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Abstract

Energy Efficiency and Security for Embedded AI: Challenges and Opportunities

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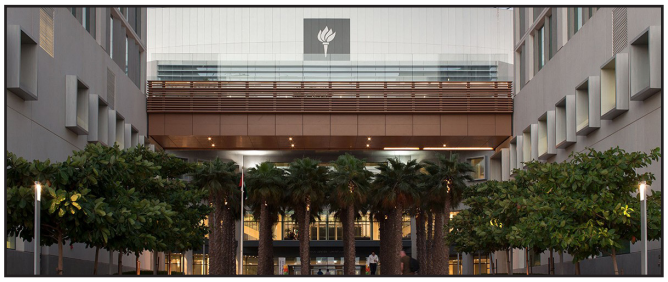
Abstract:

Gigantic rates of data production in the era of Big Data, Internet of Thing (IoT), and Smart Cyber Physical Systems (CPS) pose incessantly escalating demands for massive data processing, storage, and transmission while continuously interacting with the physical world under unpredictable, harsh, and energy-/power-constrained scenarios. Therefore, such systems need to support not only the high-performance capabilities under tight power/energy envelop, but also need to be intelligent/cognitive and robust. This has given rise to a new age of Machine Learning (and, in general Artificial Intelligence) at different levels of the computing stack, ranging from Edge and Fog to the Cloud. In particular, Deep Neural Networks (DNNs) have shown tremendous improvement over the past 6-8 years to achieve a significantly high accuracy for a certain set of tasks, like image classification, object detection, natural language processing, and medical data analytics. However, these DNN require highly complex computations, incurring huge processing, memory, and energy costs. To some extent, Moore's Law help by packing more transistors in the chip. However, at the same time, every new generation of device technology faces new issues and challenges in terms of energy efficiency, power density, and diverse reliability threats. These technological issues and the escalating challenges posed by the new generation of IoT and CPS systems force to rethink the computing foundations, architectures and the system software for embedded intelligence. Moreover, in the era of growing cyber-security threats, the intelligent features of a smart CPS and IoT system face new type of attacks, requiring novel design principles for enabling Robust Machine Learning.

Biography:

Muhammad Shafique received the Ph.D. degree in computer science from the Karlsruhe Institute of Technology (KIT), Germany, in 2011. Afterwards, he established and led a highly recognized research group at KIT for several



years as well as conducted impactful R&D activities in Pakistan. Besides co-founding a technology startup in Pakistan, he was also an initiator and team lead of an ICT R&D project. He has also established strong research ties with multiple universities in Pakistan, where he is actively co-supervising various R&D activities, resulting in top-quality research outcome and scientific publications. Before, he was with Streaming Networks Pvt. Ltd. where he was involved in research and development of video coding systems several years. In Oct.2016, he joined the Institute of Computer Engineering at the Faculty of Informatics, Technische Universität Wien (TU Wien), Vienna, Austria as a Full Professor of Computer Architecture and Robust, Energy-Efficient Technologies. Since Sep.2020, he is with the Division of Engineering, New York University Abu Dhabi (NYUAD), United Arab Emirates, and is a Global Network faculty at the NYU Tandon School of Engineering, USA.

Publication of speakers:

1. Shafiq, Muhammad & Afzal, Muneeb. (2021). Improving Construction Job Site Safety with Building Information Models: Opportunities and Barriers. 10.1007/978-3-030-51295-8_71.
2. Shafiq, Muhammad & Afzal, Muneeb. (2020). Potential of Virtual Design Construction Technologies to Improve Job-Site Safety in Gulf Corporation Council. Sustainability. 12. 10.3390/su12093826.
3. Shafiq, Muhammad & Lockley, Stephen. (2020). Application of signature-based matching for IFC model comparison. International Journal of Construction Management. 1-10. 10.1080/15623599.2020.1742630.

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