SUPERVISORS & RESEARCH TOPICS

Contents

UCD School of Computer
University College Dublin,
Belfield, Dublin 4, Ireland
www.ucd.ie/cs

Dr Abraham Campbell
https://people.ucd.ie/abey.campbell

I am Director of UCD VR lab exploring the use of a Augmented Reality and Virtual Reality in STEM education and its applications in the wider world.

I have supervised 4 PhD student to completion and currently have two PhD about to enter their final year. I previously mentored one postdoc in the past and I have a Post Doc funded through IRC that will be join me in September to explore the use of VR/AR in Veterinary education . I am a funded investigator for the CONSUS SFI centre and a funded investigator on the EU pilot funded AHA – AdHd Augmented project.
(max 140 words)

Research topic proposed for the Postdoctoral Fellowship call

Virtual Reality and Augmented Reality use with LLM powered AVATAR's as learning assistants and guides.

Virtual Reality and Augmented Reality use for home improvements such as solar panel/ wind mill placement using a VR/AR assistant to aid in decision making.

Keywords

- VR/AR
- LLM / GPT4
- AI powered Avatar's
- VR/AR assistant decision making

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University College Dublin,
Belfield, Dublin 4, Ireland
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Dr Alzubair Hassan

https://people.ucd.ie/alzubair.mohamedtahir

Dr Alzubair Hassan received his B.S.c. in Computer Science from the University of Kassala in 2010. He received his M.Sc. in Mathematical Science from the University of Khartoum in 2013. He received his Ph. D. in computer science and technology from the University of Electronic Science and Technology of China in 2018. Currently, he is an assistant professor at the School of Computer Science, University College Dublin. In addition, he was a postdoctoral researcher at the School of Computer Science and Cyber Engineering at Guangzhou University. Furthermore, he was a research scientist at the School of Computer Science, University College Dublin. He was also a researcher at Lero - the Irish Software Research Centre, as part of the CyberSecurity4Eroupe Project. His research interests include cryptography, network security, privacy-preserving in machine learning, and adaptive security.

Research topic proposed for the Postdoctoral Fellowship call

- Adaptive Privacy preserving in ML/federated machine learning using homomorphic encryption.
- Verifiable Computation over encryption data.
- Group authentication protocol for Unmanned Aerial Systems (UAS).
- MATE attack detection for Software Defined Network using machine learning.

Keywords

- Homomorphic encryption
- Privacy preserving
- Adaptive security
- Authentication
- Homomorphic signature
- Machine learning
- MATE attack
- Software Defined Network

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Belfield, Dublin 4, Ireland
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Dr Anca Jurcut

https://www.cs.ucd.ie/AcademicProfile/AncaJurcut/

Assistant Professor (Tenured) in the UCD School of Computer Science since 2015. Researcher with 15 years of experience in the area of Data and Network Security, Security for Internet of Things (IoT), Design of Security Protocols, Attack Detection and Prevention, Formal Verification and Application of Blockchain Technology in Security and Privacy, Cybersecurity and Machine Learning for Security.

Dr. Jurcut has an excellent international collaboration resulting in research papers publication, submission of funding proposals or organisation of tutorials and tool demos on formal verification and cybersecurity. She is a H2020 expert reviewer and on the review committee for successful H2020 proposals for the European Commission. She contributed to the successful proposals for the H2020-MSCA, H2020, IRC and SFI. She successfully supervised 3 PhD students, who are currently postdocs in UCD or working for big network provider companies. She is currently leading a team of 8 researchers. She has published a book and more than 85 scientific papers in peer-reviewed journals and conferences in the cybersecurity area and received several best paper awards including from IEEE MCE.

Research topic proposed for the Postdoctoral Fellowship call

Topic 1: Novel Framework including new Generated Dataset for Accurate Anomaly Attack Detection in Software-Defined Networking (SDN)
Topic 2: Ransomware Detection using Machine Learning Approaches and Generation of a Comprehensive Dataset with the Current Ransomware Samples
Topic 3: Intrusion Detection: Zero Day Attack Detection for the Multi Environment (SDN, IoT, etc) using Hybrid Machine Learning Approaches
Topic 4: Blockchain integrated security enhancements for future Vehicle-to-Everything (V2X) communications or for the healthcare systems
Topic 5: Design of New Security Protocols and their Formal Verification

Keywords

- Attack Detection
- Network Security
- Security Protocols
- Formal Verification
- Security for IoT
- Intrusion Detection Systems
- Cybersecurity
- Blockchain
- Software -Defined Networking
- MEC Security & Privacy

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Dr Andrew Hines

qxlab.ucd.ie, people.ucd.ie/andrew.hines

Research in data driven modelling for Multimedia, speech and listening technology applications.

My research group, QxLab, currently has 3 postdoctoral fellow and 6 PhD students. We have active collaborations with multinational companies (e.g. Google and Xperi Corp) and have recently participated in a European Horizon 2020 Research Consortium using machine learning for Stroke Rehabilitation decision support systems. The group has postdocs with a range of experience. I seek to mentor and match the research fellows activity to their career goals. Previous postdocs in the group have gone on to careers in academia as lecturers (2), started their own company (1) and working in industry (2).

Research topic proposed for the Postdoctoral Fellowship call

- Teleconferencing and/or codec quality prediction models
- Movie dialogue understandability enhancement models
- Health diagnostics: Deep learning models for acquired neurological speech disorders
- Music Quality for Cochlear Implant Users using AR/VR

Keywords

- Self-supervised learning (e.g. wav2vec2)
- Data driven models
- Quality of Experience
- Speech
- Audio
- Multimedia

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Belfield, Dublin 4, Ireland
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Dr Colm J. Ryan

https://cancerdata.ucd.ie/

The UCD Cancer Data Lab are a supportive and collaborative interdisciplinary research group based in the Conway Institute and affiliated with the School of Computer Science in University College Dublin. Researchers in the group come from a variety of backgrounds including computer science, genetics, and biochemistry. We are broadly interested in understanding how mutations in cancer alter molecular interaction networks and in identifying ways to target these alterations therapeutically. We use machine learning and network analysis approaches to identify new drug targets in cancer. We have strong collaborations with with experimental groups at the Wellcome Sanger Institute & at the Institute of Cancer Research in London.

I have previously supported two successful applications for MSCA Co-funded postdoctoral fellowships.

Research topics proposed for the Postdoctoral Fellowship call

- Active learning to map biological networks
  - Many biological networks are too large to map comprehensively experimentally (e.g. ~200 million gene pairs in humans)
  - Can we use an active learning approach to identify the most informative edges to sample experimentally? E.g. sampling 50,000 edges at a time.
- Generative models for functional ncRNAs
  - Generative models have been widely used to predict functional proteins, peptides, and antibodies
  - The goal of this project would be to develop generative models capable of generating functional non-coding RNAs
- Predicting & explaining genetic dependencies in individual tumours and cell lines
  - Genes that are essential in subsets of cancer cells can make good drug targets, as they may be targeted without killing health cells
  - Explaining why a given gene is essential in a given cell line or tumour is necessary in order to target that gene therapeutically.
  - The goal of this project would be to develop explainable models that can use diverse data (genomes, proteomes, transcriptomes) to explain why gene is essential in a specific context.

Keywords

- Bioinformatics
- Computational Biology
- Networks
- Cancer
- Precision-medicine
- Machine learning
- Evolution

UCD School of Computer
University College Dublin,
Belfield, Dublin 4, Ireland
www.ucd.ie/cs

Dr David Coyle

www.davidcoyle.org
https://scholar.google.co.uk/citations?user=9d9bOOUAAAAJ&hl=en

I am an Associate Professor with the School of Computer Science. My research focuses on Human Computer Interaction (HCI) and digital health, in particular digital mental health. From 2017-2021 I led the TEAM ITN, an EU Marie Skłodowska-Curie PhD training network in Digital Mental Health. My work has had a significant impact, including regular publications, large-scale deployments, and two successful spinout companies. Outside of the mental health space I have led HCI teams on projects exploring digital epidemiology, smart home technologies, and rehabilitation for cardiovascular disease and cancer. I am a Funded Investigator with the Insight SFI Research Centre for Data Analytics and the Adapt SFI research Centre for AI-Driven Digital Content Technology. Prior to joining the UCD I was a Senior Lecturer at the University of Bristol and Marie Curie Research Fellow at the University of Cambridge. I have earned competitive funding in excess of €7.5 million, including €5.2 million as Principal Investigator.

I am Director and founding member of the **HCI@UCD group**. HCI@UCD is an interdisciplinary research group bringing together designers, computer scientists, social and cognitive scientists. We have core research interests in areas including digital health technology, conversational user interfaces, user autonomy, and ethical aspects of design for HCI.

Research topic proposed for the Postdoctoral Fellowship call

I am interested in proposals in Digital Mental Health, Human-Centred AI in healthcare, and in Human Computer Interaction more broadly.

Potential applicants are expected to be highly driven, and capable of both setting their own research agenda and contributing to the broader HCI group.

There is an expectation that the researcher will target high impact conferences with HCI (e.g. ACM CHI) and also relevant inter-disciplinary journals.

Keywords

- Digital mental health
- Digital Health
- Health Technology
- Human Computer Interaction
- Human-centred computing
- Human-centred AI
- Implementation Science, Agency
- Autonomy
- ACM CHI conference

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Belfield, Dublin 4, Ireland
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Dr Deepak Ajwani

https://people.ucd.ie/deepak.ajwani

Dr. Ajwani is an Assistant Professor in the School of Computer Science. His research interest lies at the intersection of machine learning, algorithm design and analysis, algorithm engineering and combinatorial optimisation. He has extensively published in top venues in these areas.

He is currently supervising four PhD students that focus on developing machine learning techniques for algorithm design and analysis. Prior to his current role in UCD, he worked at Nokia Bell Labs where he actively recruited and mentored five Postdoctoral researchers. He was awarded his PhD degree from Max Planck Institute for Informatics, Germany in 2008.

Research topic proposed for the Postdoctoral Fellowship call

I am interested in working on combinatorial optimisation algorithms, particularly for classical graph and geometric problems. Example of topics I am interested in (but not limited to):

- Learning-augmented Algorithms/ Data-driven algorithm design
  - Learning techniques to make the optimisation algorithms more efficient
  - End-to-end machine learning techniques that integrate insights from the optimisation algorithms
  - Leveraging learning techniques to design approximation algorithms based on rounding techniques
- Learning techniques for algorithm analysis

Keywords

- Combinatorial Optimisation
- Graph Algorithms
- Geometric Algorithms
- Learning Augmented Algorithms
- Reinforcement Learning
- Learning-to-Prune
- Graph Neural Networks

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University College Dublin,
Belfield, Dublin 4, Ireland
www.ucd.ie/cs

Dr Dimitris Chatzopoulos

https://people.ucd.ie/dimitris.chatzopoulos

Dimitris research foci are on the intersection of mobile computing, distributed systems, and artificial intelligence. He currently focuses on data marketplaces and privacy-aware decentralized systems, learning and analytics. More specifically, the current focus is on the three-way trade-off between (i) financial benefits from selling personal data, (ii) quality of experience (QoE) improvements in personalized services that access, for free, personal data and (iii) data privacy. His research aims to develop (i) an AI-assisted decentralized marketplace that offers users of mobile devices a quiver to earn money without sacrificing their QoE and privacy, and (ii) an auditable, uncontrollable, and decentralized fake news detection platform. The tools he is utilizing are from distributed ledgers, smart contracts, mobile computing, federated learning, explainable AI, data analytics, game theory and others.

Dimitris is currently supervising three PhD students, and one research assistant while by September 2023 the fourth PhD student and one postdoctoral fellow will join his group. Dimitris is actively collaborating with research groups in Hong Kong, China, Greece, Ireland, Netherlands, United Kingdom, Italy, Denmark, and Finland.

Research topic proposed for the Postdoctoral Fellowship call

Data and AI model marketplaces
Explainable AI-based techniques on data privacy

Keywords

- Data marketplaces
- AI model marketplaces
- Explainable AI
- Privacy
- Decentralisation
- Smart contracts
- Fake news

UCD School of Computer
University College Dublin,
Belfield, Dublin 4, Ireland
www.ucd.ie/cs

Dr Liliana Pasquale
lili-pasquale.lero.ie

I am interested in the design and implementation of:

Self-protecting cyber-physical systems (**CPS**) that are able to continuously protect assets from harm even when security goals and requirements, the system itself, and/or the operating environment change at runtime.

Forensic-ready CPS that can store data in advance that maybe relevant to investigate potential security incidents and provide potential evidence to investigators

I have successfully co-supervised 2 PhD students to completion: Dr. Faeq Alrimawi and Dr. Mazen Azzam. I have also supervised 2 Postdoctoral researchers who are currently employed as Assistant Professors in two different universities in Ireland.
I am currently supervising 5 PhD students working on the above topics.

Research topic proposed for the Postdoctoral Fellowship call

- Identification and resolution of incompleteness in Security Requirements using Natural Language Processing techniques.
- Definition of requirements and architecture metrics to predict vulnerabilities in software systems.
- Development of software systems that are sustainably secure.
- Securing software systems based on threat models variability at design time and at runtime.
- Security assurance cases at runtime for highly compositional software (smart home, supply chain).
- Generation and prioritization of hypotheses about criminal activities for digital investigators from the data collected by a forensic-ready system.

Keywords

- Security Requirements
- Natural Language Processing
- Security metrics
- Vulnerability prediction
- Forensic-ready software systems
- Sustainable security
- Threat model variability
- Security assurance cases

UCD School of Computer
University College Dublin,
Belfield, Dublin 4, Ireland
www.ucd.ie/cs

Dr Mohamed Saadeldin

https://people.ucd.ie/mohamed.saadeldin

Dr. Mohamed Saadeldin received a B.Sc. (honours) in electrical & electronic engineering from the University of Khartoum, Sudan, in 2005. He was awarded the Ph.D. degree in computer science from University College Dublin (UCD), Ireland, in 2013. He is currently an assistant professor at UCD school of computer science. Dr. Saadeldin worked previously as postdoctoral researcher at University College Dublin & also at King Abdullah University of Science and Technology (KAUST).
During his academic career he mentored and co-supervised a number of master and PhD students, and led various projects and programs within the institutes where he has been working. His early research focused on digital signal processing, indoor location systems, and human machine interface/interaction, recently he shifted his research interest to deep learning and computer vision. Dr Saadeldin authored and co-authored 30+ publications, including IEEE transaction journals, several conference papers, and a book chapter.
His full publication list is at this link.

Research topic proposed for the Postdoctoral Fellowship call

- Tokenizers in Vision Transformer
- Hybrid CNN-Transformer models for better computer vision tasks
- Application of Deep Learning Techniques in Ultrasound Fetal Heart Images

Keywords

- Deep Learning
- Computer Vision
- ViT
- Tokenizer
- ML for medical applications

UCD School of Computer
University College Dublin,
Belfield, Dublin 4, Ireland
www.ucd.ie/cs

Dr Nhien-An Le-Khac

https://people.ucd.ie/an.lekhac

Assoc. Prof. Le-Khac is the director of UCD ASEADOS lab (https://aseados.ucd.ie/) and co-director of UCD Forensics and Security Research group with 5 academic staffs and more than 10 PhD students. His research interests spans the area of Cybersecurity, AI Security, Digital Forensics, and Security of Machine Learning and Smart IT systems. He is currently the Programme Director of MSc programme in Forensic Computing and Cybercrime Investigation (UCD MSc FCCI).

Under the supervision of Assoc. Prof. Le-Khac, 6 PhD. students were graduated, and two of them are currently permanent university lecturers. Assoc. Prof. Le-Khac is supervising to success 3 PhD students through national and international collaboration projects such as NSF-SFI-NI. He also supervised successfully two post-docs in the EU H2020 CERBERUS €2.4M project, where he is an UCD PI. Besides, Assoc. Prof. Le-Khac supervised two research fellows in an EI commercialisation €495K project, which is recently turned to a start-up run by his research fellow. He is an author and editor of 3 books and has published 200+ scientific papers in peer-reviewed journals and conferences in related research fields with 4 best paper awards recently.

Research topic proposed for the Postdoctoral Fellowship call

Topic 1: *Robust and Secure AI-Based Framework for Earth Observation Data*

Topic 2: *AI-based framework for the end-to-end analysis of crypto-laundering*

Topic 3: *A verification and assessment framework for online AI-generated content*

Keywords

- Cybersecurity
- Deep Learning
- AI Security
- Digital Forensics
- Earth Observation data
- Adversarial AI
- Adversarial Drifts
- Financial cybercrime
- Crypto-laundering
- AI-generated content
- Adversarial attacks
- Threat Models
- Explainable AI

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University College Dublin,
Belfield, Dublin 4, Ireland
www.ucd.ie/cs

Dr Nima Afraz

https://people.ucd.ie/nima.afraz, https://nima.ie

Nima Afraz is an Assistant Professor in the School of Computer Science, at University College Dublin. He is a funded investigator at the CONNECT Research Centre and his research focuses on Open Radio Access Networks, blockchain applications in telecoms, economics of networks and network virtualisation. Nima is a recipient of the government of Ireland postdoctoral fellowship and worked as a postdoctoral fellow to address the challenges in the adoption of blockchain technology in telecommunications. Nima is the vice-chair of the Linux Foundation's Hyperledger telecom special interest group.

Nima is currently supervising several PhD students and Postdocs that focus on addressing research challenges around open radio access networks, distributed decision-making affecting network performance, and wireless/optical network and network infrastructure sharing. Nima is a co-coordinator of a European MSCA Staff exchanges project addressing network connectivity challenges in multi-modal public transport.

Research topic proposed for the Postdoctoral Fellowship call

Intelligent Open Radio Access Networks
Access-Edge-Cloud Telecom network slicing
Customisable Multi-Vendor network deployment
Software Defined Networks and Network Virtualisation
Network Infrastructure sharing in Multi-Tenant deployments
Network performance monitoring and Service Level Agreement enforcement
ML/AI Based network performance prediction and infrastructure provisioning
Scalable distribution of network control functions in wireless/optical networks

Keywords

- Open RAN
- Wireless/Optical
- Network Sharing
- Network Slicing
- Optical Networks
- Wireless Networks
- Network QoS
- SDN
- NFV

UCD School of Computer
University College Dublin,
Belfield, Dublin 4, Ireland
www.ucd.ie/cs

Dr Rem Collier

https://people.ucd.ie/rem.collier

Hypermedia Multi-Agent Systems, Agent Based Modelling, Smart Agriculture, Microservices

My core research interests lie at the intersection of Multi-Agent Systems (MAS), Semantic Web and Microservices. I am particularly interested in the recently proposed area of Hypermedia MAS and the potential use of such technologies in modern software architecture. Areas in which I am applying these techniques include: Distributed Knowledge Graphs, Decision Support Tools, Digital Twins and Agent-Based Modelling & Simulation.

Currently I am working in the area of Precision Agriculture. I am Lead-PI of CONSUS (Crop Optimisation through Sensing, Understanding and viSualisation) where I am working on Cognitive Digital Twins and a Co-PI on CAMEO (Creating an Architecture for Manipulating Earth Observation data) where I am working on Intelligent Data Processing Pipelines and applications of remote sensing in Agriculture. To date I have supervised 10 PhD students and 1 MSc student to completion

Research topic proposed for the Postdoctoral Fellowship call

I am interested in working in an area that explores the intersection of Multi-Agent Systems, Semantic Web and Microservices architecture.

- One area I am interested in exploring further is their use in the design of Cognitive Digital Twins that leverage microservices architecture to construct distributed knowledge graphs that expose knowledge to higher-level decision support services.
- Another area of interest is Urban Simulation through an approach known as Hypermedia MAS Simulation that exploits knowledge graphs and microservices to build distributed agent-based simulations.

Keywords

- Multi Agent Systems
- Semantic Web
- Microservices
- Digital Twins
- Decision Support Tools
- Precision Agriculture
- Smart / Sustainable Cities

UCD School of Computer
University College Dublin,
Belfield, Dublin 4, Ireland
www.ucd.ie/cs

Dr Ruihai Dong

https://people.ucd.ie/ruihai.dong

Dr Ruihai Dong's research interests lie broadly in Machine Learning, Deep Learning and Natural Language Processing and their applications in recommender systems, finance and geology. He has published over 60 papers in top peer-reviewed journals and conferences such as IJCAI, WWW, AAAI, ACL, IUI, RECSYS etc.

Dr Ruihai Dong has supervised three PhD students who graduated successfully, and he is currently supervising six PhD students in the following three directions: Recommender Systems, AI-first Finance, and Semi-supervised Medical Image Analysis.

The Next Generation of Recommender Systems

We are focusing on developing the next generation of recommender systems and personalisation technologies. These new techniques will learn about our preferences from a wider range of data sources and use this deeper understanding of our needs to make more relevant recommendations and so inform more effective decision-making across a wide range of application domains. In addition, to address the challenge of ensuring trustworthy recommender systems, we are interested in the project to improve the transparency and explainability of recommendation algorithms and are also interested in developing a multi-purpose simulation environment for studying the dynamics of user behaviours.

Knowledge Graph and Graph Evolution for Financial Prediction Explanation

Artificial intelligence-based knowledge extraction from unstructured data and from various sources enables machines to understand relationships between companies, people, products, etc. and enables machines to detect relevant real-time events. We are interested in the projects to generate dynamic knowledge graphs and further harness these generated dynamic graphs and such as event detection techniques to make financial predictions and generate prediction explanations.

Keywords

- Recommender Systems (RS)
- Customer Reviews
- Explainable RS
- Recommendation Simulation Framework
- Knowledge Graph
- Event Detection
- Financial Prediction

UCD School of Computer
University College Dublin,
Belfield, Dublin 4, Ireland
www.ucd.ie/cs

Dr Simon Caton

https://people.ucd.ie/simon.caton
https://www.ucd.ie/quantum/

My research has always focussed on the applications of machine learning to a wide variety of problem domains. I have been publishing machine learning related work since 2008. At present, I am looking to extend my group in the applications of machine learning within the quantum computing domain. Specifically in reinforcement learning for quantum control and the use(s) of machine learning for quantum algorithm design and development. I am one of UCD's founding members of the UCD Centre for Quantum Engineering, Science, and Technology (C-QuEST) and offer one of the few quantum machine learning taught graduate courses currently available in Europe. Within C-QuEST there are plenty of collaboration opportunities between the schools of Physics, Maths & Stats, Engineering, and Computer Science.

I have supervised 3 PhD students to completion (two now hold faculty positions), with another 3 currently pursuing their PhD. I have one postdoc in my group currently, and have mentored another 4 in their transition from early career researcher to faculty member.

Research topic proposed for the Postdoctoral Fellowship call

The ideal candidate for me would have obtained (or be about to obtain) a physics PhD. You would have worked in quantum control, many body systems, quantum algorithms, VQE, etc. and have a significant interest in effectively leveraging machine learning methods in your work, or in general working with machine learning for/with quantum computing.

Example proposals I could imagine submitting are (but not limited to) using machine and/or reinforcement learning for:

- the control of quantum systems,
- quantum error correction,
- quantum machine learning (quantum kernels, QNNs etc.), and
- quantum program synthesis

Keywords

- Quantum Computing
- Machine Learning
- Reinforcement Learning
- VQML
- Quantum Control

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Belfield, Dublin 4, Ireland
www.ucd.ie/cs

Dr Vivek Nallur

https://viveknallur.github.io/

I work in the area of Machine Ethics and Multi-Agent Systems. It is an inter-disciplinary area that seeks to understand, and address the challenges involved in ensuring that AI-enabled systems can be imbued with ethical reasoning mechanisms, and be sensitive to human values. I investigate machine ethics from various perspectives, and develop practical solutions to ethical dilemmas arising from the integration of machines into decision-making.

I currently have four PhD students, at various stages of their research journey, some focussing on uncertainty and bias in decision-making, and others focussing on framework for ethical reasoning in elder-care robots. I am a Senior Member of the IEEE. I am also a full voting member on the IEEE P7008 Standards committee for Ethically Driven Nudging for Robotic, Intelligent and Autonomous Systems.

I am the co-PI on an inter-disciplinary IRC COALESCE project that attempts to use multi-agent system modelling to compute whether existing (or modifications of) rules result in human rights violations of economic migrants into Ireland.

Research topic proposed for the Postdoctoral Fellowship call

- Eliciting human ethical preferences in a few-shot interactions, and translating them into behavioural rules for agents
- Providing causal explanations for autonomous decisions
- Detecting human cognitive biases from few-shot interactions in sequential decision-making tasks
- Detecting emergent properties from mixed human-AI interactions

Keywords

- Machine Ethics
- Multi-Agent Systems
- Cognitive Bias Detection
- Uncertainty
- Decision-Making