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Guest Editorial

Special Issue on Advances in Self-organizing Maps



It has been 17 years since the first Workshop on Self-organizing Maps (WSOM) was held in Helsinki, Finland in 1997, under the leadership of Teuvo Kohonen. The workshop brings together researchers and practitioners in the field of self-organizing systems and related areas. The 9th WSOM was held for the first time in Latin-America, at the Universidad de Chile, Santiago, Chile, on December 2012. This special issue contains 17 extended papers selected from the WSOM 2012, covering theory and applications in December.

The first part of this special issue is a collection of nine papers on the theory and methodology of self-organizing maps, learning vector quantization and dimensionality reduction. The paper “*Self Organizing Maps with Information Theoretic Learning*” analyzes the kernel SOM in terms of a similarity measure called correntropy induced metric (CIM) and empirically shows that the kernel bandwidth can be adapted to enhance the magnification of the mapping. The main advantage of using the CIM lies in its strong outlier rejection capability and taking into account higher order moments. The paper “*On-line Relational and Multiple Relational SOM*” proposes an online multiple relational SOM that is Able to Handle Non-vectorial Data Described through Several Dissimilarities. The paper “*Regional Models: A New Approach for Nonlinear System Identification via Clustering of the Self-Organizing Map*” proposes building Regional Models that stands in between the global and local models for regression and system identification tasks. The proposal uses a two-level clustering approach and then builds regional linear and nonlinear regression models over the clusters of SOM prototypes. The paper “*Automatic Design of Interpretable Fuzzy Predicate Systems for Clustering using Self-Organizing Maps*” combines SOM with predicative fuzzy logic to perform the clustering task. The paper “*Self-Organization and Missing Values in SOM and GTM*” investigates convergence properties of the SOM and the Generative Topographic Mapping (GTM), and their behavior in presence of missing data. An imputation SOM algorithm is proposed, and it is showed that this revision makes the SOM more robust in terms of the combined error when missing values are present. The paper “*Parametric Nonlinear Dimensionality Reduction using Kernel t-SNE*” proposes a kernelized extension of t-distributed stochastic neighbor embedding (t-SNE) for high-dimensional data visualization, which enables explicit out-of-sample extensions. The paper “*Kernelized Vector Quantization in Gradient Descent Learning*” shows that the data space equipped with a metric of a universal continuous and differentiable kernel is isomorphic to the respective kernel Hilbert space. This allows obtaining learning rules for adapting prototypes in the original space instead of using the standard Euclidean distance. The paper “*Efficient Approximations of Robust Soft Learning Vector Quantization for Non-vectorial Data*” considers a robust soft LVQ

approach to data which can be described by a general Gram matrix. In particular, the authors investigate the speed-up of training by means of low rank approximations of the Gram matrix (Nystrom approximation). The paper “*Non-Euclidean Principal Component Analysis by Hebbian Learning*” introduces an extension of Oja’s Hebbian learning approach for non-Euclidean spaces. For kernels space, an online learning scheme based on the differentiable kernel can be formulated. This allows us to carry out principal component analysis in the respective data space but equipped with a non-Euclidean metric.

The second part of this special issue is a collection of eight papers on the applications of self-organizing maps to text analysis and mining, data mining, image processing and economic problems. The paper “*How to Improve Robustness in Kohonen Maps and Display Additional Information in Factorial Analysis: Application to Text Mining*” proposes using Kohonen maps to improve the information provided by the different projections of the Factorial Correspondence Analysis methods classically used in lexicometry, and to make the maps more robust with respect to the randomness of the SOM algorithm. The paper “*Federating Clustering and Cluster Labeling Capabilities with a Single Approach based on Feature Maximization: French Verb Classes Identification with IGF Neural Clustering*” proposes a verb clustering approach that permits to obtain relevant verb classes and to associate them with a semantic role set and a set of sub-categorization frames. The paper “*Stylistics Analysis and Authorship Attribution Algorithms based on Self-organizing Maps*” presents a SOM based method for the task of authorship attribution. The proposed approach view texts as time series and styles as regularities in the use of words. The paper “*Intuitive Volume Exploration through Spherical Self-Organizing Map and Color Harmonization*” proposes a new approach to transfer function for mapping color and opacity values in direct volume rendering using an intuitive Spherical SOM visualization. The paper “*Self-Organizing Maps for Hand and Full Body Tracking*” uses an extension of SOM to 1D and 2D segments for hand and full body tracking. The paper “*Analysis of Professional Trajectories using Disconnected Self-Organizing Maps*” analyzes the situations of American workers with respect to employment using a SOM with an alternative topology having disconnected components called D-SOM. The paper “*Clustering of the Self-Organizing Map Reveals Profiles of Farm Profitability and Upscaling Weights*” analyzes profitability and other economic aspects of farming in Finland using clustering of the SOM. The paper “*An Agent-based Simulator Driven by Variants of Self Organizing Maps*” proposes using SOM as a simulation tool to reproduce the dynamic of economic systems.

As guest editors of this special issue, we would like to thank to all the authors for their contributions, and the reviewers for their

diligent and dedicated work in order to improve the quality of the papers. Our sincere thanks to the Neurocomputing editorial board for their support in publishing this special issue.

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