

Commenced Publication in 1973

Founding and Former Series Editors:

Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Editorial Board

David Hutchison

Lancaster University, UK

Takeo Kanade

Carnegie Mellon University, Pittsburgh, PA, USA

Josef Kittler

University of Surrey, Guildford, UK

Jon M. Kleinberg

Cornell University, Ithaca, NY, USA

Alfred Kobsa

University of California, Irvine, CA, USA

Friedemann Mattern

ETH Zurich, Switzerland

John C. Mitchell

Stanford University, CA, USA

Moni Naor

Weizmann Institute of Science, Rehovot, Israel

Oscar Nierstrasz

University of Bern, Switzerland

C. Pandu Rangan

Indian Institute of Technology, Madras, India

Bernhard Steffen

University of Dortmund, Germany

Madhu Sudan

Massachusetts Institute of Technology, MA, USA

Demetri Terzopoulos

University of California, Los Angeles, CA, USA

Doug Tygar

University of California, Berkeley, CA, USA

Gerhard Weikum

Max-Planck Institute of Computer Science, Saarbruecken, Germany

José C. Príncipe
Risto Miikkulainen (Eds.)

Advances in Self-Organizing Maps

7th International Workshop, WSOM 2009
St. Augustine, FL, USA, June 8-10, 2009
Proceedings

Volume Editors

José C. Príncipe
Computational NeuroEngineering Laboratory
University of Florida, Gainesville, FL 32611, USA
E-mail: principe@cnel.ufl.edu

Risto Miikkulainen
Department of Computer Sciences
The University of Texas, Austin, TX 78712-0233, USA
E-mail: risto@cs.utexas.edu

Library of Congress Control Number: Applied for

CR Subject Classification (1998): F.1, I.2, D.2, J.3

LNCS Sublibrary: SL 1 – Theoretical Computer Science and General Issues

ISSN 0302-9743
ISBN-10 3-642-02396-7 Springer Berlin Heidelberg New York
ISBN-13 978-3-642-02396-5 Springer Berlin Heidelberg New York

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer. Violations are liable to prosecution under the German Copyright Law.

springer.com

© Springer-Verlag Berlin Heidelberg 2009
Printed in Germany

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India
Printed on acid-free paper SPIN: 12697267 06/3180 5 4 3 2 1 0

Preface

These proceedings contain refereed papers presented at the 7th WSOM held at the Casa Monica Hotel, St. Augustine, Florida, June 8–10, 2009. We designed the workshop to serve as a regular forum for researchers in academia and industry who are interested in the exciting field of self-organizing maps (SOM). The program includes excellent examples of the use of SOM in many areas of social sciences, economics, computational biology, engineering, time series analysis, data visualization and computer science as well a vibrant set of theoretical papers that keep pushing the envelope of the original SOM.

Our deep appreciation is extended to Teuvo Kohonen and Ping Li for the plenary talks and Amaury Lendasse for the organization of the special sessions. Our sincere thanks go to the members of the Technical Committee and other reviewers for their excellent and timely reviews, and above all to the authors whose contributions made this workshop possible. Special thanks go to Julie Veal for her dedication and hard work in coordinating the many details necessary to put together the program and local arrangements.

Jose C. Principe
Risto Miikkulainen

Organization

Technical Committee Members

- Guilherme Barreto (Federal University of Ceara, Brazil)
- James Bednar (University of Edinburgh, UK)
- Yoonsuck Choe (Texas A&M University, USA)
- Jose Alfredo F. Costa (Federal University, UFRN, Brazil)
- Pablo Estevez (University of Chile, Santiago)
- Adrian Flanagan (Nokia Research Center, Finland)
- Tetsuo Furukawa (Kyushu Institute of Technology, Japan)
- Colin Fyfe (University of Paisley, UK)
- Barbara Hammer (Clausthal University of Technology, Germany)
- Masumi Ishikawa (Kyushu Inst. of Technology, Japan)
- Samuel Kaski (Helsinki University of Technology)
- Thomas Martinetz (University of Lübeck, Germany)
- Rudolf Mayer (Vienna University of Technology, Austria)
- Daniel Polani (University of Hertfordshire, UK)
- Bernardete Ribeiro (University of Coimbra, Portugal)
- Olli Simula (Helsinki University of Technology, Finland)
- Carme Torras (University of Catalonia, Spain)
- Kadim Tasdemir (Yasar University, Turkey)
- Alfred Ultsch (University of Marburg, Germany)
- Marc van Hulle (KU Leuven, Belgium)
- Michel Verleysen (Université catholique de Louvain, Belgium)
- Thomas Villmann (University of Applied Sciences Mittweida, Germany)
- Axel Wismueller (University of Rochester, USA)

Table of Contents

Batch-Learning Self-Organizing Map for Predicting Functions of Poorly-Characterized Proteins Massively Accumulated	1
<i>Takashi Abe, Shigehiko Kanaya, and Toshimichi Ikemura</i>	
Incremental Unsupervised Time Series Analysis Using Merge Growing Neural Gas	10
<i>Andreas Andreakis, Nicolai v. Hoyningen-Huene, and Michael Beetz</i>	
Clustering Hierarchical Data Using Self-Organizing Map: A Graph-Theoretical Approach	19
<i>Argyris Argyrou</i>	
Time Series Clustering for Anomaly Detection Using Competitive Neural Networks	28
<i>Guilherme A. Barreto and Leonardo Aguayo</i>	
Fault Prediction in Aircraft Engines Using Self-Organizing Maps	37
<i>Marie Cottrell, Patrice Gaubert, Cédric Eloy, Damien François, Geoffroy Hallaux, Jérôme Lacaille, and Michel Verleysen</i>	
Incremental Figure-Ground Segmentation Using Localized Adaptive Metrics in LVQ	45
<i>Alexander Denecke, Heiko Wersing, Jochen J. Steil, and Edgar Körner</i>	
Application of Supervised Pareto Learning Self Organizing Maps and Its Incremental Learning	54
<i>Hiroshi Dozono, Shigeomi Hara, Shinsuke Itou, and Masanori Nakakuni</i>	
Gamma SOM for Temporal Sequence Processing	63
<i>Pablo A. Estévez and Rodrigo Hernández</i>	
Fuzzy Variant of Affinity Propagation in Comparison to Median Fuzzy c-Means	72
<i>T. Geweniger, D. Zühlke, B. Hammer, and Thomas Villmann</i>	
Clustering with Swarm Algorithms Compared to Emergent SOM	80
<i>Lutz Herrmann and Alfred Ultsch</i>	
Cartograms, Self-Organizing Maps, and Magnification Control	89
<i>Roberto Henriques, Fernando Bação, and Victor Lobo</i>	
Concept Mining with Self-Organizing Maps for the Semantic Web	98
<i>Timo Honkela and Matti Pöllä</i>	

ViSOM for Dimensionality Reduction in Face Recognition	107
<i>Weilin Huang and Hujun Yin</i>	
Early Recognition of Gesture Patterns Using Sparse Code of Self-Organizing Map	116
<i>Manabu Kawashima, Atsushi Shimada, and Rin-ichiro Taniguchi</i>	
Bag-of-Features Codebook Generation by Self-Organisation	124
<i>Teemu Kinnunen, Joni-Kristian Kamarainen, Lasse Lensu, and Heikki Kälviäinen</i>	
On the Quantization Error in SOM vs. VQ: A Critical and Systematic Study	133
<i>Teuvo Kohonen, Ilari T. Nieminen, and Timo Honkela</i>	
Approaching the Time Dependent Cocktail Party Problem with Online Sparse Coding Neural Gas	145
<i>Kai Labusch, Erhardt Barth, and Thomas Martinetz</i>	
Career-Path Analysis Using Optimal Matching and Self-Organizing Maps	154
<i>Sébastien Massoni, Madalina Olteanu, and Patrick Rousset</i>	
Network-Structured Particle Swarm Optimizer with Various Topology and Its Behaviors	163
<i>Haruna Matsushita and Yoshifumi Nishio</i>	
Representing Semantic Graphs in a Self-Organizing Map	172
<i>Marshall R. Mayberry and Risto Miikkulainen</i>	
Analytic Comparison of Self-Organising Maps	182
<i>Rudolf Mayer, Robert Neumayer, Doris Baum, and Andreas Rauber</i>	
Modeling the Bilingual Lexicon of an Individual Subject	191
<i>Risto Miikkulainen and Swathi Kiran</i>	
Self-Organizing Maps with Non-cooperative Strategies (SOM-NC)	200
<i>Antonio Neme, Sergio Hernández, Omar Neme, and Leticia Hernández</i>	
Analysis of Parliamentary Election Results and Socio-Economic Situation Using Self-Organizing Map	209
<i>Pyyri Niemelä and Timo Honkela</i>	
Line Image Classification by $NG \times SOM$: Application to Handwritten Character Recognition	219
<i>Makoto Otani, Kouichi Gunya, and Tetsuo Furukawa</i>	
Self-Organization of Tactile Receptive Fields: Exploring Their Textural Origin and Their Representational Properties	228
<i>Choonseog Park, Heeyoul Choi, and Yoonsuck Choe</i>	

Visualization by Linear Projections as Information Retrieval	237
<i>Jaakko Peltonen</i>	
Analyzing Domestic Violence with Topographic Maps: A Comparative Study	246
<i>Jonas Poelmans, Paul Elzinga, Stijn Viaene, Guido Dedene, and Marc M. Van Hulle</i>	
On the Finding Process of Volcano-Domain Ontology Components Using Self-Organizing Maps	255
<i>J.R.G. Pulido, M.A. Aréchiga, E.M.R. Michel, G. Reyes, and V. Zobin</i>	
Elimination of Useless Neurons in Incremental Learnable Self-Organizing Map	264
<i>Atsushi Shimada and Rin-ichiro Taniguchi</i>	
Hierarchical PCA Using Tree-SOM for the Identification of Bacteria	272
<i>Stephan Simmteit, Frank-Michael Schleif, Thomas Villmann, and Markus Kostrzewa</i>	
Optimal Combination of SOM Search in Best-Matching Units and Map Neighborhood	281
<i>Mats Sjöberg and Jorma Laaksonen</i>	
Sparse Linear Combination of SOMs for Data Imputation: Application to Financial Database	290
<i>Antti Sorjamaa, Francesco Corona, Yoan Miche, Paul Merlin, Bertrand Maillet, Eric Séverin, and Amaury Lendasse</i>	
Towards Semi-supervised Manifold Learning: UKR with Structural Hints	298
<i>Jan Steffen, Stefan Klanke, Sethu Vijayakumar, and Helge Ritter</i>	
Construction of a General Physical Condition Judgment System Using Acceleration Plethysmogram Pulse-Wave Analysis	307
<i>Heizo Tokutaka, Yoshio Maniwa, Eikou Gonda, Masashi Yamamoto, Toshiyuki Kakihara, Masahumi Kurata, Kikuo Fujimura, Li Shigang, and Masaaki Ohkita</i>	
Top-Down Control of Learning in Biological Self-Organizing Maps	316
<i>Thomas Trappenberg, Pitoyo Hartono, and Douglas Rasmusson</i>	
Functional Principal Component Learning Using Oja's Method and Sobolev Norms	325
<i>Thomas Villmann and Barbara Hammer</i>	
A Computational Framework for Nonlinear Dimensionality Reduction and Clustering	334
<i>Axel Wismüller</i>	

The Exploration Machine – A Novel Method for Data Visualization . . .	344
<i>Axel Wismüller</i>	
Generalized Self-Organizing Mixture Autoregressive Model	353
<i>Hujun Yin and He Ni</i>	
An SOM-Hybrid Supervised Model for the Prediction of Underlying Physical Parameters from Near-Infrared Planetary Spectra	362
<i>Lili Zhang, Erzsébet Merényi, William M. Grundy, and Eliot F. Young</i>	
Author Index	373