

Preface

Special Issue on Electronic, Telecommunications, Automation, and Informatics with Computer Science (ETAI)

The Guest Editors are honored and proud to present this *Special Issue of Acta Polytechnica Hungarica* comprising the final selection of nine *best papers of the International Conference ETAI-2018*, which have been considerably extended and modified. The manuscripts that appear in this special issue were finally selected following additional three rounds of reviews of the initially recommended collection of the 12 best ETAI-2018 papers, recommended by the Editorial Board. The finally selected manuscripts have been additionally upgraded with new authentic research ingredients hence potential overlaps with ones in the conference proceedings has been further reduced to much less than the required standard of the journal. The underlying criteria for this selection were the essential novelty of contributions, quality of research, potential interest of the world-wide scientific and professional community as well as clarity of the presentation. Each expanded manuscript was reviewed by internationally recognized experts in the respective technical fields. Thus, we are convinced the scientific values of these selected manuscripts will enhance broadening the existing knowledge and deepening the understanding in the corresponding expertise areas of all potentially interested readers.

The thematic Conferences on Electronic, Telecommunications, Automation, and Informatics with Computer Science (ETAI) became fully International in 2003 after the independence the Republic of North Macedonia. However initially these were established in 1982 during former S.F.R. of Yugoslavia as all-Yugoslav ones created and organized in Macedonia. Traditionally, the ETAI Conferences all have taken place in the natural ambient of exceptional beauty of Ohridian Lake region and cradle of cultural heritage of Ohrid City, which make the world-wide is a well-known UNESCO protected region for both cultural and natural heritage of the mankind. The ETAI 2018 was the fourteenth one in this series of conferences. International ETAI Conferences have thus grown and matured as one of the largest international meetings of professional experts and researchers from academic, business and industrial community in countries of Balkan region, which are dedicated to the ETAI fields and their mutual cross-fertilizing synergies.

This special issue begins with the symbol *E* novel contribution (Electrical-Electronics fields) to the ever interesting and intriguing field of Electromagnetic Compatibility. Although more than century and a half has elapsed since celebrated Maxwell's Equations were published still their exact application in some areas appears to be a challenge. The approximation if often used in order to enable fast

yet accurate modeling. Article “***Accurate Low-Frequency Approximation for Wires within a Two-Layered Earth***” is authored by Blagoja Markovski, Leonid Grcev, Vesna Arnautovski-Toseva, and Andrijana Kuhar, and it is focused on approximating the electromagnetic model based on transverse Hertz vector potentials as applied to wires embedded in two-layered earth. The authors show that this approximation is more accurate than the one based on Sommerfeld’s resolution for frequencies within the range 10 kHz – 10 MHz. Therefore their novel approximation is made applicable in transient analysis where currents with significant high frequency contents are involved, such as the ones initiated by subsequent lightning strikes. Their result has been validated for a range of different wire geometries and soil characteristics. The development of the proposed low-frequency approximation model is based on exact solution for the spatial domain Green’s functions, which are cast in an appropriate form.

The subsequent two articles present research novelties within the symbol *T* (Telecommunications) field. The first one is dedicated to considerations in the currently rather hot topic of 5G mobile broadband networks, while the second one explored further the elastic optical networks. It should be noted in addition, these manuscripts contribute certain cross-fertilization synergies of communications networks and systems with computer science and information signal processing.

The new 5G concept of mobile broadband networks raises very high interest and expectations not only in the scientific community, but also in the broader community. The forthcoming networks are analyzed from many different aspects. The security and quality-of-service (QoS) is investigated in the paper “***Future 5G Mobile Broadband Networks using Cloud-based Services with Advanced Security and QoS Framework***” is authored by Mitko Bogdanoski, Tomislav Shuminoski, Metodi Hadji-Janev, Aleksandar Risteski, and Toni Janevski. The paper presents a Security and Quality of Service (QoS) framework that provides safety based on high level of security features. The framework, conveniently named ASECQUA, assures QoS for different multimedia services in the presence of different types of disturbances and Denial of Service attacks, by providing the highest level of multimedia secure access probability ratio and highest aggregated throughputs for each multimedia service over secure traffic tunnels.

The contribution “***Analysis of Latency, Blocking Probability and Network Utilization for Specific Routing and Spectrum Assignment Algorithm in Elastic Optical Networks***”, which is authored by Teodora Kocevaska, Pero Latkoski, Marko Potjazoski, and Borislav Popovski, is focused on coping with the problem of ever increasing traffic volumes. Understanding the limitations and inappropriateness of the currently used technologies to meet the heterogeneous and variable traffic demands, they research new intelligent routing and spectrum allocation algorithms that support different class of service (CoS). The proposed algorithm assumes a coexistence of two traffic categories in the network, and a central Software Defined Networking (SDN) controller. The priority of different classes is determined by a dynamic RSA algorithm with two controlling

coefficients. The paper presents a simulation tool for analysis of the impact of controlling algorithm's coefficients on the network conditions. The results of the simulation could enable network operators to perform fine tuning of the utilization of the network, its blocking probability and data traffic latency, which is essential for the forthcoming 5G communication networks.

This journal issue continues with a rather important contribution in the field symbolized by letter *A* (Automation and Control), which is entitled "***Stability of Nonlinear Descriptor Systems and Application to Stabilization of Quadcopters***". It has been authored by Drilon Bunjaku, Jovan D. Stefanovski, and Georgi M. Dimirovski. The authors argue that in some cases stability can be achieved via employing solely the differentiation of functions, and thus solving of combined nonlinear differential equations and nonlinear algebraic equations was shown unnecessary. Their approach is based on nonlinear descriptor systems, for which they present new sufficient Lyapunov-like stability conditions and new sufficient Lyapunov-like stabilizability conditions. Thus this original result appears extremely important for various applications of nonlinear descriptor system models. In order to validate their result, they apply the conditions to very popular problem of quadcopter's flight stabilization, for which they elaborate a new representation of the quadcopter as a nonlinear descriptor system. The numerical simulations show that the achieved stabilization is better than the one achieved with pure tracking control. This result appears to imply great practical importance since it enables simple and efficient stability control design. This article does bring certain cross-fertilization synergy of systems science, control theory and advanced computing.

The following three articles consider different machine learning techniques applied to relevant problems in different domains; hence largely contribute innovations in the field symbolized by letter *I* (Informatics with Computer Science). Though, it should be noted, these manuscripts also bring cross-fertilization synergies of computational intelligence with computer and systems sciences.

This group of contributions begins with article "***Feature Space Reduction Using PCA in the Algorithm for Epilepsy Detection Using Adaptive Neuro-Fuzzy Inference System and Comparative Analysis***" is authored by Marjan Stoimchev and Vesna Ojleska Latkoska. The research presented in this article is a problem specific one. This article considers the application of Adaptive Neuro-Fuzzy Inference System as a classifier for detection of epilepsy from EEG signals. The feature extraction is performed using statistical moments of the wavelet transform of the signal. This approach has been previously used with success, and the paper presents an attempt to further improve the performance and lower probability of over-fitting through reduction of the number of features based on Principal Component Analysis (PCA). The experimental results clearly show the advantages of using PCA. The paper also includes algorithms performance

analysis when different data splitting methods and different input space partitioning methods are used.

The subsequent article is entitled “**Option Predictive Clustering Trees for Multi-label Classification**” and authored by Tomaž Stepišnik, Dragi Kocev, and Sašo Džeroski. This article investigates the feasible possibilities of performance improvement of general classifiers. The research presented in the paper considers the application of clustering trees for the problem of multi-label classification. The presented algorithm is an attempt to overcome the shortsightedness of the standard tree induction algorithm, regardless of the type of the classification problem that is considered. The approach is based on allowing for alternative splits in the internal nodes of the tree and introduction of option nodes (thus entitled ‘Option Predictive Clustering Trees’), which in essence broadens the space of trees that is searched during the tree induction procedure. The performance evaluation of the algorithm is conducted by means of processing 12 benchmark MLC datasets from completely different domains, which range from text to biology and multimedia, in order to demonstrate its applicability to different classification problems. The achieved performance of the Option Predictive Clustering Trees as ensembles is closing that of bagging ensembles in Predictive Clustering Trees.

The third paper in this group “**Feature Ranking for Hierarchical Multi-Label Classification with Tree Ensemble Methods**” is authored by Matej Petković, Sašo Džeroski, and Dragi Kocev and explores the timely topic of hierarchical multi-label classification. The techniques in this group are gaining increased attention due to their potential for application in text document classification and functional genomics. The focus of the research is on the feature ranking for hierarchical multi-label classification. The authors propose a group of feature ranking methods based on three established ensemble methods of predictive clustering trees: Bagging, Random Forests and Extra Trees, and the usage of three scoring functions for calculating the feature importance: Symbolic, Genie3 and Random Forest. The performances of the proposed methods are evaluated on 30 benchmark HMLC datasets. The results show that first two scoring functions, Symbolic and Genie3 scores, yield relevant rankings and that most suitable ensemble method for them is Random Forests ensemble. Moreover, when coupled with the suitable ensemble method, all three scores outperform the existing HMLC-Relief feature ranking.

The last, but not the least of the papers in this special issue of the journal APH is entirely devoted to model-based information processing **I**. This article investigates the challenging and rather interesting topic of model development and forecasting the demand in hospitality and tourism business. Modeling and forecasting the tourist demand has been in the focus of multi-disciplinary research for a long time, yet reaching the goal of accurate forecast appears still not in the grasp of the researchers. Article “**Modelling, Forecasting and Testing Decisions on Seasonal Time Series in Tourism**” by authors Cvetko Andreeski and Daniela Meckaroska is focused on time series analysis applied to tourist demand forecasting problem.

This research considers data from two closed-continental different-size countries North Macedonia and Serbia, also having considerably different economies. Though for both these countries the authors claim that they have accentuated seasonal component and accentuated trend in the last several years. Thus, they are amenable for modeling the tourism demand, but also appeared to possess rising variances that makes the modeling challenging. The model of choice for time series analysis is ARIMA. Several model parameters have been analyzed and then the best choice forecast and decision test is generated. The applied analysis and performance testing is quite comprehensive and the obtained application results are very interesting in terms of comprehension information.

We remain hopping that each and every interested reader shall find some article of her/his personal specific interest. Thank you.

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