Guest Editors’ Introduction: Special Issue on Smart and Autonomous Systems for Sustainability

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We are pleased to present the special issue on “Smart and Autonomous Systems for Sustainability: Sustainable Computing and Computing for Sustainability.” We are witnessing the rise of the data-driven science paradigm, in which massive amounts of streaming data—much of it collected as a side-effect of ordinary human activity—can be analyzed to make sense and be able to make intelligent decisions for sustainability over multiple time scales (e.g., short-term versus long-term planning). Intuitively, sustainability refers to the ability to maintain a certain performance or efficiency over time. This concept in the context of computing systems can be seen as sustainable computing—computing systems that maintain a certain performance reliably by consuming low power for a very long period of time. To enable sustainable computing, we need adaptive approaches for managing the computing resources and methods for improving reliability and security of computing systems.

In another direction, computing algorithms and computing systems together with a large amount of data can be used to meet the human needs of the present without compromising the ability of future generations to meet their own needs (computing for sustainability). We have three articles covering diverse aspects of this important and emerging area. We also have a survey article summarizing the current state of the art and future opportunities challenges.

The first article presents a data-driven framework to improve the reliability of computing systems in the context of core router systems. Rapid error discovery is crucial for timely correction mechanisms and reliable router systems. Aiming to achieve a high degree of reliability, this article presents a machine learning framework for analyzing router time-series data to automatically evaluate the health status and detect anomalies while accounting for the important temporal characteristics of complex communication systems.

The second article presents a data-driven indoor localization framework for smartphones. Fingerprinting is essential for indoor navigation and localization due to its low cost, accuracy, and resiliency to multipath effects in constrained environments. This article aims to overcome the challenge of device heterogeneity and describes a portable lightweight fingerprinting framework while improving localization accuracy.

The third article presents an open-source platform for wearable health monitoring. It aims to design a standard set of hardware/software and wearable devices that can enable an autonomous collection of clinically relevant data. It provides reference implementations of human activity and gesture recognition applications within this platform.
We believe that the topic of this special issue is very important and fertile. We refer the readers to our survey article to understand the opportunities and challenges in this problem space.

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