Neural Computing and Applications (2019) 31:1679–1681
https://doi.org/10.1007/s00521-019-04032-z

EDITORIAL

Editorial

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Published online: 22 January 2019

This Neural Computing and Applications Special Issue comprises of selected papers from the 18th EANN 2017 (Engineering Applications of Neural Networks) conference. EANN is technically supported by the International Neural Networks Society (INNS) and more specifically by the EANN Special Interest Group.

Artificial intelligence (AI) has evolved significantly since the beginning of twenty-first century, both in terms of theoretical findings and practical achievements. Its numerous applications are spread in various domains, from medicine to engineering. As an example, deep learning and more specifically convolutional neural networks (CNNs) are nowadays employed as very powerful solutions for solving many visual interpretation and image processing tasks. Machine learning (ML) algorithms offer very robust approaches, which are becoming more and more pervasive. Cloud robotics has entered our lives, and it is being used in critical applications.

The Engineering Applications of Neural Networks conference was organized for the first time in Otaniemi Finland, in 1995. Since then, it has grown through the years and it has become a mature annual event run by a scientific steering committee.

A cluster of quality contributions presented in the 18th EANN 2017 conference (organized in Athens, Greece) have been selected for potential inclusion in this Special Issue (SI). All of them have passed through a peer review process by independent academic referees. Fourteen papers were submitted to this SI of the Neural Computing and Applications Springer Journal, and nine of them were finally accepted to be published after several rounds of reviewing.

The first paper is entitled "Improving the evaluation process of students' performance utilizing a decision support software," and it is authored by Ioannis Livieris, Theodore Kotsilieris, Vassilis Tampakas from Technological Educational Institute of Western Greece and Panagiotis Pintelas from the University of Patras, Greece. This paper presents a classification system for accurately predicting students' performance at the final examinations of the academic year. Firstly, it classifies the students at risk of failing the final examinations; secondly, it classifies the students based on their predicted grades. ANN (multilayer feed-forward, radial basis function) support vector machines and a series of well-established algorithms have been considered in order to determine the optimal model.

The second paper "New Trends on Digitisation of Complex Engineering Drawings" is by Carlos Francisco Moreno García, Eyad Elyan from Robert Gordon University Aberdeen, UK, and Chrisina Jayne from Oxford Brookes University, UK. They present an interesting framework for complex engineering drawing digitization using AI. The paper includes a detailed and critical literature review on machine learning and machine vision methods that have been used for this purpose. A real-life industrial scenario has been investigated with a particular emphasis on the contextualization of digitized information for a specific type of drawings. An interesting discussion on the current and future contribution of deep learning to this domain concludes the paper.

The paper "Customized ensemble methodologies for Deep Learning: Boosted Residual Networks and related approaches" by Alan Mosca and John Magoulas from Birkbeck University of London, UK, introduces a family of novel customized ensemble approaches called boosted residual networks. Specifically, they have built a boosted ensemble of residual networks, by growing the member

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network at each round of boosting. The proposed approach builds upon recent developments in residual networks—specific architectures for creating very deep networks by including a shortcut layer between different layers.

The fourth paper "Long Term Temporal Averaging for Stochastic Optimization of Deep Neural Networks" is authored by Nikolaos Passalis and Anastasios Tefas from the Aristotle University of Thessaloniki, Greece. The major issue addressed in this paper is that, due to their stochastic nature, most optimization techniques inevitably lead to instabilities during training, and this holds also for state-of-the-art stochastic optimization techniques. The authors propose an exponential temporal averaging technique to stabilize the convergence of stochastic optimization methods during ANN training. Six different data sets and evaluation setups have been used to extensively evaluate the proposed method and demonstrate the performance benefits.

The fifth paper "Modeling of Beach Realignment Using a Neuro-Fuzzy Network Optimized by a Novel Backtracking Search Algorithm" is authored by Antonios Chatzipavlis, George Tsekouras, Vasilis Trygonis, Adonis Velegrakis, John Tsimikas, Anastasios Rigos, Thomas Hasiotis, and Constantinos Salmas, from the University of the Aegean Greece. This is an interesting environmental AI modeling effort. This paper studies the phenomenon of beach realignment, which is caused by the ever-changing incident waves that move sediments along and across beaches. The authors propose a neuro-fuzzy multilayer ANN for modeling this complex phenomenon and a novel backtracking search algorithm to optimize this model. Beach realignment estimates have been improved by modifying the existing mutation and crossover operations of the standard algorithm. A novel experimental setup has been deployed in a touristic beach of Santorini island, Greece, to collect high-frequency morphological and hydrodynamic information, and to generate a data set described by few representative input variables. Three networks have been designed and trained using this data set, and experiments prove the benefits of the proposed approach.

The paper "A neuroplasticity-inspired neural circuit for acoustic navigation with obstacle avoidance that learns smooth motion paths," presents the research of Danish Shaikh and Poramate Manoonpong, from the Syddansk Universitet Odense M, Denmark. Their study concerns reactive robot navigation which requires the generation of smooth motion paths toward the acoustic target in order to avoid obstacles. The paper extends a previous research of this team, by adding a path-smoothing behavior to generate smooth motion paths for a simulated mobile robot. This allows the robot to learn to navigate smoothly toward a virtual sound source, while avoiding randomly placed obstacles in the environment. A successful demonstration has been developed through five independent learning simulation trials.

The seventh paper is "Limitations of Shallow Networks Representing Finite Mappings," authored by Vera Kurkova, Czech Academy of Sciences, Czech Republic. It presents a theoretical analysis of the limitations of shallow ANN to efficiently compute real-valued functions over finite domains. This research paper studies the efficiency in terms of network sparsity, measured by its convex relaxation, the ℓ^1 norm. It has been proven that the computation of almost any randomly chosen function either represents a well-conditioned task performed by a large network or an ill-conditioned task performed by a network of a moderate size. This conclusion stands when a dictionary of computational units is not sufficiently large. As an illustrative example, a class of functions which cannot be efficiently computed by shallow perceptron networks is presented.

The title of the eighth paper, by Dimos Makris, Maximos Kaliakatsos, Ioannis Karydis Katia-Linda Kermanidis, from the Ionio University Greece, is "Conditional Neural Sequence Learners for Generating Drums' Rhythms." It is well known in the literature that ML has been successfully employed for automatic music composition. More specifically, the long short-term memory (LSTM)-based architectures are capable of efficiently learning and reproducing music styles. This research paper introduces a novel architecture entitled "conditional neural sequence learner" (CNSL) that combines the LSTM sequence learner, with a feed-forward (FF) model which is called the "conditional layer." The LSTM and the FF layers are fed to a single layer that makes the final decision on the next drums event, thus considering previous events (LSTM layer) and current constraints (FF layer). Testing on drum rhythm sequences has shown that the CNSL architecture can effectively produce patterns of drum sequences similar to a learned style, while conforming to given constraints. Experiments also show that the CNSL can correctly compose drums' rhythms in time signature that has not been encountered during training.

The last paper is contributed by Spiros Georgakopoulos, Konstantina Kottari, Kostas Delibasis, Vassilis Plagianakos and Ilias Maglogiannis from University of Piraeus, Greece. Its title is "Improving the performance of Convolutional Neural Network for Skin Image Classification using the response of image analysis filters." This paper introduces an AI approach for medical images, and in particular deals with the analysis of dermoscopy images by means of convolutional neural networks (CNN). The authors investigate the impact of feeding as input to the CNN also the response of mid-level vision filters. The developed model has been successfully tested on two pattern recognition problems in dermoscopy images which are relevant in

terms of clinical implications, namely the binary classification of skin lesions as "Malignant" and "Non-malignant" (nevus skin lesions) and the classification of each superpixel extracted from a skin lesion in 4 classes depending on its peculiar structures.

We hope that the readers of this Special Issue will appreciate these novel and promising approaches. May the foundations of this publication inspire further successful research and contribute to shape the role of AI in our post-industrial societies. The Guest Editors wish to thank the authors and the reviewers for their valuable contribution. Moreover, we would like to express our gratitude to the Editor-in-chief Professor John Macintyre, for giving us the chance to publish this Special Issue. Last but not least, we wish to thank the editorial office of the Neural Computing and Applications (Springer) journal for their kind support.