1995 IEEE WORKSHOP ON NONLINEAR
SIGNAL AND
IMAGE PROCESSING

Neos Marmaras
Greece
20 - 22 June 1995

Sponsored by

Aristotle University of Thessaloniki
Commission of the EU, Long Term Research
Domaine Carras
ESPRIT III Project NAT
EURASIP
Greek Ministry of Research and Technology
IEEE CAS and ASSP Societies
INTRACOM
1995 IEEE WORKSHOP ON NONLINEAR SIGNAL AND IMAGE PROCESSING

June 20-22, 1995

Neos Marmaras, Halkidiki, GREECE

Invited Papers

II Multichannel Image Processing ................................................................. 1
A. N. Venetsanopoulos, K. N. Plataniotis

I2 Signal Processing with Alpha-Stable Distributions and Applications ........................................... 5
Chrysostomos L. Nikias

I3 Polynomial Methods for Computer Vision ..................................................... 9
Thomas S. Huang, Robert J. Holt, Arun N. Netravali

I4 Very Low Bitrate Coding: Which Way Ahead?  
E. Reusens, O. Egger, T. Ebrahimi, M. Kunt  
Included in the Late Arrival Section

1 Mathematical Morphology I

1.1 Watersheds in Color Image Segmentation ............................................... 14
Kari Saarinen

1.2 Parallel Method Based on a NEW Genetic Approach for Detection of Skin Objects ......................................................... 18
Andrea Kutics, Akihiko Nakagawa, Munehiro Date

1.3 Gradient Watersheds in Morphological Scale-Space ................................ 22
Paul Jackway
1.4 An Adaptive Threshold Model for the Hough Transform based on Binary Statistical Morphology ........................................... 26
Carlo S. Regazzoni, Gianluca Foresti, Anastasios N. Venetsanopoulos

1.5 A New Class of Alternating Sequential Filters ......................................................... 30
Henk J.A.M. Heijmans

1.6 Grayscale Morphology using Nonlinear Lp Mean Filters ........................................... 34
M. Pappas, I. Pitas

1.7 Multiframe MAP Signal Estimation in Morphologically Smooth Images ...................... 38
N. D. Sidiropoulos, D. Meleas, T. Stragas

1.8 Theoretical Aspects of the Gray-Level Morphological V-Opening and its Applications on Adaptive Signal Filtering .................. 42
Chu-Song Chen, Ja-Ling Wu, Yi-Ping Hung

2 Neural Networks I

2.1 Recurrent Neural Network for the Eigen-Decomposition of Positive Definite Matrices ................................................................. 46
Fa-Long Luo, Rolf Unbehauen, Konrad Reif

2.2 Realization of Polyhedral Decision Regions by Neural Networks ................................ 50
K. Koutroumbas, N. Kalouptsidis

2.3 Signal Classification and Relative Compactness ...................................................... 54
Irwin W. Sandberg, Ajit T. Dingankar

2.4 The Compartmental Model Neuron and its Application to Time Series Analysis ........... 58
Stathis Kasderidis, John G. Taylor

2.5 On the Convergence of the Backpropagation Training Algorithms ............................ 62
3 Radial Basis Functions Networks

3.1 Radial Basis Functions for Nonlinear Prediction of Speech in Analysis-by-Synthesis Coders ......................................................... 66
Fernando Diaz-de-Maria, Anibal R. Figueiras-Vidal

3.2 Versatile Gaussian Networks .............................................................. 70
H.N.Mhaskar

3.3 Gaussian-Mixture Basis Function Networks for Nonlinear Signal Processing ................................................................. 74
Inhyok Cha, Saleem A. Kassam

3.4 RBF Neural Classifier for Hand-written Character Recognition ................................................................. 78
F. M. Frattale Mascioli, R. Parisi, G. Martinelli

3.5 Estimation of Transit Time In Multiphase Flow with a Radial Basis Function Network ................................................................. 82
Sherif Mekhail, Jonathon Chambers

4 Nonlinear Techniques in Image Restoration and Recovery I

4.1 Some results about Wiener-Volterra Restoration of the Original Colour Quality in Old Painting Imagery ......................................................... 86
G.M. Cortelazzo, G.L. Geremia, G.A. Mian

4.2 Image Restoration Using Boolean and Stack Filters ................................................................. 90
Ioan Tăbuș, Moncef Gabbouj

4.3 Bayesian Image Reconstruction with Image-Modeling Priors ................................................................. 94
Gabor T. Herman, Michael Chan

4.4 Higher-Order Order-Statistic Filters for Signal-dependent Noise ................................................................. 98

VII
Richard P. Kleihorst, Reginald L. Lagendijk, Jan Biemond

4.5 Blind Deconvolution with Application to Astronomical Imaging
Julian C. Christou
Included in the Late Arrival Section

4.6 Prior Models and Methods of Choosing the Unknown Parameters in
the Bayesian and Regularization Approaches to Image Restoration
Rafael Molina, Aggelos K. Katsaggelos

4.7 Variable Resolution Bayesian Image Reconstruction
Jorge Nunez, Jorge Llacer

4.8 Interpolation by Regeneration Using Gibbs Random Field Models
Levent Onural, Nicos Herodotou, Anastasios N. Venetsanopoulos

4.9 Image Restoration for the Hubble Space Telescope:
Accomplishments and Prospects
Robert Hanisch
Not arrived at the date of printing

5 Chaotic Systems in Signal Processing
Special Session

5.1 CNN Information Technology via Nonlinear Dynamics and Chaos
Leon O. Chua

5.2 Tree-based Modeling, Prediction and Analysis of Chaotic Time Series
Olivier Michel, Alfred Hero, Anne-Emmanuelle Badel, Patrick Flandrin

5.3 Synchronization of Dynamical Systems: Recent Progress, Potential
Applications and Limitations
Michael Peter Kennedy, Hervé Dedieu

5.4 Chaos Detection Methods with Application to Heart Rate Variability
Karin Vibe, Jean-Marc Vesin

VIII
5.5 Generation of Broadband Signals by Chaotic Discrete-Time Systems .......... 129
Wolfgang Schwarz, Kristina Kutzer, Torsten Kilias

5.6 Chaos Control Techniques for Signal Processing ............................. 133
Maciej Ogorzalek, Herve Dedieu

5.7 Modern Mathematical Tools for Analysing Nonlinear Effects in Digital Filters ......................................................... 137
Zbigniew Galias, Maciej Ogorzalek, Ljupco Kocarev

5.8 What is a Chaotic Signal? .......................................................... 141
Gernot Kubin

5.9 Chaotic Systems of Difference Equations for Real-time Encryption ................................................................. 145
S. Papadimitriou, G. Pavlides, A. Bezerianos, T. Bountis

5.10 A New Circuit for Communication Using Solitons .......................... 150
Andrew C. Singer

6 Image Analysis and Motion

6.1 Extraction of Photochromic Flow Traces Using Active Contours ............ 154
D. Androutsos, P.E. Trahanias, A.N. Venetsanopoulos

6.2 Translation of Isothetic Rectangles in a Linear Quadtree Domain ............ 158
Uwe Ast, Gunther Schrack

6.3 Identification of Text-Only Areas in Mixed Type Documents ................. 162
C. Strouthopoulos, N. Papamarkos, C. Chamzas

6.4 A Fast Thinning Algorithm for Character ..................................... 166
Edna L. Flores, Eder N. Rezende, Gilberto A. Carrijo, Joao B.T. Yabu-tti

6.5 Global Rigid Alignment Method for Deformable Contours Based on the Strength of Materials Theory ................................. 170
P. Audin-Olivaux, M. Ferney
6.6 Contour Extraction by Determination of a Minimum Deformation Energy.
Application: recognition of characteristic curves on X-ray radiographs .......... 174
P. O. Lair, P. Audin-Olivaux, M. Ferney, A. El Hami

6.7 A Nonlinear Measure of Edge Activity ............................................. 178
John Immerkær

6.8 Nonlinear Image Operators for the Detection of Local Intrinsic
Dimensionality ................................................................. 182
G. Krieger, C. Zetzsche, E. Barth

6.9 Texture Classification Using the Fractal Dimension as Computed
in a Wavelet Decomposed Image ............................................. 186
Y.A. Karayiannis, T. Stouraitis

6.10 Nonlinear Filtering for Colour Segmentation and Enhancement ............. 190
L. Shafarenko, M. Petrou, J. Kittler

6.11 Block-Level Motion Vector Refinement in Layered Video ..................... 194
Vince Rhee, Jerry D. Gibson

6.12 A Nonlinear Fluid Model for Describing Frequency Modulation
of Image Orientations ....................................................... 198
Marios S. Pattichis, Alan C. Bovik

6.13 Texture Description through Rank-Order Functions
Roberto Fioravanti, Stefano Fioravanti
Not arrived at the date of printing

6.14 A Method Coding Connections by Separation of Connected
Domains of Arbitrary Form on Binary Images
Oleg Trofimov
Not arrived at the date of printing

7 Coding

7.1 On Objective Performance Measures in Image Compression
by Subband Coding ............................................................. 202
Dragorad Milovanović, Zoran Bojković, Andreja Samčović

X
8 Detection, Estimation, Modeling I

8.1 Signal Detection in Non-Additive Non-Gaussian Noise ........................................... 218
Andreas M. Maras, Evangelos A. Kokkinos

8.2 Nonlinear Effects of Envelope Extraction in Beamforming
Imaging Systems ......................................................... 222
Vittorio Murino, Andrea Trucco

8.3 Robust Adaptive Kalman Filtering Using QQ-Plot Approach .................................... 226
Željko M. Durović, Branko D. Kovačević

8.4 Identification of Nonlinear $S_M$-Systems ......................................................... 230
Wolfgang Klippel

8.5 Blind Identification of Instantaneous Nonlinear Polynomial Systems ..................... 234
Lonnie C. Ludeman

8.6 Supervised Recognition of Events in Signals with Changing
Probabilistic Properties ................................................ 238
V.V. Mottl, S.D. Dvoyenko

8.7 Robust Identification in Discrete Time Chaotic Systems
Dominique Guegan
8.8 A Polynomial-Algebraic Approach to Non-Stationary Time-Dependent ARMA (TARMA) Model Estimation
R. Benmrad, S. D. Fassois, J. E. Levitt
Not arrived at the date of printing

8.9 Nonlinear Least Squares: Blockwise Recursive-Iterative Procedures
Sam L. Blyumin, Anatoly K. Pogodajev
Not arrived at the date of printing

9 Nonlinear Techniques for Image Coding
Special Session

9.1 Triangle-Based Motion Estimation and Temporal Interpolation 242
Marie Dudon, Olivier Avaro, Christian Roux

9.2 Morphological Segmentation Using Texture and Coding Cost 246
Beatriz Marcotegui, Jose Crespo, Fernand Meyer

9.3 Coding of Image Partitions by Morphological Skeleton Using Overlapping Structuring Elements 250
F. Marqués, S. Fioravanti, P. Brigger

9.4 Extinction Value: A New Measurement of Persistence 254
Corinne Vachier, Fernand Meyer

9.5 Texture Coding using Morphological Interpolation 258
Philippe Salembier, Roger Rüé

9.6 New Morphological Skeleton Properties Applicable to its Efficient Coding 262
R. Kresch, D. Malah

9.7 A Methodology for Image Segmentation Based on the Spectral Content of Regions 266
Marc Van Droogenbroeck

XII
9.8 Neural Network Post-Processing of Coded Images Using Perceptual Masking .................................................. 270
O. Bruyndonckx, M. Mattavelli, S. Comes, B. Macq

9.9 Contour Coding System in the Hexagonal Raster ......................... 274
Fernand Meyer, Òscar Ribes

9.10 Fractal Image Encoding and Binary Quantization ....................... 278
Wladyslaw Skarbek

10 Neural Networks II
Special Session

10.1 Classification of Moving Objects from Real World Image Sequences ...... 281
Gek Lim, Mike Alder, Christopher J.S. deSilva, Yianni Attikiouzel

10.2 Dynamic Multi-level Resolution for Handwritten Word Recognition .......... 285
Andrew Jennings, Brett Eastwood

10.3 Evolution and Modularity in Neural Networks ................................ 289
Terry Bossomaier, Nigel Snoad

10.4 Intra-Vascular Ultrasound Tissue Identification Using Artificial Neural Networks and Fuzzy Expert Classifiers ......................... 293
Laurence W. Cahill, Duncan A. Campbell, Jenine M. Vandenberg, James D. Cameron

11 Fuzzy signal and image processing

11.1 Mean and Median of Fuzzy Numbers ...................................... 297
Vassilios Chatzis, Ioannis Pitas

11.2 Detecting Flaws in Industrial Radiograph Images by Multi-Scale Restoration and Fuzzy Reasoning ............................... 301
E. Fleuet, B. Lavayssiere, M. Lefèvre, H. Finet

11.3 Adaptive Image Smoothing using Fuzzy Operators .......................... 305
Fabrizio Russo, Giovanni Ramponi

XIII
11.4 A Fuzzy Reasoning System for Binocular Scene Matching ........................................ 309
F.J. Jiménez Rodriguez, J.M. Molina López, J.R. Casar Corredera

11.5 An Adaptive Window Hybrid Filter ................................................................. 313
Shaomin Peng, Lori Lucke

12 Nonlinear Techniques in Image Restoration and Recovery II
Special Session

12.1 Deconvolution of Hubble Space Telescope Images ......................................... 317
Sylvie Roques, François Bourzeix

12.2 Weighted Median Predictive Techniques for Coefficient
Estimation in NonGaussian Markov Random Fields ............................................. 321
Sean Borman, Ken Sauer, Charles Bouman

12.3 Generalized Morphological Center: Convergence ...................................... 325
Mohammed Charif-Chefchaouni, Dan Schonfeld

12.4 Multiresolution Support Applied to Image Restoration .................................. 329
J.-L. Starck, F. Murtagh, A. Bijaoui

12.5 Restoration of Quantum-Limited Images by Convex Projections .................. 333
Henry Stark, Jane Wurster, Yongyi Yang

13 Color Image Transmission and Calibration
Special Session

13.1 Block Truncation Coding of Color Images by Hierarchical Clustering ............ 337
Tak Po Chan, Bing Zeng, Ming L. Liou

13.2 Adaptive Windowed JPEG Coding of Still Images Using Neural Networks ...... 340
Dimitrios Kalogeras, Stefanos Kollias

XIV
13.3 New Transform Coding of Color Still Images Based on Variable-Shape Blocks
Susumu Itoh, Ichiro Matsuda

13.4 Colour Calibration Methods for CRT Monitors
Rod Campeanu
Not arrived at the date of printing

14 Nonlinear Signal Processing for Future Satellite Communications
Special Session

14.1 Preliminary results on the Performance Evaluation of a Concatenated Coding Scheme with Outer Reed-Solomon Codes and Inner TCM Codes on Multilevel QAM Signalling through Nonlinear Channels
C.E. Dimakis, I.K. Nissopoulos, S.S. Kouris

14.2 A Novel Topology for Large Signal Travelling Wave Amplifier
Stefano D’Agostino, Claudio Paoloni

14.3 Nonlinear Feedforward Carrier Synchronizer for TDMA Burst Mode Satellite Link
Maria Gouta, Jacques Duntronc

14.4 An Efficient CAD Tool to Estimate Intermodulation Products in Mobile SATCOM Nonlinear Channels with Intense Traffic
P. Rougeris, A. Ferrarotti, S.A. Kosmopoulos, M.T. Sarris

14.5 Robust Estimation of Cross-bicorrelations
Ronald K. Pearson

14.6 Nonlinear Control of PLL Operation in Symmetry Clock Recovery Circuits for NRZ data
Nicola Leone, Piero Marietti, Alessandro Trifiletti
Not arrived at the date of printing.
15 Volterra filters

15.1 Quadratic Volterra Filters with Mean-Weighted Highpass Characteristics ................................................. 368
Stefan Thurnhofer, Sanjit K. Mitra

15.2 Limits and Cures of Nonlinear Channel Equalization by Polynomial Filters ......................................................... 372
Patrick Grohan, Sylvie Marcos

15.3 Some Results on Infinite Extent Polynomial Interpolation ......................................................... 376
Pascal Bondon, Christophe Bourin

15.4 On the use of Frequency Domain Volterra Filters ......................................................... 380
P.O. Amblard, E. Moisan

15.5 Low Complexity 3rd Order Nonlinear Filtering ......................................................... 384
Walter A. Frank

16 Speech Processing I

16.1 Cepstral Speech/Pause Detectors ......................................................... 388
Petr Pollák, Pavel Sovka, Jan Uhliř

16.2 Unsupervised Learning in Robust Recursive Identification of Non-Stationary AR Model of Speech Production System ......................................................... 392
Milan Ž. Marković

16.3 Speech Characterisation by Nonlinear Methods ......................................................... 396
Mike Banbrook, Steve McLaughlin

16.4 Subband Coder for Telephone Quality Audio Signals ......................................................... 400
Harri Raittinen, Kimmo Kaski

16.5 ASR_L Speech Recognition System Based on Expert Defined Focusing Structural Analysis ......................................................... 404
Goran Jovanović

XVI
17 Higher Order Statistics and Volterra filters

17.1 A Fast M-D Recursive Least Square Adaptive Second Order Volterra Filter .......................................................... 408
F. Fnaiech, S. Guillon, M. Najim

17.2 High Order System Identification with Second Order Volterra IIR Filters .......................................................... 412
E. Roy, R.W. Stewart, T.S. Durrani

17.3 Nonlinear Noise Cancellation: Bilinear Filtering of a Sonar Experiment .......................................................... 416
Karine Mio, Eric Moisan, Pierre Olivier Amblard

17.4 A Fast Convolution Technique for Volterra Filtering .......................................................... 420
R. Bernardini, G.M. Cortelazzo, G.A. Mian

17.5 Time-Frequency Distribution and Turbulence .......................................................... 424
Guy Gourbebaisse

17.6 A HOS Technique for Coherent Radar Detection in Mixed Clutter Environment .......................................................... 428
Fulvio Gini, Lucio Verrazzani

17.7 Second-order Adaptive Volterra System Identification with Sequential Processing Lattice Stages Mehmet Tahir Ozden, Ahmet Hamdi Kayran, Erdal Panayirci
Not arrived at the date of printing

18 Coding and Vector Quatization

18.1 Coding Mouth Images using the Relation between Speech and Image Data .......................................................... 432
D. Shah, S. Marshall

18.2 Image Compression for Facial Photographs .......................................................... 436
Panos Nasiopoulos, Rabab K. Ward

XVII
18.3 Design of Subset Averaged Median Predictors for
DPCM Coding of Images .................................................. 440
Dong Hee Kang, Yong Hoon Lee

18.4 VQ Based Adaptive Block Transform Design Techniques .................. 444
Hakan Caglar, Emin Anarim, Bulent Sankur, Ibrahim Olcer

18.5 A Space-filling Curve Image-scan for the Parallelization
of the Two-Dimensional Fast Wavelet Transform ................................ 448
G. Lafruit, J. Cornelis

19 Image Signatures

19.1 Towards Robust and Hidden Image Copyright Labeling .................... 452
E. Koch, J. Zhao

19.2 Spatial Method for Copyright Labeling of Digital Images ........................ 456
O. Bruyndonckx, J.-J. Quisquater, B. Macq

19.3 Applying Signatures on Digital Images ........................................ 460
I. Pitas, T. H. Kaskalis

20 Mathematical Morphology II

20.1 Characterizing Alternating Sequential Filters .................................. 464
Imants Svalbe

20.2 On Commutative Properties of Halftoning, or How to Reduce
3-Dimensional Mathematical Morphology to 2-Dimensional One. ................ 468
Y.B. Karasik

20.3 A Parallel Voronoi Tessellation Algorithm Based on
Mathematical Morphology ..................................................... 471
I. Pitas

20.4 Using Queues in Mathematical Morphology: Algorithms
Analysis and Propositions for a Hardware Implementation .................... 475
A. Merle, D. Noguet, R. Lionti, D. David

20.5 Fast Dilation by Large 1D Structuring Elements ........................................ 479
F. Lemonnier, J.C. Klein

21 Biomedical DSP I

21.1 Application of Methods of Non-Linear Dynamics in Comparison
to Traditional Methods in Heart Rate Variability Analysis .......................... 483
A. Voss, J. Kurths, H.J. Kleiner, A. Witt, R. Dietz, P. Saparin, N. Wessel

21.2 Multiple Knot Spline Approximation for ECG Data Compression .............. 487
Marta Karczewicz, Matti Hamalainen, Moncef Gabbouj

21.3 Application of Nonlinear Filters to Analysis of Sleep Process .................. 491
A. Asano, A. Varri, N. Takano, J. Hasan, P. Loula, V. Hakkinen

21.4 A Comparison of Linear and Nonlinear Techniques for Distinguishing
Phase-Dissimilar VEP's .................................................. 495
André J.W. van der Kouwe, Pierre J. Cilliers

21.5 Non Linear Dynamics in Heart Rate Variability Signal
Through Deterministic Chaotic Approach ......................................................... 499
Maria G. Signorini, Sergio Cerutti, Angela Filannino, Stefano Guzzetti

22 Color Image Filtering, Analysis and Applications
Special Session

22.1 Multichannel Filters Using Composite Distance Metrics ......................... 503
S. Fotopoulos, G. Economou

22.2 Optimal Multichannel L Filters Based on Reduced Ordering ..................... 507
N. Nikolaidis, I. Pitas

22.3 Colour Image Edge Detection Using Directional Operators ....................... 511
J. Scharcanski, A.N. Venetsanopoulos