



Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

AI Research In Action (ARIA) Programme

Funded PhD Positions in Artificial Intelligence

CKDelta have recently established a research programme in collaboration with the School of Computer Science & Statistics, Trinity College Dublin. The *AI Research In Action (ARIA) Programme* will establish a globally excellent research team which will assist in the application of leading edge AI techniques to a range of real-world problems within the utilities sector.

Trinity College Dublin, located in the heart of Dublin, is Ireland's number 1 university and ranked 87th internationally (QS Rankings 2024). The School of Computer Science and Statistics, Trinity College Dublin is the highest ranked School of Computer Science on the island of Ireland (QS World University Subject rankings 2024) and delivers a collegiate, friendly, and a world-class research-intensive centre for academic study and research excellence attracting scholars of global calibre from across the globe.

CKDelta is headquartered in Dublin, Ireland, and is part of CK Hutchison Holdings Limited, a multi-national conglomerate employing 300,000 people in over 50 countries around the world. CKDelta is an AI software business within the CK Hutchison Holdings Ltd group, leveraging data, expertise and intellectual property on a conglomerate scale. The company has a mission to empower customers with insights that transform decision-making and deliver impact, leveraging assets from across CK Hutchison group companies. CKDelta develop and offer innovative solutions across utilities, retail, financial services, transport and logistics solving digital transformation challenges to promote a safe and sustainable future.

A number of fully funded PhD scholarships are available providing a tax-free bursary of €25,000 per annum for 4 years together with fee payment. Three areas will be addressed in the first instance:

1. *Generative AI*

We are seeking a highly motivated PhD-level candidate in Generative AI, focusing on transformative AI solutions focused mainly in the utilities sector. This role blends cutting-edge research with real-world application, driving innovation in energy, water, and infrastructure systems through GenAI technologies.

Potential GenAI Use Cases in Utilities

1. Automating customer service via LLM-powered virtual agents

2. Enhancing workforce training via AI-generated procedural guides and immersive simulations.
3. Assisting field engineers with real-time AI-generated instructions from equipment manuals as knowledge sharing that combine company proprietary documentation, back end systems life data and external documentation to support mobile field service workforces
4. Multi modal models that combine voice, text, drawings and pictures to assess the most impactful activities.
5. Enabling natural language querying of utility data dashboards.
6. Creating proactive customer communications using GenAI-tailored content.

What GenAI Will Bring to the Future

- Self-learning infrastructure systems capable of continuous optimization.
- AI-powered digital twins that evolve through generative simulations.
- Cross-utility interoperability through multi-agent GenAI coordination.
- Hyper-personalized customer engagement at utility scale.

The PhD would address a number of the following Research Topics:

- Retrieval-Augmented Generation (RAG) for structured/unstructured utility data.
- Multi-modal and multi-agent GenAI for operational environments.
- Multi agent communication & human communication protocols
- Energy-efficient and domain-adapted LLMs.
- Safety, explainability, and hallucination mitigation in high-stakes domains.
- Prompt engineering and fine-tuning for utility-specific applications.
- Scalable GenAI architectures for time series, geospatial, and sensor data.
- Human-in-the-loop GenAI workflows for decision-critical processes.
- Evolution of human skills over time with Gen AI agents as assistants for long periods of time.
- Large language models evaluation versus small language models and Mixture of experts.
- Virtual customers generated through customer interaction transcripts.

Preferred Qualifications

- MSc in Computer Science, AI or cognate field.
- Experience with utility industry data or use cases is a plus.
- Excellent communication and collaboration skills.

2. Predictive Maintenance

One of the key challenges that many industries face is how to optimise the maintenance of their assets and equipment, while minimising the costs and risks of failures. Predictive maintenance is a

data-driven approach that uses AI to monitor the condition and performance of assets and importantly to predict when they need servicing and/or replacement. This facilitates maintenance scheduling at the optimal time, avoiding unnecessary downtime, reducing operational expenses, and improving safety and reliability.

Predictive maintenance can be applied to various types of assets, such as pumps, valves, turbines, generators, boilers, compressors, pipelines, cables, and transformers. By collecting and analysing data from sensors, historical records, weather history & forecasts, and other sources, predictive maintenance models can identify patterns and anomalies that indicate the health and degradation of the assets. These models can also provide recommendations and alerts for preventive actions, such as adjusting the settings, cleaning, repairing, or replacing the components.

CKDelta is working with Northumbrian Water and Northern Gas Networks on projects that would benefit from the use of predictive maintenance techniques.

3. Early Warning Systems

Early warning systems are a set of tools and methods that aim to detect, monitor, and forecast potential threats or disruptions to utilities companies. In the case of the water industry, it provides benefits in cases such as leaks, bursts, floods, sewerage overflows and blockages. By combining IoT sensor data from various sources, such as flow meters, pressure gauges, water quality sensors, and smart valves, combined with weather historical and forecast data an early warning system can provide timely and accurate information to water operators, managers, and customers, enabling proactive and preventive actions to mitigate the impacts of water-related hazards.

The objective of this piece of work is to provide an early warning system that can improve the efficiency, reliability, and resilience of the water network, reduce operational and maintenance costs, enhance customer satisfaction and trust, and protect public health and the environment.

CKDelta is working with Northumbrian Water to create an early warning system.

Applications ought to have a 2.1 or 1 Degree in Computer Science or cognate discipline and/or an M.Sc in Computer Science/cognate discipline. Applications will be received until the positions are filled.

Prospective candidates would be expected to have an interest in several of the following areas: Artificial Intelligence, Multi-Agent Systems, Machine Learning, Data Analytics, IoT systems & Ubiquitous Sensing. Interested parties should send a detailed academic Curriculum Vitae together with a letter of application indicating their interest in research, Trinity College and the ARIA programme, to Professor Gregory O'Hare Gregory.OHare@tcd.ie with a subject Heading ARIA Application.