SUPERVISORS & RESEARCH TOPICS

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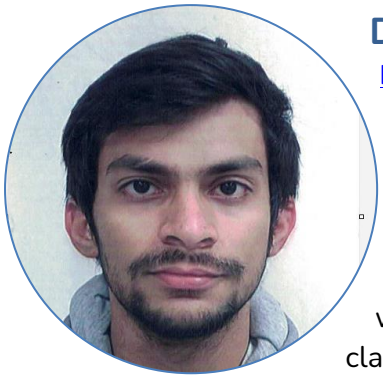

Dr Arjun Pakrasi
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My current research focus is on robust and explainable machine learning algorithms and models. This is a particularly important problem to address in making responsible AI, as AI products become closer daily to their users in decision-making. I have also worked actively on multi-label classification and ensemble classification methods, which I continue to work on. Along with this, I also work and have worked on challenging data science projects in domains such as finance, digital agriculture, environmental science, and social science.

I am co-supervising one PhD student and on awaiting a PhD student, and another student on a funded project to work under my supervision starting next semester. Previously, I have mentored three PhD students. I have collaborated with industry and academic partners before, with projects spanning domains like finance, digital agriculture, greenhouse gas, and social science. I am actively collaborating with universities in Ireland, Italy, India, and USA.

Research topics of Interest for the MSCA Postdoctoral Fellowship

Topic 1: Abstention Prediction
To build effective machine learning algorithms to train models which will abstain from prediction, unless it is “sure enough” about the prediction.
Topic 2: Robust machine learning models with explanation
Build machine learning algorithms and/or models which makes the prediction to be robust as with human-understandable and actionable explanations.
Topic 3: Explainable Multi-label learning
Build explainable algorithms and models for multi-label/multi-target learning

Keywords

- Explainable AI
- Multi-label Learning
- Ensemble Methods
- Robust ML
- Responsible AI

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Dr Avishek Nag

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Dr Avishek Nag's research focuses on applying ML models as tools for data-driven optimisation in telecom networks. Telecom networks are generally complex, with several inter-dependent parameters and constraints. Optimum allocation of bandwidth according to the dynamic demands generated by various applications like streaming video, voice, data, etc., is a challenge. Regular mathematical optimisation is sometimes non-scalable and intractable for an extensive telecom network with several nodes and links. So, my research intends to translate these optimisation problems into ML models that learn from the network data and produce optimum decisions regarding network resource allocations. Another aspect of my research involves optimising ML models to be deployed on low-power edge devices for specific edge applications. Dr Nag has supervised two PhD students and mentored six master's theses.

Research Topics of Interest for the MSCA Postdoctoral Fellowship

Topic 1: Energy-Efficient Digital Twin for Wireless Networks: This project focuses on developing a wireless network-specific Digital Twin to reduce energy consumption. The approach involves creating a proof-of-concept Digital Twin by emulating network behaviour and implementing Software Defined Networking (SDN) using testbeds like Fed4Fire and emulators like Mininet.

Topic 2: QROUTE: A Game-Changing Capacity-Aware Routing Scheme for Quantum Communication Networks: This research aims to develop a routing algorithm that optimally utilises the quantum channel capacity, considering the quantum entanglement and superposition phenomena. By doing so, the algorithm seeks to revolutionise the efficiency, security, and reliability of quantum communication networks, a crucial area of research in your field of expertise.

Keywords

- Digital Twin
- Emulation
- Testbeds
- Optimisation
- Quantum Communication
- Quantum Error Correction
- Quantum Networks

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Dr David Lillis

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Most recently, my research has primarily focused on the application of Natural Language Processing (including Large Language Models) in the domain of law and regulation. I have held multiple leadership positions in a variety of research groups including PI of TRANSPIRE (Trained AI for Law and Regulation), PI of CeADAR (Ireland's Centre for Applied AI), Funded Investigator of CONSUS (Crop Optimisation through Sensing, Understanding and Visualisation).

I have mentored 7 postdoctoral researchers. Of these, 4 directly secured faculty positions and the others have progressed to senior postdoctoral roles. I currently supervise 4 PhD students (1 of whom has recently submitted their thesis) and have had 1 graduated PhD student who currently holds a faculty position. I maintain research links with the Data Mining and Security Lab at Beijing University of Technology.

Research topics of Interest for the MSCA Postdoctoral Fellowship

- Exploring eXplainable AI (XAI) in the context of legal practitioners as end users.
- Argumentation and evidence mining from court judgments.
- Retrieval Augmented Generation in the context of legal judgments and/or contracts.

Keywords
- Natural Language Processing
- Large Language Models
- Law and Regulation
- eXplainable AI (XAI)
- Retrieval-Augmented Generation (RAG)

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Dr Deepak Ajwani

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Dr. Ajwani is an Assistant Professor (tenured) in the School of Computer Science with more than 20 years of research experience in the areas of algorithm design and engineering, machine learning and combinatorial optimisation. His research is driven by the vision of creating novel machine learning techniques that integrate algorithmic insights to effectively solve combinatorial optimisation problems. He has extensively published in top venues in these areas.

He is a funded investigator with the SFI CRT on Machine Learning (ML-Labs). He is currently supervising five PhD students that focus on developing machine learning techniques for optimisation problems. 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 and he completed his B.Tech and M.Tech from the prestigious Indian Institute of Technology, Delhi.

Research topics of Interest for the MSCA Postdoctoral Fellowship

I am interested in the design of neural network architecture and representations to solve discrete optimisation problems, such as those arising in the context of graphs and geometry. The representations should ideally generalise the known approximation algorithms for classical problems (such as those based on semi-definite programming).

My research group has done a lot of work at the intersection of machine learning and combinatorial optimisation and the MSCA proposal can build on this research.

Example of other topics I am interested in (but not limited to):

- Learning-augmented Algorithms/ Data-driven algorithm design
  - Integrating algorithmic insights into Graph Neural Networks for solving harder instances of optimisation problems on graphs
  - Leveraging learning techniques to design approximation algorithms based on rounding techniques
- Learning techniques for algorithm analysis

Researchers with PhD in machine learning or optimisation or algorithm design/analysis are encouraged to apply.

Keywords

- Combinatorial Optimisation
- Graph Algorithms
- Learning Augmented Algorithms
- Reinforcement Learning
- Graph Neural Networks

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Dr Dimitris Chatzopoulos

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Dimitris Chatzopoulos is an Assistant professor and Ad Astra fellow at the School of Computer Science. His research foci are on the intersection of artificial intelligence, mobile computing, distributed systems, and data marketplaces. He focuses on large-scale machine learning systems, data marketplaces and privacy-aware decentralised systems. He is utilising tools from distributed ledgers, smart contracts, mobile computing, federated learning, explainable AI, data analytics, game theory and others. Dimitris is currently supervising four PhD students, one postdoctoral fellow, and one research assistant, while by the end of 2024, the fifth PhD student and a second postdoctoral fellow will join his group. Dimitris actively collaborates with research groups in Hong Kong, China, Greece, Ireland, the Netherlands, the United Kingdom, Italy, Denmark, and Finland and participates in two European projects under the Horizon Europe scheme and has received funding from the industry.

Research topics of Interest for the MSCA Postdoctoral Fellowship

- On device Machine learning
- Small language models
- Machine learning systems for the cloud edge continuum
- Data and AI model marketplaces
- Explainable AI-based techniques on data privacy
- AI/ML-based energy management systems

Keywords

- On-device ML
- ML Systems
- Data marketplaces
- AI model marketplaces
- Explainable AI
- Privacy
- Decentralisation
- Smart contracts
- Fake news

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Dr. Hadi Tabatabaee

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Research in the edge-cloud continuum, including sustainable computing, carbon-aware resource management, and services orchestration across various edge and cloud systems, including serverless computing, multi-access edge computing, and fog computing.

I received my PhD in computer engineering-software in 2012. I'm currently an assistant professor at the School of Computer Science, with previous roles at Shahid Beheshti University, Trinity College Dublin, and Maynooth University. Over the past decade, I've focused on distributed systems research addressing challenges in smart cities, social sensing, and human activity recognition. Additionally, I worked in SFI-ENABLE, one of Ireland's largest research spokes that aims to connect communities with IoT-driven urban environments.

I supervised one PhD to completion and the supervisor of two PhD students. I also serve as an associate editor at IEEE ACCESS, a technical committee member at IEEE CloudCom, and an associate investigator at the CONNECT research center.

Research Topics of Interest for the MSCA Postdoctoral Fellowship

- Elastic resource provisioning in a geo-distributed MEC infrastructure.
- Carbon-aware orchestration of containerized services in edge-cloud systems.
- Energy-aware task scheduling in a multi-cloud environment.
- Energy-efficient serverless computing

Keywords

Sustainable Computing
Carbon-awareness
Energy-efficiency
Services Orchestration
Service Placement
Task Scheduling
Resource Provisioning
Serverless Computing
Mobile Edge Computing
Fog Computing
Multi-cloud Ecosystem

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Dr Liliana Pasquale
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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 4 PhD students to completion and 2 Postdoctoral researchers who are currently employed as Assistant Professors in two different universities in Ireland. I am currently supervising 4 PhD students working on the above topics.

Research topics of Interest for the MSCA Postdoctoral Fellowship

- Using LLMs for security requirements generation and secure software development.
- Definition of requirements and architecture metrics to predict vulnerabilities in software systems.
- Human-AI collaboration to support security tasks (security monitoring, attack detection and diagnosis).
- 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

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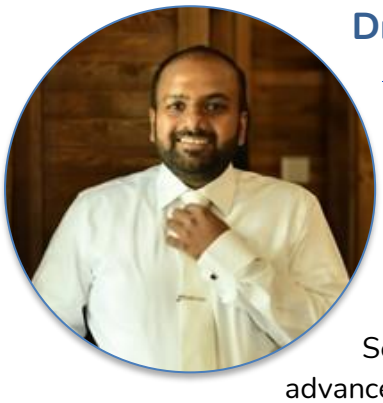

Dr Madhusanka Liyanage

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I am an Associate Professor and Ad Astra Fellow (formerly a Marie Curie Fellow), as well as the Director of Graduate Research at the School of Computer Science, University College Dublin, Ireland. Additionally, I direct the Network Softwarization and Security Labs (NetsLab) at UCD, a dynamic research group leading advancements in the security and privacy of next-generation mobile networks, including 5G and 6G.

NetsLab is dedicated to developing innovative solutions to protect critical mobile network infrastructures across various sectors. Our research focuses on network slicing, software-defined networking, and edge computing. We are also pioneering the integration of blockchain and Artificial Intelligence (AI) into network security, redefining how mobile networks are safeguarded against emerging threats. This forward-thinking approach positions NetsLab at the forefront of network security research.

The NetsLab research group comprises 25 members, including 5 postdoctoral researchers and 15 PhD students. Our dynamic team features members from universities across Europe and Asia, fostering a collaborative and diverse research environment. I have successfully supervised 5 PhD candidates to completion and 2 postdoctoral researchers. Currently, I am supervising one IRC fellow within my team.

Research topics of Interest for the MSCA Postdoctoral Fellowship

- Mitigating Adversarial Threats from Generative AI and Proactive Fraud Prevention of distributed AI/ML-driven O-RAN for Future Networks
- Blockchain-Empowered Dynamic Spectrum Allocation for 6G networks
- Poisoning-robust Distributed Machine Learning algorithm for 6G networks
- Privacy Preservation Techniques for Peer-To-Peer (P2p) Collaborative FL Platforms
- Fair and explainable AI methodologies for threat detection and prediction
- AI/ML-Driven security orchestration to enable Zero-trust Security for 6G
- AI-driven predictive cybersecurity algorithms
- Quantum Resistance Security for 6G and Beyond

Keywords

- Security
- Privacy
- 6G
- Federated Learning
- Explainable AI
- Blockchain
- Trust
- IoT
- PQC

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Dr Nhien-An Le-Khac

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Assoc. Prof. Le-Khac is the director of UCD ASEADOS lab (https://aseados.ucd.ie/) with 10+ academic staffs, research scientists and PhD students. His research interests span 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, 8 PhD. students were graduated, who are currently permanent university lecturers and senior data scientists in industry. Assoc. Prof. Le-Khac is supervising 4 PhD students through national and international collaboration projects such as NSF-SFI-NI, SFI Ml-Labs. He also supervised successfully 2 postdocs 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 Enterprise Ireland commercialisation €495K project, which is recently turned to a start-up run by these research fellows. Recently, his team's start-up project Mirror Security, a cybersecurity platform for GenAI that brings both security and assurance to organisations using GenAI in their operations has been a finalist of UCD Nova Venture Launch Accelerator Programme. Dr. Le-Khac is an author/editor of 3 books and has published 200+ scientific papers with 5 best paper awards recently. For the full list of publications refer to the google scholar.

Research topics of Interest for the MSCA Postdoctoral Fellowship

- Robust and Secure AI-Based Framework for Earth Observation Data
- AI-based framework for the end-to-end analysis of crypto-laundering
- 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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Dr Rem Collier

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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 areas of Precision Agriculture, Sustainability and Climate Resilience. I am Lead-PI of CONSUS (Crop Optimisation through Sensing, Understanding and viSualisation), a Co-PI on CAMEO (Creating an Architecture for Manipulating Earth Observation data), Co-Lead of HOLOS-IE (A Systems-based Digital Platform for Agricultural Land Use Planning, Management Decisions, and Inventory Reporting). I am also a co-chair of the W3C Web Agents Community Group.

Research topics of Interest for the MSCA Postdoctoral Fellowship
I am happy to work with candidates in any area related to my research interests

- I am generally interested in the integration of Hypermedia Multi-Agent Systems, Machine Learning and Distributed Knowledge Graphs with the goal of understanding how to create long-lived autonomous systems that are capable of learning how to operate effectively on the Web.
- Much of my recent research work has explored the application of Hypermedia MAS technologies to Microservices Architecture to improve the adaptability, maintainability and evolvability of software.
- My main areas of interest are the development of Cognitive Digital Twins and other Decision Support Tools for Smart Agriculture, Sustainability and Climate Resilience. I am also interested in the use of Hypermedia MAS in Agent-Based Modelling & Simulation.

Keywords

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

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Dr Ruihai Dong

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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.

Research topics of Interest for the MSCA Postdoctoral Fellowship

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

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Dr Shen Wang

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Dr. Wang is a senior member of IEEE and an active member of its Intelligent Transportation Systems (ITS) society. He is also a member of the UCD Earth Institute which focuses on interdisciplinary sustainability research, and an academic co-director of Netslab (https://netslab.ucd.ie/). He has supervised 4 PhD students and co-supervised another 4 PhD students. Dr. Wang has been involved with several EU projects (e.g., AURORA, SPATIAL, CONFIDENTIAL6G, and ROBUST6G) as a co-PI, WP, and Task leader in big data streaming for air traffic control, and trustworthy AI for intelligent cybersecurity systems. Some key industry partners of his applied research projects are IBM Research Brazil, Boeing Research and Technology Europe, Telefónica Research, Fraunhofer FOKUS, etc. His research interests include connected autonomous vehicles, edge AI for UAVs, explainable AI, and security and privacy for mobile networks.

Research topics of Interest for the MSCA Postdoctoral Fellowship

- Dynamic Pricing for Charging Electric Vehicles
- Sustainable Deep Reinforcement Learning for Urban Traffic Management
- LLM-based Explainable AI for Mobile Network Management

Keywords

- Edge AI
- Sustainable AI
- Explainable AI
- CAV
- UAV
- Traffic Management
- Electric Vehicles
- Trustworthy Networks

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Prof Tahar Kechadi

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The core and central focus of my research is how to manage and analyse very large datasets quickly and efficiently. This brought me to look at the challenges of large-scale data mining in the heterogeneous, complex, distributed environment, Big Data analytics, data warehouses, distributed systems, cloud computing, data privacy and cybersecurity.

I have supervised more than 33 PhDs, 22 MScs by research to completion, and 18 post-doctoral research fellows. All the PhD students and post-docs I have supervised and trained are employed in academia or hold senior positions in the industry.

I have been a visiting professor in many Universities, including the University of Liverpool, where I was involved in developing CERN data analysis and organising events data; the University of Artois, the University of Fuzhou, where I am currently an adjunct professor, I delivered summer schools and organised an international conference on Spatial Data Mining in 2015. I am currently a visiting professor at the Dalian University of Technology, where I developed a strong collaboration in Cyber-Physical Systems (CPS).

Research topics of Interest for the MSCA Postdoctoral Fellowship

Privacy-preserving Data analytics at Scale

Keywords

- Data Privacy
- Data Analytics
- Big Data analysis
- Secure data analytics
- Secure DW
- Data privacy at scale
- Adversarial ML