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Institiúid Teicneolaíochta
Leitir Ceanainn

Letterkenny Institute
of Technology

Project Title: Scalable Intelligent Resource Orchestration of service function chains in Multi-layer Fog networks

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Keywords: Deep Neural Networks, Graph Neural Networks, Self-Supervision Learning, Intelligent Fog Computing

Project Summary:

The project aims to provide a revolutionary holistic network function virtualization (NFV) orchestration system, termed SIROM-Fog NFV Resource Orchestrator (NRO), by designing and developing the first ETSI NFV-MANO reference architecture implementation of the NRO, as part of the integrated infrastructure management system, engineered for resource orchestration, resource management, resource monitoring, and resource automation in a multi-layer fog network.

Specifically, the project aims to develop a framework, SIROM-Fog, a self-supervised mutual reinforced structure learning using Graph Neural Networks (GNNs) for dynamic resource allocation of service function chains in a large-scale multi-layer fog network. The main goal is to significantly improve the resource management for the next-generation network management systems and provide a better quality of experience (QoE) for the offered services via a fog platform using deep learning, attention, and self-supervision. This will be achieved using advanced machine learning libraries/tools, validating datasets of several NFV resource management scenarios for service function chains (SFCs), and testing the NRO system's performance and potentials against a landscape of scalable multi-layer fog networks. In particular, the project will provide: (a) a set of advanced infrastructure management technological enablers; (b) innovation beyond the state of the art contributions in software-defined paradigm, resource-efficient VNFs, autoscaling of virtualized infrastructure, and innovative advanced high-performance deep learning algorithms for (i) resource management for single fog layer, (ii) resource orchestration for a large-scale fog network, (iii), better QoE to the Internet of Things (IoT) applications, such as smart cities, connected healthcare, real-time analytics, and (iv) reduced capital (CAPEX) and operational expenditures (OPEX) for the NFV infrastructure; (c) validation of the capabilities of NRO system through more than 10 key performance indicators (KPIs) over different use case scenarios requiring scalable and dynamic resource management based on multi-layer SFCs.

Candidate Qualifications/Requirements:

- Masters in Artificial Intelligence & Big Data Analytics/Master's in Computer Science.
- Student should have at least a 2:1 Honour's degree, or equivalent, in Computer Science. Experience in Machine Learning, i.e., supervised, unsupervised and reinforcement and tools (TensorFlow, PyTorch, Keras), and deep learning (deep neural network, recurrent neural network, LSTM), Optimisation Theory, and Computer Networks/ Resource allocation and optimization/ Network virtualization is strongly desirable.

- Ability to pursue independent research and excellent writing and fluency in English are mandatory.
- Ideally, Student should have published at least one conference paper in an international conference or one journal paper in an international journal as a primary author.