Department	School of Computing
Supervisors	Dr. O. Bamgboye, Prof. X. Liu, Dr.K Babaagba
Project Title	Enhanced Deep Learning and Semantic-based Predictive Analytics for Reactive IoT Streaming Data and Applications

PROJECT DESCRIPTION

The emergence of Internet of Things (IoT) has formed a bridge that connects most of the real-world entities with therelated computing entities. IoT provides considerable support for context sensing, network communication and data processing methodologies. The objectives of IoT includes; (i) sensing the critical information from the external physical environment, (ii) the sampling of internal system signals, and (iii) obtaining meaningful information from sensor data to perform decision- making, while taking advantage of the data availability from sensors.

The application of IoT and data analytics provides further opportunities for innovative applications across different fields such as; industrial IoTs, intelligent transportation systems (ITSs), smart buildings and many other related areas. Inthe domains, data produced from different sensors can form an insightful patterns that readily support real-time events for reactive or complex event processing systems.

These IoT streaming data requires semantic processing for data interoperability, analysis and even correlating with other heterogeneous sources for the purpose of producing inference in real time. This can also be considered necessary for prediction that will be useful in the automated management of smart buildings and safety-critical systems.

The field of Complex Event Processing (CEP) is known to be capable of processing IoT streaming data in real time butunable to provide predictive functionality that are readily provided by Machine Learning and related statistical approaches. In addition, CEP uses rules to support processing of IoT streams but does not include historical data which itself can help in gaining better insights.

On the contrary, Machine Learning approach have been known for its ability to support predictive analytics but are notsuitable to support data interoperability, semantic data reasoning and correlating different heterogeneous IoT data streams, which are readily provided by semantic stream modelling and reasoning techniques.

Therefore, it is necessary to set a foundation to form a bridge between the semantic technology and Machine Learningin order to be able to predict events before they occur such as in real-time domestic and environmental safety-critical systems. The aim and objectives for the oroject is as follows:

- Develop an adaptive machine learning algorithm suitable for the processing and analysis of IoT streaming data for realtime event prediction.
- To adopt an approach for the combination of historical and real-time IoT Streaming data to support the continuous analysisand correlation for accurate prediction of events for reactive applications
- Develop a prototype of Intelligent-driven software architecture for IoT stream quality and predictive analytics by through the Integrationof Semantic-based processing with enhanced Machine learning approach, thereby creating a bridge between data analytics and semantic technologies.

Perspective applicants are encouraged to contact the Supervisor before submitting their applications. Applications should make it clear the project you are applying for and the name of the supervisors.

Academic qualifications
A first degree (at least a 2.1) ideally in Computer Science or any related discipline with a good fundamental knowledge of Computer programming, Internet of Things, Machine learning, data science, semantic technologies or knowledge graph.

English language requirement
IELTS score must be at least 6.5 (with not less than 6.0 in each of the four components). Other, equivalent qualifications will be accepted. Full details of the University's policy are available online.

Essential attributes:
- Experience of fundamental software engineering or data science
- Competent in fundamental programming language
- Knowledge of IoT, data analytics, semantic technologies or machine learning
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management

Desirable attributes:
Research Skills including academic writing

Indicative Bibliography	Akbar, A., Khan, A., Carrez, F., & Moessner, K. (2017). Predictive analytics for complex IoT data streams. *IEEE Internet of Things Journal*, *4*(5), 1571-1582. Bamgboye, O., Liu, X., & Cruickshank, P. (2019, July). Semantic stream management framework for data consistency in smart spaces. In *2019 IEEE 43rd Annual Computer Software and Applications Conference (COMPSAC)* (Vol. 2, pp. 85-90). IEEE. Babaagba, K. O., Tan, Z., & Hart, E. (2020, July). Improving Classification of Metamorphic Malware by Augmenting Training Data with a Diverse Set of Evolved Mutant Samples. In *2020 IEEE Congress on Evolutionary Computation (CEC)* (pp. 1-7). IEEE.
Enquiries	For informal enquiries about this PhD project, please contact o.bamgboye@napier.ac.uk
Web page	https://www.napier.ac.uk/research-and-innovation/research-degrees/application-process