Guest Editors' Introduction: Design and Management of Mobile Platforms: From Smartphones to Wearable Devices

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There are close to five million apps that run on more than a billion smartphones as of 2020 [1]. This number is likely to continue increasing rapidly with the technological advancements in mobile computing, smaller form-factor wearable computers, and the Internet-of-Things (IoT) devices. Although form factors and specific system requirements vary, mobile platforms share common design goals, which include energy-efficiency, competitive performance, battery life, and reliability. Competitive performance requires faster operating frequency and leads to higher power consumption. In turn, power consumption increases the junction and skin temperatures, which have adverse effects on the device reliability and user experience. Therefore, highly heterogeneous systems-on-chips (SoCs) are required to achieve the performance requirements in terms of tight power consumption, energy, and cost. The design of these platforms remains challenging. Moreover, application development, let alone aggressive optimization, is notoriously difficult and time-consuming when utilizing highly specialized accelerators. The optimization problem is exacerbated by dynamic variations of application workloads and operating conditions. As a result, there is a need for novel software- and hardware-based adaptive resource management approaches that consider the platform as a whole, rather than focusing on a subset of the target system.

Due to the theoretical challenges and broad practical impact potentials, dynamic resource management of mobile and wearable platforms has received significant attention. This special issue features a keynote article titled "A Survey on Energy Management for Mobile and IoT Devices" from Pasricha et al. This article surveys the landscape of energy management solutions for mobile and the IoT devices. It discusses a wide range of topics proposed to optimize the performance, energy, and quality-of-service within the varying resource-constraints of these devices. Another survey article, "Dynamic Energy and Thermal Management of Multicore Mobile Platforms: A Survey" from Singh et al., focuses specifically on dynamic energy

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and thermal management of multicore platforms. It also discusses open challenges and upcoming trends.

Beyond these in-depth surveys, this special issue features two contributions that address specific resource management challenges on mobile devices. It is well-known that limited cooling capabilities in mobile devices make thermal management in such devices challenging. In "Coordinated Self-Tuning Thermal Management Controller for Mobile Devices," Chetoui and Reda present a coordinated self-tuning controller that manages both the junction and skin temperature. They achieve this by dynamically updating neural network weights and tuning the proportional–integral–derivative (PID) controller parameters. Pröbstl et al. address another important, yet frequently neglected, aspect of mobile devices: battery aging and charging in their paper titled "Intelligent Chargers Will Make Mobile Devices Live Longer." The authors provide an overview of recent techniques on battery-friendly charging and discuss the benefits of improving the charge cycle of battery-powered devices.

The last two articles focus on the applications of mobile and wearable devices. Mobile devices are equipped with heterogeneous multiprocessor SoCs to process machine learning workloads, such as those involving convolutional neural network (CNN) inference. These SoCs integrate different types of machine learning capable components, such as CPU, GPU, and accelerators, with different power-performance characteristics. Wang et al. provide a quantitative evaluation of the inference capabilities of the different components on mobile SoCs in the article titled "Neural Network Inference on Mobile SoCs." Last, Masinelli et al. propose a self-aware machine learning technique that enables mobile and wearable systems to monitor themselves in interaction with the environment and to manage their resources more efficiently in the article "Self-Aware Machine Learning for Multimodal Workload Monitoring During Manual Labor on Edge Wearable Sensors."

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Reference

[1] Statista. *Mobile App Usage—Statistics & Facts.* Accessed: Jun. 1, 2020. [Online]. Available: https://www.statista.com/topics/1002/mobile-app-usage/

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