Lecture Notes in Computer Science 974
Edited by G. Goos, J. Hartmanis and J. van Leeuwen

Advisory Board: W. Brauer D. Gries J. Stoer

Carlo Braccini Leila DeFloriani
Gianni Vernazza (Eds.)

Image Analysis and Processing

8th International Conference, ICIAP '95
San Remo, Italy, September 13-15, 1995
Proceedings

Springer

Series Editors

Gerhard Goos, Karlsruhe University, Germany

Juris Hartmanis, Cornell University, NY, USA

Jan van Leeuwen, Utrecht University, The Netherlands

Volume Editors

Carlo Braccini
DIST, University of Genova
Via Opera Pia,13, I-16145 Genova, Italy

Leila DeFloriani
DISI, University of Genova
Via Dodecaneso, 35, I-16146 Genova, Italy

Gianni Vernazza
DIEE, University of Cagliari
Piazza d' Armi, I-09123 Cagliari, Italy

Cataloging-in-Publication data applied for

Die Deutsche Bibliothek - CIP-Einheitsaufnahme

Image analysis and processing : 8th international conference ; proceedings / ICIAP '95, Sanremo, Italy, September 1995. Carlo Braccini ... (ed.). [IAPR]. - Berlin ; Heidelberg ; New York ; Barcelona ; Budapest ; Hong Kong ; London ; Milan ; Paris ; Tokyo : Springer, 1995
(Lecture notes in computer science ; Vol. 974)
ISBN 3-540-60298-4
NE: Braccini, Carlo [Hrsg.]; ICIAP <8, 1995, San Remo>; International Association for Pattern Recognition; GT

CR Subject Classification (1991): I.4, I.5, I.3.3, I.3.5, I.3.7, I.2.10

ISBN 3-540-60298-4 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 1995
Printed in Germany

Typesetting: Camera-ready by author
SPIN 10485511 06/3142 – 5 4 3 2 1 0 Printed on acid-free paper

Foreword

This volume collects the papers accepted for presentation at the eighth International Conference on Image Analysis and Processing (ICIAP), to be held in Sanremo, Italy, September 13-15, 1995. ICIAP'95 is the eighth of a series of international conferences promoted since 1981 by the Italian Chapter of the International Association for Pattern Recognition (IAPR) as an international forum for presentation and discussion of the most recent advances in the fields of image analysis and processing, and of pattern recognition.

The 8th ICIAP is organized jointly by the Department of Biophysical and Electronic Engineering (DIBE), by the Department of Computer and Information Sciences (DISI), by the Department of Communication, Computer and System Science (DIST) of the University of Genoa, and by Elsag Bailey.

An international call for papers, mainly sent by electronic mail, resulted in over 180 papers submitted. The submissions spanned over both theoretical and applicative aspects in low-level image processing, image coding, range and acoustic images, statistical and structural pattern recognition, shape recognition, texture analysis, motion analysis, scene understanding, neural networks, and architectures. The application domains covered include document analysis, biomedicine, remote sensing, robotics and industrial automation.

Each paper underwent a careful refereeing process, at the end of which 108 contributions were selected for inclusion in this volume. The selection of the papers has been extremely difficult because of the many good-quality submissions. We wish to thank all the members of the Program Committee and the other referees for their invaluable cooperation in reviewing the papers in a very restricted amount of time. We would like to thank all the authors for the quality of their work and for their collaboration in keeping the length of their papers within the page limit.

The technical program consists of 34 oral presentations and of 74 posters, and is enhanced by six invited talks given by the A. Jain (University of Michigan), H. Bunke (University of Bern), L. Shapiro (University of Washington), M.D. Levine (McGill University), G. Nagy (Rensselaer Polytechnic Institute) and A.N. Netravali (AT&T Bell Labs.). The lectures survey established approaches, recent results and directions of future work on different topics of primary importance within the field, namely texture analysis, graph-based shape recognition, CAD-based vision, three-dimensional object description, document analysis and image communication.

We wish to express our appreciation to all those who have cooperated for the success of the 8th ICIAP. First of all, we want to thank Giovanni Garibotto for his invaluable contribution to continuously monitoring the scientific level of the conference. Special thanks are due to Enrico Puppo for his invaluable cooperation in handling the refereeing process and putting together the technical program. We are also grateful to Fabio Cocurullo for his fundamental assistance in preparing these proceedings and to Sebastiano Serpico for coordinating the local

organization. It is a pleasure to thank Ombretta Arvigo, Michela Bertolotto, and Paola Magillo of DISI, and Franco Fontana, Alessandra Tesei, Paolo Pellegretti, and Cinthya Ottonello of DIBE for their friendly help with the conference organization.

Finally, we would like to stress that the conference could not take place without the support of all the different organizations, companies and local institutions listed in this volume.

Genova, June 1995

Carlo Braccini Leila De Floriani Gianni Vernazza

General Chairs

C. Braccini	DIST, University of Genova
L. De Floriani	DISI, University of Genova
G. Vernazza	DIBE, University of Genova
	DIEE, University of Cagliari

Scientific Chair

G. Garibotto	Elsag Bailey - A Finmeccanica Company

Scientific Coordinators

F. Cocurullo	DIST, University of Genova
E. Puppo	IMA - CNR, Genova
S.B. Serpico	DIBE, University of Genova

Program Committee

J.K. Aggarwal, U.S.A.	C. Arcelli, Italy
V. Cantoni, Italy	V. Cappellini, Italy
L.P. Cordella, Italy	J. Desachy, France
V. Di Gesù, Italy	O. Faugeras, France
M. Ferretti, Italy	H. Freeman, U.S.A.
C. Guerra, Italy	T. Huang, U.S.A.
S. Impedovo, Italy	J. Kittler, U.K.
W. Kropatsch, Austria	O. Kübler, Switzerland
M. Kunt, Switzerland	S. Levialdi, Italy
P. Mussio, Italy	T. Pavlidis, U.S.A.
S. Peleg, Israel	V. Roberto, Italy
H. Samet, U.S.A.	A. Sanfeliu, Spain
R. Stefanelli, Italy	S. Tanimoto, U.S.A.
A. Venetsanopoulos, Canada	S. Vitulano, Italy
P. Zamperoni, Germany	B. Zavidovique, France

Scientific Secretariat

O. Arvigo	DISI, University of Genova

Local Arrangements

S. Vaccaro	DIBE, University of Genova

Financial

F. Bagnus	AEI - Ligurian Chapter

Publications

F. Cocurullo	DIST, University of Genova

Registration

F. Ravaschio	Elsag Bailey - A Finmeccanica Company

Additional Referees

Albanesi, M.G.
Ayer, S.
Bigun, J.
Borgefors, G.
Bruzzone, E.
Cocurullo, F.
Curinga, S.
De Natale, F.
Dellepiane, S.
Dickinson, S.
Duc, B.
Euriemdy, G.
Fischer, S.
Gong, X.
Lancini, R.
Magillo, P.
Marcelli, A.
Menard, C.
Murino, V.
Nicchiotti, G.
Ottonello, C.
Ramella, G.
Reusens, E.
Rosenfeld, A.
Sansone, C.
Scagliola, C.
Tesei, A.
Tubaro, S.
Werman, M.
Zappatore, S.
Alessandri, A.
Bertolotto, M.
Bischof, H.
Brelstaff, G.
Castello, P.
Colla, A.
De Micheli, E.
De Stefano, C.
Di Zenzo, S.
Doermann, D.
Egger, O.
Ferenberg, G.
Foresti, G.L.
Grattarola, A.
Lavagetto, F.
Makarov, A.
Masciangelo, S.
Moccagatta, I.
Nagy, G.
Ottaviani, E.
Puppo, E
Regazzoni, C.
Roli, F.
Sanniti di Baja, G.
Sazaklis, G.
Soffer, A.
Trucco, A.
Vento, M.
Yacoob, Y.

Organization and Support

Organized by:

- University of Genova
  DIBE - Dept. of Biophysical and Electronic Engineering
  DISI - Dept. of Computer and Information Sciences
  DIST - Dept. of Communication, Computer and System Science
- Elsag Bailey - A Finmeccanica Company

Sponsored by:

- IAPR - International Association for Pattern Recognition
- AEI - Electrical and Electronics Engineers Association (Ligurian Chapter)
- EURASIP - European Association for Signal Processing
- IEEE - Institute of Electrical and Electronics Engineers (North Italy Section)

Supported by:

- APT Riviera dei Fiori
- Banca CARIGE - Cassa di Risparmio di Genova ed Imperia.
- Casinò Municipale di Sanremo
- Città di Sanremo
- CNR - Consiglio Nazionale delle Ricerche
- Consorzio Sanremo Congressi Turismo
- Elsag Bailey - A Finmeccanica Company
- Gruppo Marazzi
- IRST - Istituto per la Ricerca e lo Sviluppo del Trentino
- Orsi Impianti
- Provincia di Imperia
- Telecom Italia - Direzione Regionale Liguria
- University of Cagliari
- 3M Italia

Contents

Textures

Texture Analysis: Representation and Matching 3
A.K. Jain, K. Karu

Region-Based Segmentation of Textured Images 11
C. Rouquet, P. Bonton

A New Approach to Image Segmentation 17
A. Succi, V. Torre

Segmentation

Using Hopfield Networks to Segment Color Images 25
P. Campadelli, D. Medici, R. Schettini

The Watershed Transformation for Multiresolution Image Segmentation.. 31
S. Wegner, T. Harms, J.H. Builtjes, H. Oswald, E. Fleck

Bounds on the Optimal Elasticity Parameters for a Snake 37
O.V. Larsen, P. Radeva, E. Martí

Matching

Efficient Attributed Graph Matching and Its Application to Image Analysis 45
H. Bunke, B.T. Messmer

Matching Delaunay Graphs 56
A.M. Finch, E.R. Hancock

An Integrated Approach to Grouping and Matching 62
R.C. Wilson, E.R. Hancock

An Adaptive Reject Option for LVQ Classifiers 68
L.P. Cordella, C. De Stefano, C. Sansone, M. Vento

Shape Features

A Model Based Method for Characterization and Location
of Curved Image Features 77
T. Blaszka, R. Deriche

Estimation of Curvature and Tangent Direction by Median
Filtered Differencing 83
J. Matas, Z. Shao, J. Kittler

Adaptive Elimination of False Edges for First Order Detectors *89*
D. Ziou, S. Tabbone

Software and Hardware Architectures for Image Processing

An Image Processing Library Based on Abstract Image Data-Types in C++ *97*
D. Koelma, A. Smeulders

Spatio-Temporal Data Management for a 3D Graphical Information System *103*
M. Maruyama, T. Teraoka, T. Tamada, S. Nishida

PhotoPix: an Object-Oriented Framework for Digital Image Processing Systems *109*
A.A. Souza Sol, A. de Albuquerque Araújo

Data Packing vs Processing Speed on Low-Cost Massively Parallel Systems: a Case Study *115*
A. Broggi

A New Parallel Method Based on a Genetic Approach for Determination and Classification of Skin Spots *121*
A. Kutics, M. Date

A VLSI Scalable Processor Array for Motion Estimation *127*
P. Baglietto, M. Maresca, A. Migliaro, M. Migliardi

Evaluating Digital Angles by a Parallel Diffusion Process *133*
V. Cantoni, L. Cinque, S. Levialdi, L. Lombardi

A Pyramidal Approach to Convex Hull and Filling Algorithms *139*
M.G. Albanesi, M. Ferretti, L. Zangrandi

A Code Based Approach to Image-Processing Teaching *145*
A. Biancardi, M. Pini

Neural Networks

A Visual Speech Model Based on Fuzzy-Neuro Methods *153*
H.H. Bothe

Edge Detection Filters Based on Artificial Neural Networks *159*
A.J. Pinho, L.B. Almeida

Use of Cortical Filters and Neural Networks in a Self-Organising Image Classification System *165*
N. Petkov

Occluded Objects Recognition Using Multiscale Features and Hopfield Neural Networks 171
J.-S. Lee, C.-H. Chen, Y.-N. Sun, G.-S. Tseng

Image Coding I

Automatic Video Segmentation Through Editing Analysis 179
J.M. Corridoni, A. Del Bimbo

Image Retrieval by Elastic Matching of User Sketches 185
A. Del Bimbo, P. Pala

Finding Facial Features Using an HLS Colour Space 191
P. Ranefall, B. Nordin, E. Bengtsson

A New and Fast Real-Time Implementation of 2-D DCT 197
J. Jiang

A Hybrid Lossless Compression of Still Images Using Markov Models and Linear Prediction 203
S. Takamura, M. Takagi

The Impact of Aliasing and Quantization on Motion Compensation 209
C. Stiller

Biomedical Applications I

Rule-Based Method for Tumor Recognition in Liver Ultrasonic Images ... 217
V.A. Kovalev

An Understanding of Muscle Fibre Images 223
C.C. Taylor, M.R. Faghihi, I.L. Dryden

A New Plant Cell Image Segmentation Algorithm 229
G. Fernàndez, M. Kunt, J.-P. Zrÿd

Extraction of Tumours from MR Images of the Brain by Texture and Clustering 235
J. Batista, R. Kitney

Automatic Identification of Brain Contours in Magnetic Resonance Images of the Head 241
F. Bello, R. Kitney

Analysis of the Spatial Arrangement of Cells in the Proliferative Breast Lesions 247
V. Della Mea, C.A. Beltrami

Application of Image Processing in Neurobiology: Detection of Low Signals with High Spatial Resolution and a Non-Uniform Variance *253*
Y. Chitti

Computer Assisted Analysis of Echocardiographic Image Sequences *258*
A. Giachetti, M. Cappello, G. Gigli, V. Torre

Tissue Segmentation in MRI as an Informative Indicator of Disease Activity in the Brain *265*
S. Vinitski, C. Gonzalez, C. Burnett, F. Mohamed, T. Iwanaga, H. Ortega, S. Faro

Scene Understanding

Analysis of Scenes Containing Multiple Non-Polyhedral 3D Objects *273*
M.S. Costa, L.G. Shapiro

Fuzzy Segmentation and Astronomical Images Interpretation *281*
P. Dhérété, L. Wendling, J. Desachy

Learning How to Find Patterns or Objects in Complex Scenes *287*
W.F. Bischof, T. Caelli

Adaptive Matching Using Object Models Generated from Photometric Stereo Images *293*
G. Bellaire, K. Schlüns, A. Mitritz, K. Gwinner

Robot Vision

Sensor Planning Techniques and Active Visual Inspection *301*
V. Roberto, E. Trucco

Experimental Self-Calibration from Four Views *307*
R. Enciso, T. Viéville

Vision-Based Navigation in Service Robotics *313*
G. Garibotto, M. Ilic, S. Masciangelo

Digital Topology and Morphology

Segmenting 3D Objects into Geons *321*
K. Wu, M.D. Levine

Delineation of Elongated Sub-Patterns in a Piecewise Constant Foreground *335*
C. Arcelli, G. Ramella

On a New Basic Concept and Topological Invariant *341*
F. Xia

Line Moments and Invariants for Real Time Processing of Vectorized Contour Data 347
G. Lambert, H. Gao

Range and Acoustic Images

Restoration of Noisy Underwater Acoustic Images Using Markov Random Fields 355
V. Murino, E. Frumento, F. Gabino

Plausibilistic Preprocessing of Sparse Range Images 361
B. Krebs, B. Korn, F.M. Wahl

Segmentation/Reconstruction of Range Images Based on Piecewise-Linear Approximation 367
E. Puppo

Low-Level Image Processing

In-Place Covariance Operators for Computer Vision 375
T. Caelli, M. Ollila

A New Heuristic Search for Boundary Detection 381
M. Salotti, M. Hatimi

Sub-Pixel Registration for Super High Resolution Image Acquisition Based on Temporal Integration 387
Y. Nakazawa, T. Komatsu, T. Saito

Robust Features for Textures in Additive Noise 393
C. Ottonello, S. Pagnan, V. Murino

Decomposing Contours into Curves of Different Families 399
V. Caglioti

A Proposal on Local and Adaptive Determination of Filter Scale for Edge Detection 405
D.G. Sorrenti

On the Detection of Step Edges in Algorithms Based on Gradient Vector Analysis 411
A. Larré, E. Montseny

Directions Analysis in Grey-level Images 417
S. Bres, H. Emptoz

An Unsupervised and Non-Parametric Bayesian Image Segmentation 423
M. Zribi, F. Ghorbel

A.I. Based Image Segmentation 429
S. Vitulano, C. Di Ruberto, M. Nappi

Quality Enhancement in Image Enlargement 435
F. Marino, G. Mastronardi

Synthesising Objects and Scenes Using the Reverse Distance Transformation in 2D and 3D 441
I. Nyström, G. Borgefors

Texture Segmentation Using Local Phase Differences in Gabor Filtered Images 447
A.M. Landraud, S. Oh Yum

Disparity Estimation for Stereo Sequences Based on Adaptive Size Hierarchical Block Matching 453
M. Accame, F. De Natale

Matching of Stereo Curves - A Closed Form Solution 459
Y. Zhang, J.J. Gerbrands

Multi-Polygonal Object Tracking 465
G. Tascini, P. Puliti, P. Zingaretti

Optimal Parameter Estimation of Ellipses 471
Y. Cui, J. Weng, H. Reynolds

A Linear Discriminator of Width 477
J.A.F. Leite, E.R. Hancock

Binarization of Inhomogeneously Illuminated Images 483
V.V. Kindratenko, B.A. Treiger, P.J.M. Van Espen

Pruning Discrete and Semicontinuous Skeletons 488
D. Attali, G. Sanniti di Baja, E. Thiel

On Commutative Properties of Halftoning and Their Applications 494
Y.B. Karasik

Pattern Recognition and Document Processing

Combining Resolution and Granularity for Pattern Recognition 503
P. Bottoni, L. Cinque, S. Levialdi, L. Lombardi, P. Mussio

Line and Cell Searching in Tables or Forms 509
E. Turolla, Y. Belaïd, A. Belaïd

Describing Words by Graphs 515
G. Congedo, G. Dimauro, S. Impedovo, G. Pirlo

Selecting Reference Signatures for On-Line Signature Verification *521*
G. Congedo, G. Dimauro, A.M. Forte, S. Impedovo, G. Pirlo

ApOFIS: an A priori Optical Font Identification System *527*
A. Zramdini, R. Ingold

Extracting Words and Multi-Part Symbols in Graphics Rich Documents . *533*
M. Burge, G. Monagan

A Semi-Automatic Method for Form Layout Description *539*
S. Bussi, F. Mangili

Improving the Use of Contours for Off-line Cursive Script Segmentation.. *545*
G. Boccignone, M. De Santo, A. Chianese, A. Picariello

A Method for Determining Address Format in the Automated Sorting of Japanese Mail *551*
T. Tsuchiya, N. Nakajima, T. Kamimura

Structural Features by MCR Expression for Printed Arabic Character Recognition *557*
A.B.C. Zidouri, S. Chinveeraphan, M. Sato

Genetic Algorithm for Thinning Gray-Scale Images of Characters *563*
T. Shioyama, A. Okumura, Y. Aoki

Blue-Print Document Analysis for Color Classification *569*
G. Marcu, S. Abe

Optical Character Recognition

Document Image Analysis: What is Missing? *577*
G. Nagy

Invariant Features for HMM Based On-Line Handwriting Recognition.... *588*
J. Hu, M.K. Brown, W. Turin

A Robust Analytical Approach for Handwritten Word Recognition..... *594*
G. Congedo, G. Dimauro, S. Impedovo, G. Pirlo, D. Sfregola

Recognition of Rotated Characters by Inexact Matching *600*
L. Cinque, S. Di Zenzo, S. Levialdi

Biomedical Applications II

Bayesian Image Reconstruction Using a High-Order Interacting MRF Model *609*
M. Chan, G.T. Herman, E. Levitan

Minimum Spanning Trees (MST) as a Tool for Describing Tissue Architecture when Grading Bladder Carcinoma *615*
H.-K. Choi, E. Bengtsson, T. Jarkrans, J. Vasko, K. Wester, P.-U. Malmström, C. Busch

Symbolic Indexing of Cardiological Sequences Through Dynamic Curve Representations *621*
M. Baroni, G. Congiu, A. Del Bimbo, A. Evangelisti, E. Vicario

Image Coding II

Visual Communication *629*
A.N. Netravali

Generalized Square Isometries - An Improvement for Fractal Image Coding *637*
D.C. Popescu, A. Dimca, H. Yan

A Fast Algorithm for High Quality Vector Quantization Codebook Design *643*
C. Braccini, F. Cocurullo, F. Lavagetto

Fast Fractal Image Coding Using Pyramids *649*
H. Lin, A.N. Venetsanopoulos

Motion

Hidden MRF Detection of Motion of Objects with Uniform Brightness ... *657*
A. Kuriański, M. Nieniewski

Motion Analysis and Segmentation for Object-Oriented Mid-Level Image Representation *663*
T. Saito, T. Komatsu

Miscellaneous Applications

Speckle Noise Filtering in SAR Images Using Wavelets *671*
L. Böröczky, R. Fioravanti, S. Fioravanti, D.D. Giusto

Prediction of Short-Term Evolution of Cloud Formations Based on Meteosat Image Sequences *677*
R. Bolla, M. Marchese, C. Nobile, S. Zappatore

Prototyping of Interactive Satellite Image Analysis Tools Using a Real-Time Data-Flow Computer *683*
S. Praud, P. Germain, J. Plantier

Simulation of Aircraft Images for Airport Surface Traffic Control *689*
F. Marti, M. Naldi

Cooperation of Knowledge Based Systems for Galaxy Classification *697*
J.-C. Ossola, M. Thonnat

Fuzzy Segmentation and Structural Knowledge for Satellite Image Analysis *703*
L. Wendling, M. Zehana, J. Desachy

Detection of Lofar Lines *709*
J.-C. Di Martino, S. Tabbone

A Fast Object Orientation Estimation and Recognition Technique for Underwater Acoustic Imaging *715*
A. Tesei, A. Trucco, D. Zambonini

Applying Contextual Constraints to Extract Symbolic Representation for Image Understanding *721*
N. Semmar

Application of the Hough Transform for Weld Inspection Underwater *731*
A.R. Greig

Development of an Automated Bond Verification System for Advanced Electronic Packages *737*
M. Darboux, J.-M. Dinten

Crack Detection by a Mesure of Texture Anisotropy *743*
L. Bruzzone, F. Roli, S.B. Serpico

A Vision System for Automatic Inspection of Meat Quality *748*
M. Barni, V. Cappellini, A. Mecocci

Author Index *755*