Young researchers on radio communication advances, various machine learning applications, and traffic congestion in smart cities

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THIS issue of the Infocommunications Journal raises our spirits by presenting the papers of young researchers as first authors. The first six papers are selected from the distinguished topics and awarded works of the Scientific Student Association of the Faculty of Electrical Engineering and Informatics, BME. The two papers that close the issue are submitted to our open call by young researchers, as well.

In their paper, Árpád László Makara and László Csurgai-Horváth analyze the wave propagation conditions for 5G FR2 bands regarding indoor cases, compare their measurements with the current models, and present an improved model for indoor propagation loss in real indoor scenarios. When calculating the average absolute error during a given measurement, it is found that it is nearly 70% smaller (by more than 80% in some cases) comparing it by the ITU model.

Ádám Marosits et. al. explore the embedding limits for MIMO channel decoding on quantum annealers. First, they showed that a linear QuAMax formulation can be employed together with Gray coding of 64-QAM to reduce the negative effect of bit errors during transmission. Besides, they have extended the range of embedding of MIMO ML decoding problems regarding both the modulation complexity and the transmitter number.

Donát Takács, Boldizsár Markotics, and Levente Dudás present their real-life measurement results on the SMOG satellite project. They briefly describe both the SMOG-P and ATL-1 PocketQube class satellites (they are 5x5x5cm and 5x5x10cm in size, respectively), and how they carried out LEO (Low Earth Orbit) radio frequency spectrum measurements with the help of these equipment. They analyzed and visualized the results, and present what sort and amount of radiated power is there, continuously heating the space and disturbing the communication system of LEO satellites.

Focusing on our everyday fears, Gábor Szűcs and Marcell Németh apply the few-shot hypothesis learning method to classify COVID-19 cases through X-ray images. Their method and results aim to help the work of those working in medicine and use merely a few images for the given problem. They compare various machine learning methods that they applied, and found that the so-called Double-View Matching Network (DVMN) reaches the best accuracy on a multi-view dataset at 1-shot, 2-shot, and 5-shot learning.

Following the machine learning thread in this issue, Daniel Vajda, Adrian Pekar, and Karoly Farkas present their new algorithm, Alter-Re2. It is an improved version of ReRe, the Long Short-Term Memory-based algorithm, and they developed it to solve anomaly detection problems in time-series data with certain conditions that often arise in network infrastructure monitoring. Their evaluation found that Alter-Re2 can identify three times more anomalies on average when compared to ReRe on the same data.

In their paper, Attila M. Nagy and Vilmos Simon present their novel method for identifying traffic congestion propagation in smart cities. They compare the new SCPP (Spatial Congestion Propagation Patterns) algorithm with the STC (Spatio-Temporal Congestion) process, and found that SCPP is able to identify a much greater number of congestion propagation paths with better computational performance than STC.

Hamid Garmani et. al. aim to tackle the problem of joint beacon power and beacon rate in vehicular ad hoc networks (VANETs). They formulate cooperative and non-cooperative gaming approaches, where each vehicle in the VANET chooses the joint beaconing rate and beaconing power. They have performed the equilibrium analysis and proposed a three distributed algorithm for computing the equilibrium point. After extensive simulations they found that the Cooperative Bargaining Algorithm is a good choice, because it is fast and converges the equilibrium.

Finally, Mohammad Moghadasi and Gabor Fazekas propose a system that aims to reduce the effect of bias field on the MRI image using N3 (Nonparametric Non-uniform intensity Normalization) algorithm and pixels of MRI images clustered by k-means algorithm. Data dimensionality is reduced by Principal Component Analysis (PCA) algorithm, whereas the segmentation is done by the Support Vector Machine (SVM) algorithm. Their results show that the proposed system can diagnose multiple sclerosis with an average accuracy of 93.28%.

Pal Varga received his Ph.D. degree from the Budapest University of Technology and Economics, Hungary. He is currently an Associate Professor at the Budapest University of Technology and Economics and also the Director at AITIA International Inc. His main research interests include communication systems, Cyber-Physical Systems and Industrial Internet of Things, network traffic analysis, end-to-end QoS and SLA issues – for which he is keen to apply hardware acceleration and artificial intelligence, machine learning techniques as well. Besides being a member of HTE, he is a senior member of IEEE, where he is active both in the IEEE ComSoc (Communication Society) and IEEE IES (Industrial Electronics Society) communities. He is Editorial Board member of the Sensors (MDPI) and Electronics (MDPI) journals, and the Editor-in-Chief of the Infocommunications Journal.