
SPECIAL SECTION ON RECENT ADVANCES IN INFORMATION TECHNOLOGY

This issue of the Journal of Automation, Mobile Robotics and Intelligent Systems is devoted to selected aspects of current studies in the area of Information Technology, presented by young talented contributors working in this field of research. Among included papers, one can find contributions dealing with neural networks, time-domain analysis, regression modelling, visualisation in mixed reality and programming in Unity 3D engine in microcontroller's environment. The idea of creating this special issue was born as a result of broad and interesting discussions during the Fourth Doctoral Symposium on Recent Advances in Information Technology (DS-RAIT 2017) which was held in Prague (Czech Republic) on September 3-6, 2017 as a satellite event of the Federated Conference on Computer Science and Information Systems (FedCSIS 2017). The aim of this meeting was to provide a platform for the exchange of ideas between early-stage researchers, in Computer Science, PhD students in particular. Furthermore, the Symposium was to provide all participants an opportunity to obtain feedback on their ideas and explorations from the vastly experienced members of the IT research community who had been invited to chair all DS-RAIT thematic sessions. Therefore, submission of research proposals with limited preliminary results was strongly encouraged.

This issue contains the following DS-RAIT papers in their special, extended versions.

The first paper entitled *Neural Network Structure Optimization Algorithm* authored by Grzegorz Nowakowski, Yaroslaw Dorogyy and Olena Doroga-Ivaniuk, presents a deep analysis of current literature on the problems of the optimization of neural network parameters and their structure. The analysis includes a discussion of the basic disadvantages that are present in the observed algorithms and methods. The outcome is a new algorithm for neural network structure optimization which is free of the major shortcomings of other algorithms. The paper provides a detailed description of this algorithm, its implementation and application in recognition problems.

Erich Stark, Erik Kucera, Pavol Bistak and Oto Haffner in their work entitled *Experiment with Javascript on Client and Server Side of the Virtual Laboratory and Visualized in Mixed Reality Using Microsoft HoloLens*, investigate aspects of the remote control of a test experiment within a virtual laboratory. This is a common problem, but the authors provide alternative way to solve it. The paper also compares several currently existing virtual laboratories along with their possible shortcomings. To develop their a new solution, JavaScript technology was applied on both the client and server side, using Node.js runtime library. This modern approach is a visualization of received data in mixed reality using Microsoft HoloLens or any device compatible with the Windows Mixed Reality platform.

The paper entitled *The North Sea Bicycle Race ECG Project: Time-Domain Analysis*, was written by the team consisting of Dominika Długosz, Trygve Eftestøl, Aleksandra Królak, Tomasz Wiktorski and Stein Ørn. The North Sea Bicycle Race is an annual endurance cycling competition in Norway, and the examination of ECG recordings collected from participants of this race may allow defining and evaluating the relationship between physical endurance exercises and heart electrophysiology. The study also identifies the parameters reflecting potentially alarming deviations in health. In so-doing, this paper presents the results of a time-domain analysis of ECG data collected in 2014, implementing K-Means clustering. To handle this and similar data, the authors propose a double stage analysis strategy aimed at producing hierarchical clusters, The first phase allows rough separation of data. The second stage is applied to reveal the internal structure of the majority clusters. In both steps, the authors note that discrepancies driving the separation could stem from three sources. Firstly, they could be signs of abnormalities in the electrical activity of the heart. Secondly, they may allow discriminating between natural groups of participants according to sex, age and physical fitness. Finally, some deviations could result from faults in data extraction, therefore, serving in the evaluation of the parameters. After applying their strategy, the authors noted that the clusters were defined predominantly by combinations of features: heartbeat signals correlation, P-wave shape, and RR intervals; none of the features alone was discriminative for all the clusters.

The work entitled *Virtual Tour for Smart House Developed in Unity 3D Engine and Connected with Microcontroller*, written by Erik Kucera, Oto Haner and Erich Stark describes the topic of a virtual tour of a potential construction. This concept is very popular as many people would like to see a virtual house before acquiring the real counterpart. The paper demonstrates the creation of a virtual smart house tour developed in Unity engine. This virtual tour is controlled via an Arduino family microcontroller which has several sensors and actuators attached. These electronic devices react to the events in the virtual tour and vice versa.

Artur Nowosielski, Piotr A. Kowalski and Piotr Kulczycki authored the paper *Ensembling a linear regression model with an error mitigation component*. In this paper, the authors delve into a proposed model error mitigation technique based on the error distribution analysis of the original model. They then create an additional model that tempers the error impact in particular domain areas identified as being most sensitive. Both models are then combined

into a single ensemble model. The idea is demonstrated by way of the trivial two-dimensional linear regression model.

We would like to thank all those who were participating in, and contributing to the Symposium program, as well as all the authors who have submitted their papers. We also wish to thank all our colleagues, the members of the Program Committee, both for their hard work during the review process and for their cordiality and outstanding local organization of the Conference.

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