

Lecture Notes in Computer Science 1876

Edited by G. Goos, J. Hartmanis and J. van Leeuwen

Springer

Berlin

Heidelberg

New York

Barcelona

Hong Kong

London

Milan

Paris

Singapore

Tokyo

Francesc J. Ferri José M. Iñesta
Adnan Amin Pavel Pudil (Eds.)

Advances in Pattern Recognition

Joint IAPR International Workshops
SSPR 2000 and SPR 2000
Alicante, Spain, August 30 – September 1, 2000
Proceedings



Springer

Series Editors

Gerhard Goos, Karlsruhe University, Germany
Juris Hartmanis, Cornell University, NY, USA
Jan van Leeuwen, Utrecht University, The Netherlands

Volume Editors

Francesc J. Ferri
University of València, Department of Computer Science
46100 Burjassot (València), Spain
E-mail: ferri@uv.es

José M. Iñesta
University of Alicante, Department of Computer Languages and Systems
03071 Alicante, Spain
E-mail: inesta@dlsi.ua.es

Adnan Amin
University of New South Wales, School of Computer Science and Engineering
Sydney, NSW 2052, Australia
E-mail: amin@cse.unsw.edu.au

Pavel Pudil
Academy of Sciences of the Czech Republic
Institute of Information Theory and Automation
182 08 Prague 8, Czech Republic
E-mail: pudil@utia.cas.cz

Cataloguing-in-Publication Data applied for

Die Deutsche Bibliothek - CIP-Einheitsaufnahme
Advances in pattern recognition : proceedings ; joint IAPR international workshops / SSPR 2000 and SPR 2000, Alicante, Spain, August 30 - September 1, 2000, Francesc J. Ferri ... (ed.). - Berlin ; Heidelberg ; New York ; Barcelona ; Hong Kong ; London ; Milan ; Paris ; Singapore ; Tokyo : Springer, 2000
(Lecture notes in computer science ; Vol. 1876)
ISBN 3-540-67946-4

CR Subject Classification (1998): I5, I4, I2.10, I.2

ISSN 0302-9743

ISBN 3-540-67946-4 Springer-Verlag 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-Verlag. Violations are liable for prosecution under the German Copyright Law.

Springer-Verlag Berlin Heidelberg New York
a member of BertelsmannSpringer Science+Business Media GmbH
© Springer-Verlag Berlin Heidelberg 2000
Printed in Germany

Typesetting: Camera-ready by author, data conversion by PTP-Berlin, Stefan Sossna
Printed on acid-free paper SPIN 10722379 06/3142 5 4 3 2 1 0

Preface

This volume contains all the papers presented at SSPR 2000 and SPR 2000, held at the University of Alicante, Spain, August 30 – September 1, 2000.

This was the second time these two technical workshops were held back-to-back. SSPR 2000 was the eighth meeting of the international workshop on Structural and Syntactic Pattern Recognition and SPR 2000 was the third international workshop on Statistical Techniques in Pattern Recognition.

These workshops have been traditionally sponsored by two of the most representative technical committees of the International Association of Pattern Recognition (IAPR): the TC2 and TC1, respectively.

A total of 130 papers was received for consideration from almost 40 different countries. Both the submission and the reviewing process were carried out separately for each workshop even though papers were distributed among reviewers in both program committees according to their particular previously expressed interests.

As a result of this “joint” reviewing process, papers were distributed into three categories: SSPR, SPR, and SSSPR. We designed the technical program of the joint workshop according to the accepted papers and five oral sessions were allocated for each of the two first categories and two oral sessions (eight papers) for the third one.

The two poster sessions (one per workshop) were held at the same time and were allocated a large amount of space and time to encourage discussion and interaction among researchers. A total of 52 papers was selected for oral presentation and 35 papers were presented in the two poster sessions. In addition, we invited five distinguished speakers, Jim Bezdek from the University of West Florida, USA, Marco Gori from the Università di Siena, Italy, Colin de la Higuera from the Université Jean Monnet, Saint Étienne, France, Sarunas Raudys from the Institute of Mathematics and Informatics, Vilnius, Lithuania, and Josef Kittler from the University of Surrey, UK.

SSPR 2000 and SPR 2000 were sponsored by the Conselleria d’Educació de la Generalitat Valenciana under grant RG00-01-22, the Departament de Llenguatges i Sistemes Informàtics (DLSI) and the Escuela Politécnica Superior of the Universitat d’Alacant, the Departament d’Informatica (DI) of the Universitat de València, and the International Association of Pattern Recognition (IAPR).

We would like to express our gratitude to all our sponsors and, specially, to the members of the two program committees who faced a really tough task which has lead to a selection of papers of a very high quality.

Special thanks are due to Ricardo Ferrís, Esther de Ves, and Elena Díaz of the DI, Universitat de València, and Francisco Moreno-Seco, Jorge Calera-Rubio, and Luisa Micó of the DLSI, Universitat d’Alacant, for their unbeatable effort in the organization of the workshops and in the preparation of the proceedings. We appreciate the help and understanding of the editorial staff of Springer-Verlag, in

particular Alfred Hofmann, who supported the publication of these proceedings in their LNCS series.

Finally, we would like to mention two colleagues who passed away during the preparation of these workshops: Pierre Devijver, after whom the last of the 5 plenary papers in the workshop is named, and Edzard Gelsema who died whilst holding the office of President of the IAPR.

September 2000

Francesc J. Ferri
José M. Iñesta
Adnan Amin
Pavel Pudil

SSPR 2000 Organization

Co-chairmen

José M. Iñesta

Dept. Lenguajes y Sistemas
Informáticos
Universidad de Alicante
Campus de San Vicente, 03071 Alicante, Spain
inesta@dlsi.ua.es

Adnan Amin

School of Computer Science and
Engineering
University of New South Wales
Sydney 2052, NSW, Australia
amin@cse.unsw.edu.au

Program Committee

K. Abe (Japan)
H. Baird (USA)
G. Borgefors (Sweden)
H. Bunke (Switzerland)
T. Caelli (USA)
L.P. Cordella (Italy)
I. Dinstein (Israel)
D. Dori (Israel)

G. Gimelfarb (N. Zealand)
L. Goldfarb (Canada)
E. Hancock (UK)
R. Haralick (USA)
J.M. Jolian (France)
R. Kasturi (USA)
W. Kropatsch (Austria)
H-J. Lee (Taiwan)

J. Oncina (Spain)
J. Oommen (Canada)
P. Perner (Germany)
A. Sanfeliu (Spain)
G. Sanniti di Baja (Italy)
K. Tombre (France)
E. Vidal (Spain)
P. Wang (USA)

Organizing Committee

Jorge Calera-Rubio
Mikel Forcada
Eva Gómez

Luisa Micó
Francisco Moreno
Juan Ramón Rico

Jose Luis Verdú

Supported by

International Association of Pattern Recognition
Conselleria d'Educació de la Generalitat Valenciana
Departament de Llenguatges i Sistemes Informàtics, Universitat d'Alacant
Departament d'Informatica, Universitat de València
Escuela Politécnica Superior de Alicante

SPR 2000 Organization

Co-chairmen

Francesc J. Ferri

Dept. d'Informàtica
Universitat de València
Dr Moliner, 50 46100 Burjassot, Spain
ferri@uv.es

Pavel Pudil

Institute of Information Theory and
Automation
Academy of Sciences
182 08 Prague, Czech Republic
pudil@utia.cas.cz

Program Committee

V. Brailovsky (Israel)	V. Hlavač (Czech Rep.)	N. Murshed (Brazil)
R. Carrasco (Spain)	A.K. Jain (USA)	J. Novovičová (Czech Rep)
B.V. Dasarathy (USA)	J. Kittler (UK)	E. Nyssen (Belgium)
R.W. Duin (Netherlands)	M. Kudo (Japan)	Š. Raudys (Lithuania)
M. Gilloux (France)	L. Lam (Hong Kong)	P. Rocket (UK)
J. Grim (Czech Rep.)	G. Lugosi (Spain)	M. Schlesinger (Ukraine)
T.M. Ha (Switzerland)	A. Maeder (Australia)	S. Singh (UK)
J.P. Haton (France)	D. Maravall (Spain)	C.Y. Suen (Canada)

Organizing Committee

Jesús Albert
Guillermo Ayala

Elena Díaz
Ricardo Ferrís

Jesús Malo
Esther de Ves

Supported by

International Association of Pattern Recognition
Conselleria d'Educació de la Generalitat Valenciana
Departament de Llenguatges i Sistemes Informàtics, Universitat d'Alacant
Departament d'Informàtica, Universitat de València

Table of Contents

Invited Papers

Some Notes on Twenty One (21) Nearest Prototype Classifiers	1
<i>James C. Bezdek (USA), Ludmila I. Kuncheva (UK)</i>	
Adaptive Graphical Pattern Recognition Beyond Connectionist-Based Approaches	17
<i>Giovanni Adorni (Italy), Stefano Cagnoni (Italy), Marco Gori (Italy)</i>	
Current Trends in Grammatical Inference	28
<i>Colin De La Higuera (France)</i>	
Classifier's Complexity Control while Training Multilayer Perceptrons	32
<i>Šarūnas Raudys (Lithuania)</i>	

Pierre Devijver Lecture

A Framework for Classifier Fusion: Is It Still Needed?	45
<i>Josef Kittler, J. (UK)</i>	

Hybrid and Combined Methods

Image Pattern Recognition Based on Examples – A Combined Statistical and Structural-Syntactic Approach	57
<i>Jiang Gao (China), Xiaoqing Ding (China), Jing Zheng (Canada)</i>	
A Hybrid System for the Recognition of Hand-Written Characters	67
<i>Rudolf Freund (Austria), Markus Neubauer (Austria), Martin Summerer (Austria), Stefan Gruber (Austria), Jürgen Schaffer (Austria), Roland Swoboda (Austria)</i>	
Improving Statistical Measures of Feature Subsets by Conventional and Evolutionary Approaches	77
<i>Helmut A. Mayer (Austria), Petr Somol (Czech Rep.), Reinhold Huber (Austria), Pavel Pudil (Czech Rep.)</i>	
Selection of Classifiers Based on Multiple Classifier Behaviour	87
<i>Giorgio Giacinto (Italy), Fabio Roli (Italy), Giorgio Fumera (Italy)</i>	

Applications

The Adaptive Subspace Map for Image Description and Image Database Retrieval	94
<i>Dick de Ridder (The Netherlands), Olaf Lemmers (The Netherlands), Robert P.W. Duin (The Netherlands), Josef Kittler (UK)</i>	
Adaptative Automatic Target Recognition with SVM Boosting for Outlier Detection	104
<i>Kieron Messer (UK), Josef Kittler (UK), John Haddon (UK), Graham Watson (UK), Sharon Watson (UK)</i>	
A Multiresolution Causal Colour Texture Model	114
<i>Michal Haindl (Czech Republic) Vojtěch Havlíček (Czech Republic)</i>	
Writer Identification: Statistical Analysis and Dichotomizer	123
<i>Sung-Hyuk Cha (USA), Sargur N. Srihari (USA)</i>	

Document Image Analysis

Syntactic Pattern Recognition by Error Correcting Analysis on Tree Automata	133
<i>Damián López, D. (Spain), Ignacio Piñaga (Spain)</i>	
Offline Recognition of Syntax-Constrained Cursive Handwritten Text	143
<i>J. González (Spain), I. Salvador (Spain), A.H. Toselli (Spain), A. Juan (Spain), E. Vidal (Spain), F. Casacuberta (Spain)</i>	

Structural Classification for Retrospective Conversion of Documents	154
<i>Pierre Héroux (France), Éric Trupin (France), Yves Lecoutier (France)</i>	
Segmentation of Date Field on Bank Cheques	163
<i>Louisa Lam (Hong Kong), Rong Fan (Canada), Qizhi Xu (Canada), Ching Y. Suen (Canada)</i>	

Grammar and Language Methods

Grammars and Discourse Theory to Describe and Recognize Mechanical Assemblies	173
<i>Christian Bauckhage (Germany), Susanne Kronenberg (Germany), Franz Kummert (Germany), Gerhard Sagerer (Germany)</i>	

Computation of the N Best Parse Trees for Weighted and Stochastic Context-Free Grammars	183
<i>Víctor M. Jiménez (Spain), Andrés Marzal (Spain)</i>	

Partitional vs Hierarchical Clustering Using a Minimum Grammar Complexity Approach	193
<i>Ana L.N. Fred (Portugal), José M.N. Leitão (Portugal)</i>	

Encoding Nondeterministic Finite-State Tree Automata in Sigmoid Recursive Neural Networks	203
<i>Mikel L. Forcada (Spain), Rafael C. Carrasco (Spain)</i>	

Structural Matching

Retrieval of Partially Visible Shapes through Structural Feature Indexing .	211
<i>Hirobumi Nishida (Japan)</i>	

A Structural Matching Algorithm Using Generalized Deterministic Annealing	221
<i>Laura Davlea (Romania)</i>	

Alignment and Correspondence Using Singular Value Decomposition	226
<i>B. Luo (China), E.R. Hancock (UK)</i>	

Graph Matching: Fast Candidate Elimination Using Machine Learning Techniques	236
<i>M. Lazarescu (Switzerland), H. Bunke (Switzerland), S. Venkatesh (Australia)</i>	

Efficient Alignment and Correspondence Using Edit Distance	246
<i>Paolo Bergamini (Italy), Luigi Cinque (Italy), Andrew D.J. Cross (UK), Edwin R. Hancock (UK), Stefano Levialdi (Italy), Richard Myers (UK)</i>	

Graph-Based Methods

Irregular Pyramids with Combinatorial Maps	256
<i>Luc Brun (France), Walter Kropatsch (Austria)</i>	

A New Error-Correcting Distance for Attributed Relational Graph Problems	266
<i>Yasser El-Sonbaty (Egypt), M.A. Ismail (Egypt)</i>	

Distance between Attributed Graphs and Function-Described Graphs Relaxing 2 nd Order Restrictions	277
<i>René Alquézar (Spain), Francesc Serratosa (Spain), Alberto Sanfeliu (Spain)</i>	

A Graph Labelling Approach for Connected Feature Selection	287
<i>Jocelyn Marchadier (France), Sylvain Michelin (France), Yves Egels (France)</i>	

Region-Based Representation for Object Recognition by Relaxation Labelling	297
<i>Alireza Ahmadyfard (UK), Josef Kittler (UK)</i>	

Shape Analysis

Shape Boundary Tracking with Hidden Markov Models	308
<i>Terry Caelli (Canada)</i>	
Parallel Techniques for Rule-Based Scene Interpretation	318
<i>Walter F. Bischof (Canada), Terry Caelli (Canada)</i>	
Curvature Estimation Using Shape-from-Texture	327
<i>Eraldo Ribeiro (UK), Edwin R. Hancock (UK)</i>	

Efficient Techniques for a Very Accurate Measurement of Dissimilarities between Cyclic Patterns	337
<i>R.A. Mollineda (Spain), E. Vidal (Spain), F. Casacuberta (Spain)</i>	

SSPR Poster Session

Planar Symmetry Detection by Random Sampling and Voting Process	347
<i>Atsushi Imiya (Japan), Tomoki Ueno (Japan), Iris Fermin (Japan)</i>	

Assessing the Computational Effort for Structural 3D Vehicle Recognition .	357
<i>Eckart Michaelsen (Germany), Uwe Stilla (Germany)</i>	

Guided Relinking of Graph Pyramids	367
<i>R. Glantz (Austria), W.G. Kropatsch (Austria)</i>	

Texture Indexing by a Hierarchical Representation	377
<i>D. Vitulano (Italy), S. Vitulano (Italy)</i>	

Surface Skeletons Detected on the D^6 Distance Transform.....	387
<i>Gabriella Sanniti di Baja (Italy), Stina Svensson (Sweden)</i>	

Selection Strategies for Ambiguous Graph Matching by Evolutionary Optimisation	397
<i>Richard Myers (UK), Edwin R. Hancock (UK)</i>	

Studies of Radical Model for Retrieval of Cursive Chinese Handwritten Annotations	407
<i>Matthew Ma (USA), Chi Zhang (USA), Patrick Wang (USA)</i>	

A Statistical-Estimation Method for Stochastic Finite-State Transducers Based on Entropy Measures	417
<i>David Picó (Spain), Francisco Casacuberta (Spain)</i>	

Efficient Subgraph Isomorphism with ‘A Priori’ Knowledge (Application to 3D Reconstruction of Buildings for Cartography)	427
<i>Frank Fuchs (France), Hervé Le-Men (France)</i>	

Pyramid and Interior	437
<i>Jean-Gérard Pailloncy (France)</i>	

Prototype Learning with Attributed Relational Graphs	447
<i>Pasquale Foggia (Italy), Roberto Genna (Italy), Mario Vento (Italy)</i>	
Lossless Compression of Surfaces Described as Points	457
<i>Juan R. Rico-Juan (Spain), Jorge Calera-Rubio (Spain), Rafael C. Carrasco (Spain)</i>	
A Class of Solvable Consistent Labeling Problems	462
<i>Boris Flach (Germany), Michail I. Schlesinger (Ukraine)</i>	

Character Recognition, Orientation, and Scale Estimation Thanks to the Fourier Mellin Transform	472
<i>Sébastien Adam (France), Jean M. Ogier (France), Claude Cariou (France), Rémy Mullot (France), Joël Gardes (France), Jacques Labiche (France)</i>	

Using the Dual of Proximity Graphs for Binary Decision Tree Design	482
<i>J.S. Sánchez (Spain), F. Pla (Spain), M.C. Herrero (Spain)</i>	

Clustering and Density Estimation

Bayesian Approach to Mixture Models for Discrimination	491
<i>Keith Copsey (UK), Andrew Webb (UK)</i>	

Pattern Classification Based on a Piecewise Multi-linear Model for the Class Probability Densities	501
<i>Edgard Nyssen (Belgium), Luc Van Kempen (Belgium), Hichem Sahli (Belgium)</i>	

Selection of the Number of Components Using a Genetic Algorithm for Mixture Model Classifiers	511
<i>Hiroshi Tenmoto (Japan), Mineichi Kudo (Japan), Masaru Shimbo (Japan)</i>	

The Moments of the Mixel Distribution and Its Application to Statistical Image Classification	521
<i>Asanobu Kitamoto (Japan)</i>	

Object Recognition

Statistical Pattern Recognition Using the Normalized Complex Moment Components Vector	532
<i>Stavros Paschalakis (UK), Peter Lee (UK)</i>	

Initial Matching of Multiple-View Images by Affine Approximation of Relative Distorsions	540
<i>Georgy Gimel'farb (New Zealand), Jian Q. Zhang (New Zealand)</i>	

Local Discriminant Regions Using Support Vector Machines for Object Recognition	550
<i>David Guillamet (Spain), Jordi Vitrià (Spain)</i>	

Stochastic Models for Recognition of Occluded Objects	560
<i>Bir Bhanu (USA), Yingqiang Lin (USA)</i>	

General Methodology I

A Vector Approach to the Analysis of (Pattern with) Spatial Dependence	571
<i>Andrés Molina (Spain)</i>	

The Foundational Theory of Optimal Bayesian Pairwise Linear Classifiers	581
<i>Luis Rueda (Canada), B. John Oommen (Canada)</i>	

The Optimum Classifier and the Performance Evaluation by Bayesian Approach	591
<i>Xuexian Han (Japan), Tetsushi Wakabayashi (Japan), Fumitaka Kimura (Japan)</i>	

A New Approximation Method of the Quadratic Discriminant Function	601
<i>Shin'ichiro Omachi (Japan), Fang Sun (Japan), Hirotomo Aso (Japan)</i>	

An Optimal Reject Rule for Binary Classifiers	611
<i>Francesco Tortorella (Italy)</i>	

General Methodology II

Decontamination of Training Samples for Supervised Pattern Recognition Methods	621
<i>Ricardo Barandela (Mexico), Eduardo Gasca (Mexico)</i>	

The Role of Combining Rules in Bagging and Boosting	631
<i>Marina Skurichina (The Netherlands), Robert P.W. Duin (The Netherlands)</i>	

Confidence Combination Methods in Multi-expert Systems	641
<i>Yingquan Wu (USA), K. Ianakiev (USA), V. Govindaraju (USA)</i>	

Reducing the Training Times of Neural Classifiers with Dataset Condensing	650
<i>Se-Ho Choi (UK), Peter Rockett (UK)</i>	

Non-linear Invertible Representation for Joint Statistical and Perceptual Feature Decorrelation	658
<i>J. Malo (Spain), R. Navarro (Spain), I. Epifanio (Spain), F.J. Ferri (Spain), J.M. Artigas (Spain)</i>	

Feature Extraction and Selection

A Divergence Criterion for Classifier-Independent Feature Selection	668
<i>N. Abe (Japan), Mineichi Kudo (Japan), J. Toyama (Japan), Masaru Shimbo (Japan)</i>	

Comparison of Classifier-Specific Feature Selection Algorithms	677
<i>Mineichi Kudo (Japan), Petr Somol (Czech Rep), Pavel Pudil (Czech Rep), Masaru Shimbo (Japan), Jack Sklansky (USA)</i>	
Combined Classifier Optimisation via Feature Selection	687
<i>David Windridge (UK), Josef Kittler (UK)</i>	
Design Choices and Theoretical Issues for Relative Feature Importance, a Metric for Nonparametric Discriminatory Power	696
<i>Hilary J. Holz (USA), Murray H. Loew (USA)</i>	

SPR Poster Session

Real-Coded Genetic Algorithms Based on Mathematical Morphology	706
<i>Dolores Barrios (Spain), Daniel Manrique (Spain), Jaime Porras (Spain), Juan Ríos (Spain)</i>	
A New Model and Process Architecture for Facial Expression Recognition .	716
<i>Ginés García-Mateos (Spain), Cristina Vicente-Chicote (Spain)</i>	
Biologically Inspired Architecture of Feedforward Networks for Signal Classification	727
<i>Šarūnas Raudys, (Lithuania), Minija Tamošiūnaitė (Lithuania)</i>	
Optimal Threshold Estimation Using Prototype Selection	737
<i>Uri Lipowezky (Israel), Victor Shenkar (Israel)</i>	
Basic and Fine Structure of Pairwise Interactions in Gibbs Texture Models	747
<i>Georgy Gimel'farb (New Zealand)</i>	
Segmentation of Text and Graphics/Images Using the Gray-Level Histogram Fourier Transform	757
<i>M.A. Patricio (Spain), D. Maravall (Spain)</i>	
Fast and Accurate Handwritten Character Recognition Using Approximate Nearest Neighbours Search on Large Databases	767
<i>Juan C. Pérez-Cortes (Spain), Rafael Llobet (Spain), Joaquim Arlandis (Spain)</i>	
A Family of Divergences between Φ -Probabilistic Sets with Application to Handshape Recognition	777
<i>Juan M. León-Rojas (Spain), José Moreno (Spain), Antonio Silva (Spain), Montaña Morales (Spain)</i>	
Rotated, Scaled, and Noisy 2D and 3D Texture Classification with the Bispectrum-Based Invariant Feature	787
<i>Yo Horikawa (Japan)</i>	

Multiple Comparison Procedures for Determining the Optimal Complexity of a Model	796
<i>Pedro L. Galindo (Spain), Joaquín Pizarro-Junquera (Spain), Elisa Guerrero (Spain)</i>	
Image Pattern Recognition in Natural Environment Using Morphological Feature Extraction	806
<i>Yonggwan Won (Korea), Jiseung Nam (Korea), Bae-Ho Lee (Korea)</i>	
A Statistical Matrix Representation Using a Sliced Orthogonal Nonlinear Correlations for Pattern Recognition	816
<i>P. García-Martínez (Spain), H.H. Arsenault (Spain), C. Ferreira (Spain)</i>	
A Fast Approximately k -Nearest-Neighbour Search Algorithm for Classification Tasks	823
<i>Francisco Moreno-Seco (Spain), Luisa Micó (Spain), José Oncina (Spain)</i>	
Design of a Telerobotic Interface System by Using Object Recognition Techniques	832
<i>Raül Marín (Spain), Pedro J. Sanz (Spain), Antonio J. Jimeno (Spain), Jose M. Iñesta (Spain)</i>	
Comparison of Four Initialization Techniques for the K -Medians Clustering Algorithm	842
<i>A. Juan (Spain), E. Vidal (Spain)</i>	
Sensory-Flow Segmentation Using a Resource Allocating Vector Quantizer	853
<i>Frederik Linåker (Sweden), Lars Niklasson (UK)</i>	
Multiple Reject Thresholds for Improving Classification Reliability	863
<i>Giorgio Fumera (Italy), Fabio Roli (Italy), Giorgio Giacinto (Italy)</i>	
Clustering with EM: Complex Models vs. Robust Estimation	872
<i>C. Saint-Jean (France), C. Frélicot (France), B. Vachon (France)</i>	
A Simple Implementation of the Stochastic Discrimination for Pattern Recognition	882
<i>D. Chen (USA), X. Cheng (USA)</i>	
Adaptive Image Filtering and Segmentation Using Robust Statistical Estimation of Intensity	888
<i>R.M. Palenichka (Austria), P. Zinterhof (Austria), I.B. Ivasenko (Ukraine)</i>	
Author Index	899