Dependable and Efficient Intelligent Computing for Cyber-Physical Systems

Cyber-Physical Systems (CPSs) are the systematic combination of physical processes, information and communication technology, which are controlled or monitored by computer-based algorithms. CPSs are generally deployed as a network of interacting elements with a huge amount of data that involve heavy computation load. Recently, the availability of Embedded Intelligent Computing (EIC) starts being supported by deploying intelligent nodes at the edge of network, such that computing and storage resources can be located not only in the cloud server, but also at the edges close to IoT devices. EIC is beneficial for addressing the issues of edge intelligence, network bandwidth limitations, long end-to-server network latencies, and data privacy etc. Due to the deep and complex interaction among mission-critical components, the design and management of EIC for CPS applications have posed serious challenges in a variety of aspects. Two important challenges are dependability and efficiency design of EIC for CPS systems, which are also the focus of this special sections.

DEPENDABILITY: Since most CPS applications are mission-critical, the use of data-driven machine learning technologies for perception and activation has incurred serious dependability related concerns, such as security, reliability, robust, availability and sustainability. Taking autonomous driving system as an example, deep learning-based component can be dramatically destroyed by generating adversarial attacks and radiation-based fault in both training and inference stages. There still remains a significant technology gap regarding detection and adaptation of machine learning models to improve the dependability in the context of CPS.

EFFICIENCY: Due to the mobility and resource constraint like energy and storage constraints of EIC, the efficiency designs of intelligent edge computing systems have become hot research directions, e.g., the energy efficiency and latency efficiency for hardware-based accelerator of deep neural networks, efficiency of data storage and data migration on intelligent CPSs. To provide up-to-date design on the efficiency of EIC could help to further achieve the high performance of CPSs.

The aim of this special section is to provide a platform for researchers and practitioners from academia, government and industry to present their state-of-the-art research results covering design, implementation and evaluation of dependability and efficiency solutions for EIC-driven CPS applications.

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The topics of interests for this special issue include, but are not limited to:
- Novel models and architectures for dependable and efficient EIC
- Design methodologies for dependable and efficient EIC
- Performance evaluation methodologies for dependable and efficient EIC
- Services and applications in dependable and efficient EIC
- Energy-efficient design of EIC for CPS

- Storage-efficient design of EIC for CPS
- Reliability and safety design of EIC for CPS
- Security and privacy design of EIC for CPS
- Robust design of EIC for CPS

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