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Computational Intelligence for Internet of Things in the Big Data Era (Part II)

Emerging Internet of Things (IoT) applications in various domains such as smart city, smart home, smart grid, e-health, smart transportation, and computer vision critically require trustworthy networking solutions that are resilient against disturbances and disruptions, including high-mobility, high density, disasters, infrastructure failures, cyberattacks, etc. The networking framework should be capable of providing more secure, reliable and efficient communications in various network environments, especially for the performance-sensitive and mission-critical applications such as remote surgery and autonomous driving.

Two main challenges exist in enforcing trustworthy IoT. The first challenge comes from the spatial diversity of the entities involved in communications, such as the high-mobility of the devices, and the limitations of propagation media and other resources. The second challenge is due to the varying temporal features of the environment. These challenges can be solved by using computational intelligence (CI) technologies such as fuzzy logic and evolutionary computation. On the other hand, Big Data-based approaches, including deep neural networks, could facilitate data-driven prediction and performance

improvement by capturing time-dependent properties of network elements such as user traffic and behaviors. While CI technologies can achieve a flexible and self-evolving system design, Big Data can facilitate the use of deep neural networks through which learning the best strategy from complex data becomes possible.

This special issue focuses on the technical challenges and the synergistic effect of Big Data and CI for trustworthy IoT. We were successful in attracting 47 submissions. All of the submitted papers were reviewed by at least three competent independent referees and also by one editor. Following a rigorous peer review process, 7 papers have been accepted for publications, and three of them have been selected for the Part II of this special issue (the first four accepted papers were published in Part I on 2019 November).

The first paper, "Mining Mobile Intelligence for Wireless Systems: A Deep Neural Network Approach" by H. Hu et al., discusses the challenges on big data-based wireless system design, and proposes a unified framework to tackle them with the help of deep neural net-

> **This special issue puts a focus on CI-based solutions for the spatial-temporal challenges toward trustworthy Internet of Things in the Big Data Era.**

works (DNN) and online learning techniques. In particular, the authors propose a DNN architecture by incorporating an embedding layer to project different types of raw data to a latent space and utilizing a regression or classification function to predict the mobile access pattern. By evaluating the performance with a real wireless dataset, the authors show the advantage of the proposed framework over baseline approaches.

In the second paper titled "Enabling Computational Intelligence for Green Internet of Things: Data-Driven Adaptation in LPWA Networking," C. Zhang et al. develop a comprehensive solution for intelligent green IoT networking to satisfy the modern requirements through a data-driven mechanism, so that the IoT networks use computational intelligence to realize self-regulation of composition, size minimization, and throughput optimization. Both real-world evaluations and numerical comparisons are conducted to show the performance of the proposed approach.

Last but not the least, H. Song et al. propose AI-based solutions to address the challenges related to random access, spectrum access, and spectrum sensing

in their paper titled "Artificial Intelligence Enabled Internet of Things: Network Architecture and Spectrum Access." To facilitate IoT users to choose transmission parameters efficiently, several deep reinforcement learning-based approaches are introduced and discussed.

We sincerely thank all of the authors who submitted their papers to our special issue, and to a large number of distinguished reviewers who volunteered their time and expertise and helped us in curating a high-quality special issue on this important and timely topic. We

In Memoriam *(continued from page 18)*

FIGURE 4 Workshop on Fuzzy Logic, Blanes, Spain, 1989. From left to right: R. Felix, D. Dubois, B. Bouchon-Meunier, L.A. Zadeh, F. Esteva, J.L. Castro, J. Aguilar, E. Bonet, C. Freksa, A. Vila, R. Lopez de Mantaras, L.Valverde, C. Alsina, E. Trillas, J.L. Verdegay, J. Jacas, H. Prade, E. Ruspini, and colleagues.

contender because the US team "didn't have a soccer history". And so, they argued… Soccer was a passion we all shared.

Bernadette still remembers his energy and dynamism when participating in the first meetings gathering the emerging fuzzy community. The most surprising for her was probably to see him in Acapulco, where they were participating in the International Congress on Applied Systems Research and Cybernetics in December 1980. After the sessions, a small group went to the beach and Enrique disappeared

at some point, to suddenly appear again, but in the sky, doing some sort of parasailing. They could not believe what they saw!

He was a strong supporter of brand new fuzzy conferences (Figure 4). Bernadette cannot forget that he actively participated in the first issue of the IPMU conference in Paris in 1986 and he continued to attend it regularly during many years, giving for instance a plenary lecture at IPMU 2008 in Málaga, Spain. He was also a plenary lecturer at the first edition of the French

annual fuzzy conference, *Rencontres Francophones sur la Logique Floue et ses Applications*, held in Paris in 1995, which he attended in spite of a general strike in France that eliminated all means of transportation.

Enrique loved computers, travel, astronomy, photography, history, music, opera, and sports. He loved science and people. He was the corporate memory for IEEE CIS, he was a mentor and a friend. We will miss him.

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