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Editorial

# High-Performance Computing in Edge Computing Networks

The development of IoT applications has introduced large numbers of chatty devices to telecommunication networks. These devices can generate enormous amounts of data which needs to be processed in order to perform various IoT services. Edge computing networks are proposed to carry out preliminary data processing instead of transmitting raw data to data centres, greatly reducing the upload bandwidth and computation complexity needed by the clouds. In general, data processing at edge networks includes combinatorial optimization, agent-based modelling, big data analysis, parallel discrete event network simulation, etc. for secured services, energy efficiency, effective control, correct decision-making etc. These complex computation problems increasingly resort to using high-performance computing (HPC) as a prevalent tool, especially since the operating speeds of HPC at a given cost have increased exponentially over the past two decades.

We selected seven research articles for this special issue, presenting the state-of-the-art solutions for several key issues faced by edge computing networks. The paper "Combined Pre-detection and Sleeping for Energy-efficient Spectrum Sensing in Cognitive Radio Networks" looks into how to gain additional transmission capacity from the licensed radio frequency spectrum, for massive data transmissions in edge networks, in an energy-efficient manner. The authors minimize the maximum average energy consumption per sensing node by a policy combining pre-detection and idle-sleeping schemes, effectively prolonging the lifetime of edge networks with higher transmission bandwidth. The paper "DATA: A Novel Adaptive Strategy for Energy and Performance Efficient Virtual Machine Consolidation" investigates the energy efficiency challenge in large-scale virtualized data centres. The interesting idea here is to consolidate virtual machines adaptively based on their dynamic workload and energy utilization. It provides a timely reference for developing reliable and resource-efficient data centres as large-scale data centres are increasingly becoming vital at network edges. We also think highly of upcoming theoretical contributions such as those in the paper "On an Exact Solution of The Rate Matrix of G/M/1-Type Markov Process". The authors offer a theoretical method that may be applied to design novel energy-efficient schemes for a single-server edge computing system. The study may also be extensively developed for an edge system with multiple servers.

Support for edge and cloud security is another key focus of this special issue. Given the capacity constraints of IoT devices, heavier computational tasks (e.g., deep traffic inspection and classification) essential for implementing automatic attack detection systems are moved to specialized edge or cloud devices. The paper "A Scalable Distributed Machine Learning Approach for Attack Detection in Edge Computing Environments" studies how to efficiently allocate workload between edges and clouds. Referring to the recent advancements in large-scale machine learning, the authors shift operations with more computational complexity and storage requirements to the cloud. This helps edge networks to effectively perform traffic classification for security services. The paper "Security Supportive Energy-Aware Scheduling and Energy Policies for Cloud Environments" designs performance and energy aware scheduling policies that take the security demands of tasks and the trust levels of virtual machines into account. Security demands and trust levels are computed during the scheduling process in order to provide appropriate security services.

As an important role of edge computing, data analysis is of the great interest for this special issue. The selected paper "Scalable Data Analytics Using Crowdsourced Repositories and Streams" demonstrates the efficient parallelisation of profiling and recommendation algorithms using tourism crowdsourced data repositories and streams. It investigates entity-based and feature-based profiling approaches, and proposes a collaborative recommendation filter that employs singular value decomposition with stochastic gradient descent. Finally, the paper "Visual Attention Feature (VAF): A Novel Strategy for Visual Tracking Based on Cloud Platform in Intelligent Surveillance Systems" studies a new method for constructing and extracting the features of visual data based on the dynamic characteristics of tracking objects. This work contributes to visual data analysis at edge networks for intelligent surveillance systems.

With these freshly achieved study results, this special issue should provide research insights and experiences for future and emerging development in various aspects of edge computing networks. We hope that the readers will find these articles inspiring and useful.

Wanqing Tu
Florin Pop
Weijia Jia
Jie Wu
Mauro Iacono

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