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EDITORIAL

Editorial

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WSOM+ 2017 was the 12th in a series of biannual international conferences started with WSOM '97 in Helsinki under the initiative of Prof. Teuvo Kohonen. WSOM + 2017 conference has been held in the renowned city of Nancy, world famous for its group of architectural masterpieces inscribed on the UNESCO World Heritage and for the highly creative twentieth century "Art Nouveau" movement. Conference was co-organized by SAMM laboratory, Paris Sorbonne and LORIA laboratory, Nancy. The 12th edition of the WSOM conference was for the first time extending its scope from the traditional domain on Self-Organizing Maps and Learning Vector Quantization to the general domain of Unsupervised Learning, as well as to the promising and hot research domain of Visualization.

WSOM+ 2017 highlighted key advances in these fields. The conference guested seven different sessions: Three conference sessions were dedicated to theoretical aspects of SOM, LVQ, neural gases, and learning models, three other conference sessions related to applications of the models and one session mixed theoretical and practical aspects of learning for image processing. Twenty-eight papers were in total presented in oral session and six in poster session. The conference also guested six invited talks from renowned speakers.

We are really pleased to present hereafter a selection of the best papers of the conference in this Special Issue of NCAA.

The Special Issue is starting with two important plenary speakers' contributions. Paper #1 raises important issues of interpretability and explainability of machine learning and computational intelligence models putting visualization techniques into the game as a central actor. A specific demonstration of the usefulness of interpretability visualization is provided by author for data mining in the healthcare domain. Paper #2 focuses of an open problem in multi-category classification, the characterization of optimal dependance of confidence interval of guaranteed risk on basic classification parameters under minimal learning. Original approach here is to exploit a Rademacher complexity model to explore boundary conditions for risk whenever usual margin loss functions are considered.

A second group of selected contribution papers is then related to the analysis of either complex, high-dimensional or even large data with represent in overall hot research areas in data mining. Paper #3 is dealing with an extension of fuzzy c-means method that aims at reducing distance computation complexity by removing clusters boundary data. Method shows significant gain in computation complexity compared to original FCM. Papers 4# and #5 are related to analysis of data with complex structure that highlights the limits of usual clustering methods. Paper #4 questions on the optimal representation of submanifolds supporting data in high dimensional spaces and proposes a Grassman representation of the said manifolds and associated Grassman-SOM model. The method is successfully tested on gene expression and hyperspectral image datasets. Paper #5 presents another alternative that is based on automatic post-learning prototypes' segmentation based on CONN similarity measure. The approach is applied on SOM clustering results and its effectiveness is demonstrated on a synthetic dataset of hyperspectral images. Paper #6 addresses one of the main issues in social network

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analysis, which is the exploitation of inherent network properties for improving prediction tasks. Authors propose a general framework based on probabilistic graphical models for dealing with network assortativity. Approach is tested on gender assortativity analysis in mobile phone networks and proved to successfully outperform usual node label prediction methods.

The third group of paper is related to specific adaptations of SOM and LVQ algorithms as well as to the complementary analysis of operating mode and tolerance range of the original algorithms. Papers #7 and #8 are related to SOM. Paper #7 proposes a new energy-based self-organized neural model based on infinitely often differentiable energy functions. The main interest of the method, as compared to usual SOM, is to become problem-independent and thus to provide a more generic framework for dealing with outlier detection and visualization while lowering quantization error, as paper shows. Principle of the method also makes is worthy for novelty detection tasks. Paper #8 provides an original study on fault tolerance of the SOM model whenever it is implemented on FPGA frameworks. Training simulation are performed with different fault models and measures of distortion, and quantization errors are examined regarding to different online learning strategies and weight storage policies on framework. SOM fault tolerance capacities are clearly highlighted by conducted experiments. Paper #9 and #10 are related to LVQ. Paper #9 introduces a specific extension of GMLVQ model for classification of functional data by tuning the original model to work with an adaptive functional basis instead of its usual adaptive distance matrix. Experiments are conducted on spectral and time-series datasets using standard GMLVQ as well as fixed and adaptive functional approaches with various functional basis. Clear advantage of adaptive model is shown. Paper #10 proposes a new probabilistic framework for LVQ that allows to efficiently deal with confidence values exploitable for classification rejection. For that purpose, a post-processing step based on LVQ schemes conversion into scaled probability measures is experienced. Time integration is also considered. Resulting explicit method is then successfully compared with standard LVQ deterministic surrogates approach on a large panel of datasets.

The fourth group of papers is related to deep learning, incremental learning, and time series management approaches. Paper #11 deals with the problem of determination of optimal feed-forward network that has large scope of application in deep learning. A new hybrid algorithm performing in two-supervised successive steps of network growing and pruning is proposed by authors. Convergence of the algorithm is proved, and its classification performance are successfully compared to oversized networks on reference data. Paper 12# focuses on incremental learning, a research area that also draws main attention today. This paper proposes a new adaptation of the promising energy-based model presented in paper #7 for incremental learning. The principle is to stack the model in multiple layers and to combine it with a gating mechanism driven by estimated error. Authors show the ability of the adapted model to deal with concept shift without being prone to catastrophic forgetting and highlight that it can deal with convolutional operations with a lower number of free parameters as compared to usual CNNs. Paper #13 presents a new adaptation of LVQ approach for classification of time-series and functional data which can be represented in complex coefficient spaces. For that purpose, the method is exploiting Wirtinger calculus to compute distances between data and to express update learning rules. The results of the approach are favorably compared on several time-series datasets with the ones obtained with usual time series domain representation. Additional experiments with wavelets on medical data highlight the effect of coefficient truncation to control overfitting.

The last group of papers is related to different applications of SOM and neural gas algorithms for solving concrete problems in various areas. Paper #14 is related to dynamic identification and control of nonlinear systems, a key point in industrial plants. Authors propose to represent a nonlinear system by a combination of several locally linear ones whose associated local transfer systems can be identified and managed by exploiting a batch neural gas algorithm. The experimental validation on a MIMO system composed of tanks shows that approach allows more accurate control as compared to usual methods based on recurrent controllers. Paper #14 relates to surveillance missions with aerial systems. Authors shows that this problem can be considered as a Close Enough Dubins Orienteering Problem (CEDOP) involving a combination of continuous and combinatorial optimization. For solving that specific problem, they propose a growing SOM structure whose role is to represent a curvature constrained data collection path. Conversely to usual combinatorial methods, this approach can perform online sampling of way points and headings during adaptation process. Method is compared to standard combinatorial approach and to some former unsupervised SOM-based approaches. Overall performance increase for combination of solution quality and computation time are observed. Paper #16 is dedicated to the management of epilepsy, more especially on the identification of epileptic symptoms like nocturnal epileptic seizure based on EEG data. The proposed identification methodology relies on a two-dimensional SOM, the first part of the contribution focusing on the characterization of optimal input for map learning and the second one on characterization of trajectories that are typical of

positive and negative samples on resulting maps. SOM parameters sensitivity and impact on results are also studied. Paper #17 is related to measurement of urban segregation, which is a main concern for geographers. For that purpose, authors first exploit stochastic behavior of SOMs on multivariate data to highlight stable groups of criteria that should define typical geographical area profiles. In a second step, topographic properties of map are exploited to identify segregation zones by comparing areas' distances on map and on variable state space. Experimental part, specifically conducted on Paris city data, clearly highlights the interest of the proposal.

Editors really hope that you will enjoy reading of this special issue and find in it some useful research clues for your own research and thanks again NCAA Journal for accepting this Special Issue.

Sincerely yours.
Jean-Charles Lamirel, for Editorial Board (Jean-Charles Lamirel, Marie Cottrell, Madalina Olteanu and Bruno Levy).