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# New Advances in Artificial Neural Networks and Machine Learning Techniques

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We are proud to present the set of final accepted papers for the Neural Processing Letters with contributions presented at the IWANNN conference - the International Work-Conference on Artificial Neural Networks- held online during June 16–18, 2021 (http://iwann.uma.es/). Unfortunately the 2021 edition of the conference has had to be carried out remotely due to the consequences of the Covid-19 pandemic, however interactive digital platforms have been used to preserve the participatory climate of previous editions.

IWANN is a biennial conference that seeks to provide a discussion forum for scientists, engineers, educators and students about the latest ideas and realizations in the foundations, theory, models and applications of computational systems inspired on nature (neural networks, fuzzy logic and evolutionary systems) as well as in emerging areas related to the above items. As in previous editions of IWANN, it also aims to create a friendly environment that could lead to the establishment of scientific collaborations and exchanges among attendees.

Since the first edition in Granada (LNCS 540, 1991), the conference has evolved and matured. The list of topics in the successive Call for Papers has also evolved, resulting in the following list for the present edition:

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1. **Mathematical and theoretical methods in computational intelligence**. Mathematics for neural networks. RBF structures. Self-organizing networks and methods. Support vector machines and kernel methods. Fuzzy logic. Evolutionary and genetic algorithms.
2. **Neurocomputational formulations**. Single-neuron modelling. Perceptual modelling. System-level neural modelling. Spiking neurons. Models of biological learning.
3. **Learning and adaptation**. Adaptive systems. Imitation learning. Reconfigurable systems. Supervised, non-supervised, reinforcement, and statistical algorithms.
4. **Emulation of cognitive functions**. Decision-making. Multi-agent systems. Sensor mesh. Natural language. Pattern recognition. Perceptual and motor functions (visual, auditory, tactile, virtual reality, etc.). Robotics. Planning motor control.
5. **Bio-inspired systems and neuro-engineering**. Embedded intelligent systems. Evolvable computing. Evolving hardware. Microelectronics for neural, fuzzy, and bioinspired systems. Neural prostheses. Retinomorphic systems. Brain-computer interfaces (BCI), Nanosystems. Nanocognitive systems.
6. **Advanced topics in computational intelligence**. Intelligent networks. Knowledge-intensive problem-solving techniques. Multi-sensor data fusion using computational intelligence. Search and meta-heuristics. Soft computing. Neuro-fuzzy systems. Neuro-evolutionary systems. Neuro-swarm. Hybridization with novel computing paradigms.
7. **Applications**. Expert systems. Image and signal processing. Ambient intelligence. Biomimetic applications. System identification, process control, and manufacturing. Computational biology and bioinformatics. Parallel and distributed computing. Human computer interaction, Internet modeling, Communication and networking. Intelligent systems in education. Human-robot interaction. Multi-agent systems. Time series analysis and prediction. Data mining and knowledge discovery.

At the end of the submission process, and after a careful peer review and evaluation process (each submission was reviewed by at least 2, and on average 2.8, Program Committee members or additional reviewers), 85 papers were accepted for oral presentation, according to the reviewers' recommendations.

During IWANN 2021, several special sessions were held. Special sessions are a very useful tool for complementing the regular program with new and emerging topics of particular interest for the participating community. Special sessions that emphasize multi-disciplinary and transversal aspects, as well as cutting-edge topics are especially encouraged and welcome, and in this edition of IWANN 2021, a total of twelve Special Session were celebrated.

Neural Processing Letters publishes technical articles on news aspects of artificial neural networks and machine learning techniques. In this editorial we would like to summarise four relevant contributions in the field of new developments in machine learning techniques.

In the paper entitled "Contrasting Explanations for Understanding and Regularizing Model Adaptations", by André Artelt et al., the main goal is to compare contrastive explanation as a proxy for explaining and understanding model adaptations - i.e., highlighting differences in the underlying decision making rules of the models. In this context, the authors have proposed a method for finding samples where the explanation changed significantly and thus might be illustrative for understanding the model adaptation. The authors of this paper propose a new methodology, which is empirically tested, to explain the adaptations and differences of the models by contrasting explanations. A method is proposed to automatically find regions in the data space that are affected by the adaptation of a given model, i.e.,

regions where the internal reasoning of the other model (e.g., the adapted one) is affected and should therefore be explained. The authors discuss in the present contribution how to perform a regularization of model adaptations to ensure that the internal reasoning of the adapted model does not change in an undesirable way.

The second paper, "Error-Correcting Output Codes in the Framework of Deep Ordinal Classification" by Javier Barbero-Gómez et al., is focused in the field of automatic classification tasks, which is a field that has been heavily revolutionised by convolutional neural networks (CNNs), but has focused on binary and nominal classification tasks. Only recently has ordinal classification (where class labels are naturally ordered) been addressed in the CNN framework, as the adaptation of the classical proportional odds model to deep architectures. Moreover, ordinal classification datasets often have a high imbalance in the number of samples in each class, which makes it an even more challenging problem. In this paper, the authors have presented a new CNN architecture based on the Ordinal Binary Decomposition (OBD) technique using Error Corrected Output Codes (ECOC) and have shown how it can improve performance over previously proposed methods. As shown in the results presented in the article, the proposed method is able to outperform a nominal approach as well as existing ordinal approaches, achieving average nominal approach as well as existing ordinal approaches, achieving an average performance of RMSE = 1.0797 for the Retinopathy dataset and RMSE = 1.1237 for the Adience dataset of RMSE = 1.0797 for the Retinopathy dataset and RMSE = 1.1237 for the Adience dataset, averaged over 4 different architectures.

Silvia Cateni et al., in the contribution entitled "Improving the Stability of the Variable Selection with Small Datasets in Classification and Regression Tasks" presents an novel approach in the very interesting field of variable selection. Variable selection is an essential tool for gaining knowledge on a problem or phenomenon, by identifying the factors that shows the highest influence on it. It is also fundamental for the implementation of machine learning-based approaches to modelling, regression or classification tasks. Variable selection is clearly essential, but standard variable selection approaches become "unstable", as the high correlation among different variables or their similar relevance with respect to the considered target lead to multiple solutions leading to similar performances. As a consequence of the instability problem, variable selection methods reduce the confidence of the selected variables of the selected variables to the user. The authors of this paper present an automatic procedure for the selection of variables in classification (binary and multiclass) and regression tasks that provides an optimal stability index (binary and multiclass) and regression tasks, which have system stability as a priority. The authors have used different small data sets, unstable by nature, and obtained satisfactory results.

Finally, the paper, presented by Asma Sattar et al., "Graph Neural Network for Context-Aware Recommendation" is focused on emphasizing the impact of knowledge about the surrounding context on user-item interaction. Recommendation problems can be tackled as link forecasting tasks in a bipartite graph between user and element nodes, labeled with ratings on edges. Existing matrix completion methods model the user's opinion about elements by neglecting context information that can rather be associated with the edges of the bipartite graph. Context is an important factor to be considered, as it greatly affects opinions and preferences. The authors proposed a context-aware Graph Convolutional Matrix Completion which captures structural information and integrates the user's opinion on items along with the surrounding context on edges and static features of user and item nodes. To

verify the behavior of the system, the authors have used several publicly available datasets, obtaining satisfactory results.

The Guest Editors would like to express their gratitude to all the people who supported them in the compilation of this special issue, and specially to the contributing authors for their submissions and to the anonymous reviewers for their comments and useful suggestions in order to improve the quality of the papers.

They would also like to express their gratitude to Editors-in-Chief M. Verleysen and M.H. Hassoun, for providing us with the opportunity to publish this set of selected papers in the present issue. It is a pleasure for us to invite all authors and interested readers of this issue to future IWANN conferences, which will be announced at http://iwann.ugr.es.