides retailers with unprecedented insights into customer behaviours.

**Key features include:**

- **Heatmap Generation:** Visualises high-traffic areas and customer movement patterns within the store
- **Dwell Time Measurement:** Accurately measures customer time spent in different store areas, offering insights into customer engagement and store layout effectiveness
- **Advanced Group Detection:** Distinguishes between individuals and groups, enabling precise footfall counts and analysis of group behaviour
- **Behavioural Insights:** Understanding group dynamics informs store layout adjustments, promotional strategies, and staffing decisions to align with group shopping trends
- **MERN with Next.js:** Built on the MERN stack (MongoDB, Express.js, React, Node.js) with Next.js for server-side rendering, ensuring a seamless and responsive user experience

### Complexity of Dataset: Volume, Data Type, and Sources

The model has been trained and fine-tuned using an Indian ethnicity dataset comprising approximately 32,000 in-house annotated images.

### Data Solution Implementation Challenges and Strategies

Securing skilled personnel poses a significant challenge, particularly with limited financial resources.

### Risk Management, Governance, and Competitive Landscape

As the number of cameras scale up, the data load for analysis and storage also increases significantly. The AI Tech Team must optimise algorithms for efficiency.

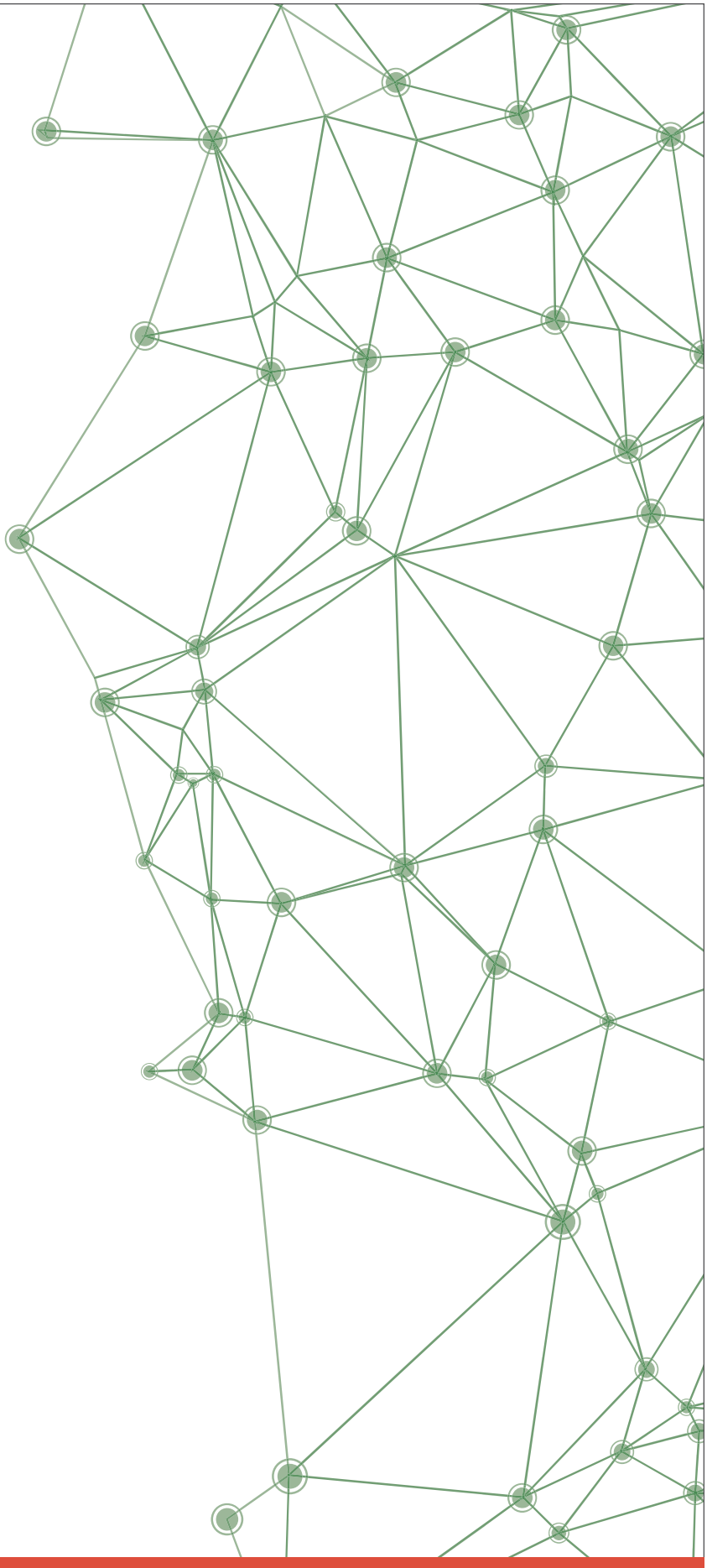
Scaling the system's infrastructure, incl. servers and storage is crucial to handle the increased load. Close collaboration among teams is necessary for effective infrastructure planning and optimisation. Implementing parallel processing techniques can enhance efficiency in handling concurrent data processing tasks.

Robust performance monitoring tools should be implemented to identify and address any bottlenecks or system issues promptly.

### Achieved Scale and Impact of the Solution

*dotEYE Labs' solution has achieved significant scale, analysing extensive volumes of retail data to enhance marketing strategies and improve customer experiences, resulting in increased sales and deeper insights into consumer behaviour.*

- ***Increased Sales and User Engagement with Promotional Videos:*** *Enhanced performance metrics by continuously evaluating multiple hybrid models and keeping abreast of AI advancements*
- ***Adaptation and Improvement:*** *Ongoing R&D efforts focus on enhancing models' efficiency, accuracy, and scalability to adapt to evolving retail environments and customer behaviours*
- ***High Accuracy and Efficiency:*** *Integration of SSD with the Optimistic Gradient algorithm ensures precise people detection and demographic analysis*
- ***Scalable and Flexible Architecture:*** *Utilising a microservices architecture and custom Docker images provides unparalleled scalability and flexibility*
- ***Comprehensive Analytics:*** *The platform offers a comprehensive view of customer behaviour, encompassing footfall, demographics, dwell time, and movement patterns*

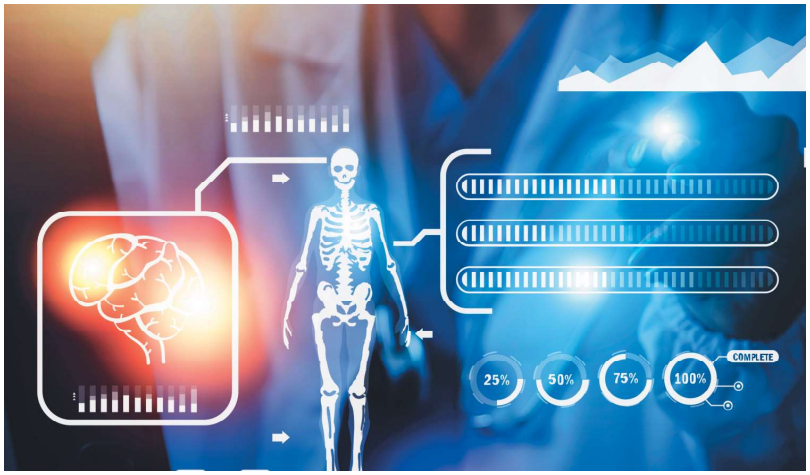


# HEALTHCARE & PHARMA

HEALTHCARE & PHARMA
GAMECHANGER

Mphasis Limited

# MPHASIS: QUANTUM AI-DRIVEN SOLUTION FOR RETAIL CUSTOMER ACQUISITION




***Industry:*** *Healthcare & Pharma*
***Business Function:*** *Marketing & Sales, Business Intelligence*
***Beneficiary:*** *Healthcare companies*
***Technologies used:*** *Quantum Computing*

**Mphasis: Engineering and AI Transformation**

Mphasis excels in engineering through design and architecture, offering next-gen services by combining domain expertise with cutting-edge technology. Utilising cross-functional teams, the Mphasis Tribes and Squads model accelerates development, transforming IT with a strong business understanding via the Mphasis Front2Back™ approach. This delivers hyper-personalised, customer-centric experiences across sectors like Banking, Healthcare, Hi-tech, and Manufacturing. Mphasis.ai, a pioneering business unit, harnesses AI to transform global organisations. Offering proprietary AI solutions and a 'platform-and-solution' approach enhances productivity, innovation, and efficiency in Contact Centres, IT, and Business Operations. Mphasis.ai provides tailored AI interventions, access to over 250 proprietary AI solutions, advanced Conversational AI platforms, and collaboration with 50+ AI-focused start-ups through the Mphasis Sparkle Innovation Ecosystem, driving growth and competitive advantage for enterprises.

**Defining the Problem Statement**

The client, a pioneer in the industry, operates a retail loyalty program that offers membership benefits to boost revenue and sales via cross-sell and up-sell strategies. They used a machine learning-based enrolment model to predict customer enrolment probability and enhance member margins, employing classical ML techniques and a suitable tech stack for development and testing. To stay ahead of the curve, the client explored quantum computing-driven ML to improve model KPIs, such as accuracy, F1 score, and AUC-ROC score, while reducing development, testing, and execution time.

**Significance of the Selected Problem: Addressing Key Priorities**

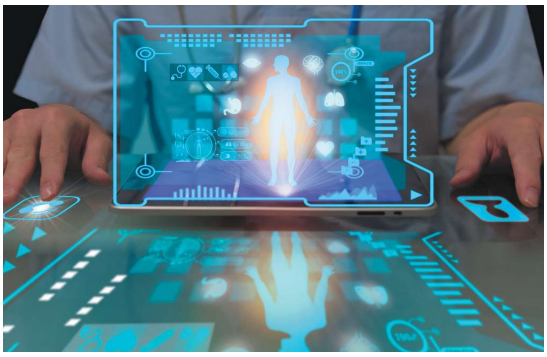
The client's challenge involves a dataset with over 3,500 features and 20 million customers per run, with a 10% enrolment rate. Each data point includes demographic details, transaction history, and program engagement, making it a high-dimensional ML, big data, and rare event detection problem. The current trial-and-error feature selection and ML methods result in model performance, training time, and computational cost issues. Addressing these challenges requires precise feature selection, dimensionality reduction, and efficient model training.

**AI-Powered Solution for High-Dimensional Data Challenges**

The solution improved the client's AI-ML workflows for high-dimensional big data rare event detection through a Quantum ML-driven pipeline with two components:

1. Quantum Feature Selection (QFS): QFS identified optimal features with maximum relevance and minimal redundancy using quantum computing-based combinatorial optimisation. It provided hyperparameters to simulate various scenarios, ensuring optimal feature selection.

2. Quantum Machine Learning (QML): QML used the optimal feature subset from QFS to train a quantum neural network within a hybrid quantum-classical framework, integrating parametrised quantum circuits with classical optimisers. This approach addressed computational costs, overfitting, and model performance issues.



By employing stratified sampling techniques, QFS and QML reduced data requirements for feature selection and model training by 90% while maintaining key performance indicators (KPIs).

**Complexity of the Dataset**

The dataset consisted of over 3,500 features, incl. numerical, categorical, and free-text data types, with over 20 million data points. Hosted on Azure data services, the feature-set information was stored across multiple 'parquet' files for machine learning model training.

**Challenges Addressed in QML-Driven Solution Implementation**

Data Processing: Implemented multi-processing to parallelise feature creation, transforming existing data or generating new attributes, leveraging multiple CPU cores for accelerated computation.

Feature Selection: Used dataset sampling and multi-threading to estimate feature relationships, effectively reducing dimensionality and identifying relevant features.

Model Training: Addressed the barren plateau problem in ML model building with parameterised quantum circuits (PQCs). Employed suitable quantum encoding, PQC architecture for expressivity and entanglement, and optimised classical algorithms to enhance time and performance.

**Scale and Impact of the Quantum-Driven Solution**

***Quantum-QML Model Evaluation: Achieved an AUC-ROC score 0.7 on the test set using QFS-driven feature selection, maintaining performance comparable to the existing classical solution while reducing training data requirements to just 10% of the original dataset.***

*Model Development Time: Automated feature selection and model training processes, reducing model building time by 80% compared to manual methods.*

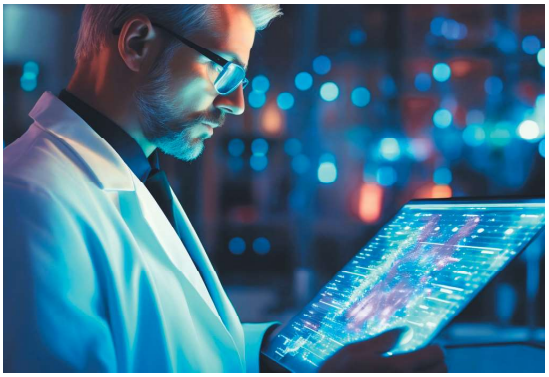
*Business Impact: Focused on enhancing the client's data science workflows for high-dimensional problems in retail analytics, the quantum solution simplified and ensured certainty in feature selection and model training.*

*Operational Efficiency: Enabled comparative model training KPIs with reduced data requirements, cutting computational costs and infrastructure needs for AI-ML solutions.*

*ESG Considerations: The reduced training data demand by 90% optimises computational resources and lowers the carbon footprint. The compact model size with a 100-fold parameter reduction in deployment enhances energy efficiency and aligns with sustainable practices. Streamlined feature selection minimises cyber-security risks, enhancing system security and governance protocols.*

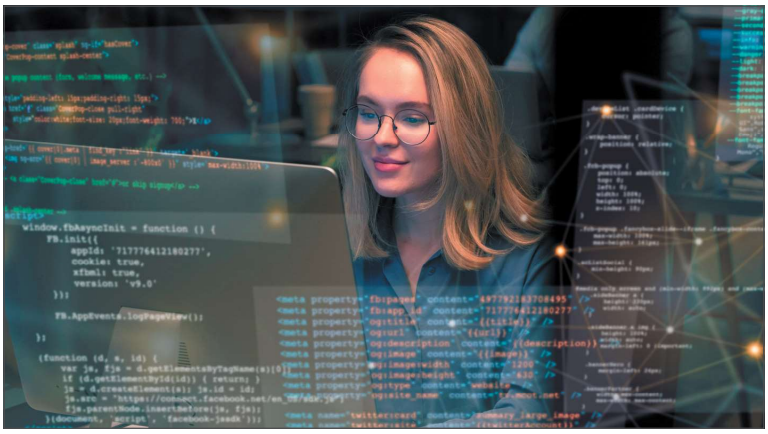
**Potential Scalability in Current Trends**

The hybrid quantum-classical QFS and QML solutions utilise reusable Mphasis IPs, providing versatility for tackling diverse high-dimensional and significant data challenges. These components are adaptable and can be customised for various use cases. This solution aims to transform client ML workflows by reducing model development and deployment times, enabling rapid prototyping and iterative experimentation at lower computational costs. This enhances efficiency in developing production-ready customer-facing solutions.



HEALTHCARE & PHARMA
CHALLENGER

**Graype Systems Private Limited**



# GRAYPE SYSTEMS: WinkNLP- OPEN SOURCE DEVELOPER FRIENDLY NLP

***Industry:*** *Across verticals, incl. healthcare, technology, agriculture, etc.*
***Business Function:*** *Usage across functions*
***Beneficiary:*** *Healthcare, Technology, and Education sectors*
***Technologies used:*** *Computational Linguistics*

## Graype Systems: Innovators in Open-Source NLP

Graype Systems, a micro-organisation, focuses on R&D in free and open-source software for Natural Language Processing (NLP). Dedicated to technical innovation, quality, standards, and comprehensive documentation, their flagship tool, WinkNLP, is part of the WinkJS suite and is utilised in healthcare, technology, and education sectors, as well as with foundation models.

### Addressing Gaps in NLP Tools

In a landscape dominated by NLTK, spaCy, and core NLP, Graype Systems identified significant gaps in NLP tools:

**Memory and Computing Efficiency:** Graype aimed to create tools with minimal memory and computing power requirements, ensuring they run on low-end mobile devices and Raspberry Pi, which is common in India.

**Green Solutions:** With winkNLP's lean codebase and low resource usage, Graype is committed to developing environmentally friendly software.

**Developer Friendly:** By simplifying NLP technology, WinkNLP is accessible to many developers.

**Permissive License:** WinkNLP maximises using small datasets available under permissive licenses, making it open-source without dependency on expensive datasets.

**Performance and Accuracy Balance:** Graype focuses on maximising performance and minimising resource consumption, even if it means a slight sacrifice in accuracy.

**Browser Support:** WinkNLP is designed to run on browsers and servers.

**JavaScript-Based:** Recognizing JavaScript as the most popular programming language, Graype developed winkNLP to increase accessibility for developers, furthering AI and NLP adoption in India, even for projects with limited funding.

**Importance of Solving NLP Tool Challenges**

Creating lightweight, developer-friendly, and open-source NLP tools is crucial for the Indian landscape. Before WinkNLP, existing JavaScript and Python libraries were hindered by slow speeds, large memory footprints, and complex APIs, limiting the adoption of NLP techniques. WinkNLP addresses these issues, offering a made-in-India tool with global impact.

### Leveraging AI to Solve NLP Challenges

Graype Systems developed an AI-driven JavaScript library for NLPto simplify and accelerate NLP application development. The approach includes:

1. Graph-Based Learning Algorithm: A specialised graph-based learning algorithm creates a tree-like structure of finite state machine graphs. It can interpret and capture extended contexts, enhancing tasks like named entity recognition.

2. Optimal Data Structure: By utilising packing, encoding, pre-computation, and caching techniques, Graype created a data structure with a small memory footprint and fast access times.

3. Minimal and Permissive Datasets: Manually labelled minimal datasets and permissive resources like WordNet allow for broad usage with low data dependencies.

### Dataset Complexity and Sources

Graype Systems utilised open-source datasets like WordNet and WikiData due to the scarcity of large labelled datasets with permissive licenses. They also included datasets like Emoji Sentiment Ranking to reflect contemporary language use, enabling WinkNLP to interpret emojis. WinkNLP was released under the MIT license using permissively licensed datasets, enhancing its accessibility.

### Data Solution and Implementation Challenges

Graype Systems faced significant challenges in sourcing permissively licensed labelled data for training models. High costs for datasets like OntoNotes Release 5.0 and restrictive licenses for Universal Dependencies (UD) data necessitated manual annotation and limited open-source datasets.

**Challenges and Solutions**

Limited Permissive Training Datasets: Graype relied on open sources like WordNet and WikiData and included the Emoji Sentiment Ranking dataset to ensure WinkNLP could interpret contemporary communication. They developed a specialised graph-based learning algorithm to handle small datasets, overcoming traditional ML limitations.

**Risks and Mitigations:**

Vulnerabilities and Security Risks: To mitigate these, Graype eliminated external dependencies through in-house development, established robust security testing and governance guidelines, achieved an OpenSSF badge, and implemented continuous monitoring via Snyk.

### Achievements and Impact of WinkNLP

- *Performance: WinkNLP efficiently handles the entire NLP pipeline processing 650,000 tokens per second on an M1 MacBook, covering tokenisation, sentence boundary detection, negation handling, sentiment analysis, part-of-speech tagging, and named entity extraction. The tokeniser alone processes ~4 million tokens per second on an M1 MacBook Pro*

- *Accessibility: Built using pure JavaScript, WinkNLP is widely accessible to developers. Its declarative API simplifies NLP application development*

- *Efficiency and Versatility: With low compute,minimal memory footprint and lightweight design, WinkNLP processes large corpora efficiently on modest hardware, incl. low-end smartphones and Raspberry Pi. Its lean codebase (10KB minified and gzipped) and compact language model (starting from 1MB) reduce model loading time to about 1 second on a 4G mobile network*

- *Popularity and Adoption: WinkNLP is used in 500+ open-source and 750+ public projects globally, incl.*

*notable institutions like the National Institute of Health, IIT Delhi, Harvard University, and AWS Labs. It earned 1,100+ GitHub stars and was downloaded >2 million times last year*

- ***Privacy and Security:*** *On-device processing safeguards user privacy, making it suitable for sensitive applications. Adherence to Open-Source Security Foundation best practices ensures robust code quality and security, outperforming even Node.js in audit scores*
- ***Simplicity of Use:*** *WinkNLP's declarative syntax mimics natural document structure, providing an intuitive and developer-friendly experience. Users have reported significant memory and CPU performance advantages and appreciate the API's simplicity*
- ***Social Impact:*** *WinkNLP has contributed to research at IIT Delhi, enhancing STEM education accessibility for visually impaired students in India*

**Potential Scale and Future Prospects of WinkNLP**

WinkNLP's usage and download count has steadily increased, highlighting its scalability potential:

**Tech for the Next Billion:** WinkNLP runs efficiently on low-performance devices, potentially providing on-device AI for millions of smartphones and low-end devices like Raspberry Pi in India and globally, making NLP technology widely accessible.

**High Performance and Low Cost:** It processes the entire "History of India Volume I" (350 pages, over 125,000 tokens) with under 80MB peak memory usage, offering significant memory and CPU advantages over other packages.

**Availability:** Released under the permissive MIT License, WinkNLP is accessible to all developers.

**Multilingual Support:** WinkNLP can add new language models without impacting performance. Upcoming features include support for word vectors and other enhancements.

HEALTHCARE & PHARMA INNOVATOR

Wipro

# WIPRO: GEN AI IMPLEMENTATION FOR MEMBER CONTACT CENTRE TRANSFORMATION

***Industry:*** *Healthcare & Pharma*
***Business Function:*** *Customer Service*
***Beneficiary:*** *Cross-industry and functions, Head of Contact Centres, Head of Innovation, Contact Centre Executives, Managers*
***Technologies used:*** *Generative AI*

## Wipro's Innovative AI Strategy

Wipro, a leading technology services firm, tackles digital transformation through four Global Business Lines: cloud, enterprise futuring, engineering, and consulting. Renowned for its AI services, Wipro has invested US$1 billion in the Wipro AI360 program over three years to drive responsible AI innovation. Led by data scientists and AI experts, Wipro's strategy focuses on advancing AI adoption with talent, training, and scalable solutions across industries.

## Enhancing Contact Centre Efficiency with AI

A leading US-based Fortune 15 healthcare payor services organisation faced challenges in its contact centre performance, resulting in decreased operational efficiency and customer dissatisfaction. Due to cumbersome information searches, there were significant delays in resolving member and broker queries related to plan selection, comparison, benefits and long call hold times.

The client sought a solution that:
a) Enhances customer experience and service scalability using Wipro's Gen AI capabilities

b) Automates and scales manual processes, making them more intelligent by leveraging new data and finding actionable insights

**Importance of Addressing Contact Centre Challenges with AI**

Contact centres struggle with long wait times, complex queries, and low productivity. High call volumes and limited agents in healthcare lead to poor customer experiences, impacting CSAT and brand image.

Generative AI provides hyper-personalised solutions, improving efficiency and accuracy with minimal human intervention. It reduces call transfers and resolution times, boosting productivity.

Gen AI enhances contact centre automation as customer expectations evolve, improving information search and customer interactions. This use case demonstrates how AI improves efficiency and personalisation in contact centres.

## AI-Powered Solution for Contact Centre Efficiency

### Problem Context

Contact Centre Agents of a global healthcare payor struggled with fragmented systems and documents while answering Medical, Dental, and Vision plan benefits queries. This led to increased hold times, inefficiency, and customer dissatisfaction.

### Solution Design

An AI-powered on-call agent assist was developed to reduce hold times and provide personalised, contextual answers. The solution leverages Gen AI, incorporating a framework and architecture optimised for performance, accuracy, cost, fault tolerance, flexibility, and extensibility.

### Key Features

- **Real-Time Answers:** Utilises retrieval-augmented generation by AI, powered by large language models (LLM) for context-based semantic analysis, delivering near-real-time answers
- **Document Comparison:** Allows natural language questions and the selection of multiple documents to compare, analyse, and summarise
- **Extensive Knowledge Base:** AI-indexed knowledge on thousands of Medicare and Commercial plan documents for 2023 and 2024, incl. Medical, Dental, and Vision benefits
- **Accuracy and Trust:** Provides citations and references from documents for each AI response
- **Responsible AI:** Ensures safe and responsible AI implementation with adherence to safety guardrails
- **User Feedback:** Includes a user-friendly mechanism for feedback on AI responses
- **Guidance:** Offers an online user guide for rephrasing questions to get better answers with examples

### Complexity of the Dataset

The dataset for this solution is extensive and complex, comprising hundreds of medical and dental plan benefits documents from government and commercial sectors.

**Volume:** Around half a million pages.

**Data Type:** Unstructured legal English, incl. tables, footnotes, multi-page tables, multi-column text, and logos.

**Content:** Documents include insurance plan details with clauses, riders, and scenarios, categorised by year, state, territory, county, and benefit types.

**Sources:** Owned by the Healthcare Payor, documents include vendor details, service specifics, and eligibility criteria, undergoing annual revisions due to business changes and regulations.

**Previous System:** Documents were scattered across systems, requiring manual search and review by agents.

The Gen AI solution automates response generation and natural language knowledge search, simplifying access to critical information.

## Data Solution Implementation and Challenges

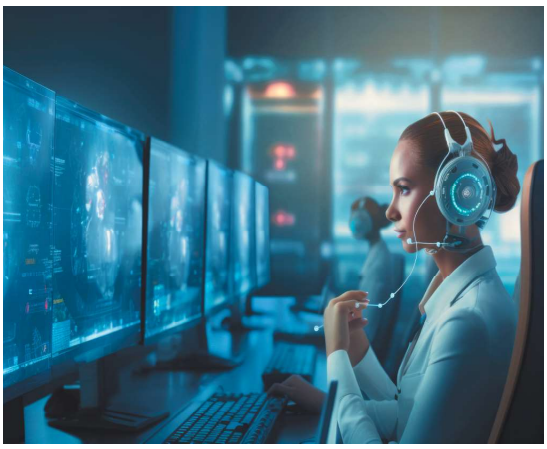
### Data Solution

The Gen-AI solution for the healthcare payor involved centralising and processing thousands of unstructured documents, totalling over half a million pages. These documents were previously scattered across various systems and under different access controls, with frequent revisions.

**Centralisation:** Automated data pipelines and Python batch jobs ingested the documents into a central repository.

**Pre-processing:** Documents were split and categorised, metadata created, tables simplified, and text tuned to create the right-sized contexts for the LLM.

**Retrieval-Augmented Generation (RAG):** Implemented a RAG framework with configuration parameters for chunk size and top-k retrievals, fine-tuning these for optimal performance.



**Multi-Document Query Handling:** Queries involving multiple documents were broken into sub-queries using LLM prompting, answered in parallel, and combined for final responses.

**User Interface:** Provided a feedback mechanism for AI responses, with feedback analysed to improve the solution design.

**Data Security:** Utilised Microsoft Azure OpenAI service, ensuring data is not stored long-term or used for model training.

**Challenges and Solutions**

- **Data Fragmentation:** Overcame by centralising documents through automated pipelines
- **Document Complexity:** Addressed by pre-processing to create simplified contexts for accurate AI comprehension
- **Large Contexts:** Mitigated the "lost in the middle" problem by re-ranking retrieved chunks with a local cross-encoder model
- **Multi-Document Queries:** Ensured efficient processing by separating queries into sub-queries and using multi-threading
- **User Feedback:** Incorporated feedback loops for continuous improvement

## Achieved Scale and Impact of AI Solution

### *Scalable Design*

- *Modular Flexibility: Allows easy addition of new documents as indexes without affecting existing ones*
- *Efficient Index Management: Indexes created at the plan level with metadata for plan-year, state, and county, optimised for faster query processing*
- *Metadata Filtering: Enhances retrieval speed by narrowing searches before top-k retrievals*
- *In-Memory Database: Redis Enterprise DB is used for faster responses, reducing latency*

### *Robust Architecture*

- *Multiple Vector DBs: Improves resilience and response times, avoiding single points of failure*
- *Micro-Service Principles: Automated failover, auto-scaling, and high availability through OpenShift and Docker containers*
- *API Gateway: Manages authentication, data masking, and logging, ensuring compliance and efficient token usage*

### *Impact*

- *Customer Experience: Reduced call hold time by 70%, providing consistent answers and enhancing broker/advocate experience*
- *Operational Efficiency: Saved an estimated 128,000 operational hours annually, leading to significant cost savings*
- *Revenue Optimization: Scalable to support new lines of business, enabling revenue growth*
- *AI for Accessibility, Sustainability, and the Next Billion: Promotes responsible AI use and inclusivity*

**Future Scalability and Impact**

**Expansion:** Can ingest more enterprise documents & data to support diverse business lines.

**Cognitive Search:** Extensible to enable Enterprise Cognitive Search, facilitating self-service and call deflection.

**Voice Integration:** Can be integrated with Voice-to-Text functionality for multi-modal AI interactions.

**Database Integration:** Compatible with structured traditional databases, offering opportunities for automating enterprise business processes.

**Industry Efficiency:** Can be offered as a service to partners and vendors.

**Enhanced Decision-Making:** AI capabilities can integrate with enterprise-wide data, enabling informed, accurate, and rapid business decisions beyond human capabilities.

HEALTHCARE & PHARMA
GAMECHANGER

Vizzhy

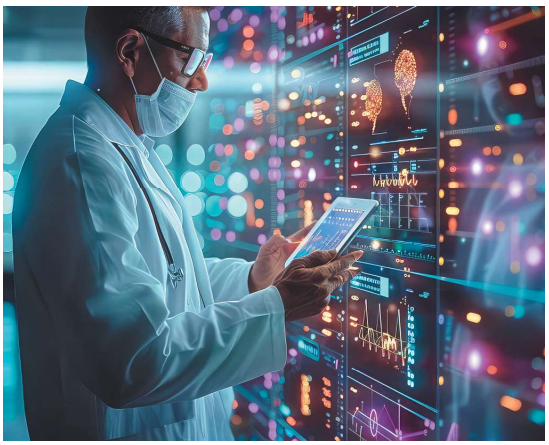
# VIZZHY: METABOLIC HEALTH SIGNATURE

***Industry:*** *Healthcare & Pharma*
***Business Function:*** *Operations, Clinical Diagnosis*
***Beneficiary:*** *Individuals, Health management organisations, Hospitals, Clinics, etc.*
***Technologies used:*** *NLP, Computer Vision, AIOps, Multi-omics & Generative AI*

### Revolutionizing Healthcare with Multi-Omics and AI

Metabolic health affects 88% of the population due to sedentary lifestyles and processed food consumption, leading to conditions like obesity, diabetes, heart disease, cancer, and Alzheimer's. Current healthcare systems mainly manage symptoms with medications, resulting in polypharmacy and excessive spending - 70% of healthcare costs are related to metabolic conditions.

Vizzhy's solution takes a holistic approach, treating each person uniquely by integrating omics data (Genomics, Proteomics, Metabolomics, Gut Microbiome) to understand cellular health comprehensively. Combined with longitudinal lifestyle studies, this approach identifies root causes rather than symptoms. By harnessing multi-omics and Gen AI, Vizzhy addresses significant healthcare challenges effectively.



**Transforming Healthcare with Advanced Technologies**

Despite strides against cancer and infections, the healthcare sector struggles with chronic conditions such as diabetes, hypertension, and cardiovascular diseases, often treating symptoms without addressing underlying causes. This fragmented approach leads to complications and reduced patient quality of life.

Unlike traditional methods reliant on lifelong medication, Vizzhy adopts a multiomics strategy, analysing DNA and protein levels to predict and prevent conditions like hypertension, diabetes, cardiovascular disease, obesity, stroke, and Alzheimer's before they manifest. This proactive approach marks Healthcare 3.0, where technology uncovers deep cellular insights, offering personalised strategies tailored to individual metabolic signatures.

## Addressing the Impact of Metabolic Health

The high prevalence of metabolic unfitness in the US, affecting 88% of the population, drives healthcare spending, with 75% directed towards related diseases. Delayed diagnosis amplifies costs and risks, with metabolically unhealthy individuals 6X more likely to suffer adverse effects from illnesses.

Vizzhy's approach is crucial in countries like India and the US, where diabetes affects 160 million and treatment-centric healthcare models prevail. By decoding biological complexities, Vizzhy predicts and prevents diseases, potentially extending health span and life expectancy. For instance, pre-emptive identification of conditions like Glioblastoma (GBM) through methionine pathway anomalies showcases its proactive potential across 33 cancer types and metabolic disorders such as diabetes, cardiovascular disease, and hypertension.

## Enhancing Healthcare with AI-Driven Solutions

### Combining Diagnostics Data

Upon onboarding each patient, Vizzhy's diagnostics generate ~250 GB of data encompassing thousands of parameters from seven different labs. Correlating cross-sectional and longitudinal data like IoT and care concierge notes at scale would typically overwhelm traditional methods. Thus, Vizzhy employs GenAI to ensure efficient, standardised care delivery.

### Insights from Metabolic Signature

Creating personalised care plans involves understanding health data and the patient's lifestyle. Vizzhy conducted a two-week exposomics study using various health trackers that monitored 40-50 factors, incl. diet, exercise, sleep, and nutrition.

### Consults & Care Plan Generation

They utilise proprietary assessments and questionnaires to gain insights into patient behaviour and lifestyle. Their caregivers conduct counselling sessions to educate patients about the programme and their health. Vizzhy have streamlined care plan generation by leveraging solutions like Automated Speech Recognition (ASR) and Language Model Generation (LLM), reducing onboarding consultation times from 40 to 15 minutes while maintaining clinician oversight.

### Continuum of Care

Addressing the challenge of care continuity and adherence, Vizzhy introduced "reflections" - brief periods where patients share daily updates with the conversational agent, ensuring ongoing engagement and improved patient outcomes.

## Data Solution Implementation Challenges and Solutions

- Securing adequate compute power posed an initial challenge - while Indian companies typically used A100 GPUs, Vizzhy's needs demanded H100 DGXs. After extensive negotiations, they became the first Indian firm to deploy H100s, accelerating their capabilities
- Accessing essential medical equipment, often confined to academic research, hindered sample processing for diagnostics. Vizzhy is establishing its own multi-omics lab to scale from handling 1,000 patients annually to 1,000 patients monthly
- Integrating data from seven omics across different labs proved complex; existing systems manage only a subset of omics data. Overcoming this, they unified longitudinal patient data captured throughout care programmes
- To address the acute shortage of specialists in computational biology in India, Vizzhy forged partnerships with top institutes to establish centres of excellence and advanced AI solutions

• Acquiring multilingual training data for LLM and ASR proved challenging. Initiating a collaboration with IIT Bombay, they launched an initiative to translate and annotate vernacular documents, enriching their training dataset

**Achieving Scale and Impact**

*Over the past five years, Vizzhy has evolved their multi-omics solution with invaluable inputs from industry experts. Focusing intensely on multi-omics for the last two years, they have garnered validation and partnerships globally. Collaborations with institutions like the Systems Biology Institute (Japan), Ohio State University, and the University of Illinois Urbana-Champaign have been instrumental. At UIUC, they have established an AI centre for wellness.*

*They have gained endorsement from key stakeholders such as KIMS Hospital and the Obesity and Metabolic Surgery Society of India, and their plans for international adoption are supported by leading health management systems. Implementing their solution at the University of Pittsburgh Medical Center (UPMC) and partnering with Chicago ARC, OFS Healthcare, and Carle Illinois College of Medicine underscores their commitment to diverse healthcare needs.*

*Currently, Vizzhy is refining their care programme for scalability, bolstered by partnerships with premier Indian institutes like IIT Bombay, IIT Jodhpur, IIT Madras, and IIT Roorkee.*

***Operational Efficiency:** Their solutions prioritise scalability and operational efficiency. Features like conversation summarisation tools streamline EHR data entry, while Large Action Models integrate seamlessly for clinicians. By automating insights from medical documents, Vizzhy aims to reduce clinician time spent on administrative tasks.*

***Customer / Patient Experience:** Centred on patient health, their program enhances care continuity through advanced conversational capabilities and IoT-driven data collection. Educating patients about diagnostic insights ensures informed decision-making for corrective actions.*

***Revenue Optimization:** Hospitals can handle higher patient throughput with reduced administrative*

*burdens, focusing on critical healthcare needs. Their platform aims to optimise the revenue mix by efficiently managing minor health episodes.*

***Environmental Focus:** Vizzhy prioritises natural interventions and environmental health, promoting sustainable practices. They aim to improve patient and familial well-being by predicting and preventing primary health conditions while reducing biomedical waste.*

**Scalability Through Strategic Partnerships**

**Vizzhy partnerships are poised for significant scale:**

KIMS Hospital: Partnering with a chain of 12 hospitals, Vizzhy anticipates~15,000 patients annually.

Obesity and Metabolic Surgery Society of India: Engaging 500+ clinicians to expandtheir outreach and pipeline development.

University of Pittsburgh Medical Center (UPMC): Collaborating with one of the largest US population health systems, they expect to manage 25,000 patients annually.

Partnerships with Chicago ARC, OFS Healthcare, and Carle Illinois College of Medicine: These partnerships target rural populations under these institutions' care.

Expansion Plans: Engaging with additional US population health systems to further scale their solutions as they evolve.

# UNITED WE CARE: EMPLOYEE WELLNESS

***Industry:*** *Healthcare & Pharma*
***Business Function:*** *Software & Applications*
***Beneficiary:*** *Individuals, organisations, and the healthcare industry for mental health programs and services*
***Technologies used:*** *Generative AI, Graph Technology, NLP, Computer Vision*

**Transformative Mental Health Innovations by United We Care**

United We Care leads the global mental health sector with Stella 2.0, their revolutionary Gen AI solution. Specialising in comprehensive mental health support, they utilise advanced technologies like Gen AI, emotion detection, and diffusion models for natural, context-aware responses. Stella, their clinical super bot, excels in 29 languages, identifies 40+ emotions, and achieves 90% diagnostic accuracy. Stella 2.0 integrates cutting-edge advancements and a strong foundation in Cognitive Behavioural Therapy (CBT).

**Stella 2.0: Redefining Workplace Mental Health**

Stella 2.0 tackles global workplace mental health challenges by addressing stress, anxiety, and support accessibility. Through behaviour analysis and virtual assistants, it offers proactive interventions and accurate diagnostic assessments using speech, facial expressions, and physiological indicators. Its evidence-based recommendations and virtual support tools ensure ongoing care and resilience-building beyond symptom management.

**Importance of Addressing Workplace Mental Health**

United We Care addresses workforce mental health challenges with Stella 2.0, their AI-driven solution pioneering a new era in mental healthcare.

**Key Features**

Gen AI: Stella 2.0 offers natural, context-aware responses tailored to individual needs, enhancing engagement and empathy.

Emotion Detection and Contextual Understanding: Advanced technologies enable the bot to engage meaningfully, discerning nuances for a more human-like support experience.

Real-time Video-based Emotion Detection: Immediate responses to users' emotional states ensure timely support, crucial in critical situations.

Behaviour Analysis and Risk Identification: AI-driven analysis tailors recommendations, adapting to user profiles for adequate support.

Clinical Governance and Cognitive Behavioural Therapy (CBT): Grounded in CBT, Stella provides evidence-based therapeutic responses for long-term well-being.

Multilingual Capabilities: Proficiency in 29 languages ensures global inclusivity and accessibility.

**Stella's AI goes beyond analytics with:**

Natural and Context-Aware Responses: Generating empathetic interactions compared to predefined messages.

Real-time Responsiveness: Immediate support based on emotional cues, surpassing traditional analytics.

Personalisation: Tailoring recommendations to individual needs for comprehensive support.

Clinical Governance: Ensuring therapeutic excellence with evidence-based approaches

Stella 2.0 exemplifies United We Care's commitment to innovation and transformative impact on global mental health care, bridging gaps with advanced AI technologies.

**Stella 2.0's Complex Dataset**

Stella 2.0's AI-driven mental health solution utilises a substantial dataset with over 5 million conversations and 550,000 Monthly Active Users globally. It includes text and real-time video data for emotion detection, behavioural insights, and multilingual perspectives, ensuring diverse and nuanced insights.

The dataset's richness supports context-aware, personalised, and culturally sensitive mental health support. Stella 2.0 prioritises user privacy, relying on anonymised medical literature and authorised medical information sources, demonstrating a responsible approach to global mental health care.

**Data Solution for Stella 2.0: Challenges and Implementation**

United We Care's data solution for Stella 2.0, the AI-driven mental health platform, tackles complexities in mental well-being while overcoming inherent data management challenges.

**Data Solution Overview**

Unified Data Integration: Breaking down data silos to integrate diverse sources like user interactions, video-based emotion detection, behavioural data, and multilingual inputs.

Cloud-Based Infrastructure: Utilising scalable cloud computing for flexible data processing, ensuring global accessibility and platform responsiveness.

Security Measures: Implementing encryption, access controls, and healthcare compliance to safeguard user confidentiality and meet privacy standards.

Real-time Processing: Optimising compute resources for efficient real-time data processing, crucial for dynamic tasks like video-based emotion detection.

**Challenges Faced and Solutions Implemented**

Data Silos: Unified integration strategy to consolidate diverse data sources, enriching AI models with comprehensive user insights.

Data Availability and Accessibility: Adoption of cloud infrastructure to enhance real-time access and scalability, meeting varied user demands globally.

Security Concerns: Robust measures like encryption and access controls to protect sensitive user data and comply with privacy regulations.

Real-time Processing Complexity: Dynamic scaling and resource optimisation for efficient handling of real-time data, particularly in video analysis.

Multilingual Data Complexity: Integration of language processing technologies for managing diverse languages and cultural nuances, ensuring inclusive support.

## Scale and Impact of Stella 2.0

*Stella 2.0 from United We Care is a global leader in mental health, addressing critical challenges*

*amplified by the looming pandemic. With projections forecasting a US$6 trillion global economic impact by 2030 and significant clinician shortages, Stella 2.0 emerges as a pivotal solution. It uniquely blends AI and human intervention to revolutionise mental health care globally.*

***Global Impact***

- ***Market Leadership:*** *Largest B2B employee wellness provider in India with extensive OPD mental health insurance coverage*
- ***Technological Advancements:*** *Powered by Gen AI with 40 billion parameters, holding ten patents and achieving record-setting accuracy in language models*
- ***Clinical Excellence:*** *>5 million conversations, proving efficacy in delivering immediate Cognitive Behavioral Therapy (CBT) care*
- ***Operational Efficiency:*** *3X revenue increase and streamlined support delivery, enhancing accessibility and reducing response times*

***Social and Governance Impact***

***Global Outreach:*** *Touching millions of lives, contributing to UN Sustainable Development Goals for health and well-being*

***Advocacy and Compliance:*** *Reducing mental health stigma with stringent clinical governance and regulatory compliance*

*Stella 2.0 sets benchmarks in mental health support and champions ethical AI use, fostering a more inclusive and supportive global community.*

**Potential Scale of Stella 2.0**

United We Care anticipates exceptional growth for Stella 2.0 in the next 6 to 24 months, driven by current trends and scenarios in the mental health sector.

**Financial Growth:** Targeting a 5X increase in annual revenue, reflecting strong market acceptance and demand.

**Market Expansion:** Rapid breakeven within 24 months, focusing on key markets like the United States and India.

**Profitability:** Aspiring to lead the most profitable company in mental health within three years, prioritising value delivery to users and customers.

**Global Reach:** Aiming to impact 1 billion users globally, making advanced mental health support universally accessible and transformative

United We Care envisions Stella 2.0 as a pioneering solution, poised to redefine mental health care with widespread accessibility and impactful outcomes on a global scale.

# immunitoAI: AI-GENERATED NOVEL THERAPEUTIC ANTIBODIES

***Industry:*** *Healthcare & Pharma*
***Business Function:*** *Software & Applications*
***Beneficiary:*** *R&D arm of Pharma companies*
***Technologies used:*** *Generative AI, Graph Technology*

### Innovative AI-driven Antibody Discovery at immunitoAI

immunitoAI is a biotech firm pioneering therapeutic antibody discovery through AI. They use a "Drug-First" strategy to develop novel antibody-based drugs targeting various diseases. Their expertise spans healthcare and biopharma sectors, employing Graph-based GenAI Architecture and proprietary Deep Learning Neural Networks.

immunitoAI employs computational and biological R&D to identify crucial epitopes to tailor antibodies to specific antigens. Their unique approach prioritises antibody structure over sequences, distinguishing them in the industry. Early successes include core models achieving ~98% accuracy and a minimal 0.08 error rate. They are refining their methods to custom-design antibodies for diverse protein targets. Experimental validation will complete the iterative process, generating proprietary data for future advancements.

### Addressing Inefficiencies in Antibody Discovery and Development

Current antibody discovery and drug development methods are inefficient. Discovery can take 8-10 months, and only 1 in 50 projects reach the market. Converting biological molecules into drugs is arduous and often impractical.
Traditionally, antibody discovery relies on animal or human sources, but even with advancements like display technologies, creating effective antibody drugs remains challenging. These molecules, originally not intended as drugs, require extensive modification, often leading to project abandonment due to lengthy timelines and high failure rates in clinical trials.

To tackle these challenges, the immunitoAI platform adopts a pioneering Drug-First approach. Leveraging AI, the platform designs novel antibody sequences with optimal drug-like properties to revolutionise therapeutic antibody development.

**Revolutionising Antibody Therapeutics with AI**

immunitoAI® aims to pioneer AI-driven discovery of novel Antibody Therapeutics with predetermined drug properties. Their AI platform generates de novo antibodies and fragments targeting any disease without reliance on biological sources. Antibodies are rigorously screened for drug-like properties computationally before progressing to experimental validation, bypassing traditional methods' limitations.
Due to current constraints, only 160 therapeutic antibodies have been approved clinically. Their computational approach promises 10X superior outcomes. Prioritising attributes like non-toxicity, specificity, and thermal stability during in-silico design enhances efficiency and success rates, transforming drug discovery.

**AI-Powered Antibody Discovery and Screening**

Their AI platform innovates by generating and screening antibodies against any protein target with precision. Designed for high binding affinity, specificity, stability, solubility, and reduced toxicity, it consists of two key components:

a) imDESIGN- This pipeline employs Gen AI to design synthetic antibodies with desired drug properties. Built from scratch, it employs neural networks and algorithms trained on structural data of antigen-antibody pairs. By generating novel protein structures and sequences tailored to specific antigens, imDESIGN revolutionises antibody discovery beyond biological templates.

b)imRANK® - Screens and ranks antibodies based on predicted binding affinity and specificity. This module uses deep learning to analyse 3D structures of antibody-antigen interactions, considering chemical bonds and biological properties at atomic levels. This approach ensures optimal antibody selection for further development, enhancing specificity and sensitivity and reducing immunogenicity.

Experimental Validation: Predictions from AI are validated in-house through DNA synthesis and antibody production in bacteria. Antibodies undergo rigorous characterisation for binding, specificity, and drug-like properties. Selected candidates proceed to pre-clinical and clinical trials via collaborative research organisations (CROs).

This integrated approach accelerates antibody discovery, overcoming traditional limitations with advanced AI capabilities and precise molecular design.

**Complexity of Dataset: Volume, Data Type, and Sources**

immunitoAI's primary data originates from X-ray crystallography experiments, essential for capturing protein structures via crystallisation. Due to its complexity, this method isn't conducive to high-throughput operations. Moreover, acquiring structures of two interacting proteins in space poses an even more significant challenge. The Protein Data Bank (PDB) is the primary data source, housing ~200,000 entries, with only 30,000 representing protein-protein complexes.

Their dataset necessitates sophisticated handling because they focus on analysing atomic interactions in 3D space. They transform raw data into spatially interacting graph structures and utilise proprietary graph-based neural network architectures for deep learning analysis.

**Data Solution and Overcoming Challenges**

Addressing the scarcity of scientific data, particularly from complex and time-consuming experiments, posed a significant challenge. immunitoAI's datasets consist of ~4,000 and 30,000 entries, respectively. To mitigate this limitation, they have employed rigorous mathematical transformations and problem formulation.

By carefully framing the problem statement and transforming the datasets mathematically, the neural networks successfully generalised from this limited data. This approach ensured comprehensive coverage of all aspects pertinent to the problem statement, enabling effective utilisation of available scientific data.

**Scale and Impact of Antibody Therapy Advancements**

*Antibodies offer superior outcomes and quality of life as compared to conventional chemical drugs, particularly in treating life-threatening diseases like cancer and autoimmune disorders. They mitigate harmful side effects and address challenges posed by antibiotic resistance, offering targeted therapies and precise diagnostics.*

*The success of therapeutic antibodies like Humira Adalimumab, generating US$20 billion annually, underscores their potential in the market. Six of the top ten highest-grossing medications are antibodies, contributing significantly to global pharmaceutical sales.*

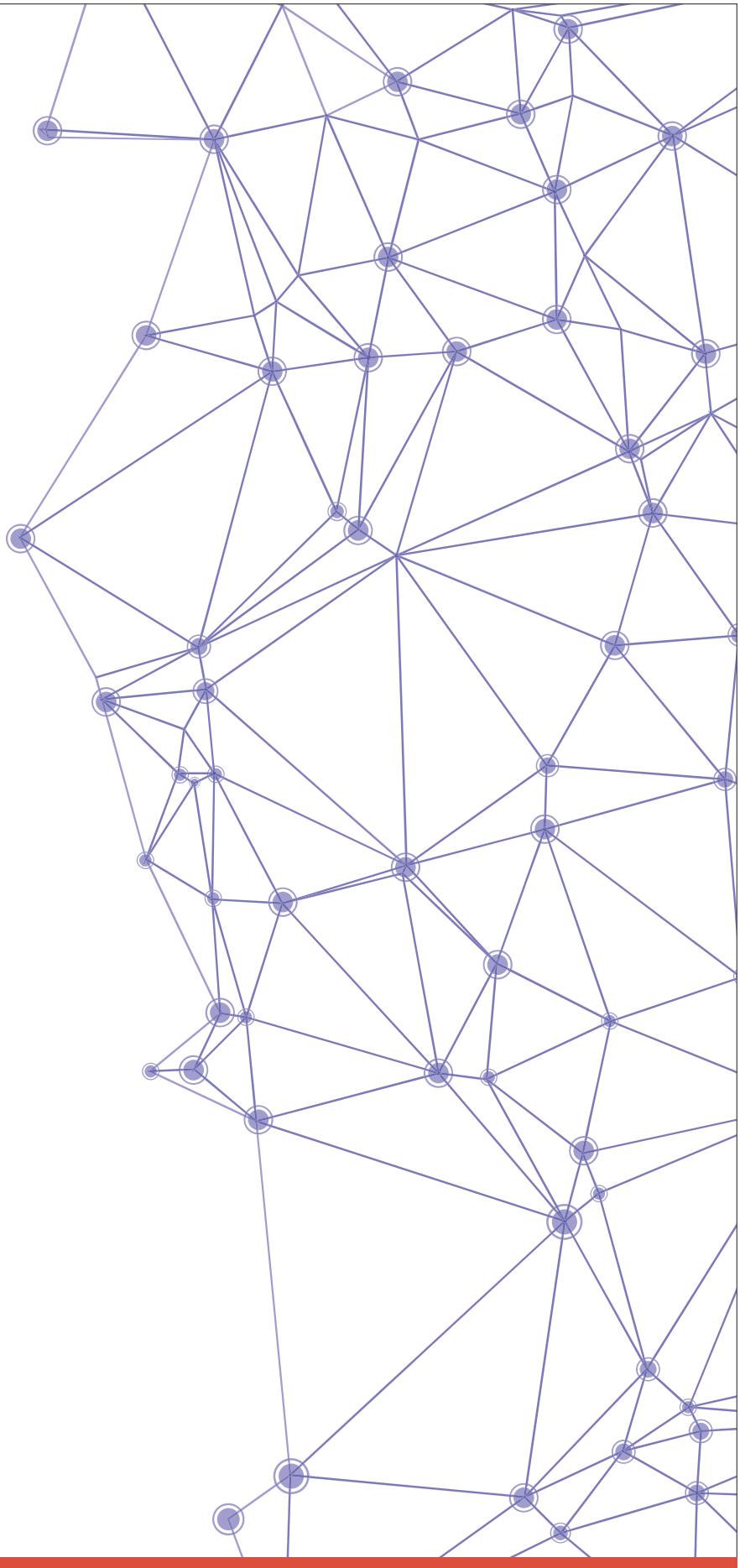
*Looking forward, integrating Biology with Deep Learning at immunitoAI aims to enhance antibody discovery efficiency and potency.*

*With the antibody therapeutics market valued at US$188 billion in 2022, immunitoAIwill strive to establish antibody therapy as standard practice, incl. for currently undruggable targets and diseases.*

**Projected Scale and Impact of Current AI Pipeline**

The AI pipeline is set to be completed in the next two months, followed by ten months for biological validation of AI-generated antibodies.
This validation serves dual purposes: proving the AI pipeline's capabilities and generating data for potential pharma partnerships, which are expected to commence revenue generation within 12-15 months.

More partnerships are anticipated as credibility grows, with 5-6 projects projected with pharma partners by 2026. Additionally, proprietary data from validations will continually refine the AI pipeline, enhancing performance and output quality with each iteration.



# AGRICULTURE

AGRICULTURE
GAMECHANGER

Tiger Analytics

# TIGER ANALYTICS: SATELLITE IMAGERY AIDED AGRI-PROCUREMENT

***Industry:*** *Agriculture, CPG & Retail*
***Business Function:*** *Operations, Business Intelligence*
***Beneficiary:*** *Agri-Procurement division of an American multinational food, snack, and beverage corporation*
***Technologies used:*** *Computer Vision*

## Tiger Analytics: Global AI and Analytics Leader

Tiger Analytics, a global AI and analytics leader, is renowned for its commitment to innovation and excellence. Their full-stack AI and analytics services have consistently delivered significant outcomes and value at scale. Their team of over 4,000 technologists and consultants operate from the US, Canada, the UK, India, Singapore, and Australia, serving clients in CPG, Retail, Insurance, BFS, Manufacturing, Life Sciences, and Healthcare.

### Problem Statement

Enhance process efficiency through improved supply time planning, cost reduction from fewer manual visits, and minimised wastage via accurate yield estimation and crop risk identification.

### Importance of the Problem

- **Manual Visits:** Current field visits are inefficient and costly
- **Supply Chain Efficiency:** Accurate crop yield estimation is essential for better planning
- **Risk Management:** Timely insights into crop health allow proactive risk identification and corrective actions
- **Global Standardisation:** A scalable solution ensures consistent monitoring across diverse global locations
- **Cost Efficiency:** Reducing manual interventions lowers costs and enhances yield precision

By leveraging satellite image processing and geospatial analytics, the Agri-Procurement division can significantly improve efficiency, reduce costs, and enable proactive risk management in global agricultural procurement for multinational clients.

### AI-Driven Solution to Agricultural Challenges

Tiger Analytics leverages AI to address agricultural inefficiencies. Satellite data from various fields are extracted using geo-coordinates over time. Advanced image processing and computer vision techniques, combined with Gradient Boosting Machine (GBM) models, analyse this data to provide insights into crop stress, fertiliser levels, and crop

growth. These models process satellite data and deliver insights through dashboards and notifications to relevant stakeholders.

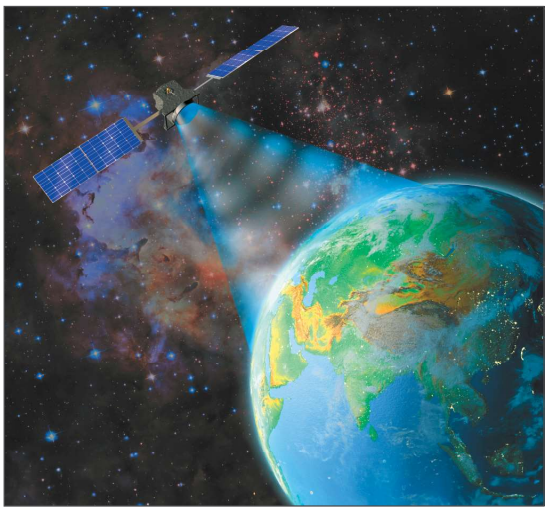
**Complexity of the Dataset**

The project utilised satellite image data and climate data from weather APIs.

- **Image Data:** Sentinel-2 images with 13 bands, incl. RGB, SWIR, and NIR
- **Climate Data:** Metrics such as temperature, precipitation, and humidity
- **Feature Engineering:** Creation of vegetation, soil, and water indices from raw bands
- **ML Model:** Gradient boosting models like CatBoost

**Key Risks**

- **Site Detection:** Identifying exact locations with low-resolution 10m satellite images is challenging
- **Cloud Cover:** Detecting and removing cloud cover from images effectively
- **Data Frequency:** Due to weather conditions, sentinel data availability is limited (5-10 days)
- **Spectral Bands:** Selecting the optimal spectral bands for vegetation analysis
- **Data Storage:** Difficulty in storing and processing large volumes of satellite imagery
- **Data Quality:** A high percentage of missing values and erroneous inputs affect model development
- **Access Delays:** Client delays in providing access to the Azure environment, leading to tight timelines



**Achieved Scale and Impact of the Solution**

***Revenue Optimisation and Operational Efficiency***

- *Implementation: Effective in the US, Latin America, and Europe, with plans to scale to other markets*
- *Versatility: Adaptable for agri-procurement of coffee, cocoa, cereals, and other produce*
- ***Positive Environmental Impact***
- *Higher Yield: Increased yield per acre*
- *Crop Health: Reduced crop damage and disease prevention*
- *Resource Efficiency: Lower fertiliser usage and soil erosion prevention*
- *Emissions Tracking: Monitoring of N2O and CH4 emissions*

***Customer Experience***

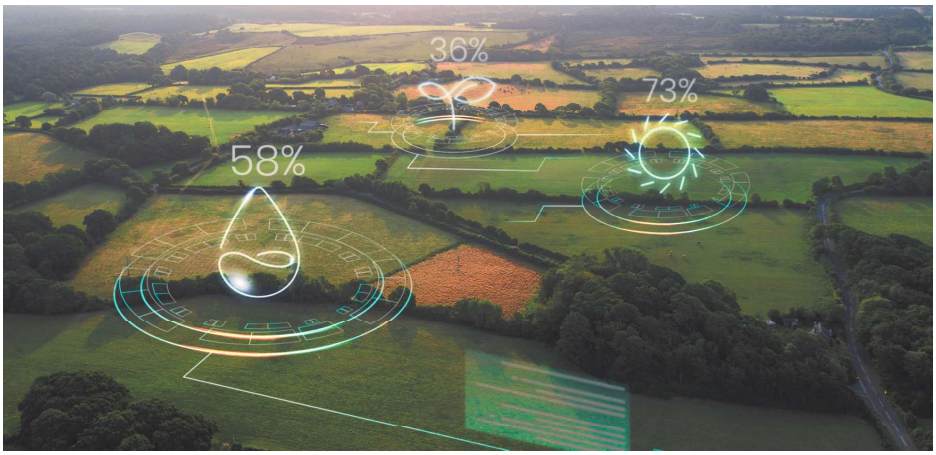
- *Feedback: Positive client feedback highlighting operational efficiency, cost reduction, and revenue optimisation*
- *Savings: 60% reduction in manual effort, 75% cost savings, and a reduced carbon footprint*
- *The solution prevents the need for in-person field visits to over 1,000 fields globally, automates 100% of audits, and prevents supply shocks.*

**Potential Scale and Future Implementation**

Plans are underway for implementation across Asia Pacific and the Middle East. The solution is also adaptable for managing the agri-procurement of coffee, cocoa, cereals like wheat and rice, and other agricultural produce.

AGRICULTURE
CHALLENGER

**ITC Infotech**




# ITC INFOTECH: KRISHI MITRA - AN AI-ENABLED BOT

***Industry:*** *Agriculture*
***Business Function:*** *Operations*
***Beneficiary:*** *Farming Community, Digital Farmer Engagement Platform*
***Technologies used:*** *Generative AI*

### ITC Infotech and Krishi Mitra: Revolutionising Agriculture with AI

ITC Infotech, a leading global technology services provider, is a wholly-owned subsidiary of ITC Ltd., one of India's top private sector companies. ITC operates across diverse sectors, incl. Consumer Goods, Hotels, Paperboards and Packaging, Agri-Business, and Information Technology.

In the agri-business sector, ITC has developed ITCMAARS, a super app featuring Krishi Mitra, the world's first AI-powered Farmer Copilot. This chatbot, unique in its ability to offer personalised agricultural advice and respond to queries in voice and vernacular languages, is a game-changer for Indian farmers. Krishi Mitra assists farmers with weather forecasts, crop advisory, pest and disease control, and market prices, leveraging enterprise knowledge specific to Indian farming and covering value chains like wheat, soybean, and millet.

### Solving Agricultural Challenges with Krishi Mitra

Krishi Mitra addresses critical issues farmers face, such as economic empowerment, which is crucial, esp. in regions like India, where agriculture is a primary sourceof income. Providing proper knowledge and tools enhances their economic well-being. Educating farmers on sustainable practices improves soil health, reduces harmful chemical use, and efficiently utilises natural resources. Increasing crop yields and quality is essential for food security amidst a growing global population. Additionally, guidance on adapting to changing weather patterns is vital for long-term viability of agriculture.

**Leveraging AI in Krishi Mitra for Agricultural Solutions**

Krishi Mitra uses AI to tackle the following mentioned key agricultural problems effectively:

**Personalised Agricultural Advice:** AI analyses individual farmer profiles, incl. land size, crop types, local climate, and farming practices, to provide tailored guidance.

**Multilingual and Vernacular Support:** The AI understands and responds to queries in various local languages and dialects, making it accessible to farmers across India.

**Voice Recognition and Response:** Advanced voice technologies allow farmers to interact with AI verbally, enhancing user-friendliness.

**Continuous Learning from Data:** The AI system improves over time by learning from interactions with farmers, refining its advice based on local conditions, pest patterns, weather impacts, and crop performance.

**Scalability and Reach:** AI enables rapid scaling, allowing the solution to reach many farmers across diverse regions without extensive physical infrastructure.

**Complexity of Krishi Mitra's Dataset**

The dataset used for Krishi Mitra is extensive and multifaceted, encompassing a large volume, diverse data types, and varied sources. It includes agronomical data for over 20 crops grown nationwide, market pricing data from 2,000+ agricultural markets for 100+ commodities and 900+ varieties, and precise weather forecasts for the day and the next 15 days. This comprehensive dataset supports farmers throughout the cultivation cycle, addressing pre- and post-harvest activities.

**Overcoming Data Challenges in Krishi Mitra**

Krishi Mitra faced significant challenges in prompt quality, which is crucial for generating accurate AI chatbot responses. A UI-based workflow was developed to address this, routing users to specific question categories with pre-built prompts, enhancing prompt quality and model accuracy. Additionally, implementing the solution in multiple languages revealed data translation issues. This was resolved by adding extensive context and translating keywords in the data sources.

**Impact and Scale of Krishi Mitra**

- ***Reach and Adoption:*** *Krishi Mitra has received 100,000+ impressions and 5,000+ queries over the past three months, with a monthly growth rate of ~100%. It serves farmers in 20 states, addressing queries on weather, market prices, pest and disease control, farming practices, government schemes, and loans. The solution is used by over 1 million farmers across 1,500+ Farmer Producer Organizations (FPOs)*
- ***Advanced AI Capabilities:*** *Features like the CROP DOCTOR use computer vision and AI to identify crop diseases from images and suggest remedial actions*
- ***Customer Experience and Market Linkages:*** *Provides market price information for 100+ commodities based on user location and helps farmers with market trends*
- *Engagement rates are growing by ~100% month-on-month. It informs farmers about government schemes and financial assistance, allowing applications through the ITCMAARS ecosystem*
- ***Vernacular support:*** *Supports six languages and ensures farmers receive optimal solutions*
- ***Environmental Sustainability:*** *Advising on the optimal use of resources like water and fertilisers and offers strategies to adapt to changing weather patterns*
- ***Social Impact:*** *The platform empowers farmers with accessible, personalised advice, enhancing their livelihoods and self-sufficiency. It also serves as an educational tool, improving understanding of modern agricultural practices and technologies and supporting community development through improved agricultural productivity and profitability*
- ***Governance:*** *Krishi Mitra adheres to data privacy and security standards, ensuring*

**Potential Scale of Krishi Mitra**

**Short-Term Growth (6-12 Months):**

- User Base Expansion: Expected growth of 100,000+ farmers per month, driven by outreach and platform value
- Diversification: Introduction of advice for additional crops and farming practices to meet diverse agricultural needs
- Enhanced Features: Continuous improvements in AI capabilities and user interface to attract more users

**Medium-Term Potential (12-24 Months):**

- Government Integration: Collaborations with government agricultural initiatives to boost user numbers and resources
- Agri-business Partnerships: Tying with agri-businesses for inputs, market linkages, technology transfer, and transactional capabilities to scale impact
- Advanced Technologies: Incorporation of sophisticated AI, satellite imagery, and vision models to attract a technologically savvy demographic

AGRICULTURE INNOVATOR

CSM Technologies

# CSM TECH: PADDY PROCUREMENT AUTOMATION SYSTEM

***Industry:*** *Agriculture*
***Business Function:*** *Software & Applications*
***Beneficiary:*** *Farmers, Agriculture industry*
***Technologies used:*** *Generative AI, Computer Vision, AR/VR, Cybersecurity*

## Comprehensive Digital Transformation

CSM Technologies is a digital transformation company specialising in IT solutions for public institutions, governments, municipalities, and public & private enterprises. They offer comprehensive IT services, incl. platforms, infrastructure, consulting, and communications.

CSM's AI and allied services focus on human-centric innovation, creating transformative solutions that impact lives and industries. They leverage machine learning and cutting-edge technologies to build a smarter, more humane future. With expertise in predictive analytics and advanced automation, CSM enhances human experiences and aims to create a future where intelligence promotes efficiency and well-being. They aim to empower humanity through technology, shaping progress with meaningful connections.

### Enhancing Agricultural Procurement Integrity

During each Kharif and Rabi paddy crop season, the Food Supplies & Consumer Welfare (F.S. & C.W.) Department registers farmers to sell paddy to the government through local procuring societies. Instances of false or inflated claims regarding cultivated land have led to undeserved MSP payouts, costing public funds. Current verification efforts by field officials are insufficient, necessitating more robust validation using remote sensing and high-resolution satellite imagery. Key challenges include lack of timely ground truth data, inadequate ground-level intelligence for optimal gains, discrepancies in land ownership records versus reality, misreporting in crop production, and potential MSP.

**Importance of Satellite Imagery in Agricultural Procurement**

During the Kharif KMS 2021-22, satellite imagery validated paddy crop areas across seven districts, detecting 83,076 plots covering 38,050 acres of non-cultivated land. This initiative saved ~₹109.5 crores in MSP expenditure, ensuring only genuine farmers were registered. Following this success, similar verification during the Rabi KMS 2021-22 in 17 districts detected 240,902 plots covering 137,963 acres of non-cultivated land, saving an estimated ₹654.6 crores. Satellite imagery has streamlined procurement processes, ensuring transparency and authentic participation of farmers.

### AI-Driven Transparency in Paddy Procurement

The F.S. & C.W. Department, Government of Odisha, enhances transparency in Paddy Procurement Cycle through "Village-wise Plot Level Analysis of Paddy Crop Growing Areas". Leveraging Remote Sensing, GIS, and AI/ML technologies, this initiative involves GIS mapping, geo-referencing Hal Cadastral Maps, and analysing high-resolution satellite images throughout the crop cycle. It integrates with existing departmental applications to validate land claims, ensure MSP benefits reach genuine farmers, and improve decision support through GIS-based visualisation and reporting. This scientific approach supports timely procurement and transparency across multiple procurement sites during the Kharif and Rabi seasons.

### Complexity of Agricultural Dataset

The dataset comprises structured data, incl. crop yield records, weather data, and market prices sourced from government departments, research institutions, and agricultural surveys. Semi-structured data includes text from reports, research papers, social media, satellite imagery, weather APIs, and market data. Unstructured data involves images, videos, and audio recordings from satellite and drone sources. Integrating these varied data types requires robust cleaning, preprocessing, and integration processes to maintain analytical accuracy and consistency.

### Data Solution Implementation Challenges and Solutions

Data Availability and Accessibility: Inconsistent data required rigorous cleaning, while collaboration was crucial for comprehensive analysis across diverse sources. Accessing SQL Server streamlined data retrieval, yet integrating State Data Center (SDC) data posed challenges, resolved through coordinated efforts for seamless usability.

Data Security: Third-party vendor management raised concerns over security oversight. To mitigate risks, CSM Technologies enhanced data processing using Tableau Prep and Python, ensuring robust Extract, Transform, and Load (ETL) processes with scheduled tasks for seamless integration and analysis.

Spatial Data Integration: ArcGIS and QGIS were instrumental in enriching datasets with spatial information. PostgreSQL facilitated enhanced data accessibility, enabling geographic boundary retrieval for in-depth analysis and visualisation via a GIS-hosted environment integrated with Tableau for comprehensive insights.

### Risk & Governance in Agricultural Innovation

**Implementation Challenges**

- Utilisation of high-end technology tools, such as satellite imagery, to detect and eliminate false or inflated farmer claims
- Necessity for capacity building, awareness, and effective communication strategies among department officials
- Requirement for automated, assisted, or physical assessment feedback mechanisms

**Governance Mechanism**

- Implemented as a best practice across all 30 districts of the state
- Mandated in government procurement policies
- The Chief Secretary convenes pre-season

meetings with district Collectors to discuss suspect land lists and ensure timely field verification

**Comparative Advantages**

- Integration with GIS, satellite imagery, and advanced processing techniques
- Granular data collection and plot-level analysis using Machine Learning (ML) models
- Mobile-app survey-driven Land Monitor MIS for comprehensive data aggregation
- Insightful analytics reports for informed decision-making
- Predictive analytics leveraging historical data, field inputs, and High-Resolution Satellite Imagery (HRSI)

## Scale and Impact of Satellite Image-Based Crop Validation

***Customer Experience***

*Accurate and timely crop analytics provide end-to-end visibility into farms and farmers, identifying genuine beneficiaries and maximising government interventions in the farm sector.*

***Operational Efficiency***

*Advanced crop analytics track farmer registration trends, new farmer registrations, drop-outs, and sharecropper plots, aiding state procurement authorities in tracing crops and their producers.*

***Revenue Optimization***

*Granular data from satellite imagery ensures MSP benefits reach only genuine farmers, optimising revenue allocation and preventing losses due to false reporting.*

***Other Key Points***

- *Registered genuine farmers, including small and marginalised: >1.8 million*
- *Total plots registered: >1.31 crore acres*
- *MSP disbursed to farmers: >₹37,000 crores (~USD 444.48 mn.)*
- *Government savings: Over ₹4,067 crores (~USD 48.85 mn.)*
- *Integration with Revenue Cadastral maps and Geo-referenced High-Resolution Satellite Images (HRSI)*
- *Contributions to effective governance and transparency under the 5T framework*
- *Optimisation of public funds through enhanced procurement processes*

**Future Scalability & Portability**

The innovation has been successfully implemented across all 30 districts of the State, supporting both Centralized and Decentralized crop procurement systems. It aggregates, visualises, and analyses land data, registration anomalies, crop patterns, and paddy productivity predictions.

While the innovation shows promise, scalability and portability must address several key factors:

**Scalability**

- **Data Volume:** Must efficiently handle increasing volumes of paddy-related data, scaling horizontally or vertically without performance degradation
- **User Base:** Support a growing user base with responsive performance for concurrent access
- **Analytical Complexity:** Evolve to handle more complex queries, algorithms, and models as analytical needs expand

**Portability**

- Platform Independence: Designed to operate on various platforms, incl. on-premises servers, cloud environments, and hybrid architectures. Utilises containerisation and virtualisation technologies for seamless deployment and management

These considerations ensure the solution's adaptability and robustness as it expands across different projects and initiatives within the agricultural sector.

AGRICULTURE
GAMECHANGER

**Iyarki Tech Lab Pvt. Ltd.**

# IYARKAI TECH LAB: HEALTHY LIVLYHOOD OF WOMEN SELF-HELP GROUPS - SILLIR - SMART MUSHROOM CULTIVATION SYSTEM

***Industry:*** *Agriculture*
***Business Function:*** *Software & Applications, Marketing & Sales, Customer Service, Operations, Sovereign Functions of Govt. of India (State-run functions)*
***Beneficiary:*** *Women Self Help Groups from various District in Tamil Nadu*
***Technologies used:*** *IoT, AI /ML*

### ITL: Pioneering AgriTech and GreenTech Solutions

iYarkai Tech Lab Private Ltd (ITL), based in Chennai, Tamil Nadu, excels in AgriTech innovation, design, technology, training, and marketing. ITL specialises in sustainable agriculture and community development and has a proven record of successful projects. ITL's dedicated team, skilled in agriculture and entrepreneurship, prioritise women's empowerment and sustainability. They propose an IoT-based mushroom cultivation unit for Women Self-Help Groups (WSHG).

### Addressing Challenges in Traditional Mushroom Cultivation

The primary issues in traditional mushroom cultivation include:

- **Manual Monitoring:** Labour-intensive and error-prone
- **Limited Precision:** Absence of real-time data for optimal growth conditions
- **Resource Inefficiencies:** Water and energy wastage due to suboptimal control

**Importance of Optimising Mushroom Cultivation**

Solving issues in mushroom cultivation through automation and precision enhances rural women's livelihoods by increasing income, developing skills, and empowering them, while also contributing to food security and community development.

**AI-Powered Smart Mushroom Cultivation**

Environmental Monitoring: AI-powered sensors continuously monitor temperature, humidity, CO2, and light intensity.

Predictive Analytics: AI algorithms use historical and current data to predict growth patterns and harvest times.

Automation: AI automates irrigation, ventilation, and lighting, maintaining consistent conditions.

Disease Detection: AI analyses images to detect early signs of diseases or pests, enabling proactive management.

Yield Optimisation: AI adjusts growing parameters in real-time to maximise yield.

Supply Chain Optimisation: AI predicts demand, manages inventory, and optimises transportation to streamline the supply chain and reduce costs.

**Complexity of the Dataset**

The dataset for this solution is complex, involving a moderate to high volume of data from various sensors monitoring temperature, humidity, and CO2 levels. It includes regular updates and details about mushroom types and environmental factors.

**Data Solution and Implementation Challenges**

ITL's data solution for mushroom cultivation involves collecting sensor data on temperature, humidity, CO2 levels, and growth stages. This data is stored and analysed to optimise cultivation conditions.

**Challenges and Solutions**

Data Volume: Implemented a robust data management system to efficiently handle large volumes of data.

Data Variety: Developed a strategy to integrate data from various sensors and sources.

Real-time Processing: Utilised advanced analytics tools for timely data processing.

Data Security: Ensured strong security measures, including encryption and access controls.

**Risks and Governance**

**Data Availability**

Limited Infrastructure: Obtaining reliable data in rural areas with limited internet and technology access.

Data Localization: Adhering to regulations requiring data storage within India is challenging for cloud-based solutions relying on international data centres.

**Accessibility**

Language and Literacy: Providing multilingual and simplified user interfaces for growers in rural areas

Digital Divide: Offering tailored training and support for diverse socioeconomic backgrounds.

**Security**

Cybersecurity Threats: Implementing robust security measures and user education to mitigate threats like phishing and data breaches.

Regulatory Compliance: Ensuring adherence to Indian cybersecurity and data privacy laws, such as the Information Technology Act and the Personal Data Protection Bill.

**Scalability**

Diverse Cultivation Practices: Creating customisable and scalable solutions for varied regional farming techniques.

Urbanization Impact: Developing scalable solutions for vertical farming or urban agriculture due to rapid urbanisation.

**Regulatory Compliance**

Complex Landscape: Navigating state-specific agricultural policies and regulations.

Certification Requirements: Meeting organic farming and food safety standards for consumer and export demands.

**Cost Management**

Affordability: Designing cost-effective solutions with flexible pricing for small-scale farmers.

Return on Investment: Demonstrating tangible benefits and ROI for marginal farmers to encourage technology adoption.

## Achieved Scale and Impact

*ITL's solution has significantly impacted mushroom cultivation across 36 districts in Tamil Nadu. Implemented in over 56 units, each involving 20 women from self-help groups, it has enhanced rural women's efficiency, sustainability, and livelihoods.*

***Transformative Impact of Smart Mushroom Cultivation System***

***Key Performance Metrics***

- *Revenue Optimisation: Sillir has increased revenue*

*by enhancing yield and quality through precise monitoring and controlling growth conditions*

- ***Operational Efficiency:*** *Reduced manual labour and errors, leading to cost savings and higher productivity*
- ***Customer Experience:*** *Consistent supply of high-quality mushrooms and transparency through traceability has improved customer satisfaction*
- ***Environmental Impact:*** *Sustainable practices, such as reducing water and energy wastage*

***Environmental, Social, and Governance (ESG) Impact:***

***Environmental Impact***

- *Promotes sustainable agricultural practices by reducing water and energy wastage*
- *Minimises pesticide use, leading to a healthier ecosystem*
- *Optimises water consumption through precise irrigation control*
- *Enhances microclimate resilience by creating optimal growth conditions*

***Social Impact***

- *Provides income-generating opportunities and valuable skills to rural communities, esp. women*
- *Fosters community development and empowerment through women's self-help groups*
- *Contributes to better nutrition and food security by providing a reliable source of nutrient-rich mushrooms*

***Governance***

- *Promotes transparency and accountability in cultivation practices*
- *Ensures compliance with regulations and standards, contributing to good governance in the agricultural sector*

**Potential Scale and Future Impact**

**Expansion:** With 36 districts in Tamil Nadu already covered, further expansion can benefit more women's self-help groups. Scaling to other Indian states and internationally can address the growing demand for sustainable agricultural practices.

**Technology Adoption:** Enhances productivity, sustainability, &profitability

**Impact on Livelihoods:** Scaling the solution can significantly improve rural women's livelihoods across India and globally, providing skill development and income opportunities

**Environmental Impact:** Expanding the solution promotes sustainable practices and reduces resource wastage, benefiting the environment.

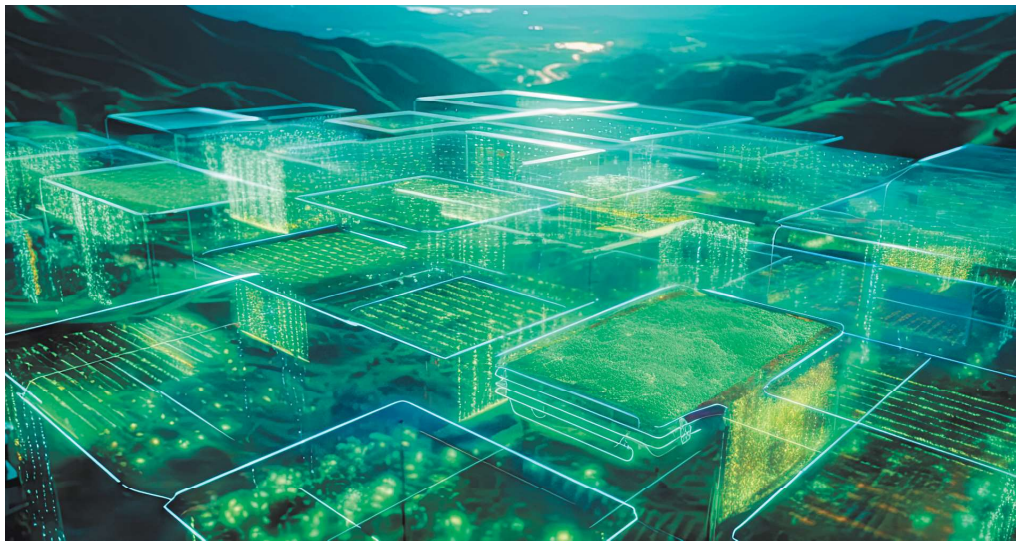
Urban Areas

- **Urban Farming:** Enables indoor or rooftop cultivation for urban dwellers
- **Community Gardens:** Supports collective mushroom cultivation, fostering community and entrepreneurship
- **Micro-Entrepreneurship:** Encourages small-scale urban mushroom businesses
- **Educational Centres:** Provides mushroom cultivation training for urban residents
- **Environmental Impact:** Promotes sustainability by reducing food miles and supporting local produce

AGRICULTURE
CHALLENGER

Garudalytics

# GARUDALYTICS: GEOSPATIAL AGRI AI SOLUTION



***Industry:*** *Agriculture*
***Business Function:*** *HR, Software & Applications*
***Beneficiary:*** *Farmers, FPOs, Insurance & Utility Companies, Government (Land and Urban Departments)*
***Technologies used:*** *Computer Vision, NLP, Geospatial Data Science*

## Innovating Geospatial Technology with AI Integration

Garudalytics Private Limited pioneers the fusion of AI and Geospatial Technology to tackle spatial complexities. Leveraging disruptive technologies like Geospatial Science, AI, IoT, and Blockchain, their flagship product, Garudalytics Smart Mapping (GSM), a Made in India innovation, stands as a game-changer. Powered by AI and location intelligence, GSM offers voice-controlled spatial analysis, raster analysis, and 3D operations.

Catering to diverse sectors, incl. government bodies, agricultural Farmer Producer Organizations (FPOs), advertising, real estate, and corporate clients, Garudalytics tailors geospatial insights to meet specific needs.

### Enhancing Agricultural Predictive Modelling in Telangana

In Telangana state, large-scale cultivation of tomatoes and chillies is prominent. Murata, a Singapore-based client, sought to implement predictive models for crop yield, growth, and health monitoring at the farm level.

To address this challenge, the Garudalytics AI platform, particularly Garudalytics Smart Mapping, was launched, equipped with a suite of AI tools. These tools harness diverse datasets, incl. satellite imagery, in-situ observations, weather station records, and soil health card data, to develop precise yield prediction models at the farm level.
An AI-driven tool using radar satellite datasets was

introduced for crop health monitoring to perform comprehensive surveillance from a satellite perspective. Any significant changes identified are promptly verified by the ground team.

**Significance of Addressing the Chosen Problem**

Bridging the geospatial skilled resource gap and optimising existing infrastructure are crucial for enhancing operational efficiency.

### Leveraging AI for Geospatial Data Processing

They focused on optimising resource efficiency to tackle the challenge of processing vast amounts of data and deriving insights using Geospatial AI.

The GeoAI Model is tailored to deliver yield predictions per pixel and per farm. It integrates 21 key parameters collected at frequent intervals from transplantation to harvest, ensuring efficient prediction with minimal runtime and memory usage.

Additionally, the model monitors crop health and growth throughout the lifecycle using multispectral and radar satellite data. Geospatial AI tools automate satellite data retrieval and analysis at the farm level, enabling timely insights generation based on ground data.

### Complexity of Dataset Utilisation

The dataset encompasses a diverse range of structured, unstructured, spatial, and non-spatial data types - PDFs, text files, images (incl. drone, aerial, satellite images), SAR and MSS datasets, and videos. They processed terabits of data to train the models, incl. over a million images and datasets.

### Overcoming Data Challenges in Model Implementation

Ensuring accurate and efficient data acquisition posed the biggest challenge, particularly the availability of timely satellite data during the rainy season. To mitigate this, Garudalytics developed an alternative solution using radar data. This model is designed to be robust and versatile, accommodating farms of varying sizes and multiple crops without needing separate models.

During implementation, significant challenges related to data size and infrastructure emerged. They engaged cloud service providers for PoC credits to address these, optimising scalability and infrastructure efficiency. Simultaneously, they forged partnerships with government agencies to access extensive datasets crucial for our predictive models.

This strategic approach enabled Garudalytics to overcome data acquisition and infrastructure hurdles, ensuring seamless integration and processing of large datasets

### Scaling Impact through Innovative Solutions

*The solution's success is underscored by its product launch, validation, customer onboarding, and multiple awards. Garudalytics has won multiple accolades for this solution including being the winners of the K-Tech Nasscom-ledAgri AI Challenge2022.*

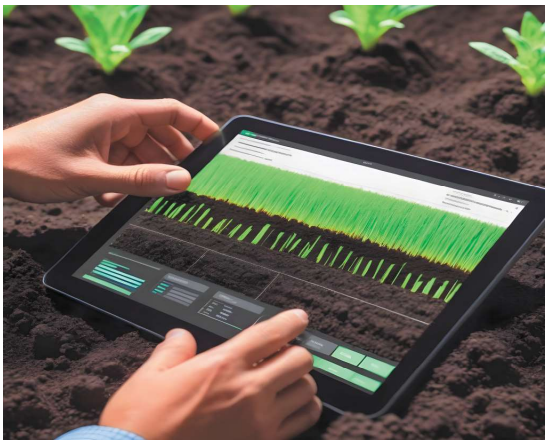
*The solution's impact extends to optimising resource utilisation, eliminating the need to hire experienced personnel with its user-friendly and voice-enabled interface.*

*Aligned with Sustainable Development Goals (SDGs), the AgriAI component significantly contributes to Goal 2 (Zero Hunger) by enabling precise crop growth monitoring, health assessment, and yield estimation. This empowers farmers with essential insights for sustainable agricultural practices.*

*Additionally, Water AI tools play a crucial role in supporting Goal 6 (Clean Water and Sanitation) by analysing surface water and enhancing water resource management, thus effectively addressing water-related challenges.*

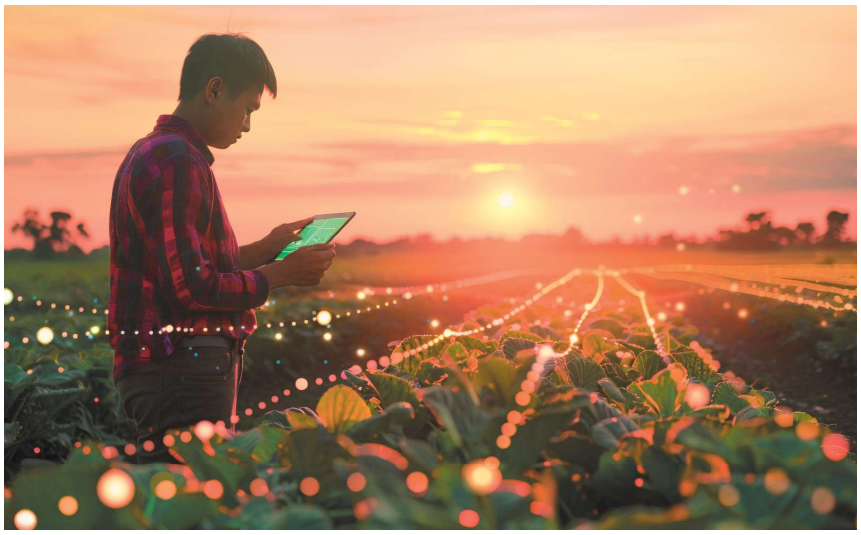
### Potential for Scalability

Garudalytics has secured funding from Tide 2.0 by CDAC and MeitY and Samridhi Conclave 2.0 by IIT Ropar, DST, and SOI. These investments will enable them to effectively implement and scale their solution in alignment with current trends and scenarios.



AGRICULTURE INNOVATOR

**Cropway-Boaz Agri Analytics Pvt. Ltd**



# TRANSFORMATIVE DEEPTECH IN AGRICULTURE - IMPACT OF CROPWAY

***Industry:*** *Agriculture*
***Business Function:*** *Software & Applications, Operations, Business Intelligence, Marketing & Sales*
***Beneficiary:*** *Farmers, Women Farmers Produce Company*
***Technologies used:*** *NLP, Computer Vision, AIOps, Blockchain, Geospatial*

## Transforming Agribusiness with Cropway

Cropway, a SaaS-based Agtech platform, offers a comprehensive, self-delivering solution to agriculture stakeholders, focusing on sustainability and data-driven decision-making. Its expertise in AI, machine learning, data science, blockchain, and geospatial technologies aligns with global goals of sustainable development, hunger eradication, and climate change mitigation, making it a powerful tool for positive change worldwide.

## Addressing Challenges in Agriculture

The agriculture sector faces disorganisation, particularly affecting small and marginal farmers.Challenges include landholding, climate change impact, inadequate infrastructure and lack of financial support. Globally, barriers like limited technology access, credit, unsustainable practices, knowledge gaps, and market inefficiencies persist. Cropway aims to create an equitable supply chain that benefits farmers and consumers.

## Significance of Addressing Agricultural Challenges

The demand for food is increasing, but limited land and potential land degradation pose significant constraints. The World Economic Forum estimates that 95% of the world's land could degrade by 2050. Current farming practices may require double the water for food production, especially in drought-prone regions. Small-scale farmers and pastoralist families, who depend on their output, face longstanding challenges in agriculture.

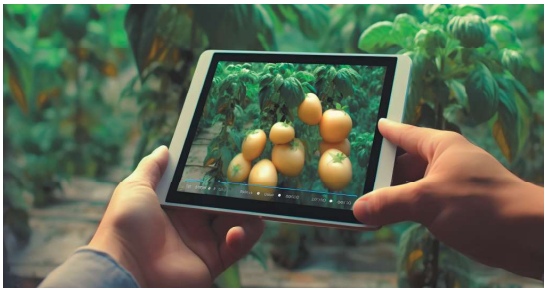
Despite this, international investments in agricultural and financial technologies and effective development programs offer unprecedented opportunities for inclusive growth. About 500 mn. households globally engage in small-scale farming or pastoralism, which is crucial for sustaining millions of families. Cropway's mission is to address these challenges and create a more sustainable and equitable future for agriculture.

### Cropway's AI-Powered Agricultural Solutions

Cropway empowers small farmers and agricultural enterprises with innovative solutions for profitability and sustainability. The platform fosters direct market connections, ensuring fair pricing and eliminating intermediaries to maximise farmer profits. Through financial inclusion, Cropway provides access to credit and insurance, enabling effective risk management and farm investment. Leveraging blockchain for traceability and quality management, Cropway enhances sustainability and reduces transaction costs across export cycles. Digitising records, promoting precision agriculture, and offering intelligent advisory services optimise resource use, minimise waste, and foster sustainable farming practices.

### Complexity of Cropway's Dataset

Cropway manages a dataset of substantial volume and diverse types – including 123+ crop varieties across 91 crops, amounting to 0.5 terabytes of data. Data types encompass farmer profiles, export-import details of agricultural commodities, satellite imagery, farming equipment specifics, and weather advisories, offering a holistic view of the agricultural ecosystem.



### Cropway's Data Solution and Implementation

#### Challenges

Cropway's data solution resolves agriculture's data silos, accessibility, and security challenges. It addresses rural-specific issues like low teledensity, inadequate IT infrastructure, and low digital literacy with user-friendly interfaces tailored for rural users.

The platform integrates government support prices, provides financial tools for credit-based purchases, and includes logistics solutions for efficient last-mile delivery.

### Impact and Achievements of Cropway's Solution

*Cropway has achieved significant scale and qualitative impact in agriculture. Geospatial services and drone capabilities cover1220 acres, generating revenue from four international clients. Over 15 products from Farmer Producer Organizations (FPOs) and individual farmers have been directly sold in supermarkets, demonstrating substantial market penetration.*

*Engaging with stakeholders includes interactions with 4 NGOs, ten government agencies, and nine institutions, solidifying Cropway's role as a trusted partner in agriculture. Collaborations with Grant Thornton and existing partners like Krishify and Digicides will expand access to 5 crore farmers in upcoming phases.*

*Strategic initiatives include an MoU with a government agency for nationwide technology deployment, which enhances Cropway's influence in rural markets. Over 50,000 farmers, FPOs, and Self-Help Groups have received 500+ hours of expert training and benefit from access to 3,500+ kgs of high-quality seeds and crop management solutions.*

*Digitally, Cropway has achieved 2,000+ downloads, uploaded 1,600+ products on its marketplace, and digitalised 100,000+ acres globally, enhancing agricultural efficiency. Their disease and pest detection module has addressed 500+ crop management requests, showcasing practical impacts on farmers' practices.*

*Through revenue optimisation, operational efficiency improvements, and enhancing customer experiences, Cropway continues to innovate in sustainable agriculture, empowering rural communities and fostering economic independence through responsible AI-driven initiatives.*

### Potential Scale and Expansion Plans

Cropway aims to scale its impact significantly by onboarding more small-holder farmers, Farmer Producer Organizations (FPOs), and Self-Help Groups (SHGs) across states and expanding services globally through partnerships. Emphasising innovative and sustainable farming practices, Cropway also focuses on vendor onboarding for agricultural inputs, exporters, and processing units. Strategic partnerships via Memorandums of Understanding (MOUs) with modern trade outlets and shopping centres are integral to its growth strategy.

# SPECIAL RECOGNITION

# IIT MADRAS : WHOLE HUMAN BRAIN IMAGING AT CELLULAR RESOLUTION

## ENHANCED CRYOPROTECTION AND FREEZING TECHNOLOGY PLATFORM FOR HIGH RESOLUTION LARGE VOLUME BRAIN TISSUE HISTOLOGY

Understanding and mapping the human connectome is a longstanding goal in neuroscience. However, challenges associated with the large size of the human brain during cryosectioning remain unsolved. While smaller brains, such as rodents and marmosets, have been the focus of previous connectomics projects, processing the larger human brain requires significant technological advancements.

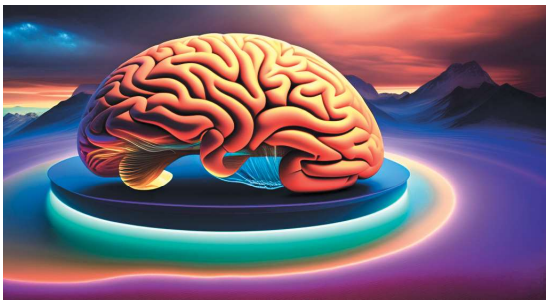
### Challenges in large-volume brain histology

As brain sizes increase from mice to humans, unique challenges emerge, necessitating standardised methods for high-quality, high-throughput cellular-scale histology, even in resource-constrained labs worldwide. Larger tissues take longer to freeze, leading to potential freezing artefacts and tissue damage.

Understanding connectivity in large-volume human brains requires interdisciplinary collaboration globally. Limited funding often restricts such projects to developed countries. There's a pressing need for affordable, reproducible technologies spanning neuroscience and engineering disciplines.

### Our approach and advancements

This paper introduces a standardised resource method for freezing large brain tissues with minimal damage, enabling high-throughput histology and 3D digital reconstruction. Utilising widely used engineering tools, customised brain-specific components, and a temperature monitoring system, IIT Madras ensures the standardised freezing of



large brain volumes. They employed high-resolution digital histology on human and animal brains to evaluate their cryo preparation method, including cryoprotectants and temperature control required for optimal freezing.

> The described technologies are affordable and not restricted to large-scale funded projects, as they are done with limited resources. They enhance the accessibility of large-scale scientific endeavours beyond developed countries, promoting diverse approaches and fostering collaborations.

### Evaluation of Our Cryo Preparation Method

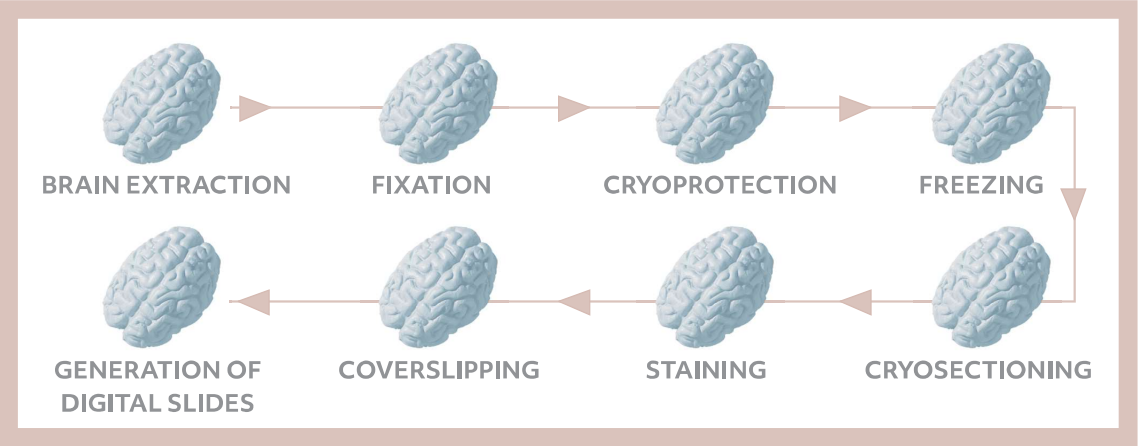
To evaluate their cryo preparation method, particularly the effectiveness of the various cryoprotectants, the cryogenic media, and the rates of temperature decrease required for optimal freezing, IIT Madras used high-resolution digital histology on large human and animal brains as a measure of the output of the techniques. This study addresses the problem of freezing large brains in aligned neuroanatomical coordinates with minimal tissue damage, facilitating large-scale distortion-free cryosectioning. IIT Madras present an efficient and stable freezing technique utilising cryoprotection and engineering tools like brain master patterns, custom-designed molds, and continuous temperature monitoring.

### Cryo Preparation for Digital Histology

The cryopreparation or freezing process is vital for processing large brain tissues efficiently in digital

histology pipelines. It surpasses alternate methods, such as wax embedding processes, in reducing distortion and shrinkage caused by dehydration.

**The cryosectioning pipeline encompasses**




**Large Brain Freezing Process**

The brain-freezing process consisted of two essential steps:

- the production of the cryomolds and
- the freezing of the brain

**The freezing protocol for large brain tissues**

1. Prepare freezing bath: Styrofoam box with dry ice and stainless steel container with isopentane
2. Log isopentane temperature data
3. Add dry ice to cool isopentane below –75°C
4. Assemble the brain master pattern in a copper base mold and pour the embedding medium
5. Place base mold in isopentane for medium freezing
6. Apply heat to remove the master pattern from mold
7. Position brain tissue in the base mold and cover it with the medium
8. Freeze tissue by placing mold in isopentane
9. Apply heat to melt the embedding medium using a heat gun
10. Remove the frozen block from mold
11. Frozen block with embedded brain tissue (medium translucent)

**Results**

Histological Outcomes of the Freezing Protocol on the Human Brain

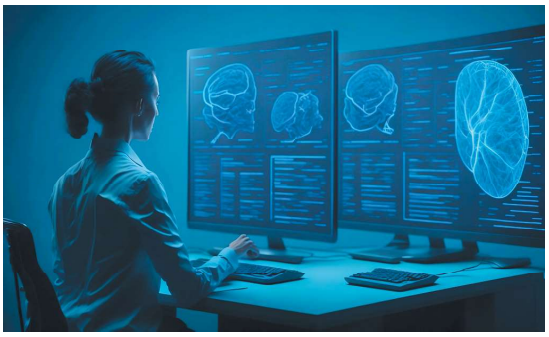
To quantify freezing parameters for large brain tissues, they assessed critical variables: cryoprotectant choice, protection duration, freezing medium, and rate. Systematic experiments on goat brains determined optimal conditions through histological section examination. Monitoring both internal and external parameters during animal experiments provided comprehensive insights.

**Choice of Cryoprotection: Sucrose vs. Glycerol and DMSO**

Cryoprotection involves immersing brain tissue in chemicals to replace water without causing expansion, preserving tissue volume during freezing. They compared two common cryoprotectants: gradient sucrose and a glycerol-DMSO combination. Optimising the choice of cryoprotectant and its duration based on the tissue size and histological quality is essential to minimise cellular osmotic shock and maintain the quality of histology.

They assessed brain tissue shrinkage by measuring dimensions before and after cryoprotection. When goat brains were cryoprotected, gradient sucrose and glycerol-DMSO combinations resulted in 8% and 2% shrinkage, respectively.

The study systematically explored cryoprotectant options, protection duration, and cryogenic mediums for large tissue block preparation before cryosectioning. Optimal results were achieved with



gradient sucrose cryoprotection until equilibrium, followed by freezing with isopentane and dry ice at –78°C to –80°C.

**Selection of the Cryogenic Medium or Source for Freezing**

They standardised freezing methods for large brain specimens (>200 cm3) based on spatial uniformity, freezing rate, and usability. Three modalities, each offering different freezing rates, were chosen.

- Liquid Nitrogen offers the fastest cooling due to its extremely low temperature (-210°C)

Isopentane in a dry ice bath offers less cooling than liquid nitrogen.

Direct freezing in a -80°C freezer provides the slowest cooling as heat transfer through the air is less efficient.

They used gradient sucrose for cryoprotection before freezing three whole goat brains (GB3, GB4, Gb5). Each brain, surrounded by an embedding medium, was placed in a copper base mold. The mold was placed in one of three freezing sources:

isopentane/dry ice bath, liquid nitrogen, or a -80°C freezer. Temperature sensors were inserted into four locations within the brain tissue to monitor temperature gradients.

**Optimal Cryoprotection Results**

The gradient sucrose protocol yielded the best outcomes for the tape transfer-based cryosectioning. On the other hand, gradient glycerol and DMSO cryoprotection, while faster than gradient sucrose, exhibited minimal shrinkage without significant cellular changes, including osmotic shock. Previous reports align with these findings, indicating that 20% gradient glycerol minimises tissue shrinkage and uniformly replaces water from the tissue.

Qualitative analysis of the 24-hour cryoprotection protocol revealed cellular osmotic shock in several regions, with compromised physical integrity in frozen blocks, particularly those cryoprotected with glycerol and DMSO. Long-term storage of larger brain specimens in sucrose cryoprotectant is typically avoided due to the risk of microbial contamination.

**Cryogenic Source and Freezing Rate**

The temperature distribution and varying freezing rates within the goat brain helped the scientists understand the thermodynamic process parameters, particularly the freezing source and rate, for large brain freezing. Direct freezing of the goat brain in a –80°C freezer caused the top surface of the embedding medium to freeze along with surfaces in contact with the copper base mold. This led to trapped liquid embedding medium and subsequent damage to brain tissue due to expansion upon freezing. However, freezing in an isopentane and dry ice bath produced blocks conducive to cryosectioning without artefacts.

**Freezing Protocol: Component Design and Material Selection**

The brain master pattern and base mold material selection significantly influence the freezing process. Employing metal 3D printing for the brain master pattern ensures precise representation of surface details.

Proper brain alignment within the embedding medium is crucial for cryosectioning and 3D reconstruction studies facilitated by the neuroanatomical coordinates. The pattern and mold enable consistent brain placement, aiding in reference during cryostat sectioning. Minimising embedding medium thickness is essential for

efficient heat transfer while ensuring tissue support. These engineering advancements bridge traditional neuroscience with large brain studies, offering a standardised approach for single-cell connectomics.

**Discussion**

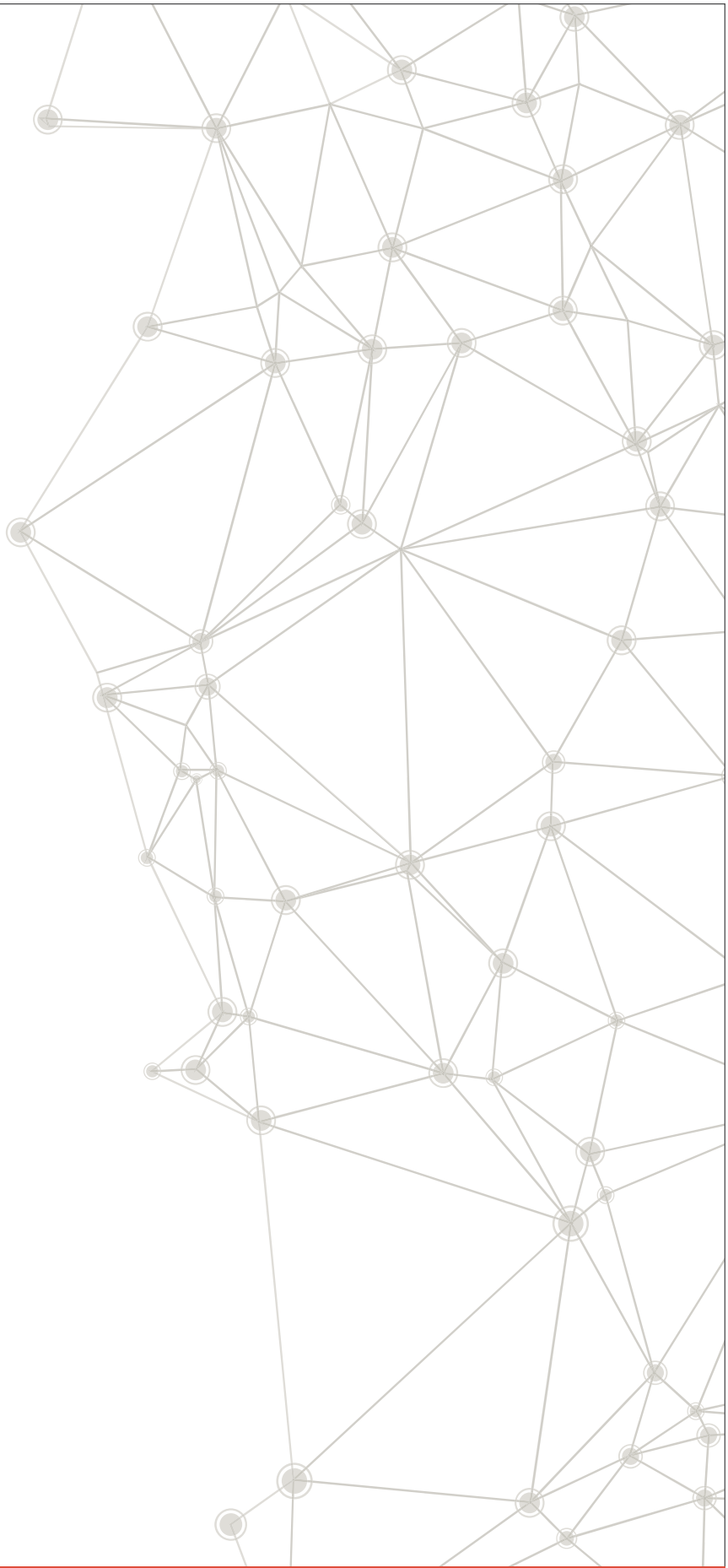
This paper systematically assessed cryoprotectant options, cryoprotection duration, and cryogenic mediums for preparing large frozen tissue blocks before cryosectioning. Optimal results were achieved by cryoprotecting specimens with gradient sucrose using the full-time protocol and freezing them with an isopentane and dry ice bath at -78°C to -80°C.

Key factors for successful freezing include:

- Cryoprotectant choice
- Cryoprotection duration
- Continuous isopentane temperature monitoring
- Brain master pattern design
- Sample-specific copper base mold usage
- Careful material selection during freezing

For digital histology and 3D reconstruction of large brain specimens, tissues are often processed in thin slices (5-10 mm) and frozen in small blocks for cryosectioning. However, this can lead to misalignment issues and complexity during registration and alignment, especially with many slices. To mitigate this, the freezing protocol focuses on thick tissue slices (40-50 mm) with minimal damage, reducing the number of slices needed (4-5 slices for an adult human brain) for accurate alignment and analysis of the entire brain volume.

IIT Madras engineering advancements offer a valuable resource to bridge traditional neuroscience with the challenges of studying large brains at a cellular level. While human connectomics studies typically rely on computational neurobiology and magnetic resonance imaging, their freezing method provides a standardised and scalable approach for single-cell level connectomics studies with minimal errors.
This interdisciplinary approach, merging neuroscience with engineering, has the potential to significantly advance our understanding of brain connectivity and drive discoveries in neuroscience.



# RESEARCH PAPERS

# V-DESIRR: VERY FAST DEEP EMBEDDED SINGLE IMAGE REFLECTION REMOVAL

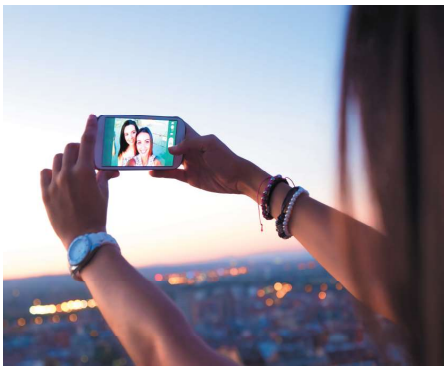
***Research Area:*** *Computer Vision*
***Authors:***
- *Samsung R&D Institute India-Bangalore (SRI-B): B H Pawan Prasad (Architect), Green Rosh K S (Chief Engineer), Lokesh R B, and Sanjoy Chowdhury*
- *IIT Madras: Kaushik Mitra*

Real-world images often become corrupted due to unwanted reflections, making their removal highly desirable. Many such images originate from smartphone cameras capable of capturing very high resolutions. Existing methods usually prioritise restoration quality at the cost of processing speed and memory requirements or focus on removing reflections at very low resolutions, limiting their practical deployability.

Researchers have proposed a lightweight deep-learning model for reflection removal using a novel scale-space architecture. This method processes corrupted images in two stages:

- Low Scale Sub-network (LSSNet) to handle the lowest scale and
- Progressive Inference (PI) stage to process higher scales

To reduce computational complexity, the sub-networks in the PI stage are designed to be much shallower than LSSNet. Additionally, weight sharing is employed between scales within the PI stage to limit the model size, allowing the method to generalise to high resolutions without explicit retraining.



The proposed method is superior both qualitatively and quantitatively as compared to current methods. **It runs 20X faster and has 50X fewer parameters** than the most recent state-of-the-art algorithm, RAGNet. The technique has been implemented on an Android smartphone, where a high-resolution 12 MP image is restored in **under 5 seconds**.

The scale-space architecture combines a deeper network at the lowest scale with shallower networks at higher scales, guided by convolutional filters that upsample lower-scale outputs. Weight sharing between sub-networks at higher levels further reduces memory usage. This approach increases the effective receptive field during inference, enabling the method to handle high-resolution images (up to 64 MP) even though the network was trained on much smaller resolutions.

The researchers also implemented a quantised version of their solution on an Android smartphone powered by a Qualcomm Snapdragon 888 chipset with 8 GB of onboard RAM, where a high-resolution 12 MP image is restored in under 5 seconds.

# KAM-COT: KNOWLEDGE AUGMENTED MULTIMODAL CHAIN-OF-THOUGHT REASONING

***Research area:*** *Multimodal reasoning*
***Authors:*** *Debjyoti Mondal, Suraj Modi, Subhadarshi Panda, Rituraj Singh, and Godawari Sudhakar Rao-Samsung R&D Institute India – Bangalore*

Large Language Models (LLMs) have shown remarkable performance in natural language processing tasks by utilising the chain of thought (CoT) approach, which enables step-by-step reasoning. The recent interest in extending LLMs with multimodal capabilities has brought challenges such as increased computational costs and the need for substantial hardware resources.

The KAM-CoT framework has been proposed to address these challenges, integrating CoT reasoning, Knowledge Graphs (KGs), and multiple modalities to understand multimodal tasks comprehensively.

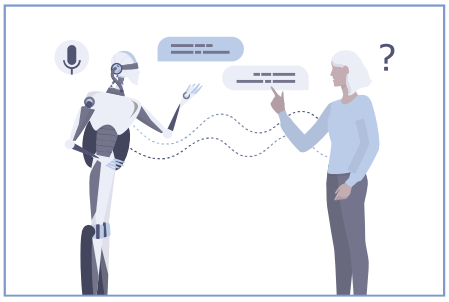
With its two-stage training process and KG grounding, KAM-Co Thas demonstrated superior performance. By incorporating external knowledge from KGs, the model achieves a deeper contextual understanding, reducing hallucinations and improving the quality of answers. This knowledge-augmented CoT reasoning allows the model to handle questions requiring external context, providing more informed answers.

Experimental results indicate that KAM-CoT outperforms state-of-the-art methods, achieving an **average accuracy of 93.87%** on the ScienceQA dataset. This surpasses GPT-3.5 by 18% and GPT-4 by 10%. KAM-CoT achieved these results with only 280 million trainable parameters, demonstrating its cost-efficiency and effectiveness and providing a practical and economical solution for multimodal reasoning tasks.

The KAM-CoT framework, designed to enhance the reasoning capability and quality of answers from language models, aims to provide a thorough understanding of multimodal tasks. By leveraging CoT reasoning and knowledge graphs, along with other modalities, this framework offers a unique approach to multimodal reasoning.

Various methods to fuse these modalities are suggested, and incorporating KG in the two-stage training process reduces hallucinations.

Future directions include integrating specific knowledge-intensive domains, exploring efficient fusion mechanisms, and scaling the solution to larger models like the LLaMA family.



# DF-PLATTER: MULTI-FACE HETEROGENEOUS DEEPFAKE DATASET

***Research Area:*** *Deepfake Detection, Responsible AI*

***Authors:***

- *Saheb Chhabra, Kartik Thakral, Surbhi Mittal, Mayank Vatsa, Richa Singh (IEEE TAI journal author list); Kartik Narayan, Harsh Agarwal, Kartik Thakral, Surbhi Mittal, Mayank Vatsa, Richa Singh (CVPR Conference author list); Richa Singh and Mayank Vatsa are Professors at IIT Jodhpur ; Other authors are students*

The significance of deepfake detection is increasingly recognised within the research community. Traditionally, research has concentrated on high-quality images and videos where individuals appear under controlled conditions. However, deepfake generation algorithms have advanced to produce low-resolution deepfakes, manage occlusions, and manipulate multiple subjects.

The DF Platter dataset has been developed to simulate real-world deep fake generation scenarios. This dataset includes low-and high-resolution deep fakes created using various generation techniques and features single-subject and multiple-subject deep fakes with faces of Indian ethnicity. Each face in the dataset is annotated for attributes such as gender, age, skin tone, and occlusion.

The dataset was compiled over 116 days using 32 GPUs, resulting in a cumulative memory usage of 1,800 GB. The total size of the dataset exceeds 500 GB and comprises 133,260 videos across three sets. It is considered one of the most enormous datasets available, offering extensive variability and numerous challenges.

Benchmark results are provided for multiple evaluation settings using popular and state-of-the-art deepfake detection models, including c0 images and videos and c23 and c40 compression variants. These results indicate a significant drop in performance when detecting low-resolution deepfakes. Additionally, existing techniques show reduced detection accuracy on multiple-subject deepfakes. The dataset is expected to advance state-of-the-art technology by enhancing the capabilities of deepfake detection algorithms to address real-world scenarios.

Given the persistent challenges in deepfake detection, the DF-Platter dataset is a timely and crucial resource. It introduces the novel concept of intra-deep fakes, generating low-resolution deepfakes from low-resolution videos instead of downsampling high-resolution videos. The dataset also includes occluded deepfakes, further complicating the detection task.

With benchmark results for various state-of-the-art deepfake detectors highlighting the need for improvement, this innovative dataset is anticipated to open new avenues in deepfake detection research and serve as a foundation for further exploration.

# PowRL : REINFORCEMENT LEARNING FRAMEWORK FOR ROBUST MANAGEMENT OF POWER GRIDS

***Research Area:*** *Enhancing Future Grids through Reinforcement Learning-driven Control*
***Authors:*** *Anand Singh Chauhan (Researcher, Tata Consultancy Services Limited), Mayank Baranwal (Senior Scientist, Tata Consultancy Services Limited), Ansuma Basumatary (ML Engineer, SalesKen)*

Power grids globally have significant societal and economic importance because they deliver uninterrupted, reliable, and transient-free power to various industries, businesses, and households. The rise of renewable power resources and electric vehicles has introduced uncertainties in generation and highly dynamic load demands, making it crucial to ensure the robust operation of power networks by effectively managing transient stability issues and localising blackout events.

In response to the increasing stress on modern grid infrastructure and the challenges grid operators face, this study introduces a reinforcement learning (RL) framework, PowRL. PowRL is designed to mitigate the effects of unexpected network events and maintain reliable electricity distribution. The framework employs a novel heuristic for overload management and RL-guided decision-making for optimal topology selection, ensuring safe and reliable grid operation without overloads.

PowRL has been rigorously tested against various competition datasets hosted by the L2RPN (Learning to Run a Power Network). Despite its reduced action space, PowRL emerged as the **top-performing agent** in the L2RPN WCCI 2020 challenge and **topped** the leaderboard in the L2RPN NeurIPS 2020 challenge (Robustness track). Its state-of-the-art performance in several test scenarios demonstrates PowRL's adaptability and robustness.

This research presents PowRL, a heuristic-guided RL framework for the robust control of power networks facing production and demand uncertainties and adversarial attacks. PowRL surpasses state-of-the-art approaches on several challenge datasets, even with a reduced action space, by utilising a careful action selection process combined with line reconnection and recovery heuristics. PowRL diversifies its actions across substations and learns to identify crucial action sequences to protect the network against targeted adversarial attacks.

# AnyDA: ANYTIME DOMAIN ADAPTATION

***Research Area:*** *Computer Vision*
***Authors:*** *Omprakash Charkraborty (PhD Scholar, IIT Kharagpur), Aadarsh Sahoo (PhD Scholar, Caltech),Rameswar Panda (Research Scientist, MIT-IBM Watson AI Lab), Abir Das (Assistant Professor, IIT Kharagpur)*

Unsupervised domain adaptation presents a significant challenge in computer vision. Although current research demonstrates promising results in addressing cross-domain distribution shifts on standard benchmarks, these studies often test within a specific target setting, limiting their applicability to many real-world scenarios. This paper introduces an effective framework for anytime domain adaptation, which is capable of operating with dynamic resource constraints to balance accuracy and efficiency under domain shifts and reassures with its adaptability. This is achieved by training a single shared network using labelled source and unlabelled data, with the ability to adjust depth, width, and input resolutions dynamically during testing to accommodate various computation budgets. The approach begins with a teacher network trained on a label-rich source domain. Bootstrapped recursive knowledge distillation is then used to bridge the source and target domains, facilitating the joint training of a student network with switchable subnetworks. Experiments conducted on multiple datasets demonstrate the superiority of this method over current state-of-the-art techniques.
However, potential negative impacts include common issues associated with deep learning models, such as susceptibility to adversarial attacks, dataset bias, and lack of interpretability.

The research on anytime domain adaptation offers several benefits, such as reducing the need for large-scale supervised data collection by transferring knowledge from auxiliary datasets. It also allows customising a single deep neural network in the target domain to meet changing demands, reducing memory and power consumption. This improves efficiency and has significant environmental benefits, which is a reason for optimism as AI systems become more widespread.

# YOUR TONE SPEAKS LOUDER THAN YOUR FACE!
## MODALITY ORDER INFUSED MULTI-MODAL SARCASM DETECTION

***Research Area:*** *Natural Language Processing*
***Authors:***
- *IIT Patna, India: Mohit Singh Tomar, Abhisek Tiwari, Sriparna Saha*
- *University of Liverpool, UK: Tulika Saha*

Figurative language plays a crucial role in human communication, making the detection of sarcasm in text a significant and challenging task within the field of natural language processing. Humans use visual and auditory cues, such as facial expressions and tone of voice, to grasp a message's meaning. The human brain is inherently trained to integrate information from multiple senses, a process known as multi-sensory integration, to understand the conveyed message comprehensively. This integration provides additional context and enhances the information conveyed by each modality. The sequence in which these modalities are integrated is critical in multimodal processing.

In this study, researchers examined the impact of different modality infusion orders on identifying sarcasm in dialogues. They introduced a modality order-driven module integrated into a transformer network called MOSarcation, which fuses modalities in a specific sequence.

This model surpassed several state-of-the-art models **by 1-3%** across various metrics, highlighting the importance of modality order in sarcasm detection. The findings indicated that infusing audio tone with textual content, followed by visual information, is most effective for identifying sarcasm.

The paper further explores the role of ordered modality infusion in sarcasm detection within conversations. The researchers proposed a transformer network with an adapter-based modality order-infused sarcasm detection model, MO-Sarcation. Extensive experiments on a benchmark sarcasm identification dataset demonstrated that ordered modality infusion leads to superior performance. It was established that combining text and audio modalities enhances understanding of visual features for the task.

Future research aims to investigate the relationship between sarcasm identification and dialogue acts.

# HOW DOES THE BRAIN PROCESS SYNTAX STRUCTURE WHILE LISTENING?

***Research Area:*** *Bridging AI and Neuroscience: Brain language processing*

***Authors:***

- *INRIA, Bordeaux (France): Subba Reddy Oota (PhD student)*
- *IIIT Hyderabad (India): Mounika Marreddy (Postdoctoral Researcher), Manish Gupta,Bapi S. Raju*
- *Microsoft India: Manish Gupta*

Syntactic parsing involves assigning a syntactic structure to a sentence, and there are two prominent methods: constituency parsing and dependency parsing. Recent studies have utilised syntactic embeddings derived from constituency trees, incremental top-down parsing, and other syntactic features to predict brain activity based on text stimuli. This research aims to understand how syntactic structures are represented in the brain's language network. However, the effectiveness of dependency parse trees and the relative predictive power of various syntactic parsers across different brain regions, particularly during listening tasks, remains unexplored.

This study investigates the predictive power of brain encoding models in three scenarios:

(i) Individual performance of constituency and dependency syntactic parsing-based embedding methods

(ii) Efficacy of these methods when controlling for essential syntactic signals

(iii) Relative effectiveness of each syntactic embedding method when controlling for the other. Additionally, the study examines the relative importance of syntactic information from these embedding methods versus semantic information using BERT embeddings.

The findings indicate that constituency parsers help explain temporal lobe and middle-frontal gyrus activations. In contrast, dependency parsers better encode syntactic structures in the angular gyrus and posterior cingulate cortex. Although semantic signals from BERT embeddings are more effective than any of the syntactic features or embedding methods, syntactic embedding methods account for additional variance in a few brain regions. The code from this study has been made publicly available.

The study highlights the relative importance of various constituency and dependency syntax parsing methods for fMRI prediction during listening tasks. The results show that:

(i) Both constituency and dependency parsing methods are effective, with constituency parsing being more critical than incremental top-down parsing

(ii) Constituency parsing is more effective in the temporal cortex and middle-frontal gyrus, while dependency parsing is more effective in the angular gyrus and posterior cingulate cortex

(iii) While BERT embeddings are the most effective overall, syntactic embedding methods also explain additional variance in specific regions of interest

Consistent with previous research, the study confirms that syntax and semantic processing are distributed across multiple brain areas.

# DOMAIN GENERALIZATION USING CAUSAL MATCHING

***Research Area:*** *Machine Learning; Out-of-distribution generalisation*
***Authors:*** *Divyat Mahajan (Research Fellow, Microsoft Research India), Shruti Tople (Microsoft Research UK), Amit Sharma (Microsoft Research India)*

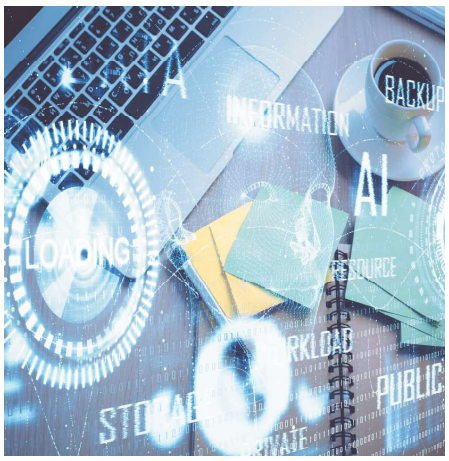
In domain generalisation, a common goal is to learn representations that remain independent of the domain once conditioned on the class label. However, this objective alone is insufficient: there are instances where a model does not generalise to unseen domains even when class-conditional domain invariance is achieved. This observation is formalised through a structural causal model, emphasising the need to account for within-class variations to enhance generalisation. Specifically, classes comprise objects that characterise specific causal features, while domains can be seen as interventions on these objects, altering non-causal features.

> An alternative condition is proposed: inputs across domains should share the exact representation if they originate from the same object.

Based on this premise, matching-based algorithms are introduced for cases where base objects are observed (e.g., through data augmentation) and approximated when objects are not observed (MatchDG). These simple matching-based algorithms are competitive with prior methods regarding out-of-domain accuracy on datasets such as rotated MNIST, Fashion-MNIST, PACS, and Chest-Xray.

The MatchDG method also demonstrates the ability to recover ground-truth object matches: on MNIST and Fashion-MNIST, **over 50%** of the top-10 matches identified by MatchDG overlap with the ground-truth matches. This causal perspective on domain generalisation introduces an object-conditional objective, with simple matching-based methods performing competitively against state-of-the-art methods on PACS, underscoring the significance of selecting the appropriate invariance.

MatchDG makes certain assumptions when objects are unknown, and further work is needed to develop improved matching methods, as evidenced by the mixed results on the Chest-Xrays dataset.



# A SHOULDER TO CRY ON: TOWARDS A MOTIVATIONAL VIRTUAL ASSISTANT FOR ASSUAGING MENTAL AGONY

***Research Area:*** *AI in Health*

***Authors:***
*Tulika Saha (Ph.D. Scholar, IITPatna, India), Saichethan Reddy (B.Tech, IITPatna, India), Anindya Das (M.Tech, IITPatna, India), Sriparna Saha (Associate Professor, IITPatna, India), Pushpak Bhattacharyya (Professor, IIT Bombay, India)*

In the realm of global mental health challenges, the scarcity of qualified mental health professionals exacerbates the issue, prompting the exploration of Virtual Assistants (VAs) as potential aids. These VAs leverage data and machine learning algorithms to automate processes, drawing from platforms where individuals anonymously share and seek support for stigmatised experiences. This study introduces a VA designed to serve as an initial point of contact and solace for mental health patients. The researchers compile the "Motivational VA: MotiVAte" dataset, comprising 7,000 dyadic conversations sourced from a peer-to-peer support network.

The system operates through two core mechanisms. First, the Mental Illness Classification utilises an attention-based BERT classifier to categorise ongoing dialogues into one of four mental disorder categories: Anxiety, Major Depressive Disorder (MDD), Obsessive-Compulsive Disorder (OCD), and Post-Traumatic Stress Disorder (PTSD).

Second, the Mental Illness Conditioned Motivational Dialogue Generation employs sentiment-driven reinforcement learning to generate motivational responses tailored to the emotional state of the support seeker. Evaluation results demonstrate the system's superiority over several baseline methods.

A significant challenge faced by online mental health platforms employing peer support lies in effectively training these supporters.

This research proposes an AI-driven virtual assistant to provide comfort and support to seekers. The MotiVAte dataset, derived from peer-to-peer interactions, underpins the system's dual framework approach: Mental Illness Classification Framework, which identifies mental health conditions from dialogues, and Mental Illness Conditioned Motivational Dialogue Generation Framework, which generates responses aligned with the seeker's emotional state using RL techniques. Empirical findings substantiate the effectiveness of this approach, suggesting promising directions for future computational models to aid peer-supported mental health initiatives.

# D-LORD: DYSL-AI DATABASE FOR LOW-RESOLUTION DISGUISED FACE RECOGNITION

***Research Area:*** *Machine Learning, Biometrics*

***Authors:***
*Sunny Manchanda, Kaushik Bhagwatkar, Kavita Balutia, Shivang Agarwal, Member, IEEE, Jyoti Chaudhary, Graduate Student Member, IEEE, Muskan Dosi, Chiranjeev Chiranjeev, Mayank Vatsa, Fellow, IEEE, and Richa Singh, Fellow, IEEE*

Recognising faces in low-resolution video streams captured by surveillance cameras is a significant challenge. This difficulty is further amplified when individuals in the videos use disguise artefacts to conceal their identities or to impersonate others. The lack of labelled datasets limits current research on low-resolution face recognition systems under disguised conditions.

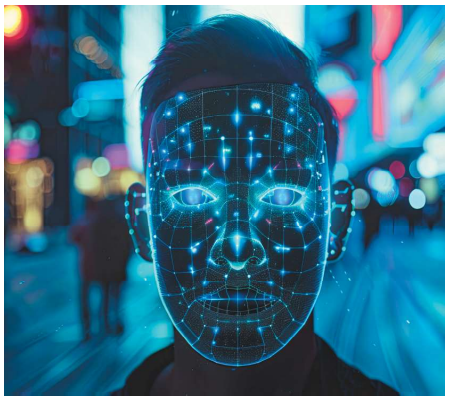
The D-LORD database is a comprehensive resource designed to advance research in low-resolution disguised face recognition. This unique dataset includes high-resolution mugshot images of 2,100 individuals and 14,098 low-resolution surveillance videos, totalling over 1.2 million frames. Each frame is annotated with five facial vital points and a single bounding box for each face. The subjects in the videos use a variety of disguise artefacts such as face masks, sunglasses, wigs, hats, and monkey caps to obscure their faces, providing a diverse and challenging set of data for researchers in the field.

D-LORD is the first database to tackle the complex issue of low-resolution face recognition with disguise variations.

The study establishes benchmark results for several state-of-the-art face detectors, frame selection algorithms, face restoration, and face verification algorithms using well-structured experimental protocols on the D-LORD dataset.

Research findings indicate that the Genuine Acceptance Rate (GAR) at a 1% False Acceptance Rate (FAR) ranges between **86.44% and 49.45%**, depending on the type of disguise and the distance.

The study also underscores the importance of frame selection in the recognition task, exploring the performance of three frame selection algorithms: DWT-based, FaceQNet, and SER-FIQ. Three face restoration models - GFPGAN, PSFR-GAN, and Real-ESRGAN - are evaluated using the selected frames. The study further involves the assessment of three face-embedding models. The results highlight the need for further enhancement and research in face recognition models for low-resolution disguised faces. The availability of a comprehensive dataset like D-LORD is crucial for advancing future research in this field.



# EXEMPLARS

# iRASTE- INTELLIGENT SOLUTIONS FOR ROAD SAFETY THROUGH TECHNOLOGY & ENGINEERING

***Industry:*** *Emerging Technology, Transport and Logistics, Technology, Media,& Telecommunications*
***Business Function:*** *Sovereign Functions of Govt. of India (State-run functions), Business Intelligence, Operations*
***Beneficiary:*** *Highway road network in Telangana, ITE&C Dept, Govt, INAI, IIIT-H, & Intel*
***Technologies used:*** *Computer Vision, AIOps*

**Telangana's Emerging Technologies Initiative**

The Emerging Technologies (ET) Wing, a pioneering initiative within Telangana's ITE&C Department, aims to establish the state as a leader in emerging technologies. Focused on Artificial Intelligence, Blockchain, Drones & Robotics, Additive Manufacturing, the Internet of Things, SpaceTech, Cloud, AR & VR, the ET Wing fosters ecosystem development and government adoption.

Key Objectives

1. Develop policy frameworks and centres of excellence to support technology proliferation.
2. Utilize deep technologies for social good and enhance governance.

Achievements

- Developed policy frameworks for AI, Drones, Blockchain, Cloud, SpaceTech, and Robotics.
- Established dedicated Centers of Excellence, including partnerships with MeitY for NCAM and E-Waste CoE.

In AI, initiatives like the Telangana AI Mission (T-AIM) and the 'Year of AI' underscore commitment to innovation. In collaboration with NASSCOM, T-AIM supports startups with acceleration, mentorship, and access to resources. Grand challenges in sectors like Agriculture and Climate Change have yielded impactful solutions backed by government and industry partnerships. Collaborations with startups and private partners have led to 27 AI projects across eight government departments, such as AgriTech innovations benefiting 7000 farmers and projects in transport, e-governance, and ClimateTech, improving conservation efforts.

**Improving Road Safety with Project iRASTE**

In India, road crashes cause 150,000 fatalities and 450,000 injuries annually, highlighting a critical issue in the transport sector. In response, Telangana implemented Project iRASTE, leveraging Artificial Intelligence to enhance road safety. Deployed across three highway corridors and 200 state buses, iRASTE aims to support the Government of India's target to reduce road accidents by 50%, ultimately saving lives.

**AI-Powered Solutions for Safer Mobility**

AI technologies are pivotal in enhancing vehicle safety, mobility planning, and road infrastructure management in Telangana. Advanced Driver Assistance Systems (ADAS) and Collision Avoidance Systems (CAS) utilise AI to warn drivers of potential collisions and prevent accidents. AI analysis of ADAS data identifies accident-prone locations ('blackspots') for targeted infrastructure improvements, promoting safer transportation systems.

**Significance of the Selected Problem**

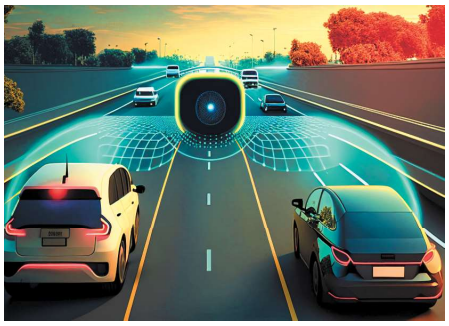
The state is committed to reducing road accidents, mainly focusing on black spots. With a robust public sector passenger road transport corporation covering over 18 lakh kilometres daily and serving more than 38 lakh passengers daily, improving road safety is crucial for enhancing public safety and commuter experience.

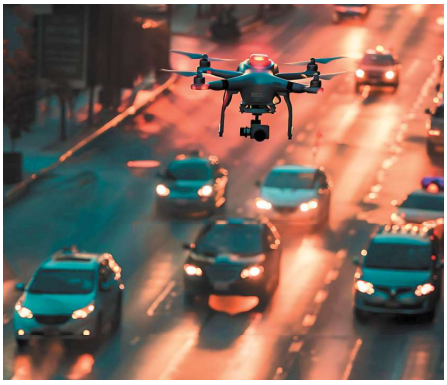
**Dataset Complexity and Collection Strategy**

Data from 200 buses was collected over three months without initially alerting drivers, and it served as the foundational dataset for the year-long project execution. Subsequent data collection has enhanced project functionality, encompassing various data types and significant volume to support ongoing improvements.

**Data Solution Implementation Challenges and Resolution**

During implementation, ADAS devices on city buses occasionally failed to communicate warning events to the cloud due to device faults or network coverage issues. Technicians resolved these challenges by upgrading firmware and replacing faulty devices as necessary, ensuring seamless data transmission and system functionality.





***Scale and Impact of Vehicle Monitoring Systems***

The implementation of vehicle monitoring systems has significantly impacted road safety, saving lives through proactive measures to mitigate road crashes:

- Cost-efficient alerts from ADAS devices have induced behavioural changes in drivers, improving adherence to traffic rules on national highways and reducing the need for extensive traffic enforcement.
- ADAS data is utilised to accurately identify 'Blackspots' in pilot corridors, replacing costly manual surveys with scalable and precise monitoring.
- The identification of Blackspots enables agencies to improve road geometry and Traffic departments to enforce them proactively, effectively lowering road risks.
- Real-time camera data provides unaltered visual records of accidents, enhancing emergency response and road safety insights, particularly in scenarios with delayed police responses.
- The ADAS fleet recorded ZERO accidents over the past four months (May '23 - Aug '23), compared to double-digit accidents in non-ADAS fleets. Behavioural improvements were also observed among 500+ TSRTC drivers following ADAS training programmes.

# RESPONSIBLE AI

# GRAMENER: AI FISH DETECTION FOR CONSERVATION

***Industry:*** *Conservation*
***Beneficiary:*** *A North Ireland based NGO*
***Technologies used:*** *Responsible AI*

The AI Fish Detection Solution identifies and classifies fish species to support conservation efforts by an NGO in Northern Ireland. Using strategically placed cameras at river locations, the system captures and processes video footage to detect fish presence, identify species, and maintain species counts. The resulting data is displayed on an accessible application, allowing stakeholders to monitor marine life health and make data-driven conservation decisions.

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**Stakeholder Identification and Documentation**
The enterprise has identified stakeholders and documented potential benefits and harms for each intended use throughout the solution's lifecycle. Collaboration with end users, incl. the IT team, biologists, and other scientific staff, was vital to understanding user journeys.

1. IT Team: Ensures seamless video processing through the model, receives alerts for camera connection issues, and reviews AI-detected fish counts to avoid omissions

2. Biologists and scientific staff: Focus on analysing fish counts and their variations over time to understand how environmental factors like water quality and pollution impact the fish population

**Ensuring AI Inclusivity**

The enterprise ensures AI systems are inclusive and non-discriminatory through rigorous practices:

- **Diverse Data Collection:** Datasets are curated to represent various demographic groups to prevent biases
- **Bias Audits:** Regular audits are conducted to identify and mitigate biases in AI models
- **Ethical Frameworks:** Adherence to ethical guidelines and industry standards promotes fairness and inclusivity in AI development and deployment

**Ensuring AI Integrity and Compliance**
The enterprise ensures AI system integrity and compliance through dedicated practices:

- **Reproducibility of Outcomes:** Standardised data processing pipelines and detailed logs of model training processes and parameters ensure reproducibility
- **Algorithm Selection:** Cutting-edge technology and the latest industry models are tested on sample video footage for accuracy, performance, cost, and scalability, ensuring the best fit for the use case
- **Human Supervisory Control:** The AI Fish Detection solution combines backend AI modelling with a front-end application that allows users to view and correct AI results. Human inputs are logged and used for continuous model improvement via an Active Learning Module
- **Quality Assurance:** The AI application is trained on actual client data, considering environmental factors to achieve high accuracy. Users can view and validate model outputs to ensure fairness
- **Regulatory and Privacy Compliance:** The solution is developed entirely within the client's secure environment, ensuring no data leaves the client's premises and adhering to all applicable regulations and guidelines

**Grievance Redressal and Compensation Mechanisms**

The enterprise has established robust support mechanisms to address issues and grievances:

- **Dedicated Support Teams:** Promptly handle technical and operational issues
- **Defined Escalation Processes:** Ensure critical issues receive immediate attention

- **Feedback Loops:** Continuously gather user feedback to improve the solution and address concerns

**Compliance with Data Protection Laws**

The AI solution operates without accessing personal data, strictly processing video footage from client-placed motion-detection cameras. The enterprise adheres to:

- **Data Minimisation:** Only necessary data is processed
- **Secure Data Handling:** Stringent security measures protect video footage within the client's environment
- **Compliance Audits:** Regular audits ensure adherence to data protection laws and regulations

**Privacy-Preserving Methods**

The AI solution processes only video footage from client-placed motion-detection cameras at river locations, without accessing personal data.

**AI System Security Measures**

- **Client-Side Deployment:** The solution is deployed on the client network for complete protection
- **Data Privacy:** Data remains within the client environment, not made public or moved out for computing or reporting
- **Network Security:** An appropriate firewall setup secures the network
- **Access Control:** Only admin users can grant permissions to onboard new users
- **Regular Security Audits:** Continuous auditing to maintain security
- **Vendor Compliance:** Ensuring third and fourth-party vendors implement necessary security measures

**Documentation and Data Transparency**

**The enterprise ensures proper documentation and visibility of AI system capabilities and limitations:**

- **Transparent Development:** Thorough documentation is provided to all users during development
- **Training Data:** Annotated by end users using Label Studio, with all annotations and data samples logged for validation
- **Scenario Documentation:** Insufficient training data scenarios are documented and communicated to the client, with discussions on how to improve model capabilities

**User Awareness and Explanation of AI Decisions**

The enterprise ensures users are aware they are interacting with an AI system:

- **Tagging Classification:** Fish are classified as AI-tagged or Human-tagged for easier review and validation

- **User Training:** A short training course helps new users understand model performance and limitations
- **User Interface Design:** The interface provides clear, easy-to-understand prompts about the model's output and performance

**Stakeholder Responsibilities and Accountability**

The enterprise has established structured access controls and policies to clarify stakeholder responsibilities, including third or fourth-party vendors:

- **Role-Based Access:** Access is determined by predefined roles
- **Access Group Definitions:** Groups are assigned specific actions and limitations
- **Administrative Controls:** Admins manage critical system changes
- **Accountability Framework:** Ensures clear accountability throughout the AI system's lifecycle

For instance, IT staff have administrative access, allowing them to view and edit AI outputs and manage user access. Public users are restricted to viewing fish count data without deeper system access, maintaining role-specific access integrity.

**Aligning AI Models with User Values**

**The enterprise actively aligns AI models with user values and beliefs through:**

- **User-Centric Design:** Engaging users in design and development phases
- **Feedback Integration:** Continuously refining the AI solution based on user feedback
- **Transparent Communication:** Ensuring users comprehend the AI system's capabilities and limitations through clear communication

# HIREMEE: ENHANCING EMPLOYABILITY ASSESSMENTS WITH AI

***Industry:*** *Industry agnostic*
***Beneficiary:*** *Human Resources, Talent Acquisition*
***Technologies used:*** *Responsible AI*

HireMee's AI System is designed to:

- Mitigate Malpractice: Prevent cheating and ensure assessment integrity
- Reduce Reliance on Human Proctors: Automate proctoring tasks, allowing proctors to focus on strategic aspects
- Flag Violations: Analyse test-taker images to identify violations across seven categories, determining an Honesty Level. This credibility score helps corporates trust the results and engage with potential candidates

These features have enabled significant scaling:

- 700,000+ candidates have completed free employability assessments, with >240,000 identified by corporates for further selection
- >70% of these candidates are from Tier-3 and Tier-4 towns and cities

This achievement would have been impossible without such technologies. Recently, HireMee received the Global Impact Sourcing Award from IAOP, USA, and the Rockefeller Foundation in Chicago on 22nd May 2024.

**Stakeholders - Impacts Assessment**

HireMee's AI System identifies stakeholders and assesses lifecycle impacts, highlighting benefits and potential harms:

1. Government Skilling Bodies: Utilises AI-enabled assessments to identify nationwide talent and attract investment

2. Educational Institutions: Personalised assessments enhance upskilling and reduce administrative effort. Infrastructure challenges may delay test completions and result processing

3. Corporates: Evaluate candidates remotely to ensure fairness and efficiency in hiring. Infrastructure challenges may delay test completions and result processing

4. Candidates: Quick image processing for instant report generation, enhancing credibility. Connectivity issues may delay image processing and result delivery

**Ensuring Inclusivity and Preventing Discrimination in AI Systems**

HireMee's AI system focuses solely on identifying potential malpractice cases without considering sensitive attributes like race, ethnicity, or religion. To ensure unbiased evaluations, it follows these practices: it provides training and testing data that is diverse and representative of various groups and communities, utilises data from multiple internal and external sources for accuracy and precision, collects, stores, and processes data concerning individual and group privacy, implements informed consent, access controls, and encryption measures, develops AI models that are fair and transparent to avoid biases present in traditional proctoring methods, and designs AI models to be inclusive and culturally sensitive, ensuring no marginalisation or exclusion of any group or community.

**Ensuring Robustness and Compliance in AI Systems**

**Ensuring Reproducibility, Algorithm Selection, and Human Supervision:** HireMee's AI systems maintain robust version control for data and models to replicate outcomes consistently. Detailed documentation covers data, model architecture, training methods, and evaluation metrics. Methodologies like filtering, segmentation, registration, and morphology are

employed for image processing and are supported by reliable libraries such as Dlib, YOLO, and MTCNN. Specific algorithms like Dlib for person identification, Yolov8 for object detection, and MTCNN for facial orientation are selected based on their effectiveness.

Regular evaluations by human experts across diverse scenarios and fail-safe mechanisms ensure intervention during low model confidence or unexpected situations, enhancing system performance continually.

**Quality Assurance and Compliance:** Comprehensive performance metrics, incl. precision, recall, and error rates across different categories, surpass a standard F1 score (95%). The system adheres to compliance standards by obtaining candidate consent and automating image deletion as per ISO 27001:2013 ISMS requirements. Regular audits keep HireMee updated with regulatory developments, ensuring ongoing adherence to standards. These practices uphold robust performance and regulatory compliance in HireMee's AI systems.

### Grievance Redressal and Compensation Mechanisms

HireMee is committed to providing accessible and effective grievance redressal mechanisms for users of its AI system through the following measures:

**Multiple Communication Channels: Email, Chatbot and On-Call Support**

**Fair Resolution Process:**

- Acknowledgement of grievances
- Investigation and Timely Resolution
- Escalation of unresolved grievances

**Transparency and Communication:** Users are updated throughout the process

### Ensuring Data Protection Compliance

HireMee ensures robust compliance with data protection regulations, including the Digital Personal Data Protection Act 2023 and other sector-specific standards, through these measures:

- **Dedicated Data Protection Officer (DPO):** Oversees strategy and GDPR compliance
- **Comprehensive Policies:** Aligned with ISO 27001, ISO 27701, and GDPR for data handling
- **Privacy Impact Assessments (PIAs):** Conducted for high-risk processing activities
- **Regular Audits:** Internal and external audits ensure compliance and review data handling
- **Privacy by Design:** Integrates privacy principles into AI system development
- **Minimal Data Collection:** Collects only necessary PII data with stringent retention policies
- **Explicit Consent:** Obtains clear consent for data collection and processing
- **Data Subject Rights:** Facilitates access, rectification, and erasure requests
- **Secure Data Practices:** Encrypts stored and transmitted PII data using industry-leading standards
- **AWS Security:** Hosts applications in secure AWS environments with SSL encryption
- **Incident Response Plan:** Maintains a plan to address data breaches promptly
- **Firewall Protection:** Uses multiple layers of firewalls and security groups for server protection
- **Employee Training:** Regular training on data protection and compliance requirements
- **Awareness Programs:** Ongoing education on new regulations and emerging threats
- **Monitoring and Review:** Monitors AI systems for compliance and updates policies regularly
- **Feedback Mechanism:** Maintains a mechanism for addressing concerns about data protection practices

These measures ensure that HireMee's AI systems uphold data protection laws, effectively safeguarding personal data privacy and security.

### Privacy-Preserving Methods

HireMee processes all images on a centralised server, with data stored in AWS S3 buckets.

### Securing AI Systems

HireMee prioritises AI system security by employing robust measures to guard against various threats:

- Model Stealing
- Malicious Use
- Unauthorised Access
- Continuous Improvement

### Documenting AI Capabilities and Limitations

HireMee ensures transparency and accountability throughout the AI system's lifecycle by maintaining detailed documentation and allowing external scrutiny.

- **System Capabilities:** Clearly outlines functionalities, such as candidate identification and unauthorised device detection
- **System Limitations:** Details known limitations, like performance under low-light conditions
- **Data Management and Preprocessing:** Documents training data sources, preprocessing steps, and their rationale
- **Traceability:** Maintains a repository for tracking specific data points back to their source
- **Bias Identification:** Identifies and mitigates potential biases in the data
- **Independent Audits:** Engages independent auditors to assess system capabilities, limitations, and biases

- **Industry Benchmarking:** Compares system performance with established benchmarks
- **Data Sensitivity:** Anonymises or aggregates sensitive data before sharing it for external audits
- **Proprietary Information:** Protects proprietary aspects of the system while ensuring transparency

HireMee's commitment to responsible AI development is demonstrated through comprehensive documentation, transparency in its data repository, and openness to external scrutiny.

**Transparency in AI Interactions**

HireMee ensures users know they interact with an AI system and clearly explains significant AI decisions.

- **Interface Design:** Utilises icons or text labels to indicate AI involvement
- **Welcome Messages:** Displays messages like "You are now interacting with our AI system. How can we help you today?" at the start of the interaction
- **Facial Recognition Example:** If the system struggles with recognition due to lighting, it notifies the user with a message such as, "We're having trouble recognising your face. Could you adjust the lighting or position yourself differently?"

**Stakeholder Responsibilities and Accountability**

HireMee manages stakeholder responsibilities and accountability internally without involving third- or fourth-party vendors in its AI system.

**Aligning Models with User Values**

HireMee adapts its AI engine based on user feedback. Originally, it focused on detecting violations like the same person, a Person Looking Away from the Screen, and a Person Not Present. It has since expanded to include capabilities such as Another Person Present, Mobile Phone Detection, and Partially Visible Persons. This evolution includes ongoing engagement with target user groups better to understand their values and expectations during the design phase.

# KAIROS TECHNOLOGIES: ENHANCING SOFTWARE TESTING EFFICIENCY WITH AI AUTOMATION

***Industry:*** *Technology*
***Beneficiary:*** *Software Testing / Quality Assurance segment*
***Technologies used:*** *Responsible AI*

## Purpose and Intended Uses

The AI system serves three primary use cases:

**Use Case #1: Automated Conversion of Requirements -** AI converts diverse software requirements (e.g., User Stories, BDD, Use Cases) from various sources into Test Cases and Test Scripts, currently in development to streamline test preparation.

**Use Case #2: Self-Healing Test Scripts -** The system autonomously adjusts test scripts to accommodate minor application UI changes, ensuring seamless execution without script failures.

**Use Case #3: Dynamic Test Suite Creation -** Automates the creation of dynamic test suites in response to changes, optimising test coverage and reducing the likelihood of test failures.

This test automation suite is designed to benefit QA teams and software testing professionals. It facilitates testing activities from unit testing to system and user acceptance testing, even in environments without dedicated QA personnel.

### Stakeholder Engagement and Compliance

The enterprise has identified stakeholders and documented potential benefits and harms across the AI system's lifecycle while adhering to regulatory guidelines within its limited application scope. As a Test Automation Suite, the system securely manages user-provided test data, addressing data privacy and security concerns. Key functionalities include:

- **Use Case #1:** Utilizes adapted LLMs to convert various requirements into Test Cases and Scripts
- **Use Case #2:** Employs Visual AI models to detect UI changes and find closest matches in UI objects
- **Use Case #3:** Conduct risk-based assessments to optimize test and code coverage paths

These models emphasize explainability and impartiality, validated through rigorous testing and stakeholder feedback. Software development teams mainly use them to automate or execute test cases, without impacting societal, racial, ethnic, or human rights.

### Inclusive AI Practices and Processes

In ensuring inclusive AI systems at their enterprise, Kairos implements stringent practices to prevent discrimination based on sensitive attributes such as race, gender, or ethnicity, despite their product's non-influence on such data.

Their policies guarantee that AI models are trained on unbiased and representative population data, employing:

- Stratified sampling to ensure accurate representation across demographic groups
- Synthetic data to supplement accurate data, ensuring sufficient diversity without compromising privacy or using sensitive information

Furthermore, the resultant AI models undergo rigorous checks for:

- Compliance with regulations
- Ethical considerations Ensuring AI System Integrity

Kairos ensures the integrity of its AI systems through the following:

- **Reproducibility:** Models are transparent, fair, and capable of consistent outcomes through rigorous testing and version control
- **Algorithm Selection:** Choosing appropriate algorithms based on problem characteristics and evaluating for accuracy, fairness, and transparency
- **Human Oversight:** All models incorporate "Human-in-Loop" supervision to maintain control and validate outputs
- **Quality Assurance:** Continuous monitoring ensures high performance and compliance with regulatory standards
- **Data Handling:** Synthetic data mirrors real-world scenarios, avoiding PII and IP data, ensuring robustness and compliance

### Grievance Redressal and Compensation Mechanisms

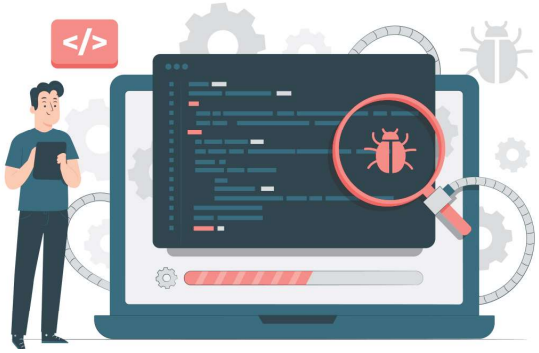
Kairos has established initial grievance redressal and compensation mechanisms to promptly address reported anomalies related to bias, explainability, reproducibility, transparency, or model functionality. These mechanisms prioritise swift resolution of issues identified both internally and externally, complementing existing AI model validation checks within the context of software engineering. Current processes effectively manage these issues without utilising PII, IP, or personal data on race, ethnicity, or gender. Ongoing efforts focus on developing more comprehensive guidelines to enhance governance and user satisfaction.

### Compliance with Data Protection Regulations

Kairos adheres to robust processes and policies ensuring compliance with data protection laws such as the Digital Personal Data Protection Act 2023 and other relevant regulations. These regulations, similar to GDPR, CCPA, and DPDP (Indian Context), focus on safeguarding individuals' data and regulating its handling by organisations. While Kairos' current products do not involve such data, stringent checks are in place to prevent potential violations. As Kairos expands its product range, continuous refinement of processes, policies, and practices is prioritised to meet evolving legislative requirements, ensuring proactive protection against emerging threats and regulatory changes.

### Privacy-Preserving Methods Adoption

Kairos does not necessitate privacy-preserving methods like on-device processing or federated learning, as indicated by the listed use cases. However, users have provisions to identify, mask, and encrypt sensitive data as required. Kairos remains proactive in innovation, actively exploring new technologies to integrate privacy-preserving methods into future product features, services, or use cases where enhanced user privacy is paramount. This forward-looking approach ensures readiness to address evolving privacy concerns effectively.




### Ensuring the Security of AI Systems

Kairos ensures the security of its AI systems through a comprehensive approach spanning data security, model development, and deployment:

- **Data Security:** Access control, sensitivity assessment, encryption, masking, cleansing, and human-led sampling to prevent data poisoning and breaches
- **Model Development:** Currently prioritises accuracy, precision, recall, and F1 Score for existing use cases. Future expansions will add Adversarial Testing to thwart data and model manipulation via Input Validation and Anomaly Detection
- **Deployment:** Employs A&A (Authentication and Authorization), Threat Modelling, Penetration Testing, Firewalls, and Encryption to secure access based on assigned privileges and enforce system accountability

### Documentation and Transparency of AI Systems

Kairos ensures comprehensive documentation of its AI systems, providing visibility into the entire lifecycle for internal and potential external scrutiny.

- **Monitoring and Documentation:** The AI model journey, from data collection to lineage, model generation, training, implementation, and support, is meticulously documented
- **Auditability:** Each phase undergoes internal audits, ensuring accountability and transparency
- **External Scrutiny:** Plans include enabling external scrutiny of documentation tailored to the sensitivity and requirements of the AI system
- **Training Data Transparency:** Detailed documentation covers training data, including sources, characteristics, and identified biases, ensuring clarity throughout development

### User Awareness and Explainability in AI Systems

Kairos informs users about machine interaction and provides clear explanations for AI-driven decisions.

**Traceability:** Despite not requiring direct human interaction, Kairos logs actions and decisions:

- In "Self-Healing," actions are logged with screenshots
- For Requirements to Test Scripts, recorded BDD (Behaviour Driven Development) and Test Cases offer modifiability, maintaining user control

**Future Considerations:** Future products will prominently disclose AI interaction through disclaimers or UI indicators. Kairos aims to employ Explainable AI (XAI) techniques for user-friendly explanations, enhancing trust and user autonomy

**Stakeholder Responsibilities and Accountability in the AI System Lifecycle**

Kairos establishes clear responsibilities and accountability for stakeholders throughout the AI system lifecycle.

- **Third or Fourth-party Vendors:** While products are sold directly to customers without involving external parties, Kairos uses Open-Source software with complete visibility and understanding of its functionality
- **Internal Stakeholders:** Roles and responsibilities (R&R) are clearly defined for all involved in model development. Each stage undergoes ongoing monitoring and reporting, incl. anomaly detection and corrective actions

**Alignment with User Values and Beliefs**

Kairos does not target specific user groups based on race, ethnicity, gender, or region; thus, alignment with their values and beliefs does not apply to our products. However, it recognises the importance of conducting thorough market research and fostering open communication with targeted groups to understand their beliefs, culture, and values. This approach ensures that our products do not inadvertently offend or harm individuals or societal norms.

# KATOMARAN: REVOLUTIONISING SECURITY AND SURVEILLANCE

***Industry:*** *Security & Surveillance*
***Technologies used:*** *Responsible AI*

The AI system is designed to enhance security and surveillance by overcoming the limitations of traditional methods. Despite widespread CCTV use, these methods have not effectively reduced crime rates.

### Enhancing Surveillance Capabilities

The AI system aims to transform passive CCTV cameras into intelligent systems capable of real-time monitoring and proactive response. This addresses the issue of security personnel's limited attention span (approx. 21 minutes), which can lead to security lapses.

#### Key Components and Uses

Real-time Video Analytics: Immediate Threat Detection, Continuous Monitoring

- Behavior Recognition

Pattern Analysis: Enhanced Threat Identification

- Predictive Analytics

Anticipating Security Risks: Proactive Safeguarding

- Automation of Response

Immediate Actions
Efficient Resource Utilization

### Addressing User Needs

- **Security Personnel:** Enhances concentration and alertness, enabling personnel to manage more feeds effectively and reducing cognitive load
- **Communities and Businesses:** Provides a safer environment by proactively identifying and mitigating threats

### Impact and Importance

The AI system creates a safer, more resilient environment by providing real-time, actionable insights and automating responses. This proactive approach significantly reduces crime rates and enhances overall security, saving lives, protecting assets, and improving community and business safety.

An AI system transforms CCTV surveillance into a proactive, intelligent security solution that addresses the limitations of traditional methods. It ensures continuous monitoring, real-time threat detection, and efficient resource utilisation.

### Identification of Stakeholders

- Security Personnel
- Residents of Gated Communities
- Commercial Sector Businesses
- Security Agencies

### Documentation of Benefits and Harms

#### Lifecycle Analysis

- **Initial Implementation:** Assess infrastructure and training needs and ensure compliance with privacy laws
- **Operational Phase:** Monitor AI performance, gather stakeholder feedback, and adjust the system to address issues
- **Maintenance and Updates:** Regularly update the AI to handle new threats, ensure data security and privacy, and provide ongoing support and training
- **Decommissioning:** Plan for decommissioning and ensure secure data handling and privacy maintenance

#### Stakeholder Engagement

- **Consultations and Surveys:** Regularly consult and survey stakeholders to gather insights on performance and impact
- **Transparency and Communication:** Keep stakeholders informed about system workings, benefits, and potential risks
- **Feedback Mechanisms:** Implement ways for stakeholders to report issues, provide feedback, and suggest improvements

### Practices and Processes

In the enterprise, practices and processes are in place to ensure AI systems are inclusive and do not discriminate against individuals, communities, or groups based on sensitive attributes like race, gender, or ethnicity. These measures emphasise inclusivity and fairness, focusing on merit and interest. Key practices include:

**Merit-Based Involvement:** Selection is based on individuals' skills, passion, and willingness to engage, ensuring that discrimination is solely related to capabilities.

**Diverse Team Composition:** Actively building diverse teams to incorporate multiple perspectives in AI system design, reducing the risk of biased outcomes.

### Ensuring Reproducibility of Outcomes

1. **Standardised Pipelines:** Encapsulate the environment using Docker containers to ensure consistency across development and deployment stages
2. **Documentation:** Employ logging frameworks to capture detailed logs of training processes, parameter settings, and data transformations
3. **Version Control:** Code versioning with branches for different features and experiments. Ensure the exact data and models used in the experiments can be retrieved and reproduced

**Appropriate Algorithm Selection**

1. **Problem Analysis:** Conduct detailed sessions to understand the problem's scope and constraints. Create documents outlining specific needs and objectives

2. **Benchmarking:** Evaluate different algorithms' performance using cross-validation techniques

3. **Expert Consultation:** Consult domain experts and senior data scientists. Conduct peer reviews of the algorithm selection process and initial results

### Grievance Redressal and Compensation Mechanisms

**Remote Monitoring Team**

- Multiple Channels for Complaint Submission
- Transparent Process
- Regular Updates

**Compensation Mechanisms**

- Impact Assessment
- Service Credits
- Clear Guidelines
- Legal Compliance

**Continuous Improvement in systems and processes**

### Ensuring Compliance with Data Protection Regulations

Through robust processes and policies, the enterprise ensures its AI systems comply with the Digital Personal Data Protection Act 2023 and other sector-specific rules. Deployed in Singapore, these systems adhere to the PDPA.

**Data Protection Policies:**

- Clear documentation covers collecting, processing, storing, and sharing personal data

- Defined roles for data protection with access restricted to authorised personnel
- Regular audits and assessments ensure compliance with data protection laws

**Data Collection and Processing:**

- Collect only essential data and regularly review practices for compliance
- Defining data collection purposes and using data only for these purposes
- Obtaining explicit consent for any additional data use

**Data Security Measures:**

- Strong encryption (e.g., AES-256) for data at rest and in transit
- Regular updates to encryption protocols
- Strict access controls and role-based access control (RBAC)

**Data Subject Rights:**

- Providing data subjects access to their data and information on its usage
- Allowing data correction and promptly updating data upon request
- Enabling data deletion requests and securely deleting data when asked

**Data Breach Management:**

- Developing and maintaining a plan to address data breaches, incl. detection, reporting, and mitigation procedures
- Timely notification to affected data subjects and authorities with clear information about the breach and mitigation steps

**Training and Awareness:**

- Regular training on data protection principles, regulatory requirements, and internal policies

- Educating employees and stakeholders about data protection practices and compliance

**Continuous Monitoring and Improvement:**

- Performing regular audits to assess compliance and identify areas for improvement
- Implementing corrective actions promptly
- Keep updated with changes in data protection laws and update policies and practices accordingly

### Ensuring the Security of AI Systems

- **Adversarial Training:** Incorporating adversarial training techniques by including perturbed data during training to make models robust against adversarial examples
- **Defence Mechanisms:** Obscuring model inner workings to make it harder for adversaries to craft effective attacks
- **Data Validation and Sanitisation:** Applying stringent data validation and sanitisation to detect and eliminate corrupted or malicious data before it enters the training pipeline
- **API Rate Limiting:** Implementing rate limiting and access control on APIs to prevent excessive querying and potential model extraction
- **Access Controls:** Enforcing strict access controls, user authentication, and multi-factor authentication ensures only authorised personnel interact with AI systems
- **Encryption:** Utilizing robust encryption protocols for data at rest and in transit to protect against unauthorised access and breaches

**Security Measures for Third- and Fourth-Party Vendors**

### Documentation About Capabilities and Limitations of AI System

The enterprise ensures proper documentation of AI system capabilities and limitations and provides visibility into training data for external scrutiny and audit as follows:

- Comprehensive Documentation
- User Manuals and Technical Reports
- Transparency Reports
- Visibility into Training Data
- Enabling External Scrutiny and Audit
- Extent of Visibility: Summaries and metrics of training data and regular updates

### Awareness of Machine Interaction

- Users are informed at the start that they interact with an AI system through onboarding messages, user guides, and notifications within the platform
- AI-generated outputs, such as notifications, alerts, and reports, are labelled accordingly within the collaboration platform to distinguish them from human-generated content
- The system tags anomalies as alerts and categorises them as true, false, or suspected alerts, providing users with precise AI assessments
- Users have the final say on AI-generated alerts. They are provided with the information to accurately label these alerts and take appropriate actions, ensuring user control based on AI suggestions
- For significant decisions, the system provides detailed explanatory reports, including graphs and charts

### Alignment with User Values and Beliefs:

- Incorporating Values into Model Design
- Ethical Framework Integration
- Continuous Improvement
- Feedback and Adaptation

# M&G GLOBAL SERVICES: ACHIEVING NET ZERO - LEVERAGING AI FOR EMISSION ESTIMATION

***Industry:*** *Financial Services*
***Beneficiary:*** *Front-office investment professionals*
***Technologies used:*** *Responsible AI*

M&G plc aims to achieve Net Zero Emissions by 2050 across its operations and investment portfolio. However, assessing and monitoring portfolio-level carbon emissions, especially for private assets, is challenging due to limited emissions data disclosure. This lack of transparency hinders effective climate engagement with investee companies and informed investment decisions.

### Carbonator: Pioneering AI for Emission Estimation

Carbonator is a web-based application that uses multiple machine learning models to estimate Scope 1 and 2 emissions of private companies that do not disclose sufficient climate data. It processes and analyses large datasets, estimating carbon emissions and learning from historical data to enhance future predictions.

Carbonator has been crucial in building trust in AI solutions, demonstrating their potential to solve complex problems. Its success has paved the way for the implementation of other AI-based tools, such as the Portfolio Analytics and Coal tools, fostering a mature MLOps environment.

### Stakeholder Benefits and Potential Harms of the Carbonator Tool

M&G plc has identified front-office investment professionals as the primary stakeholders for the Carbonator tool. This tool aids in estimating carbon emissions for companies with poor carbon disclosure, benefiting various asset types such as Leveraged Loans, CLO, Social Housing, Ground rent, and RMBS. Currently, the tool covers £13.9 billion in Assets Under Management.

**Benefits of the Carbonator Tool:**

- **Improved Emissions Estimation:** Carbonator uses machine learning to estimate private companies' Scope 1 and 2 emissions, providing accurate data for investment decisions and risk assessments
- **Support for Net Zero Goals:** The tool aids M&G in reducing emissions and achieving net zero goals through investments
- **Competitive Advantage:** Carbonator's proprietary technology gives M&G a market edge by enabling better understanding and managing investments' environmental impact
- **Enhanced Engagement and Decision-Making:** Accurate emissions data from Carbonator facilitates effective engagement with investee companies, encouraging them to set and achieve carbon reduction targets and helping M&G prioritise sustainable investments

### Ensuring Inclusivity and Fairness in AI Systems

M&G plc has implemented robust practices and processes to ensure their AI systems are inclusive and non-discriminatory regarding sensitive attributes like race, gender, and ethnicity. These measures reflect M&G's commitment to diversity, inclusion, and responsible investing.

**Key measures are listed below:**

- Governance Frameworks
- Bias Testing and Auditing
- Human-in-the-Loop
- Transparency and Reporting
- Diversity and Inclusion Strategy

### Ensuring Quality and Compliance in AI Systems

M&G plc employs several measures to ensure its AI systems' reproducibility, quality, and compliance.

- **Reproducibility of Outcome:** Thorough documentation of AI research and experiments, with clearly defined variables and parameters, ensures reproducibility. Using reproducibility metrics to quantify the reproducibility of experiments, data, and methods
- **Algorithm Selection:** Human judgment is integral to the AI-driven investment process, with human analysts reviewing and validating AI outputs
- **Quality Control:** Continuous testing and vetting of AI algorithms and data sets to ensure accuracy, fairness,

and identification of new parameters for inclusion

- **Regulatory Compliance:** AI implementation adheres to terms of service, privacy, and security principles. Consent notices ensure transparency and inform users of AI interactions

### Grievance Redressal and Compensation Mechanisms

M&G plc has a dedicated grievance redressal and compensation mechanism. A dedicated team coordinates resolutions for client and customer complaints and feedback. In the context of carbon emission estimation for private companies, this mechanism ensures effective and speedy decision-making for investment professionals. Carbon emission data, a crucial input for sustainable investing, undergoes thorough governance as part of the overall investment decision process.

### Ensuring AI Compliance with Data Protection Regulations

M&G plc has implemented robust processes and policies to ensure AI systems comply with the Digital Personal Data Protection Act 2023 and other sector-specific data protection regulations.

**Key Measures:**

- **Data Governance:** Establishes high-quality, representative data governance practices, ensuring compliance with applicable data protection laws during data collection and processing
- **Privacy by Design:** Integrates privacy safeguards into AI system architecture and implementation to protect user data and adhere to data protection regulations
- **Security Measures:** Employs strong security measures to safeguard AI systems from unauthorised access and prevent data breaches
- **Documentation and Auditing:** Maintains comprehensive documentation of AI systems, incl. data sources, model architecture, and decision-making processes, with regular internal audits to ensure regulatory and ethical compliance

These measures reflect M&G plc's commitment to data protection and regulatory compliance in their AI systems, adhering to GDPR and other data security principles.

### Adoption of Privacy-Preserving Methods

M&G plc recognises the importance of privacy-preserving methods such as on-device processing and federated learning. However, for the Carbonator project, these methods were unnecessary as the data used for training machine learning models came from public companies and contained no personally identifiable information (PII). This approach ensured data privacy while maintaining model training efficiency. M&G plc is prepared to employ privacy-preserving methods to protect sensitive or personal data.

### Ensuring AI System Security

M&G plc ensures the security of its AI systems through a comprehensive security policy that protects against adversarial attacks, data poisoning, model theft, malicious use, and unauthorised access. This policy applies to all AI use cases and third or fourth-party vendor engagements.

### Documentation and Transparency in AI System Capabilities

M&G plc maintains comprehensive documentation on its AI system's capabilities and limitations. This is achieved through a rigorous governance process that includes thorough interpretation and testing to assess and validate training data throughout the model lifecycle.

**Key Practices:**

- **Governance Process:** Ensures robust assessment and validation of training data
- **Data Quality:** Utilises licensed data sources for accuracy testing and validation throughout the model's lifecycle
- **Visibility and Auditability:** Offers comprehensive visibility into the AI system's capabilities, limitations, and data sources, facilitating external review and scrutiny

### Transparency and Explainability in AI Interactions

M&G plc ensures users are informed about their interactions with an AI system through implemented consent notices, promoting transparency. For example, in the Carbonator tool, which acts as a decision-support tool rather than an autonomous decision-maker, a Stacked Ensemble model combines multiple algorithms to enhance clarity. Users can assess each algorithm's impact on predictions, facilitating comparison with peer groups for Scope 1 and 2 estimations. This solution prioritises explainability by providing data-driven insights that inform decisions

supervised by human operators. This 'human-in-the-loop' approach integrates AI benefits with human oversight and judgement.

**Establishing Stakeholder Responsibilities in AI Governance**

M&G plc implements a comprehensive AI governance framework to establish clear responsibilities among stakeholders, incl. third or fourth-party vendors, and ensure accountability throughout the AI system's lifecycle.

**Key Structures and Policies:**

- Cross-functional Internal Governance
- Regular Audits and Reviews
- Training and Awareness

**Alignment with User Group Values and Beliefs**

M&G plc actively aligns its models with the values and beliefs of its target user groups. This alignment is rooted in the company's core values of care and integrity, evident through several initiatives as follows:

- Net Zero Commitment
- Responsible Investing
- Principle of Fairness
- M&G Code of Conduct
- User Group Evaluation

The Carbonator solution exemplifies M&G's commitment to responsible investing by tracking carbon emissions and promoting sustainable practices across diverse assets. This initiative supports the company's broader goal of achieving net zero carbon emissions and meeting the long-term investment objectives of its user groups.

# PREDULIVE LABS: TRANSFORMING INDUSTRIES THROUGH REAL-TIME DATA PROCESSING

***Industry:*** *All Industries*
***Technologies used:*** *Responsible AI*

## Enhancing Operational Efficiency and Growth

Predulive Labs' AI system integrates cutting-edge drone technology to revolutionise industries through real-time data processing and actionable insights. It optimises workflows, enhances decision-making, and boosts efficiency across agriculture, construction, and security sectors.

### Key Uses

Data-Driven Decision-Making:

- Agriculture: Monitor crop health, optimise resource usage, and increase yields through precise data analysis
- Construction: Conduct site inspections, track progress, and ensure safety compliance with up-to-date information
- Security: Enhance surveillance capabilities with real-time monitoring and swift response times

Workflow Optimization:

- Automate routine tasks and reduce manual labour and operational costs
- Streamline data collection and analysis to save time and enhance productivity

Real-Time Insights:

- Provide actionable insights for informed decision-making
- Offer predictive analytics to anticipate issues and implement proactive solutions

Addressing User Needs:

- Efficiency: Automates data processing and analysis, enabling users to focus on core activities
- Accuracy: Ensures precise data interpretation with advanced algorithms, improving decision quality
- Scalability: Adapts to increasing data volumes and operational expansions
- Compliance: Facilitates regulatory compliance through accurate records and real-time monitoring

### Stakeholder Identification and Lifecycle Management

Predulive Labs has diligently identified stakeholders for each intended use and meticulously documented potential benefits and harms throughout their solution's lifecycle.

**Stakeholders**

- Internal: Investors, Founding Team, Project Managers, Technical Staff
- External: Clients in Agriculture, Infrastructure, Energy, and Education
- Regulatory Bodies: Ensuring compliance with standards

**Benefits**

- Efficiency: AI-driven solutions optimise workflows, enhancing productivity
- Real-time Insights: Better decision-making through actionable data
- Risk Mitigation: Improved monitoring reduces manual process risks
- Job Creation: Educational initiatives and training programs foster employment

**Harms**

- Data Privacy: Ensuring secure handling of sensitive data
- Technology Misuse: Ethical use of AI and drone technology
- Environmental Impact: Minimising adverse effects of drone operations
- Job Displacement: Addressing automation concerns with reskilling programs

**Lifecycle Consideration**

- **Development:** Rigorous testing and validation
- **Deployment:** Continuous monitoring and feedback
- **Operational:** Regular updates and maintenance
- **End-of-Life:** Secure data handling and responsible resource management

### Ensuring Inclusive AI Systems

Predulive Labs has implemented robust practices and processes to ensure their AI systems are inclusive and do not discriminate based on sensitive attributes such as race, gender, or ethnicity. These practices include:

**Bias Mitigation in Data Collection**

- Ensuring diverse and representative datasets to avoid biased training data
- Regular audits of datasets to identify and correct potential biases

**Ethical AI Development**

- Incorporating fairness and ethical considerations into the AI development lifecycle
- Establishing guidelines for ethical AI usage and development

**Algorithmic Transparency**

- Developing transparent AI algorithms that can be inspected and understood by stakeholders
- Regularly reviewing algorithms for unintended biases or discriminatory patterns

**Inclusive Design**

- Engaging diverse teams in the design and development process to ensure multiple perspectives are considered
- Conducting user research with diverse groups to ensure the AI systems meet the needs of all users

**Continuous Monitoring and Evaluation**

- Implementing mechanisms for ongoing monitoring of AI systems to detect and address biases
- Regularly evaluating the impact of AI systems on different communities and making necessary adjustments

**Stakeholder Feedback**

- Creating channels for stakeholders to provide feedback on AI systems
- Actively seeking input from underrepresented groups to ensure their perspectives are included

### Ensuring Quality and Compliance in AI Systems

Predulive Labs maintains the quality and ethical standards of their AI systems through rigorous practices and processes:

- Reproducibility of Outcomes
- Appropriate Algorithm Selection
- Human Supervisory Control
- Quality Assurance (Accuracy, Fairness, etc.)
- Compliance with Regulations and Terms of Service

### Customer Grievance Redressal and Compensation

**Grievance Redressal**

- Dedicated Support Channels: Customers can report issues via email, phone, or an online portal
- Response Time: Commitment to timely responses and resolutions
- Escalation Process: Clear escalation path involving higher management for unresolved issues

**Compensation Mechanisms:**

- **Service Credits:** Providing credits or refunds for validated grievances related to service performance
- **Corrective Actions:** Implementing measures to address and prevent future issues
- **Transparency:** Maintaining transparent communication throughout the grievance resolution process

These mechanisms ensure that Predulive Labs promptly and fairly addresses customer concerns.

### Ensuring Compliance with Data Protection Regulations

Predulive Labs ensures compliance with the Digital Personal Data Protection Act 2023 and sector-specific data protection rules through the following measures:

- Data Protection Policies
- Data Handling Processes
- Consent Management
- Access Controls
- Compliance Monitoring
- Incident Response
- Sector-Specific Compliance

### Ensuring the Security of AI Systems at Predulive Labs

Predulive Labs prioritises AI system security, ensuring robust AI system security through comprehensive measures to safeguard against adversarial attacks, data poisoning, and unauthorised access.

- **Adversarial Attacks:** Implementing adversarial training and continuous monitoring
- **Data Poisoning:** Ensuring data integrity through checks and secure pipelines
- **Model Stealing:** Monitoring usage and enforcing access controls
- **Malicious Use:** Adhering to ethical guidelines and educating users
- **Unauthorized Access:** Utilising strong authentication, authorisation, and encryption
- **Vendor Security:** Thorough vetting and enforcing stringent security requirements in contracts

### Ensuring Transparency and Accountability in AI Systems

Predulive Labs ensures transparency and accountability by documenting capabilities, limitations, and training data visibility throughout the AI system's lifecycle for external scrutiny and audit:

**Documentation of Capabilities and Limitations**

- **Comprehensive Reports:** Detailed documentation of functionalities, performance metrics, and identified limitations
- **User Manuals:** Providing guidelines, including potential edge cases and failure scenarios

**Visibility into Training Data**

- **Data Transparency:** Clear records of data sources, preprocessing steps, and data characteristics used for training
- **Metadata Logs:** Maintaining logs describing the nature and structure of training data for traceability

**External Scrutiny and Audit**

- **Audit Trails:** Tracking changes and updates to models and data
- **Third-Party Audits:** Allowing external auditors to review documentation and data handling practices
- **Access Control:** Controlled access to documentation and data for external reviewers, ensuring the protection of sensitive information

### Enhancing Transparency in AI Interactions

Predulive Labs ensures transparency in AI interactions. Clear indicators like "AI-assisted analysis" are used during infrastructure inspections with AI-driven drones. For significant decisions, such as identifying structural anomalies, the system provides clear explanations based on visual analysis. These practices build user trust and facilitate effective collaboration with AI solutions.

### Establishing Accountability and Ethics in the AI Lifecycle

Predulive Labs maintains a structured framework to establish clear responsibilities and accountability for AI systems throughout their lifecycle:

- **Roles:** Clearly defined for internal teams, vendors, and end-users
- **Accountability:** Assigned responsibilities with established escalation procedures
- **Ethics:** Guidelines and compliance policies ensure the ethical use of AI
- **Monitoring:** Continuous assessment to enhance performance and compliance

### Aligning AI Models with User Values

Predulive Labs aligns AI models with user values through:

- Prioritising user needs in design
- Engaging users for feedback and co-creation
- Incorporating ethical considerations
- Customising solutions to user preferences
- Continuously improving based on user input

These practices ensure that AI solutions effectively meet user expectations and align with their values and beliefs.

# PRIVASAPIEN: PERAI – WORLD'S FIRST UNIFIED PRIVACY ENHANCING AI PLATFORM

***Industry:*** *All Sectors*
***Beneficiary:*** *CISOs, CIOs, DPOs*
***Technologies used:*** *Responsible AI*

PrivaSapien introduces PERAI, the world's first Unified Privacy-Enhancing and Responsible AI Platform. Designed for executives accountable for privacy and responsible AI, PERAI automates 'Privacy by Design' and 'Responsible AI'. This enables organisations to unlock data and AI models while complying with global regulatory standards.

**The Unified Privacy Enhancing & Responsible AI Platform**

PERAI addresses organisational needs through these integrated strategies by ensuring data privacy, promoting fairness and transparency, and maintaining security. This comprehensive approach builds stakeholder trust and enhances the effectiveness of AI technologies across diverse applications.

- User Safety: Protects users from potential AI-related harms by preventing misuse and ensuring decision-making integrity
- Model Security: Implements rigorous security measures to protect AI models from unauthorised access and manipulation
- AI Governance: Establishes frameworks to uphold ethical standards and regulatory compliance, ensuring transparency in AI decision-making
- Privacy Threat Modelling (PTM): Identifies and mitigates privacy risks throughout data handling and AI processing stages
- Privacy Enhancing Technologies (PETs): Implements encryption, anonymisation, and differential privacy techniques to protect user data while enabling effective analytics and machine learning

**Stakeholder Engagement and Risk Management in AI Solutions**

PrivaSapien identifies key stakeholders such as CISOs, CIOs, and DPOs for its AI solutions. Benefits include robust compliance tools for GDPR, CCPA, and the EU AI Act, facilitating secure AI training with privacy-preserving machine learning (PPML). Advanced security measures ensure model integrity against threats, though challenges include regulatory adaptation and cross-border data management.

**Ensuring Inclusive AI Practices**

PrivaSapien safeguards individual privacy using Privacy Enhancing Technologies (PETs) and ensures fairness through bias mitigation techniques like Privacy X-Ray and CloneLM. They adhere to NIST AI RMF recommendations, focusing on the PASSFER principles: Privacy Preserved, Accountable, Safe, Secure, Fair, Explainable, and Reliable in model development. Their LLMOps products include Privacy Threat Modelling during data collection, PETs for data processing, and Privacy-Preserving Machine Learning for ethical model training. These practices ensure fair usage, user safety, and model security, supported by AI regulatory governance reports via the RAI firewall.

**Ensuring Robustness and Compliance in AI Systems**

- Reproducibility of Outcomes
- Choosing Appropriate Algorithms
- Human Supervisory Control
- Quality Assurance of AI Systems

**Grievance Redressal and Compensation Mechanisms**

- Dedicated Grievance Handling Team
- Feedback and Complaint Channels
- Regular Review and Audits

- Transparency and Communication
- Contractual Obligations
- Continuous Improvement

**Ensuring AI Compliance with Data Protection Regulations**

It is a first-of-its-kind unified PET, PTM and RAI technologies with assessment, mitigation and governance mapped clause by clause to the DPDP Act. Provides products directly for the most potent clauses in the DPDP Act – 8.4 and 8.5 – which speak about technical safeguards and organisational measures, attracting the highest penalty of ₹250 Crores per Instance. Below are techniques and products and how these are implemented:

PrivaSapien ensures that its AI systems comply with the Digital Personal Data Protection Act 2023 and other sector-specific data protection rules and regulations through several robust processes and policies.

**Privacy-Preserving Machine Learning (PPML)**

Employ Privacy-Preserving Machine Learning (PPML) techniques to protect sensitive data throughout the AI lifecycle. PPML methods, such as federated learning and homomorphic encryption, allow them to train AI models on decentralised data without exposing it, thereby maintaining data privacy and security.

**Synthetic Data**

To further enhance data privacy, PrivaSapien uses synthetic data generation techniques. Synthetic data is artificially generated data that mimics the statistical properties of accurate data without containing any actual sensitive information. This approach to train and validate AI models without risking exposure to personal data, thus ensuring compliance with data protection regulations.

**PERAI and NIST Framework**

PrivaSapien PERAI™ (Privacy Enhancing and Responsible AI) framework aligns with the NIST AI Risk Management Framework (RMF) principles. The solution thus, ensures that the AI systems are developed, deployed, and monitored by established guidelines for risk management, privacy, and ethical considerations. This framework includes:

- **Data Minimization:** Collecting and processing only the data necessary for specific purposes
- **Data Anonymization:** Applying techniques to anonymise data, such as differential privacy, to protect individual identities
- **Continuous Monitoring:** Regularly assess AI systems for compliance with data protection regulations and promptly address any vulnerabilities
- **Accountability and Transparency:** Documenting data processing activities and maintaining transparency with stakeholders regarding how data is used and protected

These measures collectively ensure that PrivaSapien AI systems comply with the Digital Personal Data Protection Act 2023 and other relevant regulations while promoting trust and accountability in AI operations.

**Ensuring AI System Security**

PrivaSapien secures AI systems against adversarial attacks, data poisoning, model theft, and unauthorised access with OWASP-guided measures. It uses robust encryption, differential privacy, and tools like Privacy X-Ray, Nebula, PrescripTron, and Event Horizon for compliance and risk management. Third-party vendors adhere to NIST RMF standards, ensuring a secure AI ecosystem.

**Documentation and Transparency in AI System Capabilities**

PrivaSapien ensures comprehensive documentation of its AI systems' capabilities and limitations, maintaining visibility into training data throughout the model lifecycle for external scrutiny and audit. They document AI models with detailed descriptions of functionality, performance metrics, and constraints aligned with NIST RMF standards. Tools like Privacy X-Ray and Nebula provide transparency by recording data provenance, transformations, and processing steps, which are essential for audits and reviews to uphold accountability and trust.

**Transparency in AI Interaction**

PrivaSapien ensures users are aware of AI interaction by indicating AI involvement with explicit notifications and disclaimers in the interface. For significant AI decisions, they provide easy-to-understand explanations-for instance, Privacy X-ray flags privacy risks with clear explanations of their significance and detection methods. RAI Firewall justifies AI decisions, involving human oversight for critical processes and fostering transparency and user trust.

**Establishing Accountability in the AI System Lifecycle**

**Certifications:** ISO 27001 & ISO 27701 certified, with ISO 42001 (Responsible AI) & ISO 31700 (Privacy by Design) in progress

- **Frameworks:** NIST AI Risk Management Framework and NIST Privacy Framework are integrated into their products
- **Governance Framework:** Defines roles and responsibilities throughout the AI lifecycle for clear accountability

- **Role-Based Accountability:** Specific responsibilities assigned to roles like data scientists, AI engineers, compliance officers, and project managers
- **Internal Policies:** Regular audits, performance reviews, and documentation to track AI system performance and decision-making
- **Training and Education:** Ongoing training programs to educate stakeholders on their roles and compliance obligations
- **Accountability Structures:** Structured reporting and oversight committees to address deviations from expected outcomes
- **Vendor Management:** Contracts with third or fourth-party vendors detailing responsibilities and compliance standards

**Aligning AI Models with User Values**

- **Ethical AI Practices:** Adopts Responsible AI and Privacy by Design principles to ensure fairness, transparency, and accountability
- **Privacy by Design:** Uses synthetic data for model training to enhance privacy protections
- **DPIA & AI Impact Assessment:** Conducts assessments to evaluate risks and impacts during model development and deployment

- **Governance Report for Model Usage:** Tracks and reports prompt usage by SLMs & LLMs, highlighting associated risks and mitigations
- **Synthetic Prompt Engineering:** Mitigates risks using privacy-preserving and ethical synthetic prompt engineering
- **RAGAM Implementation:** Integrates RAG-based systems for comprehensively assessing and mitigating AI risks

# TREDENCE: RESPONSIBLE AI SOLUTION FOR THE MARITIME INDUSTRY

***Industry:*** *Marine, Shipping*
***Beneficiary:*** *Marine Surveyors*
***Technologies used:*** *Responsible AI*

The AI system, guided by core principles such as fairness, explainability, and security, serves marine surveyors by providing quick, accurate access to specialised information from extensive documents. It delivers precise, context-aware responses, saves time with rapid searches using advanced NLP techniques, operates 24/7, aids compliance with industry standards, supports decision-making on vessel conditions and safety, and fosters knowledge sharing among marine surveyors. This clear understanding of its function and benefits is key to fostering collaboration among stakeholders.

## Identifying Stakeholders and Assessing AI Lifecycle Impacts

### Stakeholder Identification and Documentation

The enterprise has identified the system's stakeholders and documented potential benefits and harms throughout the AI system's lifecycle. For example, 67 task lists were considered across the AI development lifecycle, from planning to operation and monitoring.

**Marine Surveyors (Primary Users)**

- **Role:** Conduct vessel inspections, ensure compliance, assess conditions, generate reports
- **Needs:** Quick, accurate information; up-to-date standards; efficient documentation; decision-making assistance
- **Benefits:** Increased efficiency, accuracy, 24/7 access, and immediate compliance information
- **Harms:** Over-reliance might reduce critical thinking and deep knowledge development

**Marine Surveying Companies**

- **Role:** Oversee surveyors, ensure quality, manage operations, and provide client services
- **Needs:** Improved productivity, high-quality reports, regulatory compliance, efficiency
- **Benefits:** Streamlined processes, enhanced decision-making, better training
- **Harms:** High setup and maintenance costs, resistance to new technology

**Maritime Regulatory Bodies**

- **Role:** Set and enforce regulations and standards
- **Needs:** Ensured compliance, updated standards dissemination, and accurate reporting
- **Benefits:** Consistent, accurate reporting enhances compliance and safety
- **Harms:** Risk of outdated or incorrect information affecting compliance

**Shipping Companies and Vessel Owners**

- **Role:** Operate and maintain vessels, ensure compliance, safety, and reliability
- **Needs:** Reliable reports, timely compliance information, reduced inspection downtime
- **Benefits:** Improved maintenance, reduced compliance issues, and operational efficiency
- **Harms:** Incorrect information could lead to non-compliance or safety issues and initial integration disruptions

### Lifecycle Considerations

- **Development:** Engaged stakeholders for requirements and planned rigorous testing
- **Implementation:** Conducted training and ensured data security
- **Operational:** Regular updates and ongoing monitoring for proper functionality and relevance

## Inclusivity and Preventing Discrimination in AI Systems

- **Inclusive Design and Development:** The enterprise promotes inclusivity by fostering diverse teams and providing training on ethics, bias, and responsible AI
- **Data Collection and Management:** Regular bias audits are conducted to ensure fairness and sensitive attributes are excluded from training data
- **Fairness and Accountability Mechanisms:** Fairness metrics are monitored, and regular assessments are conducted to address biased behaviour

- **Transparency and Explainability:** AI systems are designed to be transparent, with mechanisms for user feedback to drive continuous improvement
- **Compliance and Ongoing Monitoring:** The enterprise aligns with regulations like GDPR and continuously monitors and improves systems to ensure fairness

**Ensuring AI System Integrity and Compliance**

- **Reproducibility:** The enterprise uses Git for version control, comprehensive documentation, automated ML pipelines with CI/CD, and Docker for environment management
- **Algorithm Selection:** Collaboration with stakeholders defines problems, benchmarks algorithms, involves experts, follows an MVP approach for prototyping & validation
- **Human Supervisory Control:** Human-in-the-loop systems are implemented, user training is provided, real-time monitoring and alerting are set up, and explainable AI techniques ensure transparent decision-making
- **Quality Assurance:** Rigorous testing, fairness audits, performance metric monitoring (e.g., accuracy, precision), iterative improvements based on user feedback ensure quality of AI systems
- **Regulatory Compliance:** Legal reviews are conducted, adherence to terms of service is ensured, ethical guidelines (e.g., EU's Ethical Guidelines for Trustworthy AI) are followed, and regular compliance audits are performed

**Grievance Redressal and Compensation Mechanisms**

- **Support Channels for Assistance:** Helpdesk & Ticketing System; Hotline & Email Support
- **Feedback Collection and Improvement Protocol:** User Feedback Mechanism; Continuous Enhancement
- **Escalation Protocols:** Escalation Routes
- **Accessibility Measures:** Accessible Reporting Platforms

**Ensuring Compliance with Data Protection Regulations**

- **Data Minimisation and Anonymisation:** The enterprise minimises data collection and anonymises it to comply with the Digital Personal Data Protection Act 2023 and sector-specific regulations
- **Consent Management:** Strict consent management protocols are in place to ensure user data is handled appropriately
- **Robust Security Measures:** Data is safeguarded through encryption and access controls
- **Training and Awareness:** Employees receive regular

training and awareness programmes on data protection laws

- **Monitoring and Audits:** Continuous monitoring and regular audits ensure adherence to policies
- **Incident Response Plan:** A response plan is in place to promptly address data breaches
- **Data Subject Rights Management:** Protocols are established for managing data subject rights
- **Sector-Specific Compliance:** Ongoing reviews and adoption of industry standards ensure alignment with sector-specific regulations

**Privacy-Preserving Methods Implemented**

Tredence adopts privacy-preserving methods such as on-device processing and federated learning. On-device processing ensures sensitive user interactions are locally processed, reducing data exposure risk during transmission or storage, especially for personal information or sensitive queries. Federated learning enables continuous AI system improvement by learning from interactions across devices without centralising sensitive user data. These methods uphold user privacy and confidentiality, build trust in their services, and comply with stringent data protection regulations.

**Ensuring the Security of AI Systems**

Tredence implements a comprehensive security approach to protect AI systems. This includes detecting adversarial attacks, validating data to prevent poisoning, and encrypting models to guard against theft. Built-in safeguards and access controls mitigate malicious use and unauthorised access. Third and fourth-party vendors adhere to stringent security measures and undergo regular audits. This holistic strategy ensures AI systems are secure against adversarial attacks, data poisoning, model theft, misuse, and unauthorised access throughout their lifecycle.

**Documentation and Transparency in AI System Capabilities**

Tredence ensures comprehensive documentation of the AI system's capabilities, limitations, and accessibility of training data throughout its lifecycle for external scrutiny. Detailed documentation includes information on the system's intended use cases, model architecture, and training processes. Additionally, Tredence offers selective visibility into training data, maintaining records of data provenance, providing sample datasets or summaries to external auditors, and implementing data access controls. This approach promotes transparency, accountability, and trust in Tredence's AI systems.

**Transparency in AI Interactions and Decision Explanations**

Ensuring users and surveyors are informed they are interacting with a machine. Clear indications are provided, such as prefacing responses with "Generated by AI" or using chatbot icons. Additionally, the system offers straightforward explanations for significant decisions. For instance, following a compliance recommendation, the AI system clarifies its suggestion's underlying regulations and rationale. This approach fosters trust and empowers users to effectively understand and validate the AI system's decisions.

**Establishing Accountability in the AI System Lifecycle**

Tredence ensures accountability across the AI system's lifecycle with structured policies and frameworks. Stakeholder responsibilities, incl. third or fourth-party

vendors, are clearly outlined in contracts. Governance frameworks oversee system development, setting guidelines and decision-making processes. Comprehensive documentation and regular audits maintain traceability and accountability for decisions, promoting transparency in the outcomes of the AI system.

**Ensuring Model Alignment with User Values**

Tredence prioritises aligning AI models with the values and beliefs of target user groups. They employ user-centric design, integrating feedback and preferences into development. Adherence to ethical guidelines ensures fairness, transparency, and inclusivity. Diverse team representation enhances alignment with user values, supported by a continuous feedback loop for iterative improvements. Tredence educates users on AI operations, ensuring models resonate with user values and enhance trust and satisfaction.

# TRANSFORMING USER EXPERIENCES: WIPRO'S AI SOLUTIONS IN ACTION

***Industry:*** *All Sectors*
***Technologies used:*** *Responsible AI*

Wipro's AI systems automate processes, improve decision-making, and enhance customer experiences across various industries. With over 1,200 use cases tailored to specific applications, such as medical image analysis in healthcare and fraud detection in finance, Wipro ensures its AI systems directly address user needs.

By involving users in design and development through research, feedback collection, and testing, Wipro customises solutions for maximum effectiveness and user satisfaction. For instance, Wipro's Generative AI-powered bot streamlined customer support for a primary US healthcare payor, reducing call times by 70% and saving half a million person-hours annually while improving policyholder interactions.

**Stakeholder Engagement and Risk Management in AI Solutions**

Wipro adopts a meticulous approach to identify stakeholders and document potential benefits and harms throughout the lifecycle of AI solutions. This involves detailed stakeholder analysis and risk assessment, as exemplified in their healthcare payor case study. For instance, by understanding the needs of contact centre agents, Wipro developed a Gen AI-powered chatbot using Azure OpenAI Service to streamline information retrieval, reducing training times and improving customer interactions.

At Wipro, Responsible AI practices are integral. The teams ensure compliance with ethical and legal standards through frameworks like ETHICA and E-IQ. Wipro employs the 4M model for robust AI delivery, supported by AIModelAssure for data privacy and quality assurance.

Their 3-pronged risk assessment approach identifies, and measures risks early in the design phase, aligning them with Responsible AI dimensions to mitigate impacts effectively. This ensures the AI solutions are innovative but also safe, fair, and reliable across diverse domains and applications.

**Ensuring Inclusive and Ethical AI Practices at Wipro**

Wipro upholds rigorous standards to prevent bias and discrimination in AI systems, focusing on four key dimensions: Social, Individual, Technical, and Environmental. This includes privacy protection, fairness in AI outputs, robust data handling, and compliance with legal requirements. Wipro implements the ETHICA framework for transparent and responsible AI, ensuring thorough testing and mitigating biases across diverse applications. Additionally, the Business Intelligence and Transformation Services team actively monitors and mitigates risks related to AI usage, ensuring the security and integrity of data and intellectual property.

**Ensuring Robustness and Compliance in AI Solutions**

- Ensures reproducibility of AI outcomes through meticulous model governance, version control, and documentation—open-source tools aid transparency and reproducibility
- Employs a data-driven approach for algorithm selection, assessing problem relevance and employing diverse techniques like machine learning and natural language processing
- Human supervisory control is maintained through a human-in-the-loop approach, ensuring transparency and accountability in AI systems
- Quality assurance involves rigorous testing to uphold accuracy, fairness, and compliance with legal standards and terms of service. Bias detection and mitigation techniques are used to ensure fairness
- Wipro uses the ETHICA framework for ethical AI, incorporating measures like data privacy safeguards and security protocols that are compliant with industry regulations. Automated adversarial testing ensures system robustness, while user feedback informs continuous improvement
- Hallucination risks are mitigated using the RAG framework for factual accuracy and citation of source documents, enhancing user trust and system reliability

**Grievance Redressal and Ethics Oversight**

Wipro maintains robust grievance redressal policies that are aligned with ethical AI standards. The team ensures compliance with ethical and legal norms, promptly addressing issues through coordinated action with the legal team.

**Compliance with Data Protection Laws**

Wipro follows the Digital Personal Data Protection Act 2023 and sector-specific data protection regulations. Their approach includes robust policies for accurate data processing, secure data disposal, and rigorous security measures to prevent breaches. They appoint Data Protection Officers, conduct regular audits, and implement privacy-by-design principles to ensure compliance with all legal requirements.

**Privacy-Preserving Methods at Wipro**

Wipro adopts privacy-preserving methods like on-device processing and federated learning in specific cases. For instance, on-device processing ensures sensitive data remains on the device, reducing the risk of breaches. Federated learning enables training AI models using data from multiple sources without centralising it, safeguarding data privacy. These methods are assessed case-by-case based on data sensitivity, AI solution needs, and legal requirements.

**Ensuring the Security of AI Systems at Wipro**

Wipro implements a secure development methodology throughout the machine learning lifecycle to ensure robust security standards in all use case implementations. The company maintains a Responsible AI Framework, ensuring compliance with global regulations and best practices. This framework encompasses data governance, model governance, legal and regulatory compliance, third-party management, IT governance, and monitoring. Wipro conducts AI impact assessments to integrate data, systems, and human perspectives, preventing misinformation and embedding security from the outset.

Wipro mandates that all suppliers, affiliates, and third-party vendors adhere to its policies and security frameworks. Stringent reviews are conducted on third-party technologies to mitigate risks such as adversarial attacks, data poisoning, and unauthorised access. Vendors are required to provide warranties against security breaches, reinforcing Wipro's proactive approach to AI system security.

**Ensuring Transparency and audit ability of AI Systems at Wipro**

Wipro ensures comprehensive documentation of AI system capabilities and limitations and visibility into training data throughout the model lifecycle for external scrutiny. This is governed by Wipro's Responsible AI Framework, which encompasses robust data and model governance. Data governance ensures ethical data handling with documented and visible data usage. Model governance ensures transparency and explainability, documenting AI system capabilities and changes. Wipro's framework supports audits by logging all model activities, ensuring thorough external scrutiny and transparency.

**Promoting Awareness and Understanding of AI Systems at Wipro**

Wipro ensures users are informed they are interacting with AI systems through transparent communication about capabilities and limitations, incl. data use and decision-making processes. For significant decisions, such as credit assessments, Wipro provides clear explanations on factors considered, like credit history and income. This approach aligns with Wipro's ETHICA framework, prioritising explainability and transparency in AI solutions. Overall, Wipro aims to proactively educate users and provide accessible explanations to enhance understanding of AI interactions.

**Structures and Policies for AI Accountability at Wipro**

Wipro employs a robust AI and Generative AI Governance Framework to establish clear stakeholder responsibilities and ensure accountability throughout the AI lifecycle. This framework includes policies for responsible AI use and development, operational controls, and risk management assessments. Stakeholders, incl. third or fourth-party vendors, adhere to guidelines ensuring safe and secure Generative AI use, covering data privacy, ethical use, and compliance with global standards like OECD and NIST frameworks. Wipro's approach includes thorough documentation, audits, and regular assessments to maintain transparency and mitigate risks in AI deployment and development.

# WNS: ENHANCING HOME INSURANCE CLAIMS HANDLING WITH AI

***Industry:*** *Insurance*
***Technologies used:*** *Responsible AI*

A substantial volume of home insurance claims is processed daily, posing challenges in accurately identifying recoverable claims and minimising false positives. Manual review by claim handlers often results in missed recovery opportunities and incorrect referrals. An AI system thoroughly reviews claim documents using predictive models to address this. By categorising claims into approximately 350 segments of home accidents, the system enhances efficiency, increases recovery rates, and ensures accurate prioritisation for the recovery team.

**Stakeholder Identification and Benefit Documentation**

WNS Analytics (WNS Triangle) has diligently identified stakeholders for each use case of their RaaS solution and documented potential benefits and risks throughout its lifecycle. Stakeholders include global insurance companies, service providers, internal recovery specialists, claims officers, recovery agents, internal technology teams, and data science and analytics teams. Benefits such as improved claim processing accuracy and customer satisfaction have been quantitatively and qualitatively presented. Potential harms like data breaches and bias are mitigated through robust data privacy and fairness frameworks. Continuous monitoring and KPI evaluation ensure maximized benefits and prompt mitigation of any issues identified during model execution.

**Ensuring Inclusive AI Development**

WNS Analytics (WNS Triangle) upholds Responsible AI principles to prevent bias or discrimination based on sensitive attributes like race, gender, or ethnicity in their AI systems. Key practices include:

- **GDPR Compliance:** Ensuring no models use personal data revealing racial or ethnic origin, political opinions, or other sensitive information
- **Bias Detection and Mitigation:** Regular audits and fairness-aware techniques in model training to detect and mitigate biases
- **Inclusive Design:** Engaging a diverse team to consider varied perspectives during design and development phases
- **Ethical AI Framework:** Following guidelines prioritising fairness, transparency, and accountability
- **Continuous Monitoring:** Monitoring processes to promptly address discrimination or bias
- **Training and Awareness:** Educating employees on the importance of inclusivity in AI development
- **Diverse Data Usage:** Using diverse and representative datasets to reduce bias and ensure fairness across different demographics and geographies

These measures ensure that their RaaS solution adheres to ethical standards and promotes inclusivity throughout its lifecycle.

**Ensuring Robust AI Governance**

WNS Analytics (WNS Triangle) ensures:

- **Reproducibility of outcomes:** Through detailed documentation, version control, standardised testing protocols, and reproducible scripts
- **Appropriate algorithm selection:** A rigorous process involving problem analysis, benchmarking, and collaboration between domain experts and data scientists, with evaluation criteria and cross-validation techniques
- **Human supervisory control:** Implemented through trained recovery specialists who validate and adjust AI outputs
- **Quality assurance:** Includes continuous monitoring, bias audits, validation against benchmarks, and feedback loops from users to enhance accuracy, fairness, and explainability
- **Compliance with regulations:** Achieved through a governance framework, audits, legal reviews, and employee training on regulatory requirements and internal policies

**Grievance Redressal and Compensation Framework**

WNS Triangle supports clients in establishing a robust grievance redressal mechanism with multiple reporting channels and a dedicated support team. Regular stakeholder meetings ensure timely feedback. Compensation mechanisms at client organisations address financial or operational losses due to system errors, ensuring fair resolution. The AI systems accommodate refinements seamlessly to maintain operational continuity.

**Ensuring Compliance with Data Protection Laws**

WNS Triangle's data privacy framework adheres to regional laws such as the Digital Personal Data Protection Act 2023, GDPR, and EU AI Act 2024. Key aspects include robust encryption, access controls, and anonymisation for data security. Comprehensive policies align with legal requirements and undergo regular updates. Employee training ensures awareness of data protection laws, while audits and monitoring maintain ongoing compliance. Consent management ensures all data processing activities meet regulatory standards, safeguarding data principal interests across regions.

**Privacy-Preserving Technologies**

The enterprise employs on-device processing, federated learning, differential privacy, homomorphic encryption, and secure multi-party computation to enhance data security and privacy. On-device processing secures sensitive data on users' devices, mitigating transmission risks. Federated learning improves models collectively without centralising data, ensuring privacy compliance. Differential privacy protects individual data during analysis, preventing re-identification. Homomorphic encryption enables secure analysis without data decryption. Secure multi-party computation facilitates joint computation while keeping inputs private. These methods uphold robust data security and privacy standards across operations.

**Ensuring AI System Security**

- **Multi-layered Approach:** WNS Triangle employs a comprehensive strategy to secure AI systems against adversarial attacks, data poisoning, model stealing, malicious use, and unauthorised access.
- **Defensive Measures:** Includes adversarial training, regular audits for data integrity, and implementation of data quality controls
- **Preventing Model Theft:** Techniques such as model watermarking and differential privacy are used to safeguard against model stealing
- **Access Controls and Encryption:** Strict access controls and encryption protocols are enforced to prevent unauthorised access to AI systems
- **Continuous Monitoring:** AI systems are continuously monitored for signs of malicious use, with automated alerts and response mechanisms in place
- **Vendor Security Requirements:** Third and fourth-party vendors must adhere to stringent security standards, including compliance with industry regulations and undergoing regular security assessments
- **Cloud Ecosystem Compliance:** AI solutions hosted on cloud ecosystems follow industry standard guidelines such as SOC2 and undergo periodic audits by third-party auditors

**Transparency and Accountability in AI Documentation**

WNS Triangle ensures comprehensive documentation of AI system capabilities and limitations, offering visibility into training data throughout its lifecycle. This includes detailed records of model design, training processes, and performance metrics. Training data sources, preprocessing steps, and characteristics are documented to facilitate external scrutiny and audits. External auditors review documentation and processes for compliance with Responsible AI principles and regulatory requirements. Accessible summaries of anonymised training data, model performance reports, and audit logs ensure transparency and accountability across the AI system's lifecycle.

**Ensuring User Awareness and Explainability**

WNS Triangle's AI system users are informed through regular training sessions that machines generate the predictions. The AI models are designed to provide recovery predictions for claims, with an explainability feature that offers insights into various recovery scenarios. For instance, when determining claim recoverability, the AI system accompanies its decision with explanations detailing factors such as the party responsible for damage, reasons for referral, and specifics like damage location.

**Establishing Stakeholder Responsibilities and Accountability**

WNS Triangle implements key frameworks to ensure accountability for AI system outcomes. This includes establishing a Governance committee and AI Ethics Board to oversee decisions and provide strategic direction. Roles such as Data Governance lead, Data Steward, and Ethics Officer are identified and supported as needed. Structured frameworks like the RACI matrix define responsibilities, with ethical guidelines and compliance policies ensuring alignment with legal and industry standards. Risk management policies and incident response plans address potential issues, while continuous monitoring and audits maintain system integrity. Training programs and stakeholder engagement foster a culture of accountability and ethical awareness. Regular governance reviews and effective communication ensure ongoing improvement and responsiveness to stakeholder needs, supporting responsible AI development and deployment.

**Model Alignment with User Values**

WNS Triangle aligns AI models with user values by integrating feedback from stakeholders, particularly claim handlers and recovery teams. This user-centric approach ensures models meet user needs and ethical standards. Regular consultations and diverse stakeholder engagement provide varied perspectives, enhancing model development. Transparency and accountability in model capabilities and decision-making processes are maintained through documentation and ongoing evaluation. This comprehensive approach ensures AI models are technically robust, ethically sound, and aligned with user values and beliefs.

# ACKNOWLEDGMENTS

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