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# Advances in Self-Organizing Maps

8th International Workshop, WSOM 2011  
Espoo, Finland, June 13-15, 2011  
Proceedings

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# Preface

The 8th Workshop on Self-Organizing Maps, WSOM 2011, was the eighth event in a series of biennial international conferences that started with WSOM 1997 at the Helsinki University of Technology.

WSOM 2011 brought together researchers and practitioners in the field of self-organizing systems, with a particular emphasis on the self-organizing map (SOM). When academician Teuvo Kohonen was conducting his pioneering work with a small number of colleagues in the 1970s and 1980s, the prospects of neural network research were not widely acknowledged. The main focus was on artificial intelligence research based on symbol manipulation methodologies. As notable exceptions, Teuvo Kohonen as well as Stephen Grossberg, Shun-ichi Amari and Christoph von der Malsburg continued their efforts regardless of criticism that was often based on short-sighted interpretations of the book *Perceptrons* published in 1969 by Marvin Minsky and Seymour Papert.

For a long time, and regrettably also often these days, the term neural networks was considered to be synonymous with multilayer perceptrons. However, multilayer perceptrons have given ground to more advanced forms of supervised learning including support vector machines. Actually, among the three classic neural network paradigms – multilayer perceptrons, Hopfield nets and SOMs – only the last one has remained in a strong position. The persistent interest in the SOM algorithm can perhaps be explained by its strength as an unsupervised learning algorithm and by its virtues in analyzing and visualizing complex data sets.

Presently, research on artificial neural networks is a well-established scientific discipline and an area of technological development with a large number of applications. Artificial neural network research can be divided into three main strands: (1) explicit modeling of biological neural circuits and systems, (2) neurally inspired computing, and (3) statistical machine learning research that has mostly abandoned its biologically inspired roots. This classification cannot be considered clear-cut, but rather a continuum. In his banquet keynote talk at the IJCNN 2007 conference, Michael Jordan emphasized the importance of the neural network research for its role in facilitating the path to current statistical machine learning research. Obviously, the biological inspiration helped in abandoning some restricting assumptions that were commonly held in classic statistical computing.

There are hundreds of different kinds of variants of the basic SOM algorithm, each typically proposing some advantage by giving up an aspect of the original formulation, such as computational efficiency, capabilities in visualization, implementational simplicity or biological relevance. In general, the SOM has inspired a lot of methodological research and provided a tool for a large number of real-world cases.

The WSOM 2011 event covered the results of research in theory and methodology development as well as selected examples of applications. When applications of the SOM are considered, it is good to keep in mind that the thousands of uses of the SOM in different fields of science are usually reported in the specific fora of each discipline. Moreover, the commercial projects based on the SOM are typically not reported publicly, but there are many indications that the entrepreneurial use of the SOM and its variants in data analysis, knowledge management and business intelligence is widely spread.

The technical program of WSOM 2011 consisted of 36 oral or poster presentations – by a total of 96 authors – that highlighted the key advances in the area of self-organizing systems and more specifically in SOM research. We warmly thank all the authors of the contributed papers. We also gratefully acknowledge the contribution of the plenary speakers. The plenary presentations were given by Barbara Hammer (University of Bielefeld, Germany) and Teuvo Kohonen (Academy of Finland and Aalto University, Finland). The event celebrated the 30th anniversary of the first report in which Kohonen presented the basic principles of the SOM, and the 10th anniversary of the 3rd edition of his book *Self-Organizing Maps*. We also celebrated that the number of SOM-related scientific papers has reached approximately 10,000.

We warmly thank the highly respected international Steering and Program Committees whose roles were instrumental for the success of the conference. The Program Committee members and the reviewers ensured a timely and thorough evaluation of the papers. We are grateful to the members of the Executive Committee. In particular, the experience of Olli Simula as the Local Chair and the skillful efforts of Jaakko Peltonen as the Publicity Chair contributed greatly toward the success of the event.

WSOM 2011 was co-located with the ICANN 2011 conference. We wish to thank the organizers of ICANN 2011, especially General Chair Erkki Oja, Local Chair Amaury Lendasse and Finance Chair Francesco Corona. The smooth collaboration with them facilitated the success of WSOM 2011. Last but not least, we would like to thank Springer for their co-operation in publishing the proceedings in the prestigious *Lecture Notes in Computer Science series*.

The organizers had a chance to welcome the participants to the new but prestigious Aalto University School of Science. Namely, from the beginning of 2010, the 100-year-old university changed its name and form. Three universities, Helsinki University of Technology, Helsinki School of Economics, and University of Art and Design Helsinki, merged into Aalto University which became the second largest university in Finland.

April 2011

Timo Honkela  
Jorma Laaksonen

# Organization

WSOM 2011 was held during June 13–15, 2011, organized by the Department of Computer and Information Science, Aalto University School of Science, and co-located with the ICANN 2011 conference.

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