Introducing the UTS Data Science Institute

Data Science Institute

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WINNER
AUSTRALIAN DEFENCE INDUSTRY AWARDS
EXCELLENCE AWARD
2023

WINNER
AUSTRALIAN DEFENCE INDUSTRY AWARDS
ACADEMIC OF THE YEAR
2023

AUSTRALIAN MUSEUM EUREKA PRIZES (finalist)

March 2025

We’re focused on data science and AI innovation to solve real world challenges

Multidisciplinary Teams

~30 FTE researchers with expertise in data science and AI, >30 research assistants, and >110 PhD students

Trusted Partnerships

Track record of high impact projects and partnerships with industry, government and other domain experts

Research Excellence

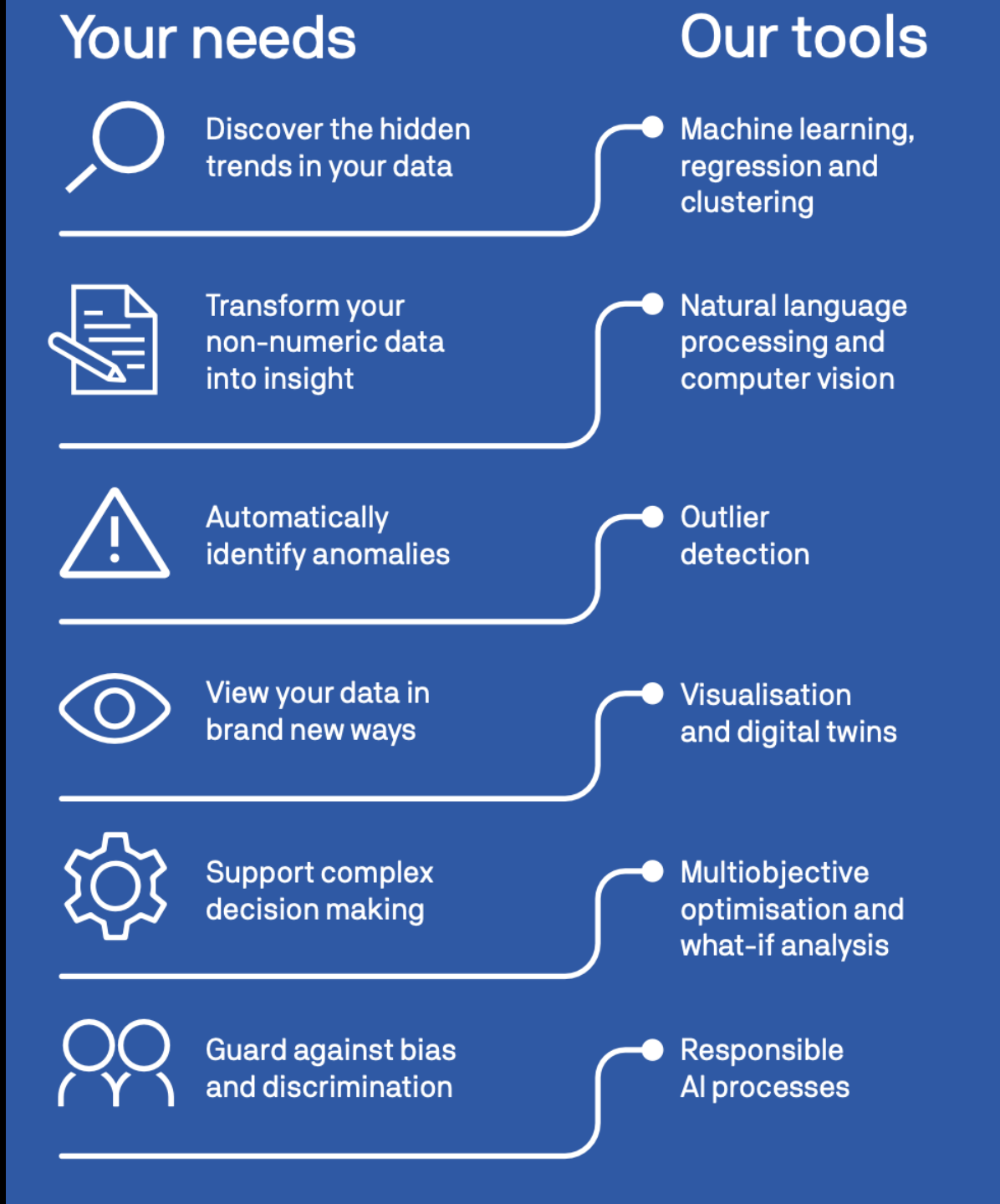
Numerous awards for our research, including the Eureka Prize, iAwards, ITS Australia Awards, and Water Professional of the Year

Our Toolset

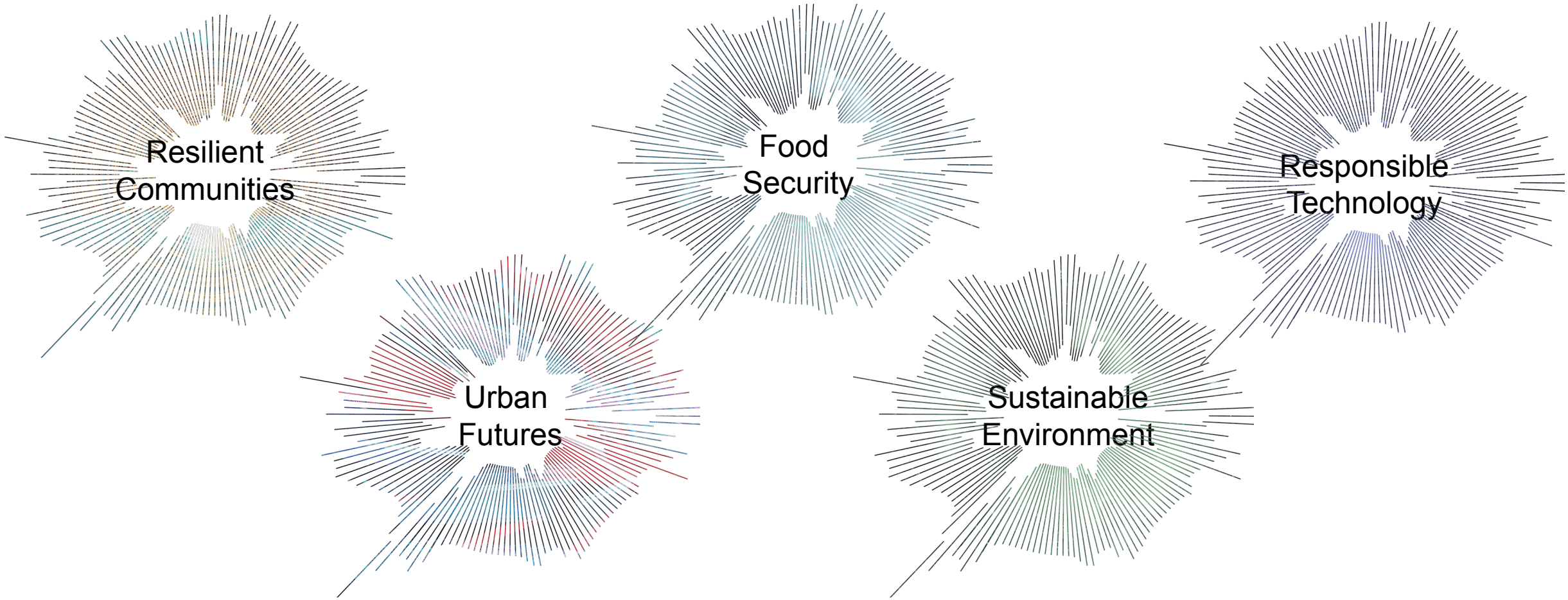
Our multidisciplinary teams will work with you to understand your needs and challenges, and identify data driven approaches, tools or solutions to address them.

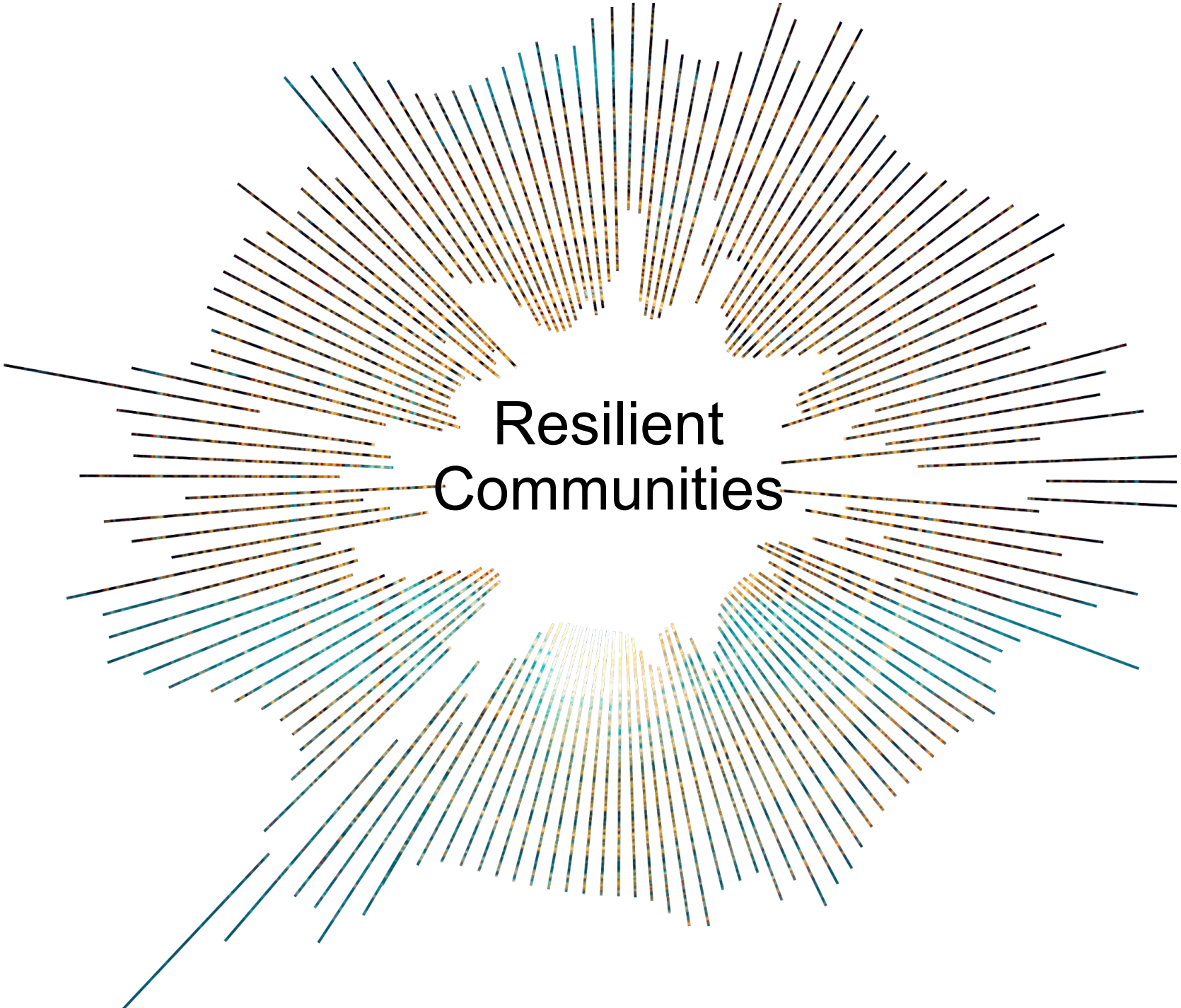
This can include discovering trends or patterns within your existing data, providing feedback on anomalies observed, or transforming your existing data into new tools or visualisations to make the data easier for your teams to use.

We're highly experienced in taking complex data and challenges, and finding a solution that suits your organisation's unique needs and requirements.



Our Impact Domains




Resilient
Communities

Resilient Communities

Our goal:

Enhance well-being through AI and data science-driven healthcare and education solutions

Research themes:

- Healthcare & Medical Technologies
- Workforce Analytics & Economic Adaptability
- Explainable, Human-Centered AI
- Data Visualisation & Decision Support

Healthcare: Smart health triaging for at-risk Australians

VLEPIS™
Advanced Sensing For Life

The Challenge

Delays in the identification and treatment of health issues in at-risk Australians has negative impacts on patient outcomes and wellbeing.

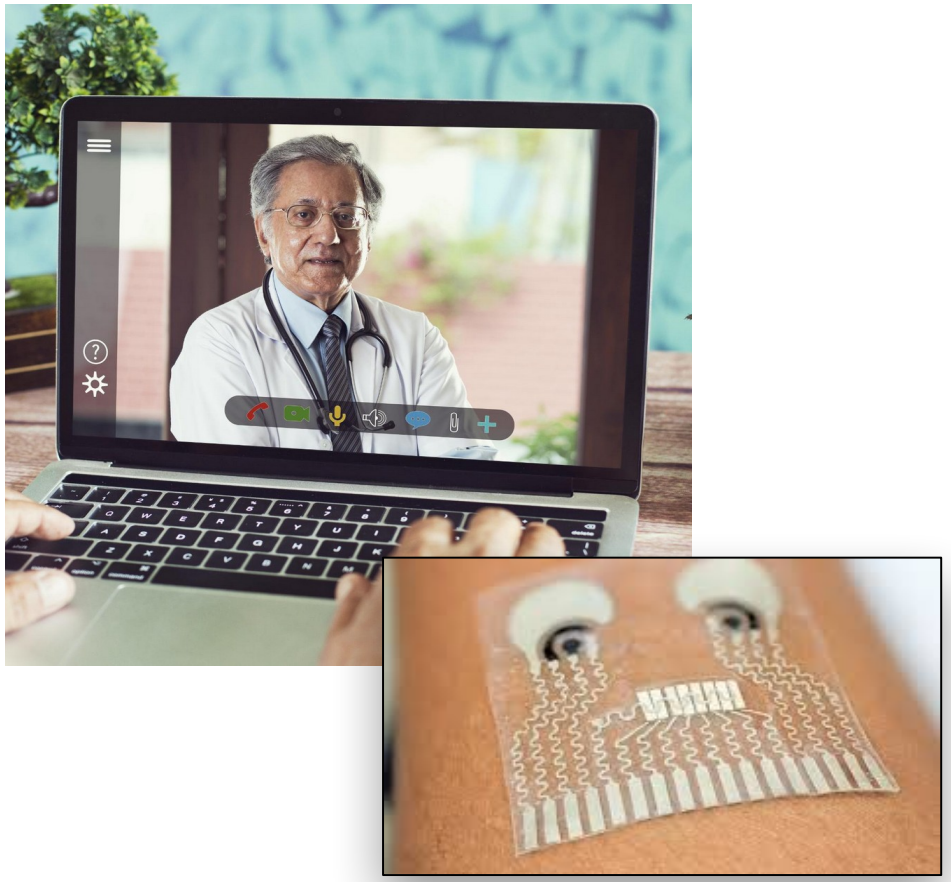
Healthcare data analytics can greatly improve outcomes by accelerating the identification of high-risk patients, predicting disease progression, and optimising treatment plans.

By personalising care, providers can also reduce the need for hospital admission, through early intervention and treatment.

DSI's Approach

We've developed a software system able to automatically collect and analyse health and wellbeing metrics from patient-worn smart sensors and activity/movement data, to accelerate health triage and assessment.

A Proof-of-Concept of the software is being trialled for the early detection of UTIs (Urinary Tract Infections).



Healthcare: Patient journey modelling

The Challenge

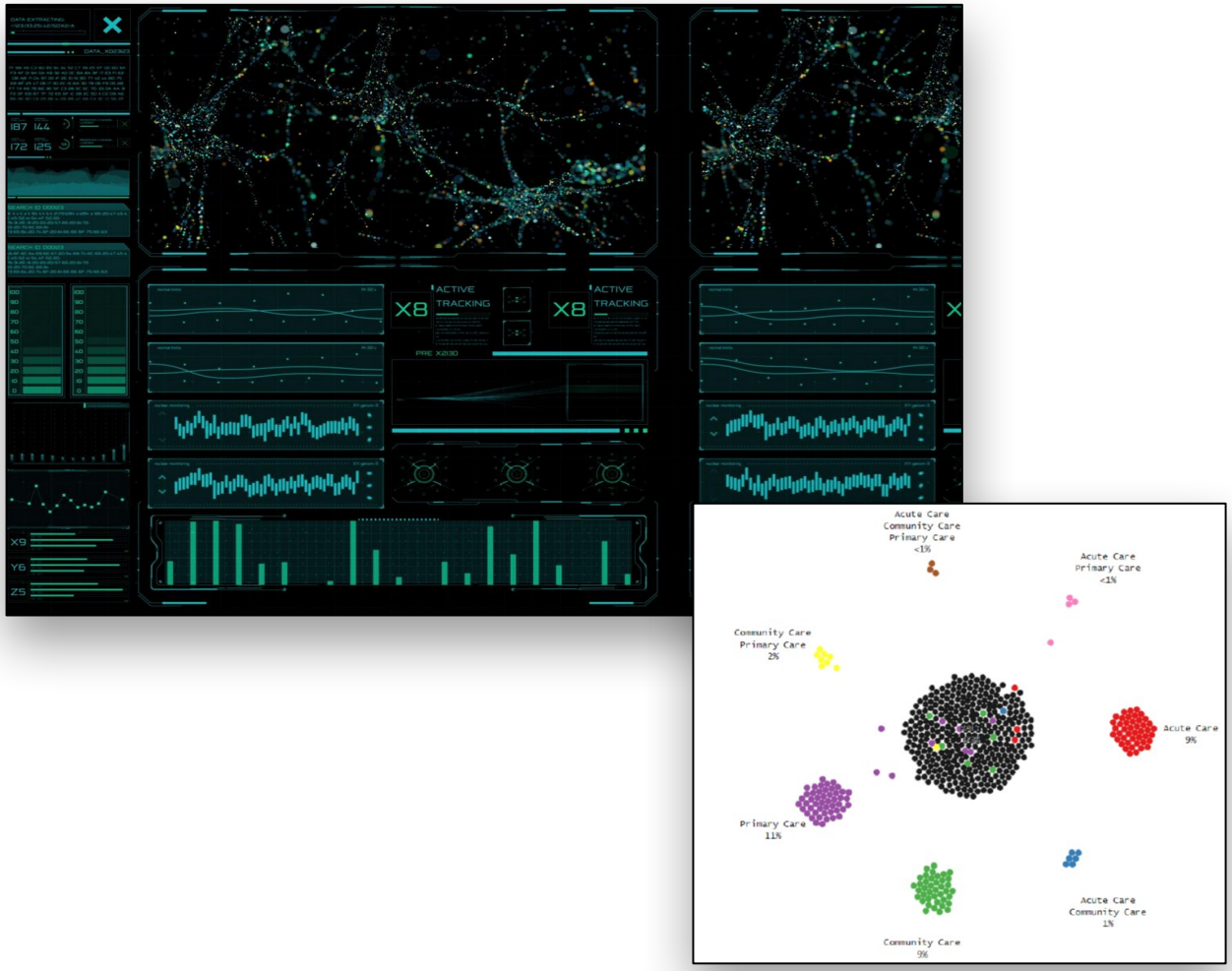
Patients can have very different healthcare experiences and outcomes based on the way they access services.

Assessing how experiences differ and where systems can be enhanced in the future is challenging, particularly when services are being provided at scale, in a variety of formats and locations.

DSI's Approach

The **Lumos Program,** delivered with **NSW Health,** used predictive modelling, data mining and real-time analytics to model and visualise patient journeys based on data provided by over 71,000 aged care patients.

The program enabled a cross comparison of patient experiences across services, providing valuable insights to inform future health system enhancement.



Healthcare: AI-Driven Colonoscopy

The Challenge

Colorectal cancer is a major global health issue and a leading cause of cancer deaths. The standard method for detecting it—colonoscopy—is invasive, expensive, and mentally taxing for both patients and doctors. It also requires doctors to interpret complex 3D anatomy using 2D scans.

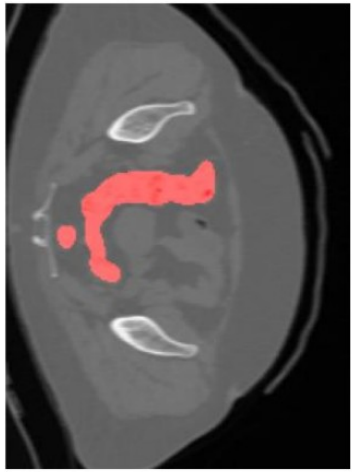
DSI's Approach

We are developing a safer, easier alternative. Instead of putting patients through uncomfortable and invasive procedures, we use AI to analyse CT scans and automatically find the colon. Then, using advanced computer graphics, we create a 3D virtual model—a digital twin—of the colon. Doctors can explore this model in virtual reality, helping them spot potential cancer risks like polyps before performing an actual colonoscopy.

This approach **reduces risk**, **saves time**, and could make colon cancer screening more **accessible** for everyone.

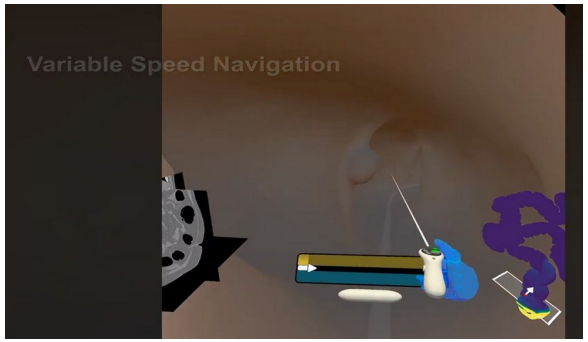
Abdomen CT Scan

AI Driven Colon Segmentation



3D Colon Reconstruction

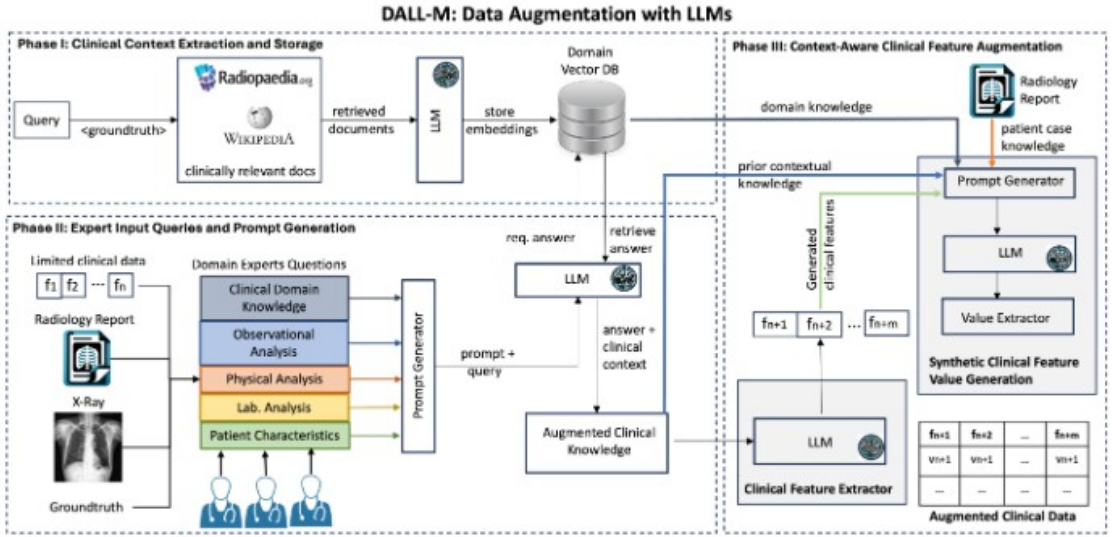
Colon assessment in VR environment



Synthetic Data Generation for Medical Research via LLMs

The Challenge

X-ray images are essential for detecting diseases, but they often lack the clinical context needed for accurate diagnosis. For example, spotting a lung lesion on a chest X-ray is incomplete without knowing the patient's vital signs, symptoms, or medical history. This missing context limits diagnostic accuracy and also makes it harder for researchers to build effective AI systems that can learn from both clinical and image data due to incomplete datasets.



DSI's Approach

We developed DALL-M, an AI framework that generates synthetic, context-rich clinical data to improve both medical research and diagnostics.

DALL-M uses LLMs to capture key patient details, enriching them using trusted medical sources, and generating new, clinically relevant features. This contextual data enables researchers to build more reliable AI systems that can help advance research in multimodal fusion for healthcare.

Advancing Human Potential: Human and Machine interaction

The Challenge

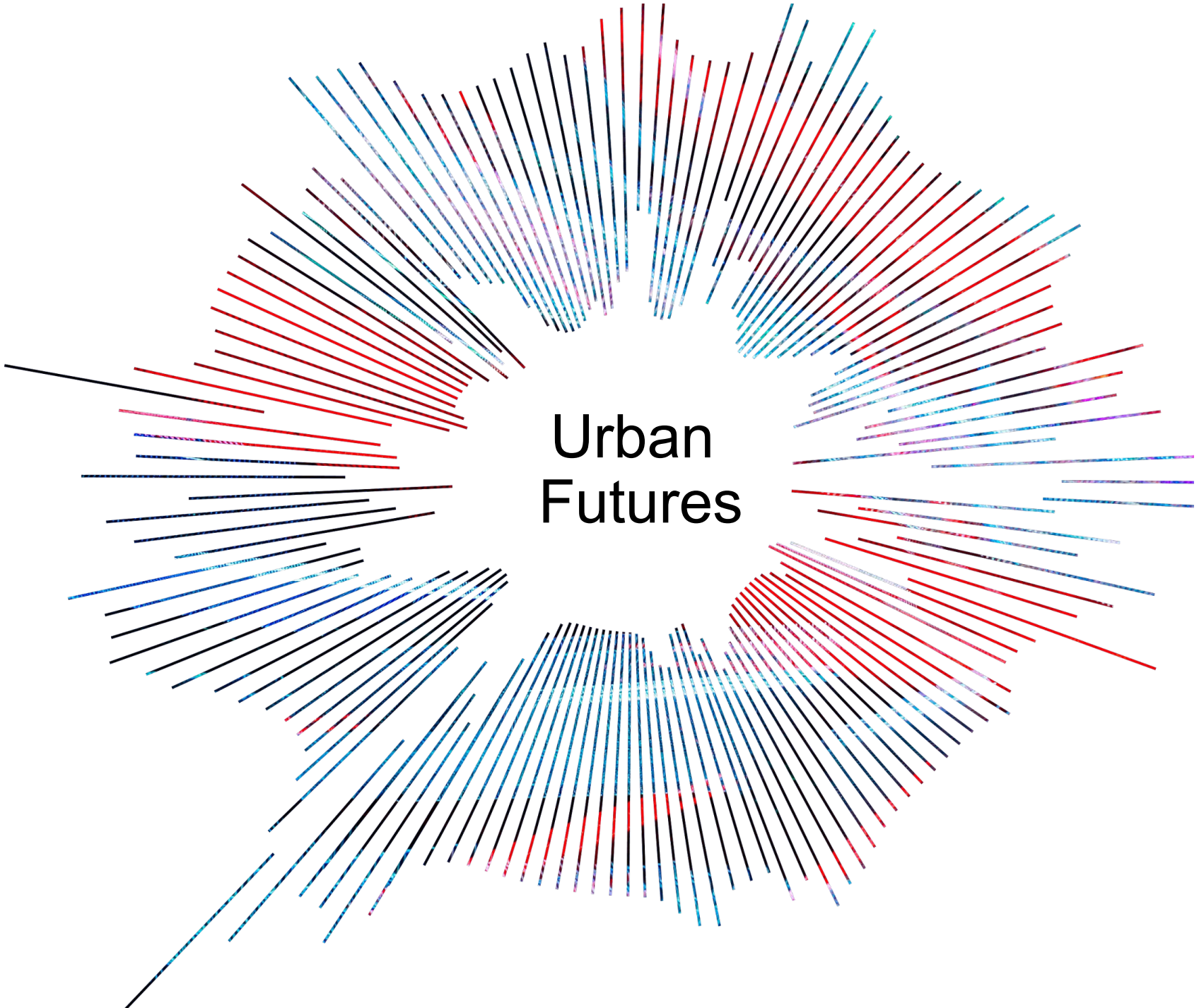
Computers and machines are increasing the volume, complexity and types of information humans are required to absorb and understand, in performing tasks.

This increase in cognitive load, if left unmanaged, can result in new risks, including human error, stress and operator fatigue.

DSI's Approach

DSI is working with emergency service agencies, defence agencies and heavy industry to better understand and positively influence human behavior and interactions with information, systems, robots and each other.

We're integrating methodologies from AI and data science, human-computer interaction (HCI), and behavioral sciences to develop tools to optimise human-machine teaming performance for enhanced outcomes.


Urban
Futures

Urban Futures

Our goal:

Optimise city infrastructure and liveability through AI and data science

Research themes:

- Smart Cities & Urban Analytics
- Mobility & Traffic Analytics
- Knowledge Graphs & Decision Support
- Digital Twins & Simulation Models

Infrastructure: Water pipe leak and failure detection

The Challenge

Water or sewer pipe leaks and failures are costly and can result in extremely costly disruptions to water supply and damage to property.

Prioritisation of pipe maintenance or replacement is typically systemised, based on the pipe's age, use and type.

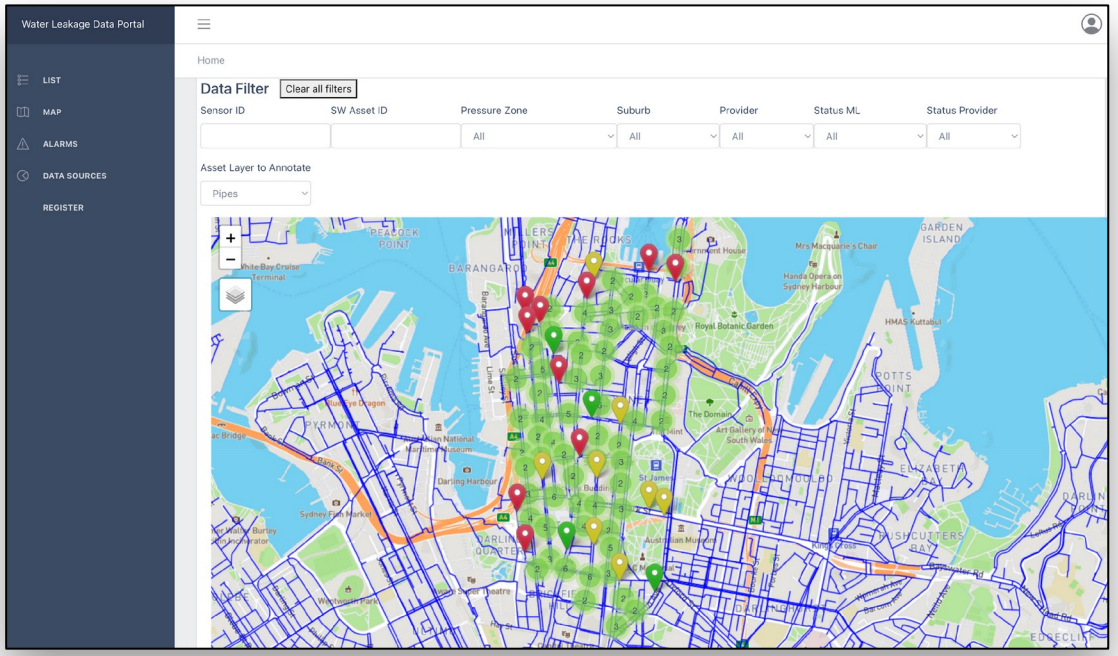
DSI's Approach

DSI developed a range of **predictive analytics tools** based on historical pipe performance data coupled with various sensors deployed on the network which enable the identification of water and sewer pipes at the highest risk of leakage or corrosion.

This insight enables proactive maintenance of pipe assets, and prioritisation for repair or replacement of high-risk infrastructure, before it fails.

DSI has worked with over 30 Australian and global water utilities and our tools have been used to examine over 10 million pipes and over 1 million failure records to date.

Our work has also received multiple industry awards and commendations.



Infrastructure: Water travel time estimation

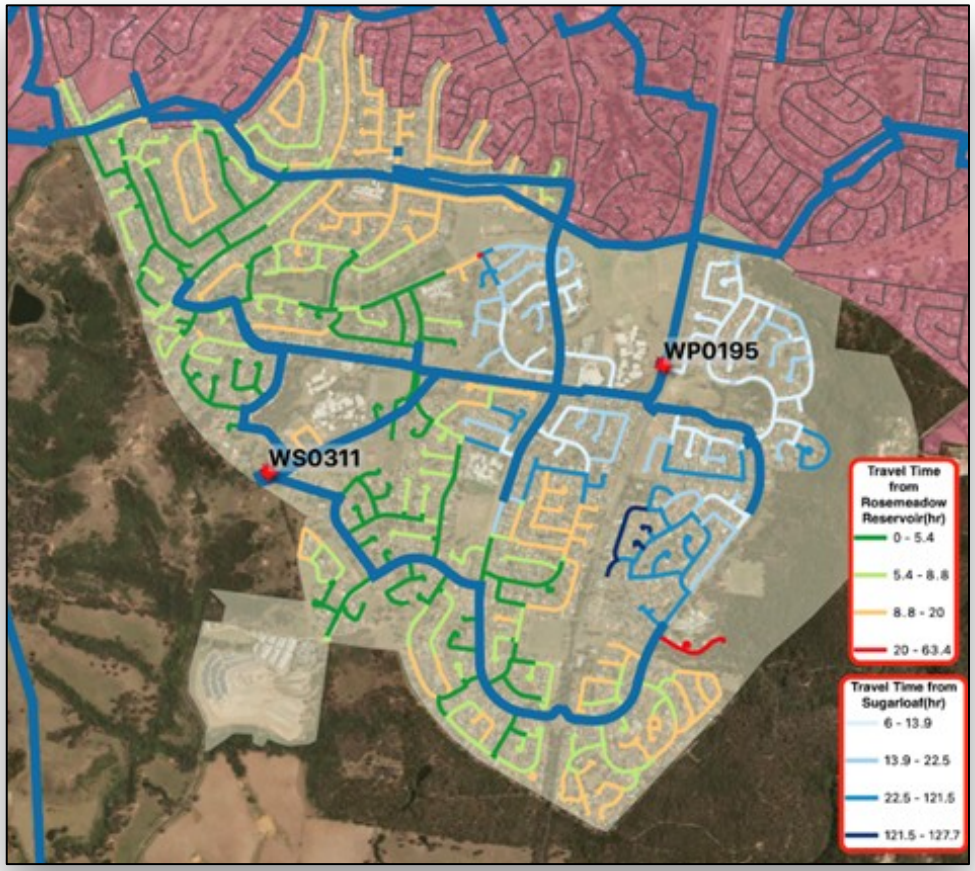
Sydney WATER

The Challenge

Ensuring supply and pressure of drinkable water for households, businesses and essential services is a highly complex and constantly changing environment. Management decisions are highly dependent on situational awareness and a deep understanding of the water network.

DSI's Approach

- Utilising **predictive analytics**, DSI collaborated with Sydney Water to develop novel methods to accurately estimate to a high level of confidence water travel time through distribution systems.
- These enable estimations to be made on the time taken for additives such as chlorine to work through distribution systems, enabling dosing optimisation.



Mobility: Modelling the impact of Electric Vehicles (EVs)

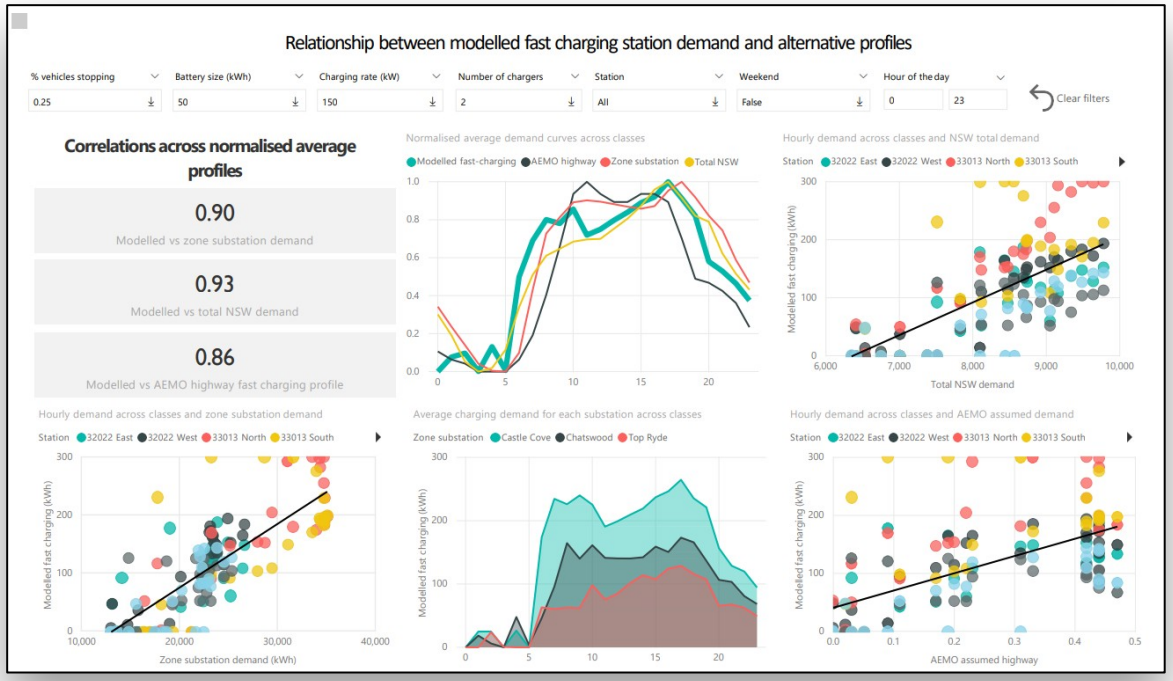
The Challenge

Increasing adoption of electric vehicles will have impacts on the current electricity grid and its performance, increasing demand and changing distribution patterns both spatially and temporally. Insufficient or inappropriately placed charging infrastructure will lead to losses in productivity and localised traffic congestion.

DSI's Approach

DSI's Future Mobility Lab (FMlab) collaborated with the **Australian Energy Market Operator (AEMO)** and **Transport for NSW** to deliver a new transdisciplinary approach for estimating electric vehicle adoption impact on consumer waiting times, traffic congestion and energy demand across multiple EV uptake scenarios.

These insights will help to inform decision making to manage potential impacts and minimise disruption in the future, as EV uptake increases.



AEMO AUSTRALIAN ENERGY MARKET OPERATOR

NSW GOVERNMENT Transport for NSW

FM LAB FUTURE MOBILITY LAB
Innovating smart cities

Infrastructure: Structural health monitoring – Sydney Harbour Bridge

The Challenge

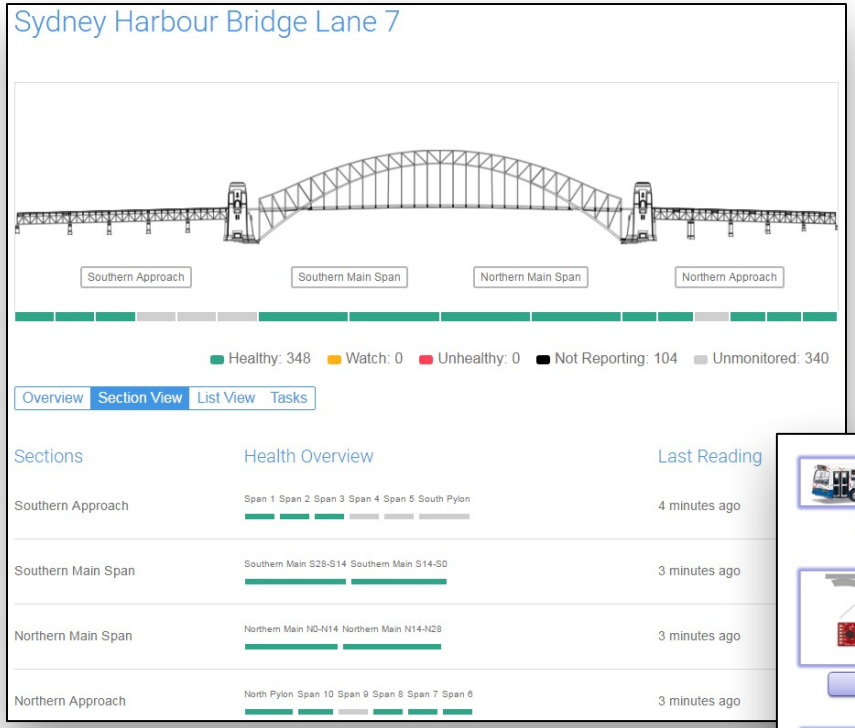
Monitoring the health of structures or completing maintenance work can require unnecessary shutdowns or delays.

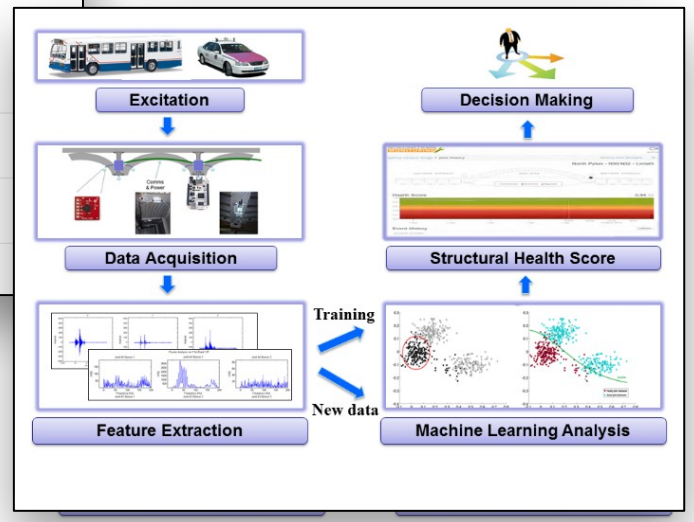
DSI's Approach

DSI collaborated with Roads and Maritime Services NSW (RMS) to deploy a system of 2400+ sensors to the Sydney Harbour Bridge structure, to detect anomalies in structural performance.

A data-driven machine learning technique was used to detect damage to the structure and rate its health, enabling proactive monitoring and maintenance.

RMS operators view live structural performance data and health via a user dashboard, enabling real time decision making and response.





Mobility: Sydney Real-time Digital Twin

FUTURE MOBILITY LAB
Innovating smart cities

NSW GOVERNMENT | Transport for NSW

arid systems

The Challenge

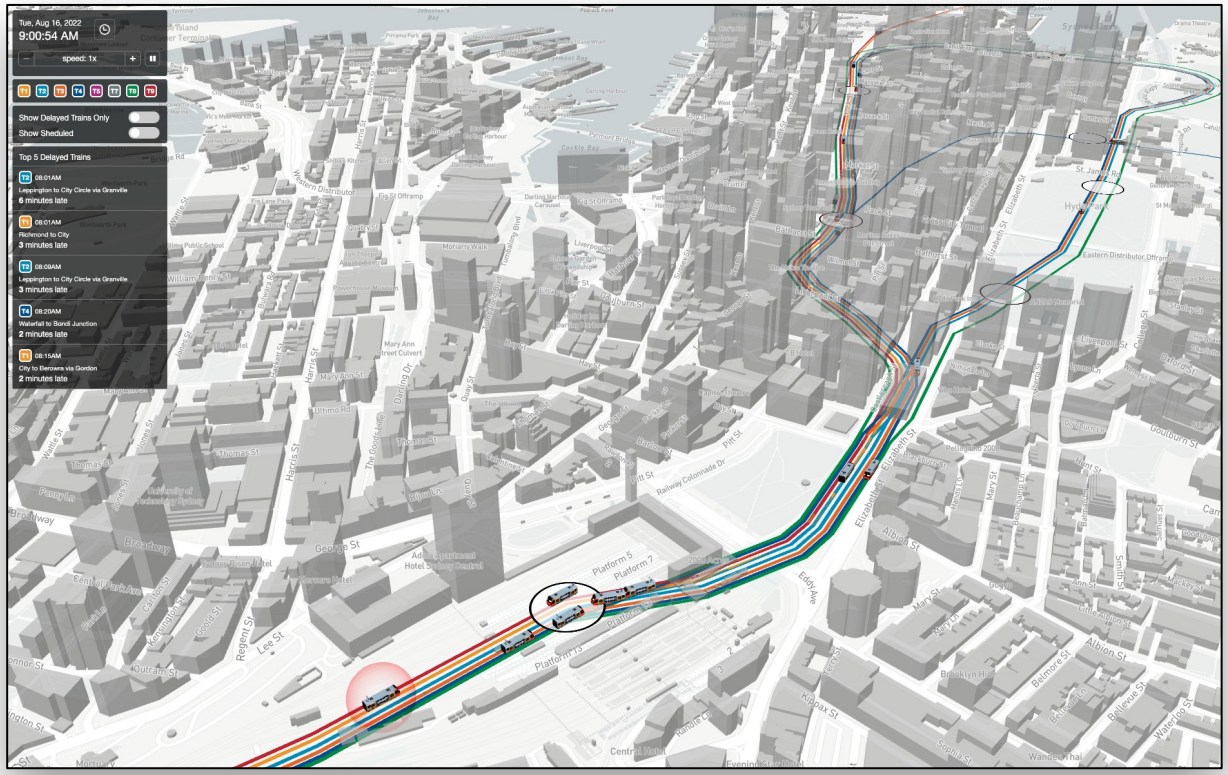
Managing complex transport and infrastructure networks requires the collection and analysis of multiple data sources, often in real time.

Digital Twins simplify the ability to review complex data, or **multiple layers of data in real time**, enabling disruptions to be more rapidly identified and managed, to minimise their impact.

DSI's Approach

UTS Data Science Institute's Future Mobility Lab has developed a **Sydney Real-Time Digital Twin Platform**, which integrates and overlays transport, water infrastructure, air quality and sensor data to a 3D map of Sydney's CBD.

IoT AWARDS 2021




Food Security

Food Security

Our goal:

Ensuring food availability through optimised agricultural productivity and distribution.

Research themes:

- AI in Agriculture & Sustainability
- Probabilistic Models, Causality & Risk Management
- Business & Supply Chain Analytics
- Agricultural Knowledge Graphs & Decision Support

Productivity: Remote sensing of viticulture crop performance

The Challenge

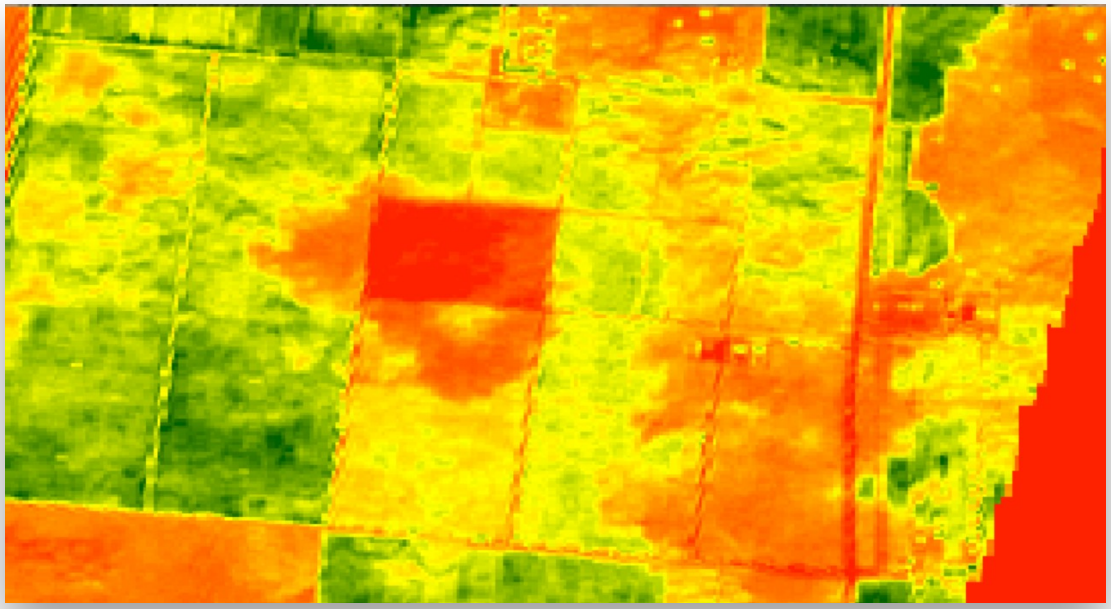
Viticulture management is resource intensive requiring visual inspection of vines and subjective assessment of intervention options leading to significant productivity issues as the industry scales.

DSI's Approach

DSI collaborated with an Australian agriculture technology company and a global technology giant to advance the use of robotics in viticulture.

We integrated various data streams to enhance harvest predictions, including high-resolution **remote sensing data** , **satellite imagery** and **visual metrics** to support water stress identification, vine energy monitoring, and canopy management.

This project demonstrated the potential of **AI to optimise agricultural practices** and provided a framework for assessing the cost-effectiveness of incorporating robotic technologies.



Productivity: Precision Farming and Yield Prediction (Kiwifruit)

The Challenge

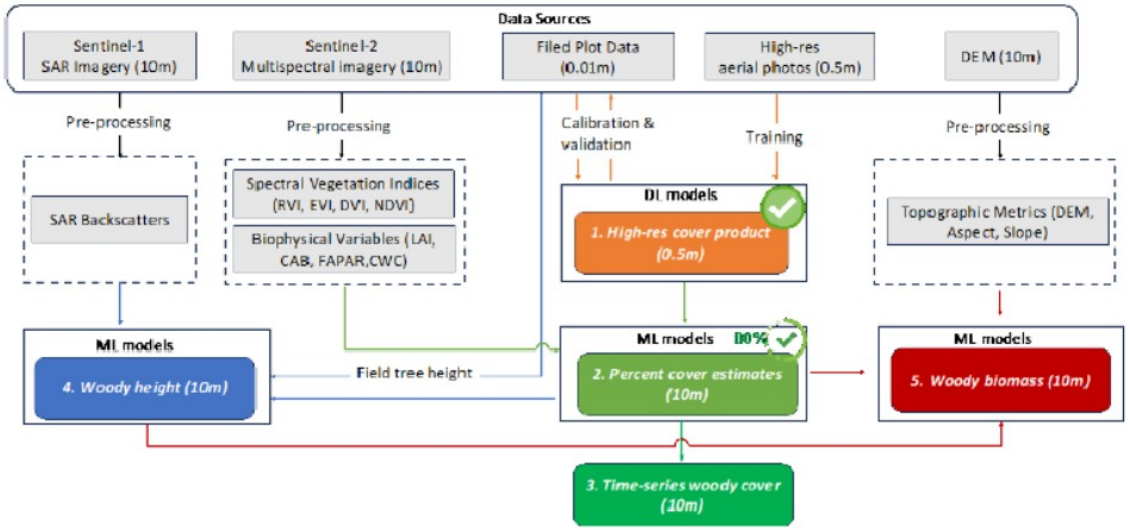
New Zealand's kiwifruit production reached approximately 622,550 metric tonnes in 2020, however, inaccurate crop forecasts have proven been a significant financial challenge for the industry.

DSI's Approach

To address this, DSI worked with industry partners to develop a machine-learning tool able to accurately **predict kiwifruit size and yield volume.**

The tool developed uses **weather data**, historical **harvest data**, and other agricultural inputs to enhance forecasting accuracy.

The resulting model achieved a **94% accuracy rate in crop yield predictions**, demonstrating the potential for data science to transform agricultural practices.



Productivity: ForageCaster

The Challenge

Current approaches to managing livestock and pasture are human-centric, influenced by a farmer's lived experience, and access to information.

These limits can lead to experiential bias and low levels of specificity and accuracy in the information available, to support decision making.

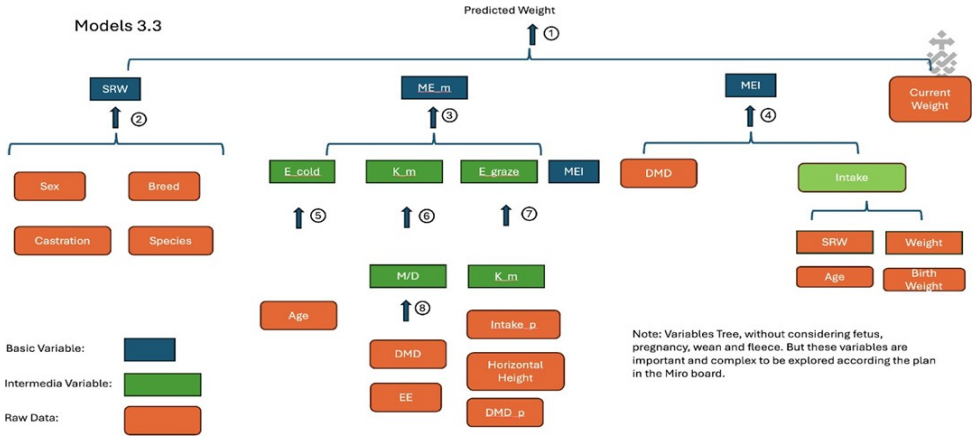
Agricultural productivity can be greatly enhanced by providing farmers with access to more accurate and automated methods to forecast pasture and animal growth.

DSI's Approach

DSI is collaborating with agricultural industry experts to develop an operational and accurate prediction tool for use by livestock producers.

The tool integrates historical livestock growth data, livestock character data, pasture data, treatment data, and weather data to deliver accurate pasture and animal growth predictions.

Our goal is to improve farm performance and sustainability, by providing an easy-to-use tool to assist farmers management decision making.




Sustainable
Environment

Sustainable Environment

Our goal:

Leveraging AI for environmental resilience, ecosystem management, and climate action.

Research themes:

- Climate Risk & Sustainability Modelling
- Environmental Management through AI
- IoT, Sensing & Machine Vision
- Digital Twins & Ecosystem Simulations

Climate: Rangeland carbon storage estimation

The Challenge

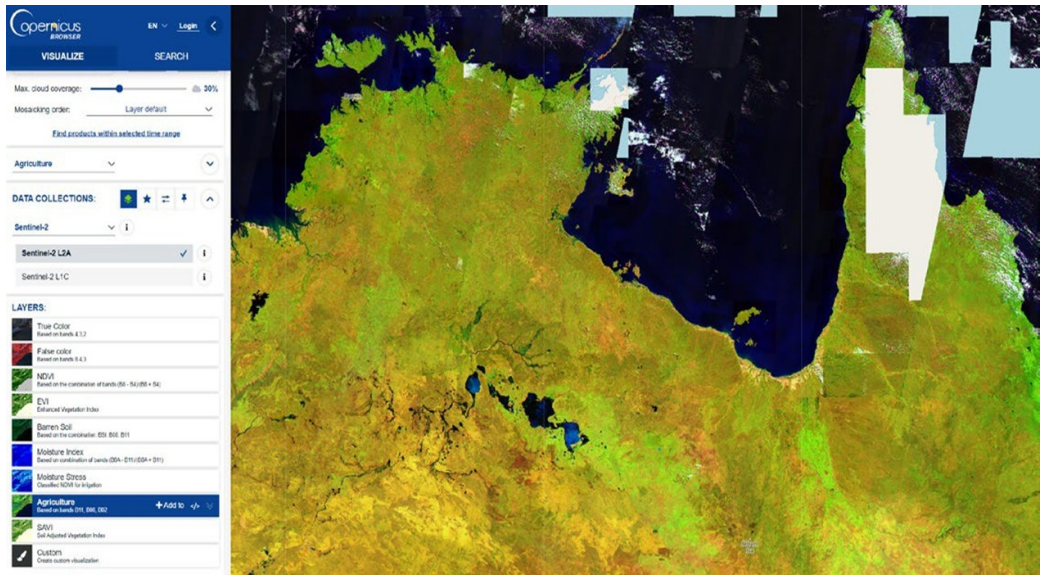
Rangeland grazing is a major export industry, and a major carbon emissions source. It is also a major opportunity for sequestration of carbon in soils and vegetation. Measuring, reporting and reducing net emissions in agriculture is being demanded by trading partners, governments and financiers.

DSI's Approach

Utilising **machine learning** and **geo-analytics**, DSI developed innovative techniques for estimating carbon storage using remote sensing and aerial data.

These methods significantly **reduce costs associated with carbon measurement** across vast rangelands, enabling more farmers to participate in carbon sequestration.

The project not only supports **environmental conservation** but also enhances the **productivity** and **economic viability** of rangeland farming.



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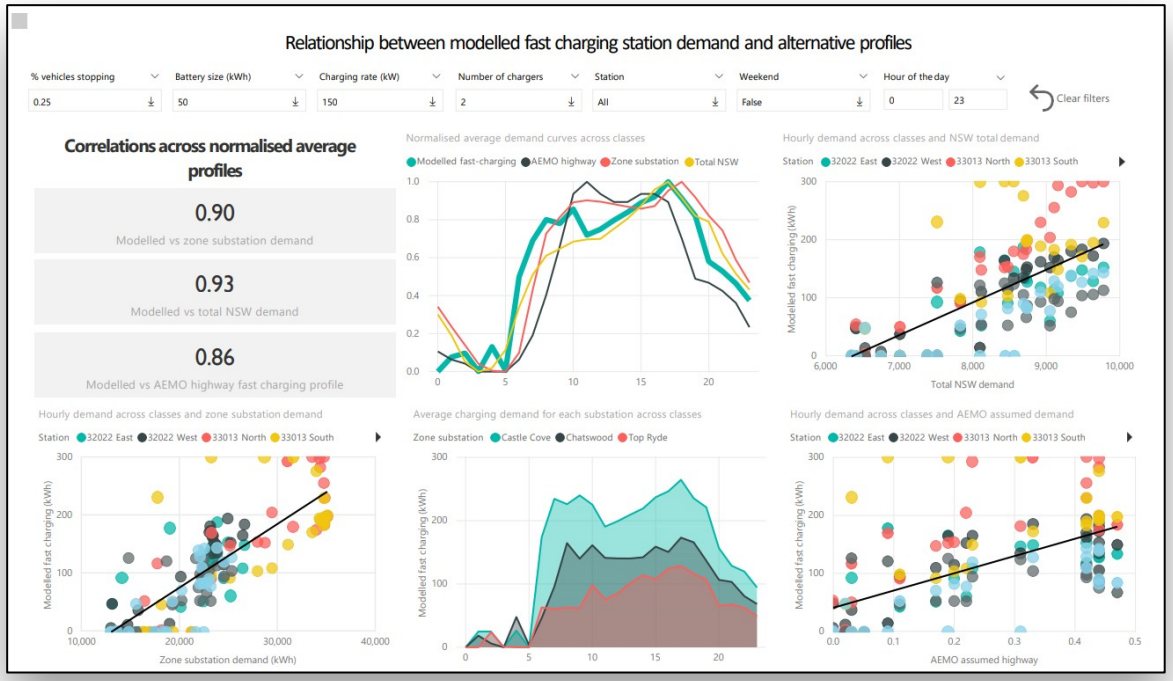

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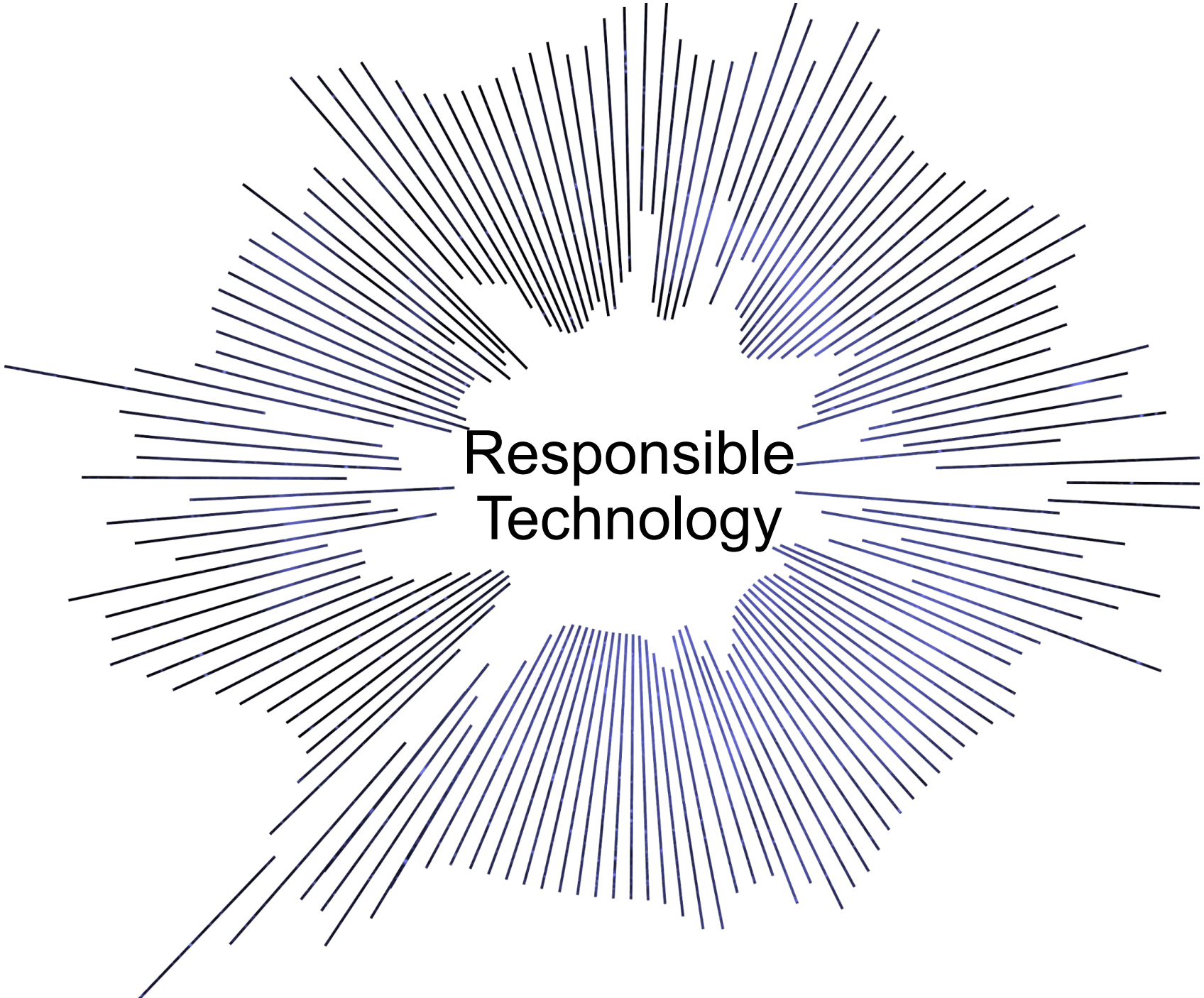

Responsible
Technology

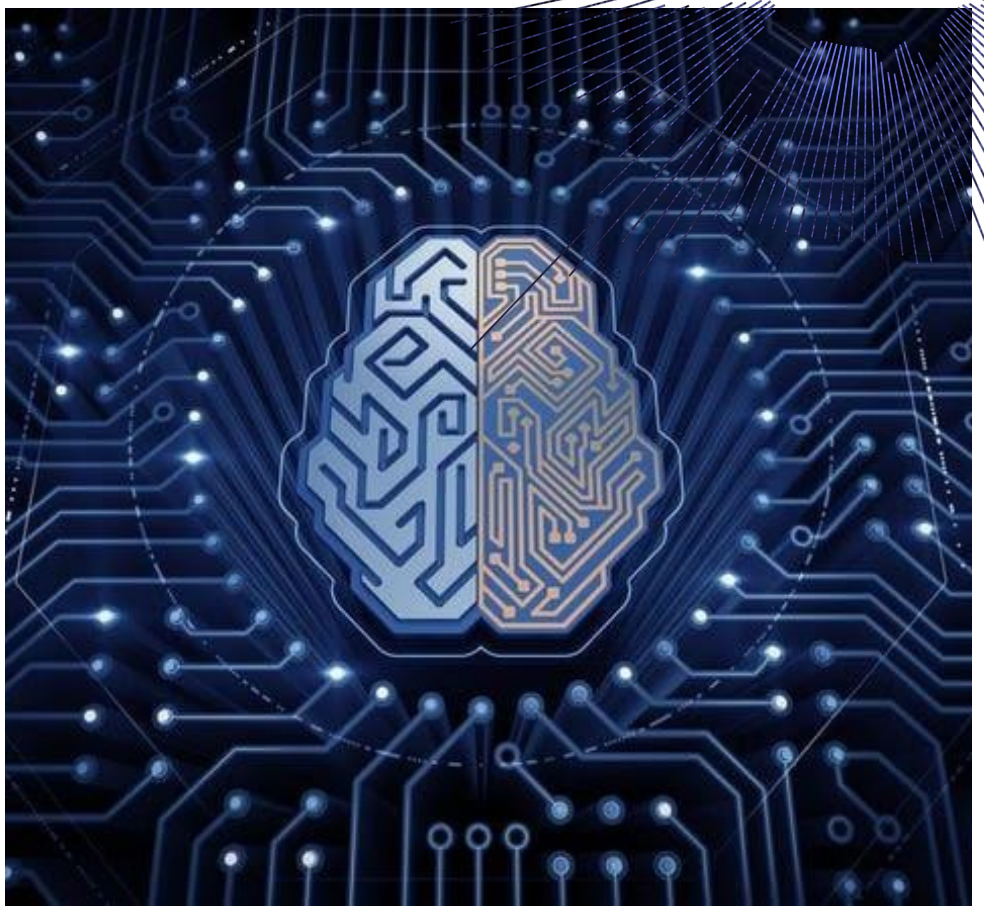
Responsible Technology

Our goal:

Prioritising ethics, transparency, and security in AI and data science applications

Research themes:

- AI Ethics, Fairness & Privacy
- Social Media & Misinformation Analytics
- Cybersecurity & Compliance
- Quantum Cognition & Quantum Machine Learning
- Generative AI & Safety



Online misinformation and countermeasures

Australian Government
Department of Home Affairs

Berkeley SCHOOL OF INFORMATION

The Challenge

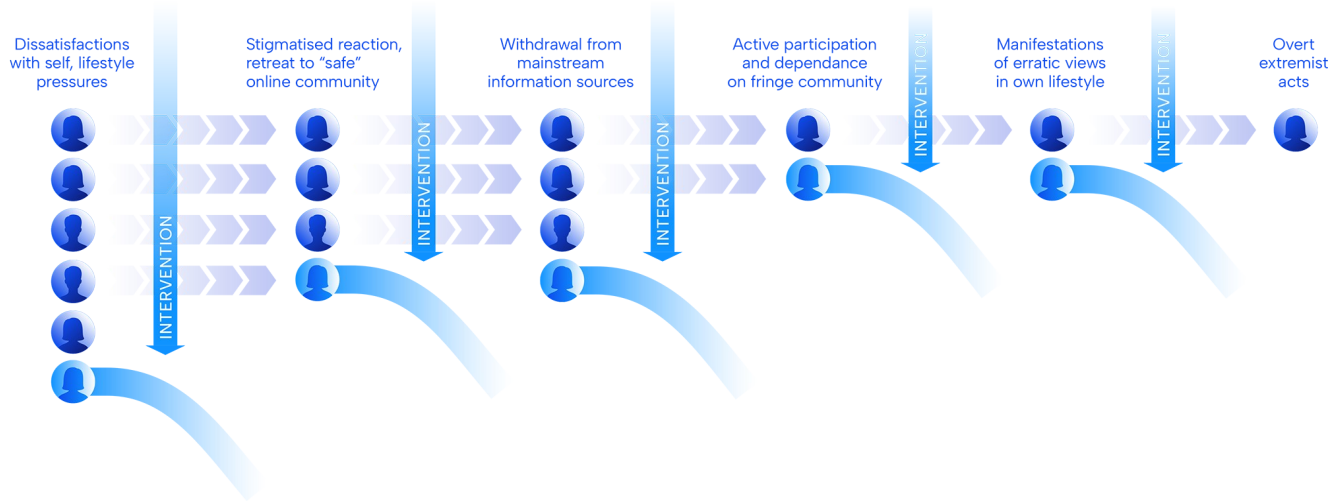
Spread and consumption of online misinformation threatens public health, social cohesion, and national security.

- Recommendation algorithms are supposed to help connect people with content that will interest them, but research has shown that the YouTube algorithm funnels people towards increasingly extreme political content.
- Examples include the “manosphere” space, where influencers like Andrew Tate promote violent ideas about women, and the self identifying “in-cel” community linked to extreme violence events.
- In our research, we found that these influencers specifically designed their content to target teenage boys, by presenting themselves as friendly older brother-like figures.

DSI’s Approach

Investigated the mechanisms of misinformation spread and developed novel approaches for intervention:

- Mapped the radicalisation pathway from initial exposure to violent extremism, identifying intervention points and offramps.
- Demonstrated that misinformation spread depends more on framing and style than factual inaccuracy.
- Developed and tested effective counter-messaging strategies that match the communication style of target audiences.



Forecasting the Effectiveness of Adversarial Information Operations

Australian Government
Department of Defence
Defence Science and Technology Group

ASCA
Advanced Strategic Capabilities Accelerator

DIN DEFENCE INNOVATION NETWORK
To go far, go together

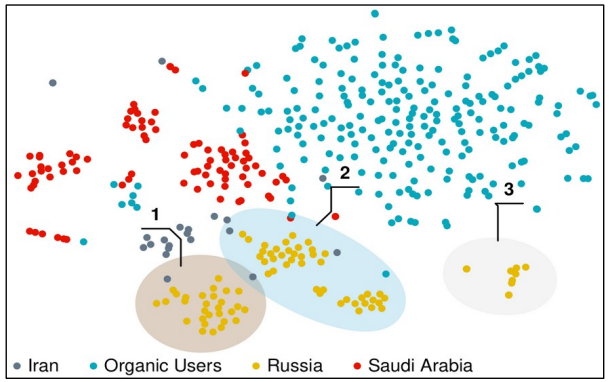
The Challenge

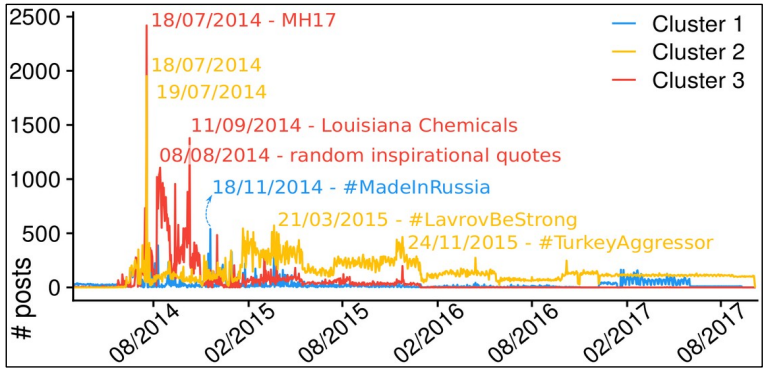
Information Operations (IO) threaten national security and social cohesion. Traditional content-based detection creates an arms race as adversaries easily adapt. This fails to measure what matters most—the target population's response to influence campaigns.

DSI's Approach

DSI's Behavioural Data Science lab developed breakthrough technology that detects and measures IO effectiveness through population response patterns:

- Agent detection by analysing social system reactions, capturing signatures that cannot be concealed
- Narrative detection combining text analysis with spread patterns, effective despite adversary adaptations
- Engagement prediction offering both reactive assessment and proactive modelling for operations





Russian trolls farms activity:
C1: Russian news with patriotic framing;
C2: Regional and conservative news;
C3: tweet in English, *#music*, *#usa*, relationship advice

Dashboard to Monitor, Detect, ai Counter Information Operations

Australian Government
Department of Defence
Defence Science and Technology Group

ASCA
Advanced Strategic Capabilities Accelerator

DIN DEFENCE INNOVATION NETWORK
To go far, go together

The Challenge

Translating advanced research into operational defence software requires specialised expertise. Security agencies need robust, intuitive systems to monitor, detect, and counter information operations in real-time while meeting strict security requirements.

DSI's Approach

DSI partnered with RAPIDO, UTS's elite software unit, to deliver:

- A comprehensive monitoring dashboard tracking cross-platform online discussions
- Advanced algorithms identifying IO agents and narratives through population responses
- Real-time effectiveness estimation with integrated countermeasure deployment capabilities

Graph-Based Explainable Algorithms

The Challenge

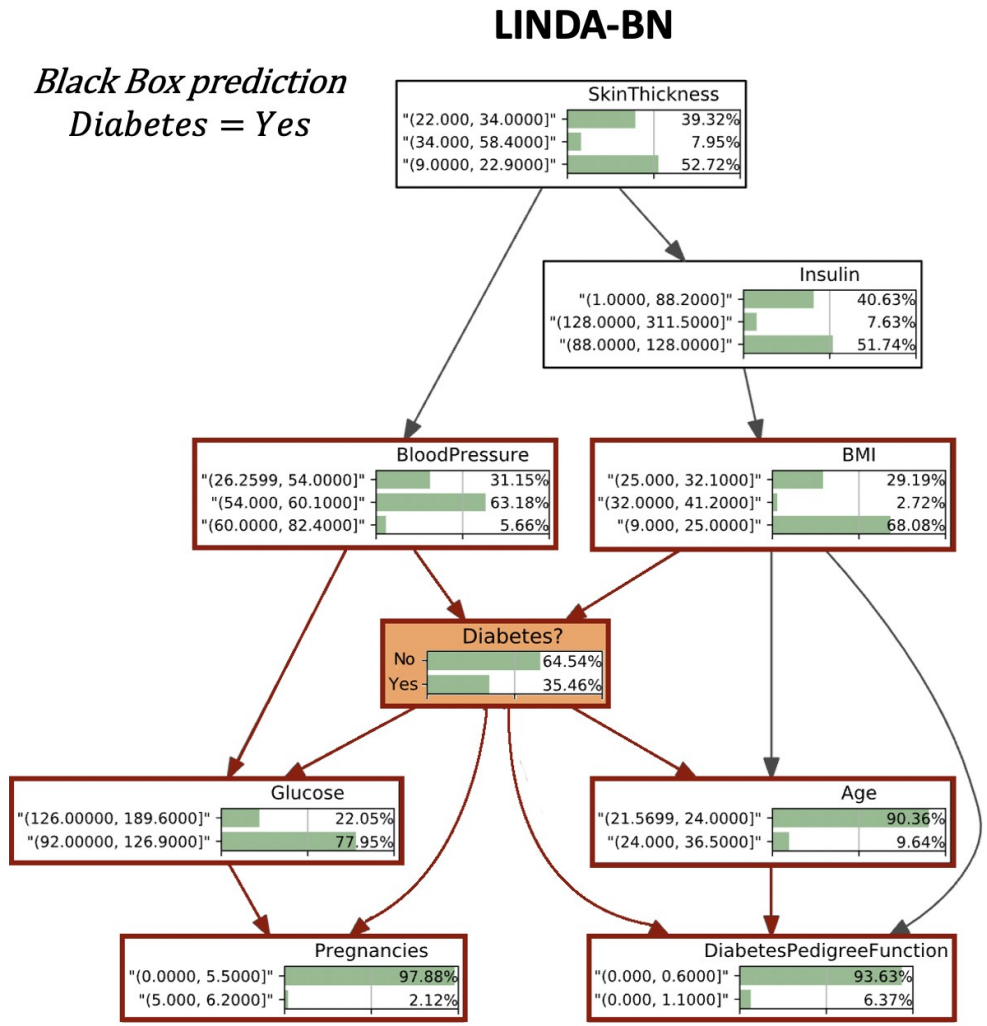
Most advanced AI systems work like a “black box” — they make predictions, but we do not really know how or why. Current explanation methods, such as showing features that are “important,” treat each feature separately. However, features often influence each other, and understanding them in isolation can lead to misleading explanations and even false confidence in the system.

DSI’s Approach

We created LINDA-BN, a new way to explain AI decisions using Bayesian Networks. LINDA-BN is:

- **Human-centric:** Designed to be easy to explore and understand.
- **Interactive:** Lets users test “what-if” scenarios by changing values and seeing how predictions shift.
- **Trust-building:** Shows how features are connected and why a decision was made.

Instead of just ranking features, LINDA-BN reveals how they work together, helping users better assess the reliability and reasoning behind AI predictions.



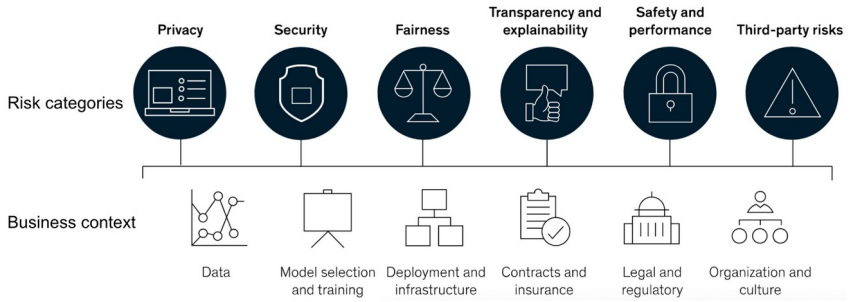
Explainable AI:

The Challenge

AI is already being used by individuals, industries and governments to generate new and powerful insights.

Use of generative AI platforms such as ChatGPT is widespread, however such tools are already raising strong concerns regarding issues such as bias, information privacy and transparency.

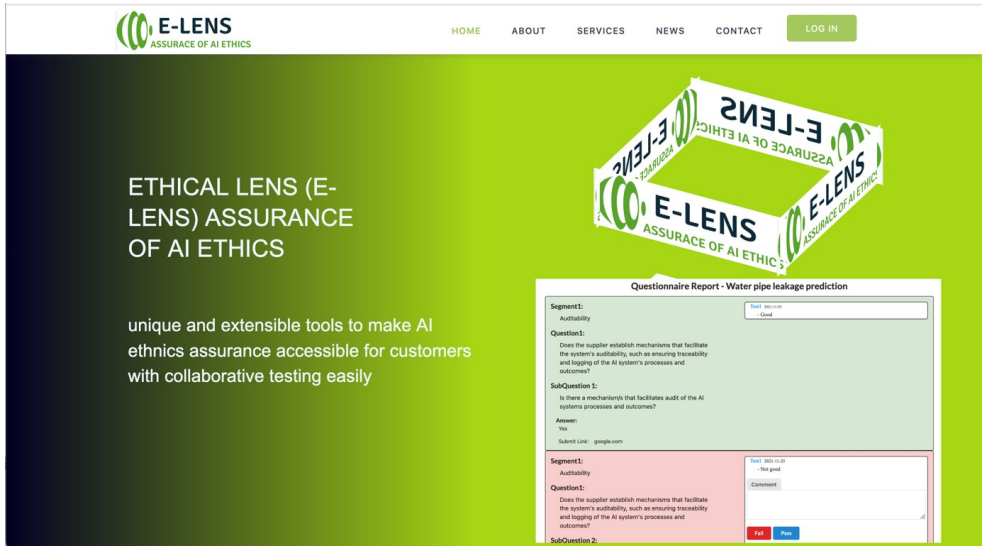
Where AI is being used to determine an outcome or action, it's critical we're able to both understand and explain how the decision was made, and what was considered.



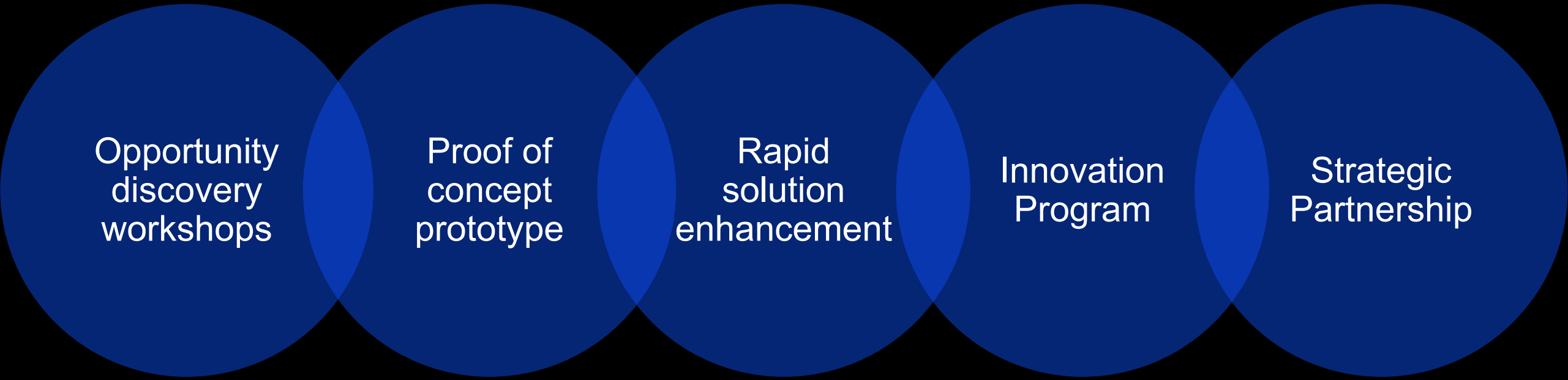
DSI's Approach

DSI is working with partners across industry and government to ensure AI-based research and solutions are developed with clear principles in place around transparency, ethical use and explainability.

We also developed E-LENS, and AI assurance platform to support companies in rapidly assessing whether their AI use is ethical and explainable.



How we work



Scope key opportunities based on your challenges, pain points, mission and data environment.

Identify a narrow and measurable objective and build out an exemplar solution.

Take an existing data solution you use and update it using contemporary approaches.

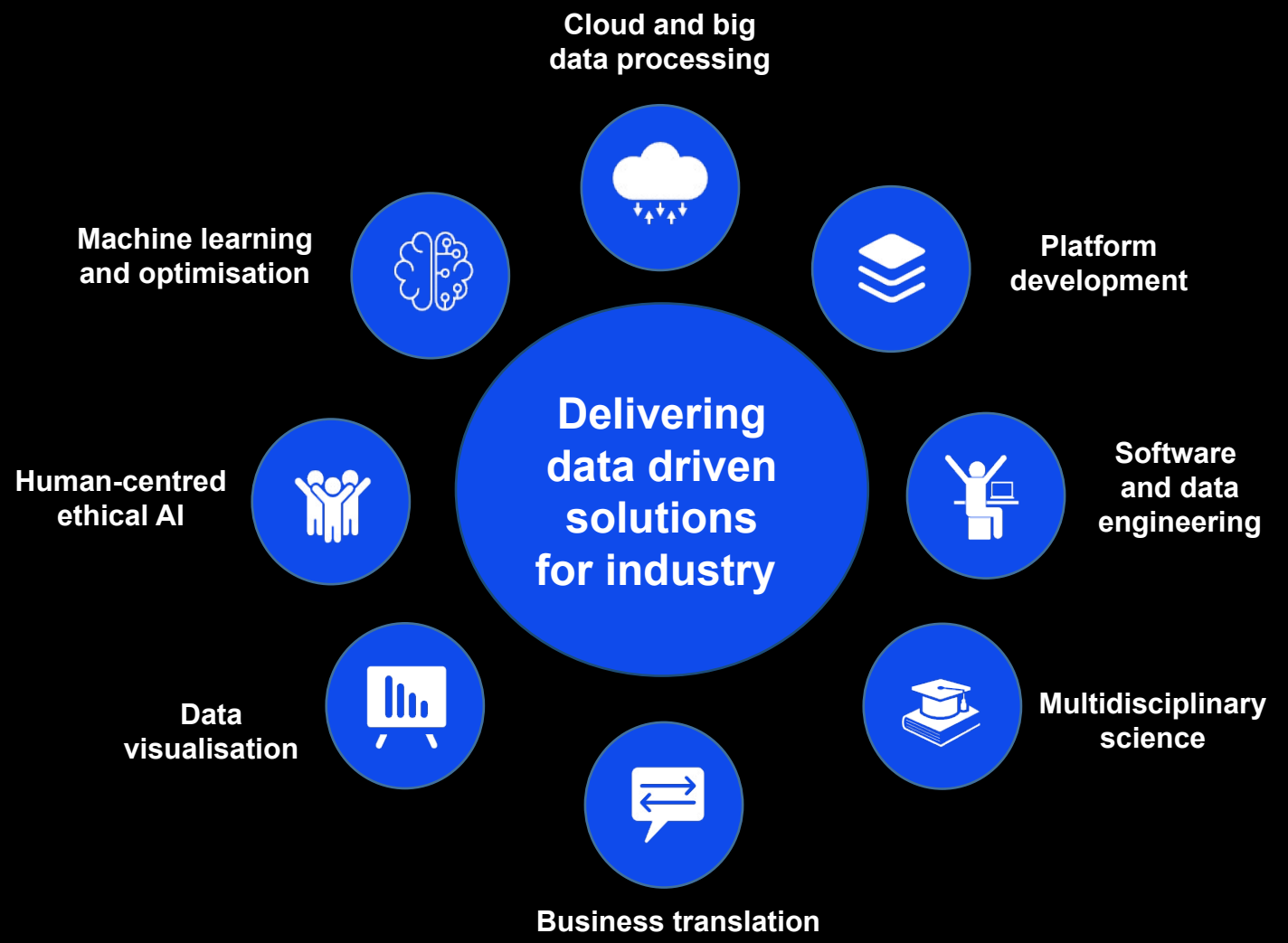
Deliver a complete operational solution to a well-defined problem

Build, test and deploy a suite of innovative, integrated solutions

UTS Data Science Institute (DSI)

Established in 2020, **UTS Data Science Institute** is an internationally acclaimed research centre, committed to delivering real world impact

Our focus is on applying our **AI and data science** expertise to help our industry and government partners solve the most complex challenges



Energy Supply: Minimising energy supply disruption impacts

The Challenge

Customer impact is a key decision-making factor in prioritising scheduled energy disruptions.

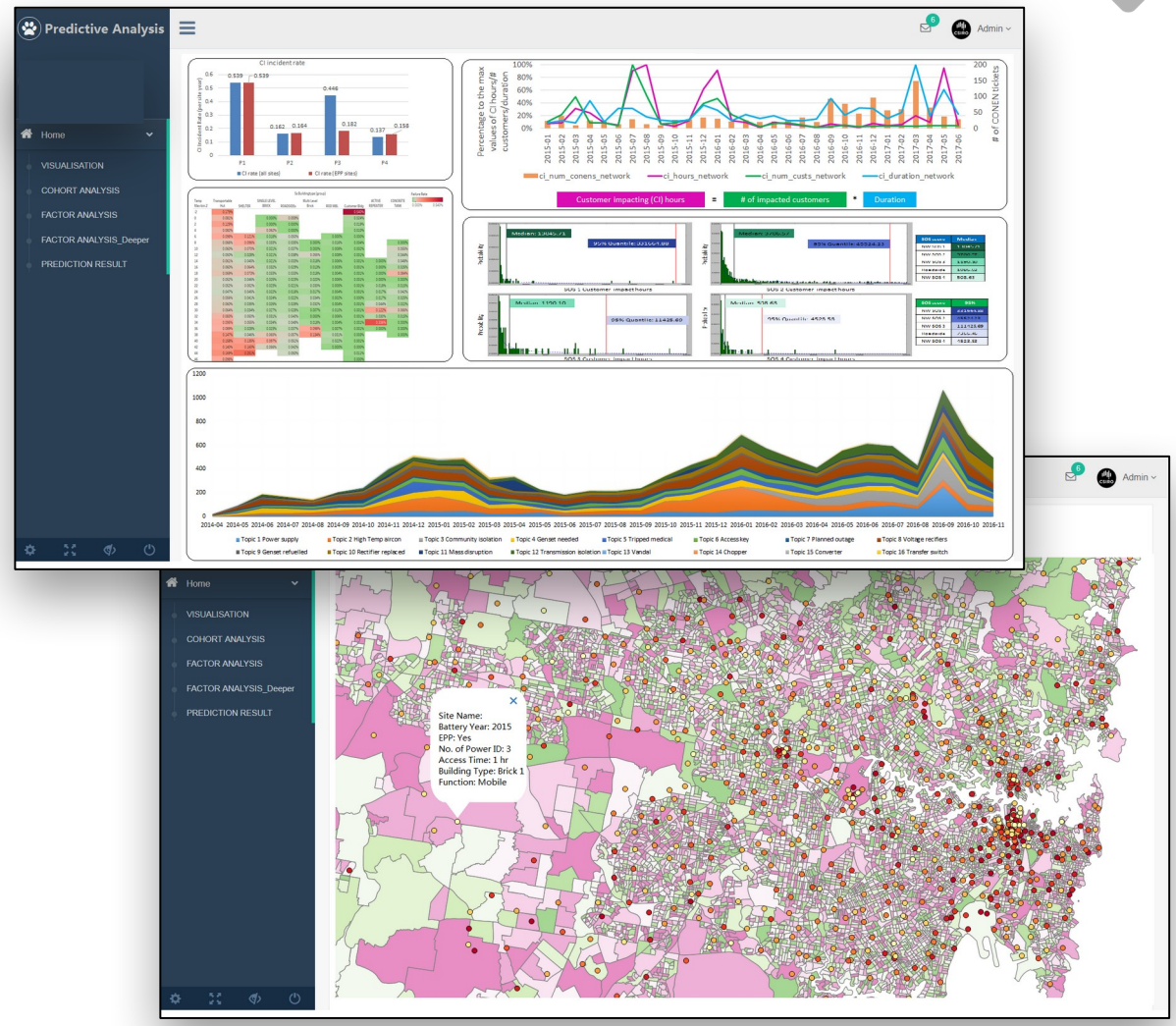
Energy companies face the challenge of considering alternative actions and making complex decisions on how to prioritise disruptions, to minimise impacts to their customers activities and businesses.

DSI's Approach

DSI worked with energy suppliers to develop a predictive model to optimise disruption scheduling and minimise customer impact.

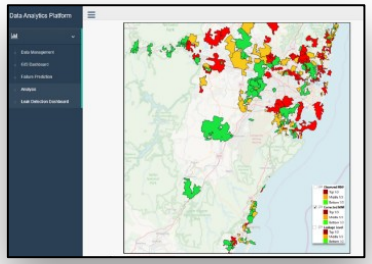
The model uses historical incident records, site load data, battery age and capacity data, power distributor information, and outdoor temperature to identify and prioritise potential fault locations.

This method has enabled 40% more potential network faults to be identified using the same budget and resources as the existing approach used.

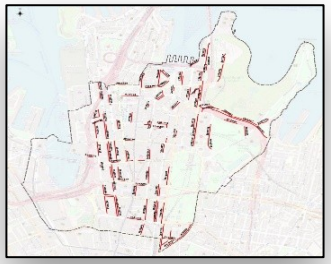


Infrastructure: Leak prevention using predictive analytics and smart sensing

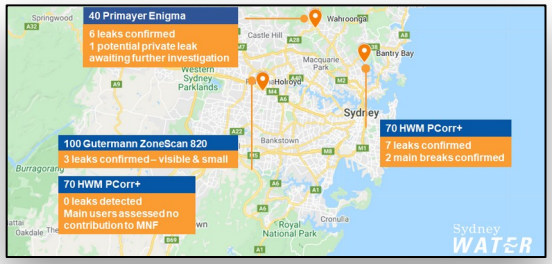
Zone Selection



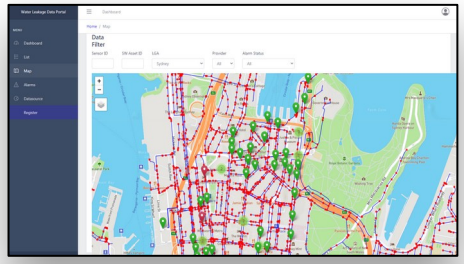
Pipe prioritisation



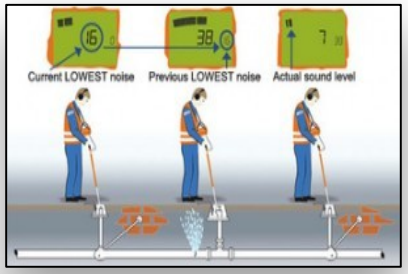
Sensor deployment

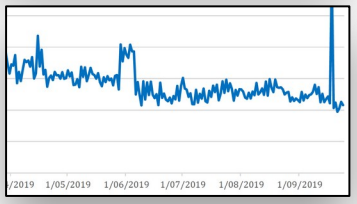


Leak Detection

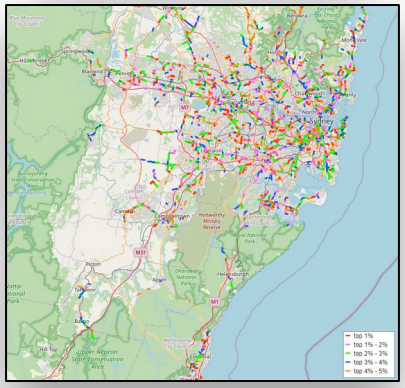


Active Leak Detection (localisation)

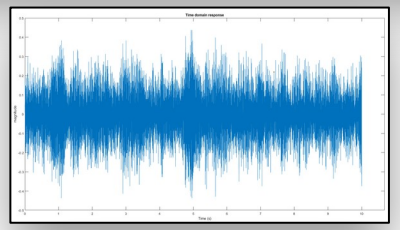


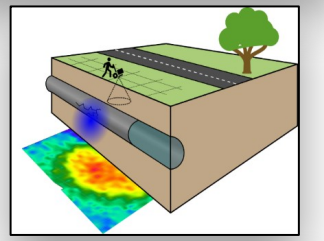


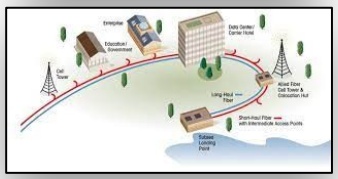
MNF

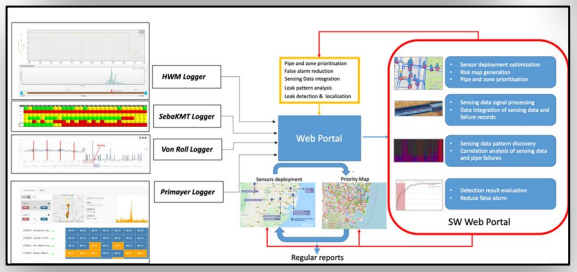


Failure prediction

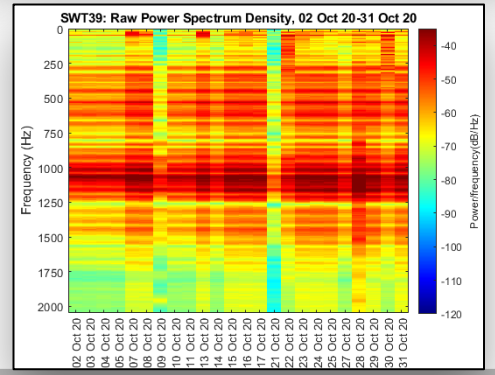


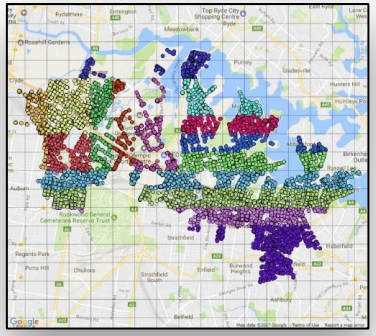






Web Portal

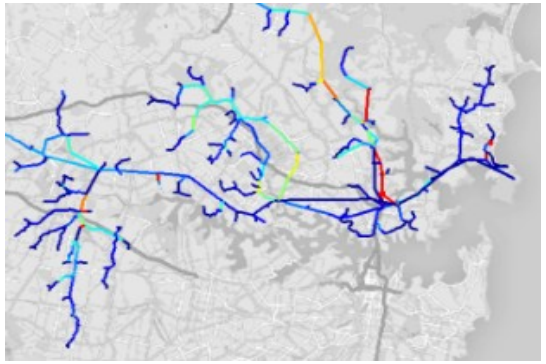




Virtual DMA

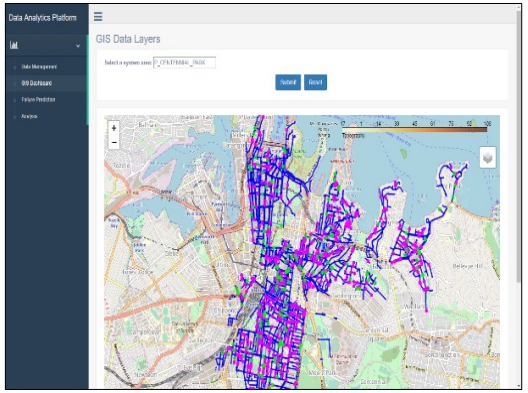
Selected Projects using AI and predictive analytics

Critical/Reticulation Water Main

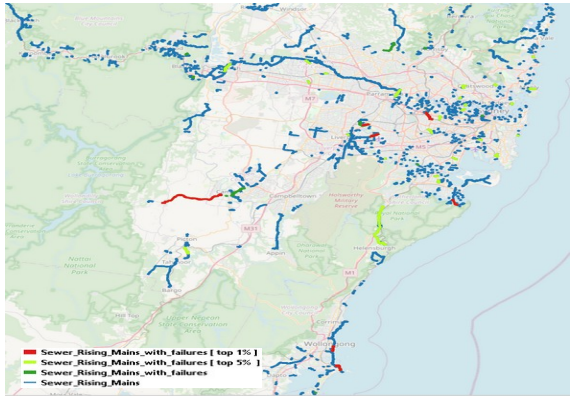


Gravity Sewer Corrosion

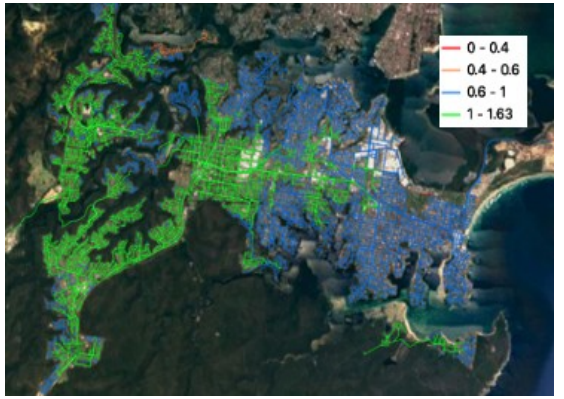
Water Demand



Leak Prevention



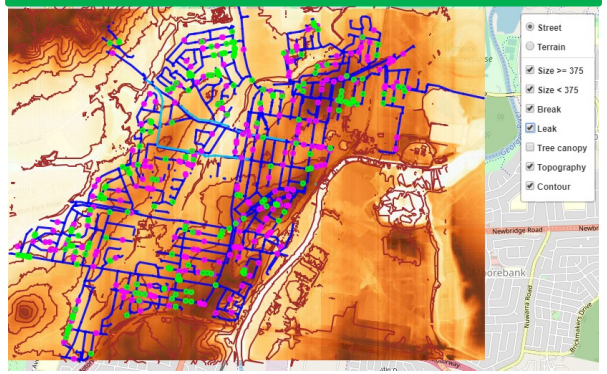
Sewer Pressure Main



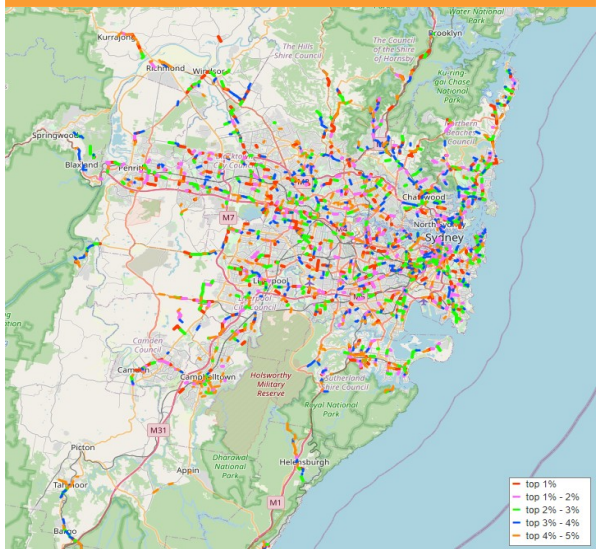
Water Quality and Energy Saving

Water Main Predictive Analytics Tool

GIS Dashboard



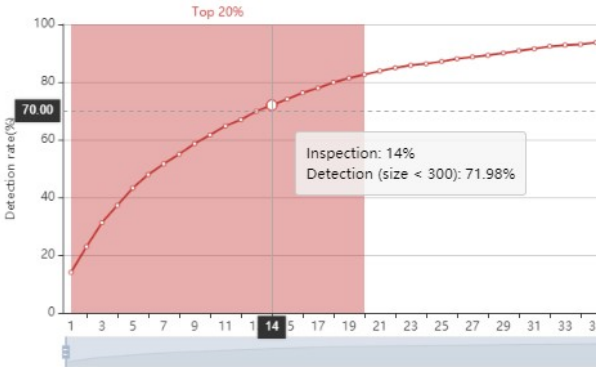
Failure Prediction



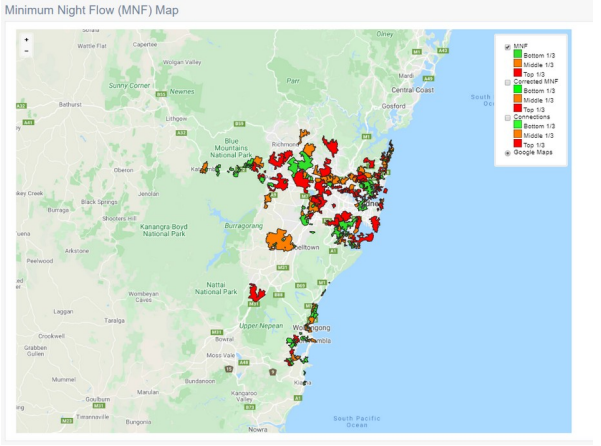
Pipe Failure Prediction

- Data Management
- GIS Dashboard
- Failure Prediction
  - Small Pipes
  - Large Pipes
- Results Analysis
  - Small Pipes
  - Large Pipes
- Leak Detection
  - MNF

Results Analysis

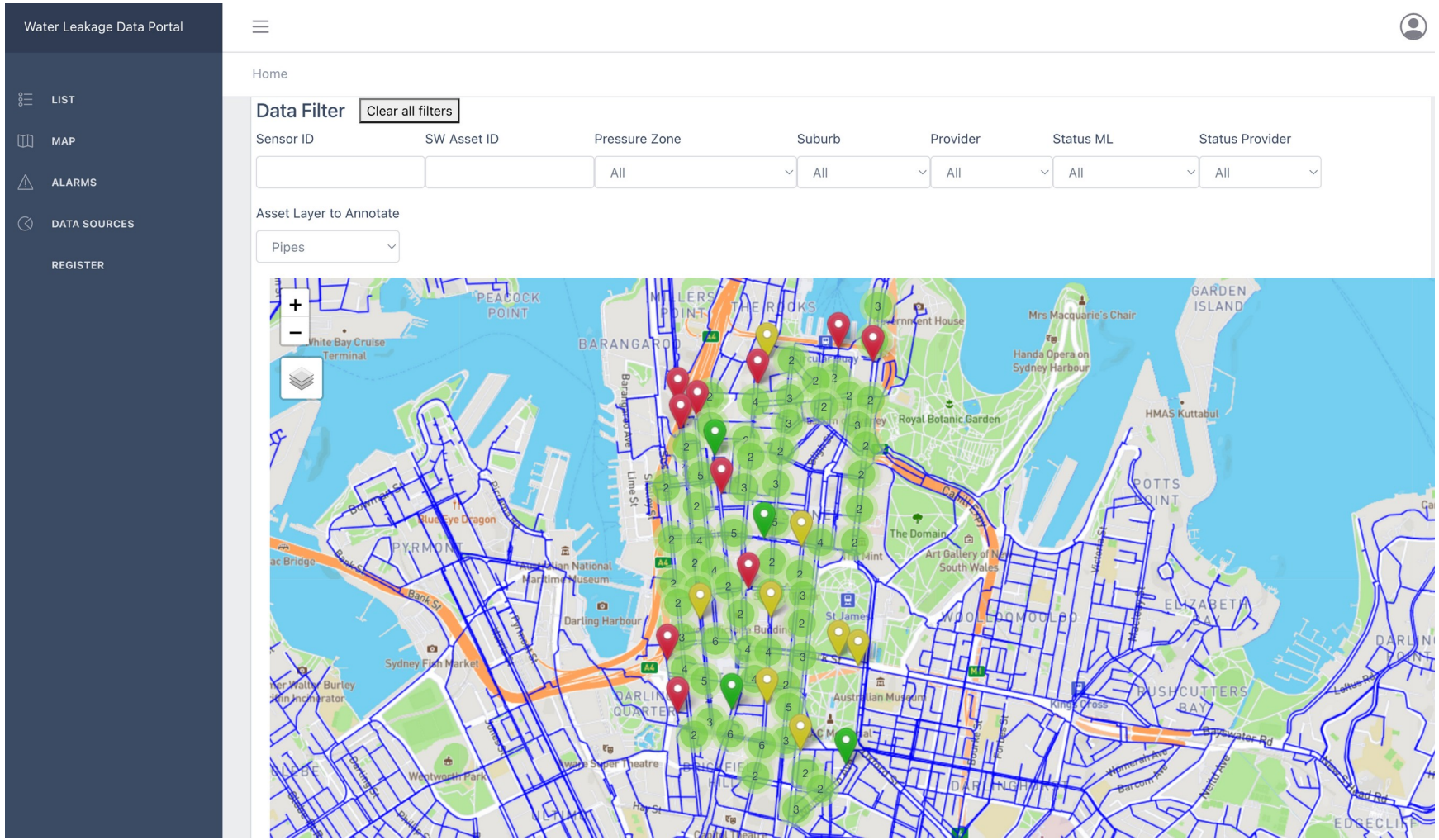


MNF Maps



Web portal – leakage prevention

Alarms or potential leaks will be shown in the map

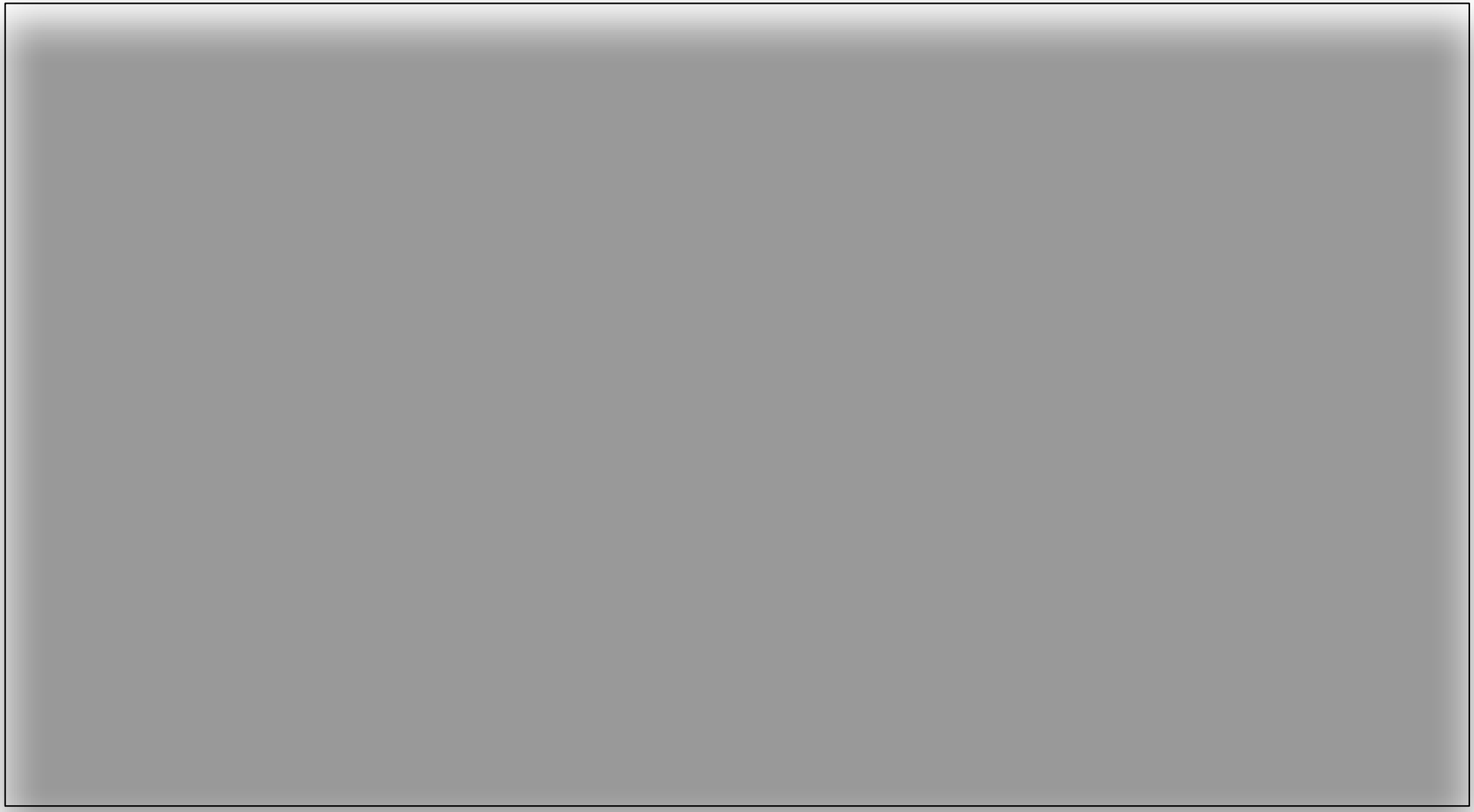


NO LEAK

System monitoring
(status may change to LEAK or NO LEAK after 2-3 days)

LEAK alarm with high confidence
(should be actioned by SW)

Infrastructure: Sewer corrosion prediction - AI and sensing



Infrastructure: Asset life prediction

The Challenge

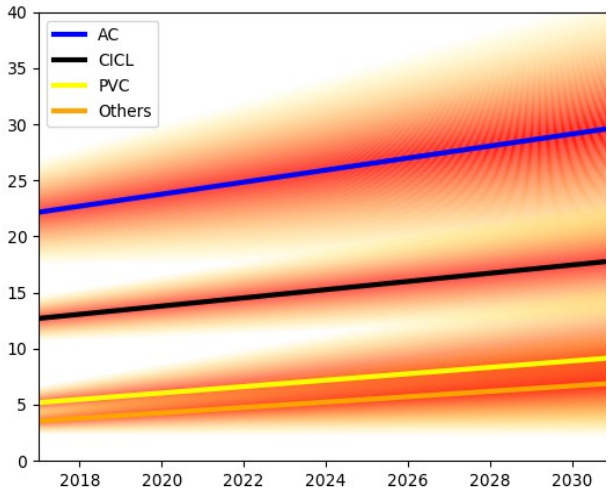
Failure of critical assets due to end-of-life is costly and disruptive. Using machine learning to confidently predict the life of assets such as pipes and cables, can provide valuable new insights on infrastructure health, enabling its lifespan and performance to be optimised.

DSI's Approach

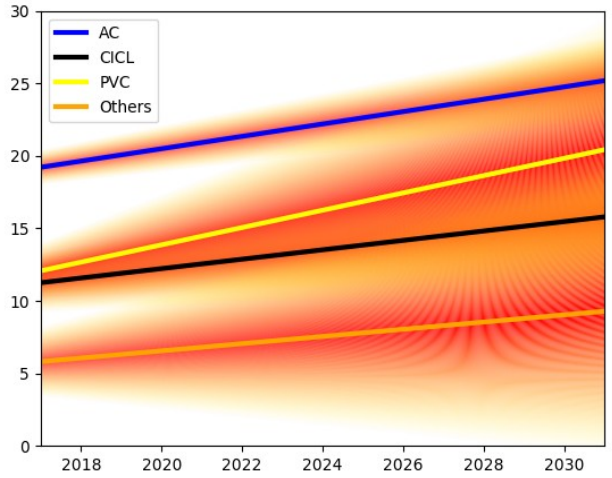
DSI worked with Western Water to develop machine learning models to predict the potential life of its assets.

The models can be used to plan timelines for asset replacement and optimise the utility of assets, across their lifetime.

Burst



Fitting



- x axis denotes the year.
- y axis denotes the predicted failure rate for different groups.
- The colour around the line denotes the variance.
- The darker the colour is, more confidence on the predicted value.

Infrastructure: Anomaly prediction – Naval vessel engines

The Challenge

Detecting potential anomalies in performance can enable early intervention, repair or replacement.

It can also prevent costly disruptions or potential harm as a result of unexpected failure events.

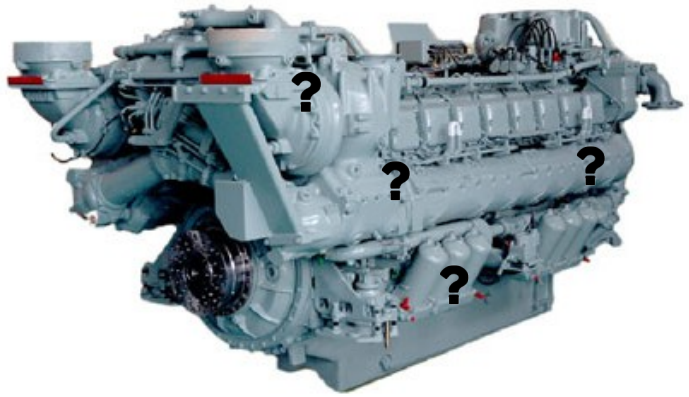
DSI's Approach

DSI worked with an engine manufacturer to develop models able to accurately detect and monitor performance anomalies in naval vessel engines.

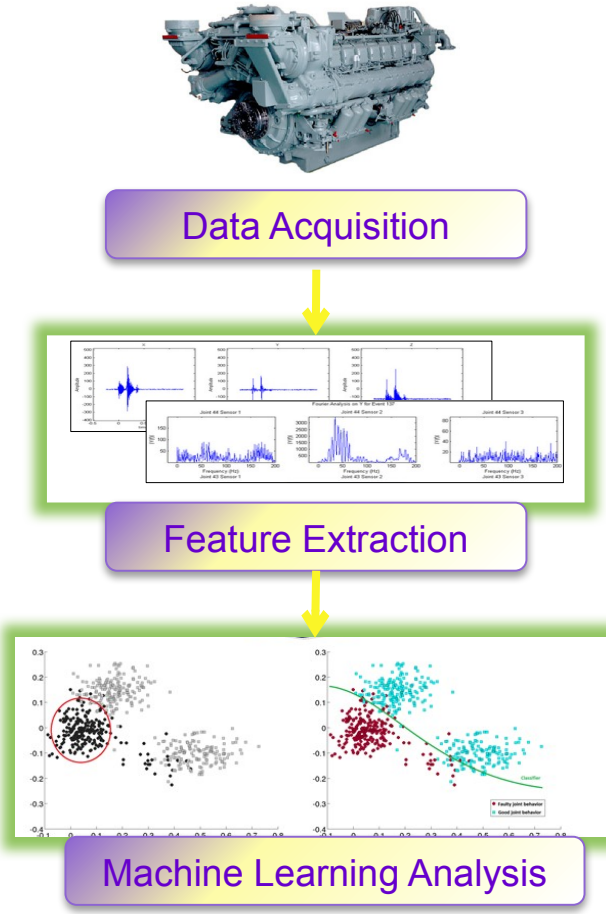
Machine learning was used to analyse data from engines to identify non-typical performance results and flag issues for proactive monitoring

Statistical outlier detection (K-NN, 1-class SVM…**)**

Subsystems (charge air, cooling system…**)**



MTU 12V-396 auxiliary diesel engine for genset application or electric power generation in Navy vessels



Infrastructure: Sewer pipe choke prediction

The Challenge

Sewer pipe chokes can be caused by different reasons, including tree roots, grease, debris and wet wipes.

Factors influencing choke events include:

- **Pipes' intrinsic characteristics** - length, material, diameter, number of previous failures
- **Environmental attributes** - tree coverage, demographical information, weather condition

DSI's Approach

DSI has developed AI-driven model which considers all available factors to predict when and where a new choke event is likely to occur.

The model draws on historical data from previous choke events to inform its predictions and will continually adapt over time, based on learnings from new choke event data.

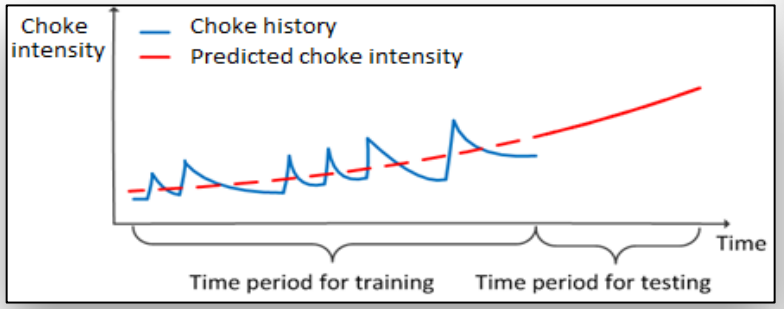


Figure 1 Different choke types

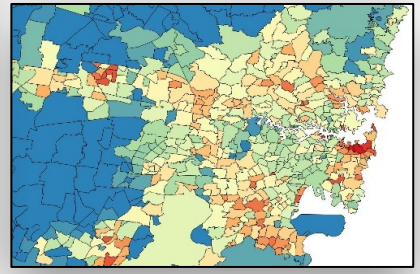


Figure 2 Choke rates for regions

Figure 3 Tree canopy and sewer pipe

Agriculture: Remote data harvesting for farms - land use and land use change (LULUC) estimation

The Challenge

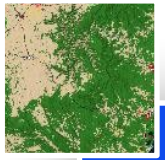
Traditional methods for collecting land use and change data requires collaboration with farm operators to enable site access, provide access to farm records and support data collection.

These methods can be highly disruptive to on-farm activity and time consuming to complete.

DSI's Approach

DSI has developed a remote data harvesting approach which combines drone, camera and manual records data to identify land use, and estimate land use change

DSI can use remote sensing to accurately collect and label land use data, which can then be used to estimate emissions.



Land Use Type Detection

- Identify land use from satellites
- Delineate land use areas
- Work towards better descriptions (e.g., tree density) and high granularity types (e.g., wheat)

Climate change

- Use weather as input
- Consider future scenarios (e.g., disorderly, hothouse, etc.)
- Work towards spatiotemporal granularity

Land use change

- Emissions sequestration with stress-tested scenarios in future climate impacted environments

Community: Automating news analysis

The Challenge

As the volumes of news articles produced globally continues to grow, the task of manually reviewing and analysing news to identify emerging trends is time consuming and unsustainable.

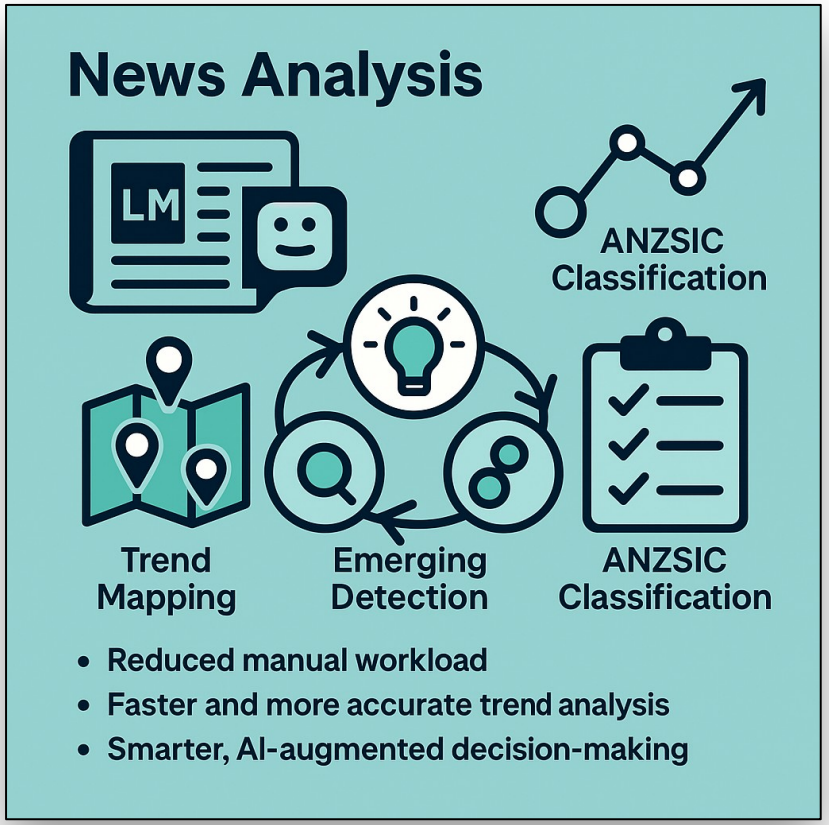
DSI's Approach

DSI has developed a 'Trend Atlas' platform which applies Large Language Models (LLMs) to streamline the process of reviewing and analysing news, to identify trends.

The platform uses:

- Trend Mapping: to match new articles to existing trends
- Emerging Theme Detection: to identify new trend themes
- Theme Linking: to discover relationships between themes
- ANZSIC Classification: to map trends to industry codes

Trend Atlas currently supports 1300+ NSW users in tracking global trends, successfully reducing manual workload and greatly enhancing trend prediction accuracy and speed.



Community: AI-Powered complaint assistant for NDIS

The Challenge

National Disability Insurance Scheme (NDIS) complaint handling is challenging:

- **Participants with disabilities** may struggle to express complaints clearly or in line with NDIS rules
- **Service providers** may respond without empathy or compliance due to stress or lack of training

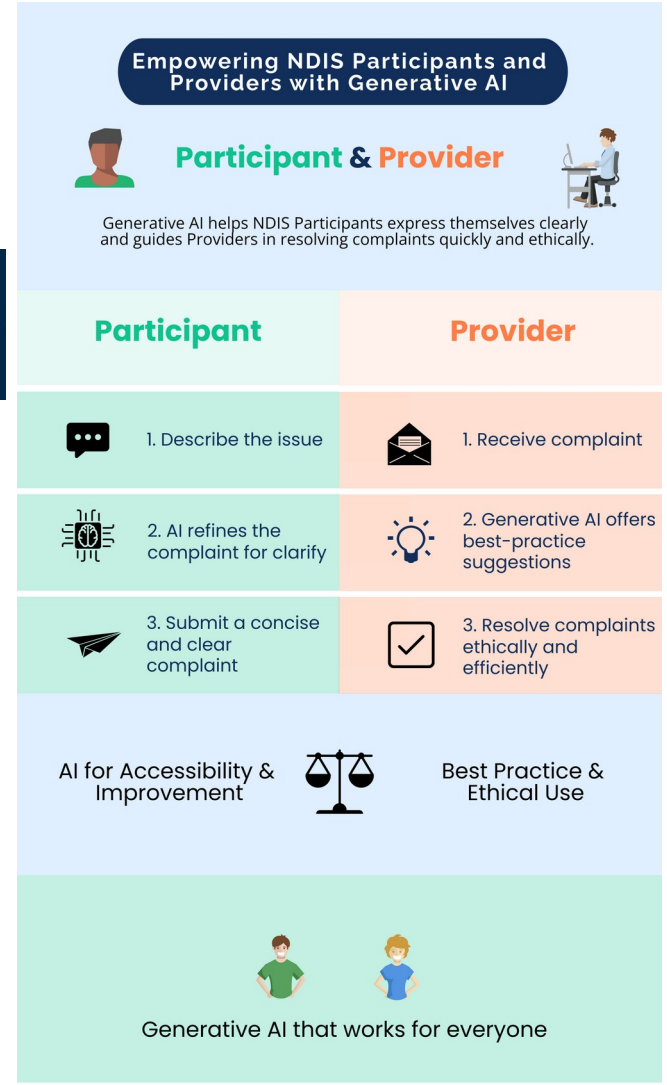
DSI's Approach

We developed two LLM-based assistants aligned with NDIS regulations:

- **Participant Assistant:** Helps express complaints clearly, respectfully, and within NDIS guidelines
- **Provider Assistant:** Generates empathetic, polite, and regulation-compliant responses

The approach promotes fairness and clarity in complaints:

- Supporting both vulnerable users and busy providers
- Demonstrating inclusive AI use in regulated environments



Community: Document Analysis & Compliance Checks

The Challenge

Real estate companies face frequent enquiries regarding legal aspects of the properties they manage, which can be time consuming to research and respond to.

DSI's Approach

DSI collaborated with a real estate company to design and build a private legal QA system, using NSW Fair Trading and other (raining documents, to support legal enquiries.

As part of the project, we:

- Deployed a **local LLM QA system** for legal inquiries
- Created a **reusable chatbot framework** adaptable to new domains
- Used **Corrective Retrieval-Augmented Generation (RAG) & Graph RAG** for smarter retrieval
- Validated with **strata and tenancy agreement** case studies

The system developed by DSI keeps sensitive data secure on-premises and enables a reliable, regulation-grounded support tool for use by staff and clients.

Image is created by GPT-4o

Community: LLM-Supported Business Workflow Automation

The Challenge

Our client was looking to boost efficiency using **intelligent automation to replace** repetitive and time-consuming business workflows.

The goal was to explore whether LLMs could be used to understand task intent and automate actions.

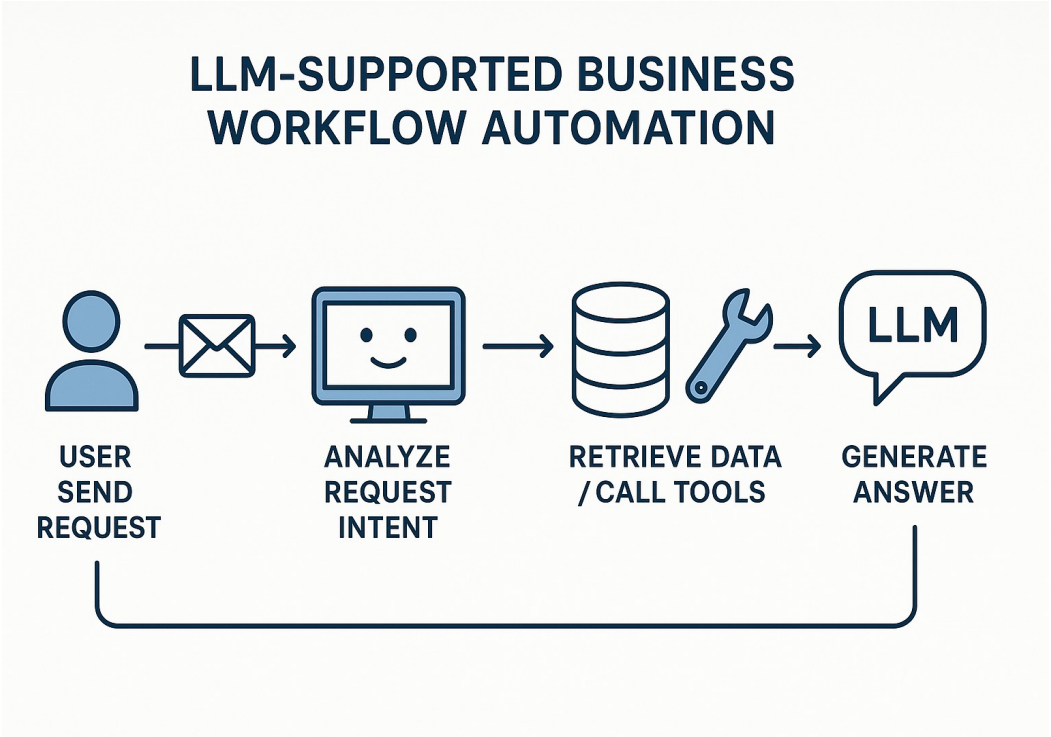
DSI's Approach

DSI collaborated with a real estate company to develop an **LLM Agent Framework** triggered via email, chatbot, or other interfaces, able to:

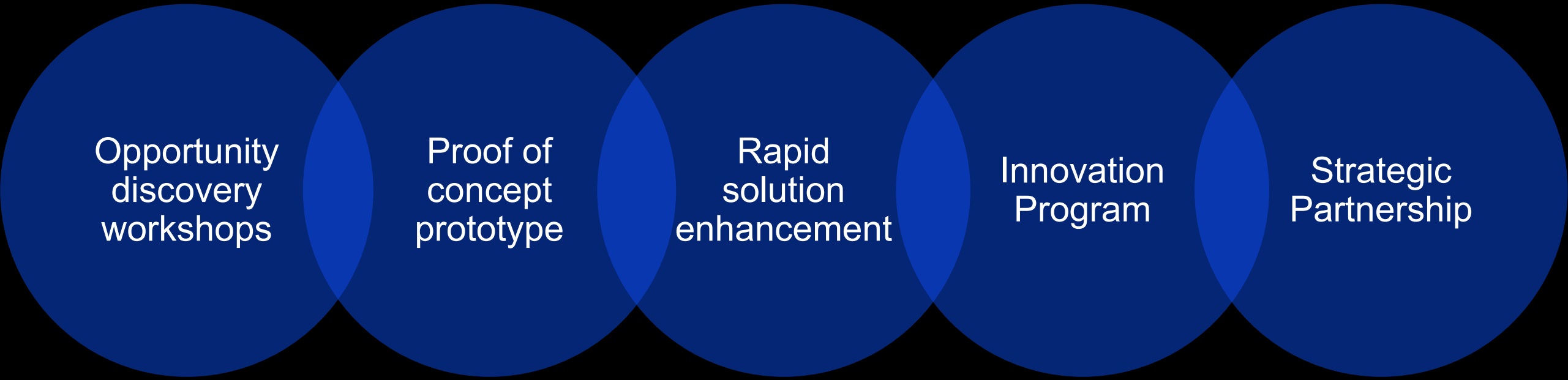
- Interpret user intent, maps to workflows, and **execute tasks**
- Integrate internal systems for **seamless automation**
- Support **full or partial** task automation

The project identified that LLM-supported models can be used to potentially:

- Reduce staff workload on routine tasks
- Improve response speed and consistency
- Be easily extended across teams
- Be used to enable virtual assistants for business operations



How we work



Scope key opportunities based on your challenges, pain points, mission and data environment.

Identify a narrow and measurable objective and build out an exemplar solution.

Take an existing data solution you use and update it using contemporary approaches.

Deliver a complete operational solution to a well-defined problem

Build, test and deploy a suite of innovative, integrated solutions

Mobility: Sydney Real-time Digital Twin

FUTURE MOBILITY LAB
Innovating smart cities

NSW GOVERNMENT | Transport for NSW

arid systems

The Challenge

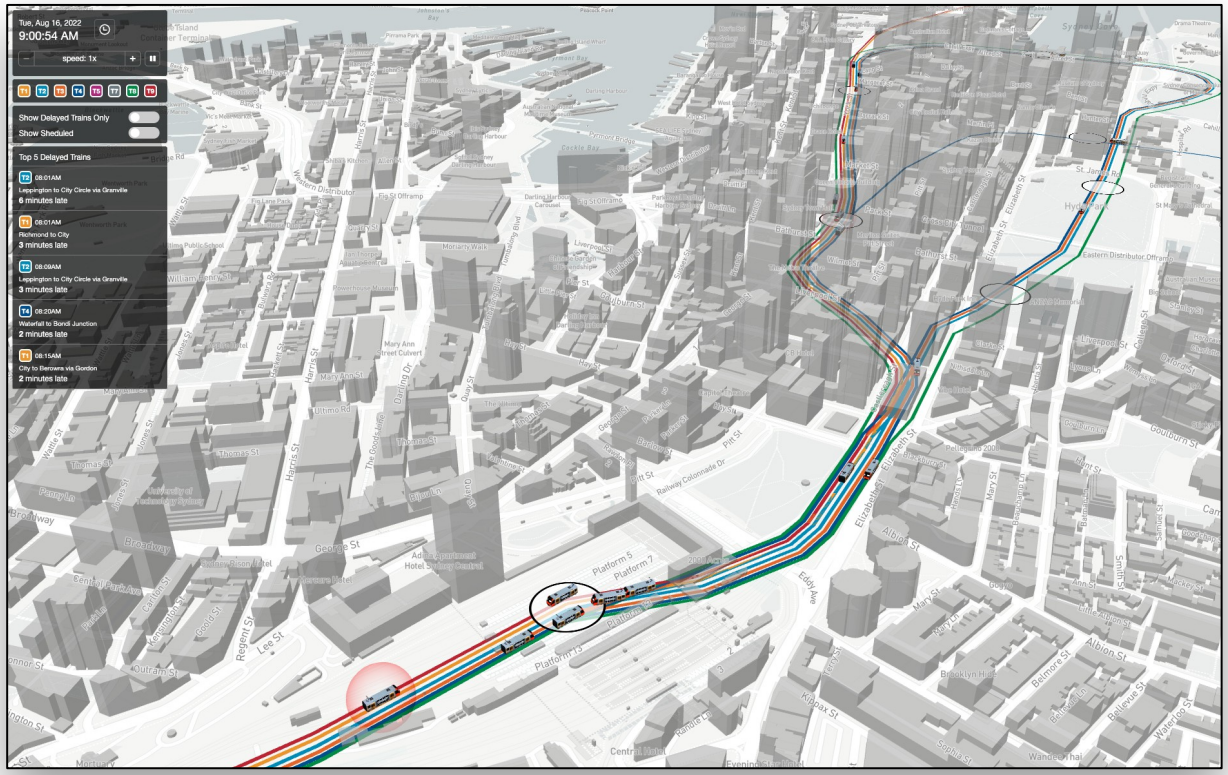
Managing complex transport and infrastructure networks requires the collection and analysis of multiple data sources, often in real time.

Digital Twins simplify the ability to review complex data, or **multiple layers of data in real time**, enabling disruptions to be more rapidly identified and managed, to minimise their impact.

DSI's Approach

UTS Data Science Institute's Future Mobility Lab has developed a **Sydney Real-Time Digital Twin Platform**, which integrates and overlays transport, water infrastructure, air quality and sensor data to a 3D map of Sydney's CBD.

IoT AWARDS 2021



Energy Supply: Minimising energy supply disruption impacts

The Challenge

Customer impact is a key decision-making factor in prioritising scheduled energy disruptions.

Energy companies face the challenge of considering alternative actions and making complex decisions on how to prioritise disruptions, to minimise impacts to their customers activities and businesses.

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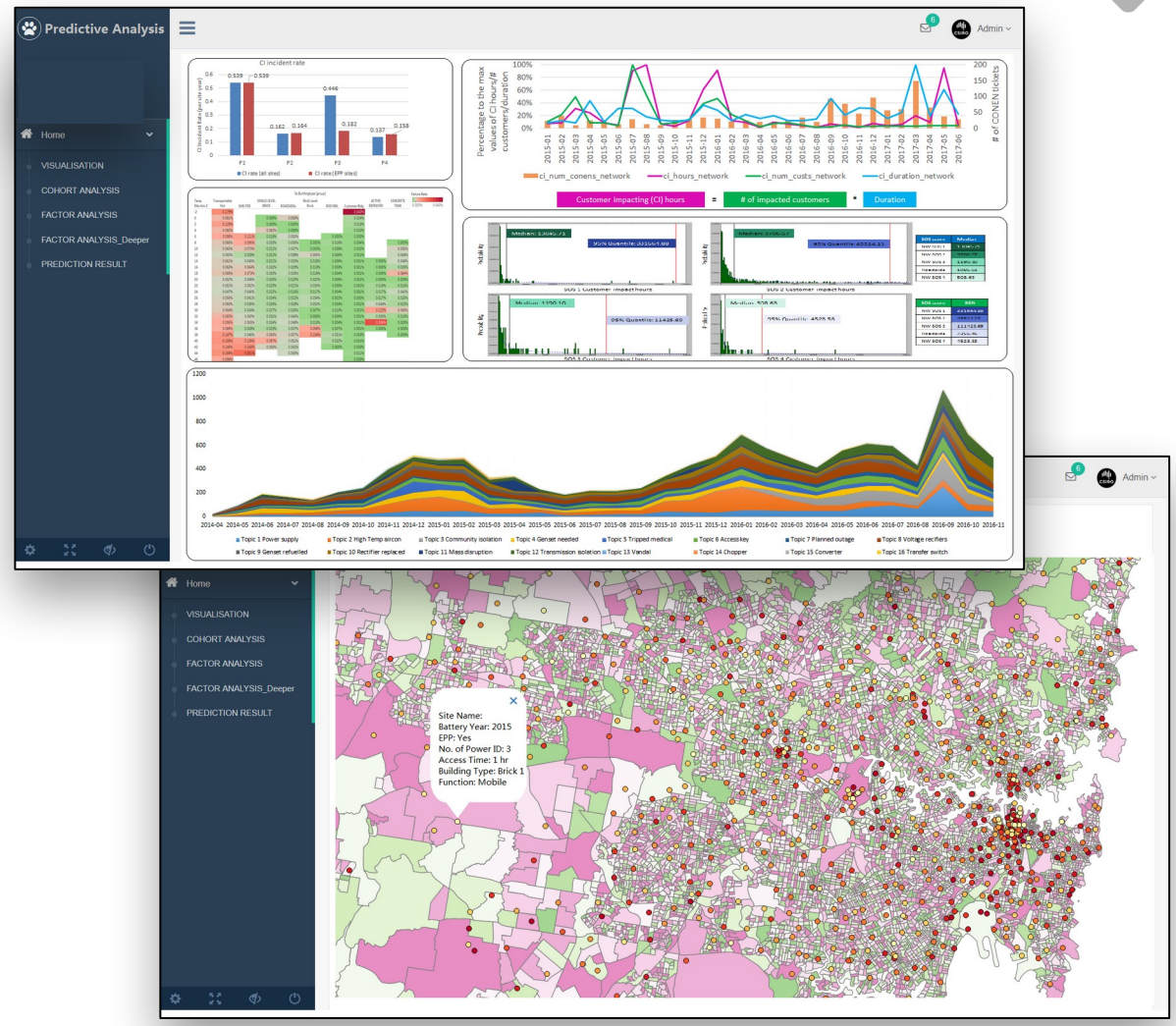
The model uses historical incident records, site load data, battery age and capacity data, power distributor information, and outdoor temperature to identify and prioritise potential fault locations.

This method has enabled 40% more potential network faults to be identified using the same budget and resources as the existing approach used.



What is Responsible AI?

Responsible AI is the practice of developing and using AI systems in a way that provides benefits to individuals, groups, and wider society, while minimising the risk of negative consequences.

Australia's **AI Ethics Principles** provide a great framework to consider whether the AI products and services you use are responsible.

Source: CSIRO

Why do we need Responsible AI?

Because AI is different…

Scale: AI solutions can be far reaching and change over time via learning, making it difficult to anticipate potential societal impacts, if deployed at scale

Opacity: AI solutions may not be transparent on how they work or makes decisions, making them difficult to monitor, validate, predict or explain

Data: AI requires large volumes of complex interconnected data to build models and systems, creating potential risks such as bias, error and privacy breaches

http://homepages.inf.ed.ac.uk/mrovatso/index.php/Main/AIEthics

AI facial recognition scanned millions of driver licences. Then an innocent man got locked up

By technology reporter **James Purtill** for **Science Friction**

ABC Science | Science and Technology

Wed 1 Nov 2023

Watchdog finds AI tools can be used unlawfully to filter candidates by race, gender

UK data regulator says some devs and providers are operating without a 'lawful basis'

Lindsay Clark Fri 8 Nov 2024 10:24 UTC

Air Canada must pay damages after chatbot lies to grieving passenger about discount

Airline tried arguing virtual assistant was solely responsible for its own actions

…and implementing AI responsibly can be challenging to get right.

Melbourne lawyer referred to complaints body after AI generated made-up case citations in family court

Legal professional used software to generate a case citation list, but did not use documents that had undergone human verification

Insight - Amazon scraps secret AI recruiting tool that showed bias against women

AI's 'insane' translation mistakes endanger US asylum cases

AI hallucinations caused artificial intelligence to falsely describe these people as criminals

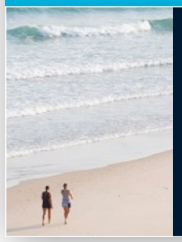
By **Anna Kelsey-Sugg** and **Damien Carrick** for **Law Report**

ABC Radio National | Artificial Intelligence

Mon 4 Nov

Australia's AI Ethics Principles

Human, societal and environmental wellbeing

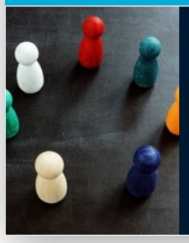


Throughout their lifecycle, AI systems should benefit individuals, society and the environment.

Human-centred values

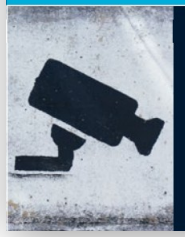
Throughout their lifecycle, AI systems should respect human rights, diversity, and the autonomy of individuals.

Fairness



Throughout their lifecycle, AI systems should be inclusive and accessible, and should not involve or result in unfair discrimination against individuals, communities or groups.

Privacy protection and security



Throughout their lifecycle, AI systems should respect and uphold privacy rights and data protection, and ensure the security of data.

Reliability and safety

Throughout their lifecycle, AI systems should reliably operate in accordance with their intended purpose.

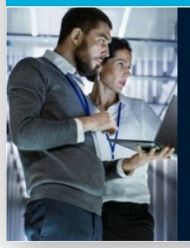
Transparency and explainability

There should be transparency and responsible disclosure so people can understand when they are being significantly impacted by AI, and can find out when an AI system is engaging with them.

Contestability

When an AI system significantly impacts a person, community, group or environment, there should be a timely process to allow people to challenge the use or outcomes of the AI system.

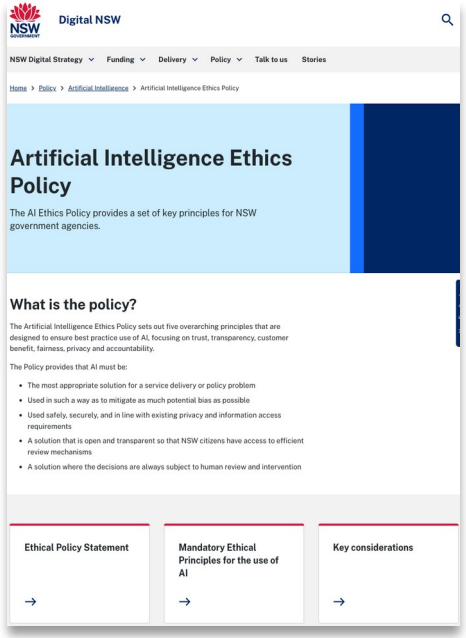
Accountability

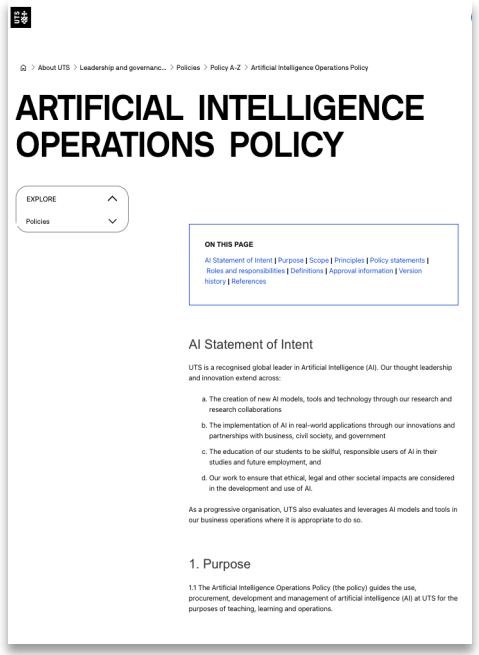


Those responsible for the different phases of the AI system lifecycle should be identifiable and accountable for the outcomes of the AI systems, and human oversight of AI systems should be enabled.

Source: Department of Industry, Science and Resources, Australian Government

AI Ethics principles are now being translated into **actionable guidelines and practices** to shape AI-based innovation, and enable practical deployment.





How can DSI help?

- Support your organisation to integrate AI Ethics principles and policies
- Complete a qualitative and quantitative assessment of your data and systems
- Identify high impact, low risk AI use cases in your organisation
- Undertake a risk analysis of your AI Strategy and deployment plan