



## **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: Xiaodong Liu (Email: X.Liu@napier.ac.uk)
- 2<sup>ND</sup> SUPERVISOR: Oluwaseun Bamgboye

**Subject Group:** Computer science

**Research Areas:** Software Engineering, IoT, Data Science, Artificial Intelligence

**Project Title:** A unified approach based on semantic models and continuous deep learning to sensor data uncertainty and inconsistency in smart systems

**Project description:**

Smart IoT (Internet Of Things) based Applications, such as smart city/building/home and smart factory, are characterized as sensor-driven technology, which has the tendency of producing huge volume of data with increasing velocity. The resulting data produced by these applications are mostly used to support organisation, planning, interpretation and decision-making activities such as context modelling, system adaptation and system evolution. However, these data come with a number of quality issues that collectively results in uncertainties and inconsistencies.

In this project, we aim to innovatively integrate semantics-based data modelling and analysis with continuous deep learning to provide a novel effective solution to the above problem.

The semantic data model will provide a machine-understandable foundation for the IoT data and its analysis, and will be able to produce near real-time solution for the detection and correction of IoT data uncertainties. However, this semantic model may be static and imprecise to cope with the highly dynamic nature of IoT systems and the data they have been generating. Therefore, we propose to use deep learning to support the continuous evolution of the semantic model and its data analysis algorithms.

**References:**

- [1] "Context-Active Resilience in Cyber Physical Systems (CAR)", EU H2020 Marie Skłodowska-Curie Actions – European Fellowships Project, Coordinator, 2016-2018, <http://www.msca-car.eu/> .
- [2] Qi Liu, Bilal, M., Xiaodong Liu, et. al. "Deep Vision in Analysis and Recognition of Radar Data: Achievements, Advancements and Challenges. IEEE Systems, Man, and Cybernetics Magazine, (in Press), 2023.
- [3] Claus Pahl, Frank Fowley, Pooyan Jamshidi, Daren Fang and Xiaodong Liu, "A classification and comparison framework for cloud service brokerage architectures", IEEE Transactions on Cloud Computing, accepted, 6(2), DOI: 10.1109/TCC.2016.2537333, 2018.

## **Candidate characteristics**

**Education:**

A second class honour degree or equivalent qualification in Computer Science

**Subject knowledge:**

- Software engineering or data science, or artificial intelligence or Internet Of Things.

**Essential attributes:**

- Experience of fundamental software design and development
- Competent in design of Internet Of Things applications
- Knowledge of data models and analysis
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management skills

**Desirable attributes:**

- Some knowledge of machine learning would be beneficial.