Special Issue on Quality Achievements at BME-VIK with Student Contributions in EFOP-3.6.2-16-013 – Guest Editorial

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The project EFOP-3.6.2-16-013, "*Thematic Research Collaborations for Innovative Informatics and Infocommunication Solutions*" (abbreviated as 3IN) started in September 2017. The abbreviation refers to the three participating institutions, Eötvös Loránd University (ELTE), Budapest University of Technology and Economics (BME), and Pázmány Péter Catholic University (PPKE), and to the three innovation areas in focus: Software Development and Information Security (A / Pillar), Infocommunication Networks and Cyberphysical Systems (B / Pillar) and Intelligent Data Analysis (C / Pillar).

Over the past three years, a total of 150 Ph.D., MSc, and BSc students have been awarded scholarships at BME. Their research covered 15 topics in the three research pillars. Supervisors and mentors from six departments of the Faculty of Electrical Engineering and Informatics (BME-VIK) supported the work and scientific progress of the students. Their research has appeared in 80+ English papers in periodicals and conference proceedings, and 160+ presentations delivered at conferences and workshops organized abroad or in Hungary. The list of other publications contains about 300 TDK (Conference of Student Research Societies) reports and presentations, MSc and BSc theses, detailed research reports, and short summaries published in three special editions of the project summary booklet series.

The fundamental objective of the project was to support regional development in Hungary. Accordingly, the Central Transdanubia target region plays a unique role in the activities of the three universities. The series of dedicated local workshops held in Balatonfüred (BME), Martonvásár (ELTE), and Esztergom (PPKE) highlights the priority and impact of the regional dissemination of the project results.

This special issue of the Infocommunications Journal offers a unique opportunity to the research students at BME since the nine representative papers chosen from the three pillars and 15 research topics present their results to the experts and the professional community. The articles reflect well the excellent cooperation between the students performing the research, and their respective supervisors and mentors guiding and helping their scientific work during the entire project. Many cases of the gradual transition from Ph.D. to mentor, MSc to Ph.D., and BSc to MSc prove the significant impact of the project.

The rich spectrum of the topics of the papers is representative of the broad coverage of research fields (and supporting departments) by the project. The first four papers cover infrastructure and security-related problems. Simon et al. propose a sidecar-based solution to evaluate available resources in a virtual environment for real-time monitoring with direct applicability to Virtualized Network Functions.

Marosits et al. introduce a quantum random number generator (QRNG) based on the phenomena of amplified spontaneous emission (ASE), describe the real-time generation hardware and software implementation. Their results are open for the broad public by a web page offering a real-time random bits generator.

Kobor et al. also deal with quantum communication. Their particular focus is on the physical layer of an optical system realizing quantum key distribution. They evaluated the weak points using simulation and suggested specific polarization-dependent optical devices to improve the transmission quality significantly.

In the last paper of this section, Ládi et al. propose a graph analysis based method (GrAMeFFSI) that can restore the message formats and field semantics of (potentially undocumented) binary protocols from network traces, and demonstrate the usability of the approach in the case of two standardized protocols, Modbus, and MQTT.

The next two articles take us into the world of data analysis, discussing methodological issues. Papp et al. investigate the known drawback of many unsupervised machine learning algorithms. Data clustering data based on similarity metrics often ignores other types of relations between the individual data. The paper presents conditions for the construction of a weighted graph used in spectral clustering, preserving the hierarchical structure of the dataset.

Pilinszki-Nagy et al. compare the Hierarchical Temporal Memory's (HTM) performance in terms of accuracy, speed, and memory complexity to the deep learning-based LSTM (Long Short-Term Memory) network.

The final three papers show inspiring examples of the use of the outcomes of the project results for very different application domains. Fábián et al. propose in the first paper an approach for creating synthetic, representative datasets consisting of embeddings and demographic data of several people, and show that even simple machine learning models are able to reach a proportion of successfully re-identified people between 6.04% and 28.90%, depending on the population size of the simulation.

Alekszejenkó et al. make decisions based on mathematical algorithms borrowed from information technology and adapt them to the traffic lights' optimal and fair timing in intelligent urban traffic control. The results show that the optimal scheduling based traffic light control can outperform the traditional light programs in extraordinary and especially rapidly evolving situations.

In the closing paper, Varnyú et al. aim at reducing the noise in positron emission tomography (PET) by comparing the most powerful image denoising filters, improving both image quality and execution time. The non-linear methods compared include the Gaussian, the bilateral, the guided, the anisotropic diffusion, and the non-local means filters, in static and dynamic PET reconstructions.

László Jereb graduated from the Budapest University of Technology in 1971, then received the Candidate of Science, and the Doctor of the Hungarian Academy of Science (MTA) titles, in 1984 and 2004, respectively. At BME, his main research interest included reliability analysis, multi-layer network planning, and performance modeling and evaluation of networks.

He launched the business information technology track in 2002 at the University of West Hungary. He served as the Dean of Faculty of Wood Industry Engineering between 2008 and 2013. He is currently professor emeritus of the Budapest University of Technology and Economics and the University of Sopron. Since 2014, he coordinates the BME participation focussed on innovation projects and innovation and entrepreneurship education in EIT Digital. Since 2017, he leads the BME activities in the project EFOP-3.6.2-16-2017-00013.

The architectural perspective of the BME Knowledge Center under construction in Balatonfüred with the support of EFOP 4.2.1-16-2017-00021.