



School of Computing, Engineering, and the Built Environment Edinburgh Napier University

PHD STUDENT PROJECT

Funding and application details

Funding status: Self funded students only

Application instructions:

Detailed instructions are available at <https://www.napier.ac.uk/research-and-innovation/research-degrees/how-to-apply>

Prospective candidates are encouraged to contact the Director of Studies (see details below) to discuss the project and their suitability for it.

Project details

Supervisory Team:

- DIRECTOR OF STUDY: Professor Ahmed Al-Dubai (Email: A.Al-Dubai@napier.ac.uk)
- 2ND SUPERVISOR: Dr Imed Romdhani and Dr Baraq Ghaleb

Subject Group: Cyber-security and system engineering

Research Areas: Artificial Intelligence, Internet of Things, Machine Learning, Networks, Edge Computing

Project Title: A Novel Machine Learning-Driven Edge Computing

Project description:

The development of Edge Computing (EC) has been evolving under the umbrella of cloud computing where resources are centralized and managed in data centers. However, the limitation of cloud-centric service architecture stands out when it comes to service delivery at the network edge such as Internet of Things (IoT) scenarios, where a plethora of devices are involved and the real-time requirement of applications really matters. Driven by the demand of time-sensitive and data-intensive applications, EC has attracted wide attention as one of the cornerstones for modern service architectures. An edge-based system involves comprehensive

aspects whilst at the core of the paradigm are the optimization problems concerning the way computation, communication, and caching are performed.

Machine Learning (ML) schemes, have shown great potential in combining powerful decision-making and high-dimensional analysis capability to facilitate a highly intelligent edge system. In this project, the candidate will explore the current state of the art of EC paradigms and the ML-based solutions. Then, the candidate will develop a new approach to challenge the current limits under the context of these key pillars: task offloading, resource allocation and caching strategy in EC. The proposed solutions should overcome the performance of existing works in terms of different key performance metrics.

References:

- [1] L. Zhao, Ahmed Al-Dubai, et al., "Novel Online Sequential Learning-Based Adaptive Routing for Edge Software-Defined Vehicular Networks," in IEEE Transactions on Wireless Communications, vol. 20, no. 5, pp. 2991-3004, May 2021, doi: 10.1109/TWC.2020.3046275.
- [2] L. Zhao, Ahmed Al-Dubai et al., "Vehicular Computation Offloading for Industrial Mobile Edge Computing," in IEEE Transactions on Industrial Informatics, vol. 17, no. 11, pp. 7871-7881, Nov. 2021, doi: 10.1109/TII.2021.3059640.
- [3] Kyle Hoffpauir, Jacob Simmons, et al. A Survey on Edge Intelligence and Lightweight Machine Learning Support for Future Applications and Services. J. Data and Information Quality 15, 2, Article 20 (June 2023), 30 pages. <https://doi.org/10.1145/3581759>

Candidate characteristics

Education:

A first-class honours degree, or a distinction at master level, or equivalent achievements in Computer Science-related area with a good fundamental knowledge of computer science and cloud Computing

Subject knowledge:

- Machine Learning and AI
- Cloud Computing and IoT

Essential attributes:

- Good AI/Machine Learning skills
- Good Knowledge of Cloud and Edge Computing
- Competent in programming
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good organisation and time management skills

Desirable attributes:

- Excellent in programming and software testing
- Experience in IoT systems
- Experience in SDN and Simulations
- Knowledge of resources allocation and offloading in distributed systems