Energy Minimization Methods in Computer Vision and Pattern Recognition

Third International Workshop, EMMCVPR 2001
Sophia Antipolis, France, September 3-5, 2001
Proceedings
Preface

This volume consists of the 42 papers presented at the International Workshop on Energy Minimization Methods in Computer Vision and Pattern Recognition (EMMCVPR 2001), which was held at INRIA (Institut National de Recherche en Informatique et en Automatique) in Sophia Antipolis, France, from September 3 through September 5, 2001. This workshop is the third of a series, which was started with EMMCVPR’97, held in Venice in May 1997, and continued with EMMCVPR’99, which took place in York, in July 1999.

Minimization problems and optimization methods permeate computer vision (CV), pattern recognition (PR), and many other fields of machine intelligence. The aim of the EMMCVPR workshops is to bring together people with research interests in this interdisciplinary topic. Although the subject is traditionally well represented at major international conferences on CV and PR, the EMMCVPR workshops provide a forum where researchers can report their recent work and engage in more informal discussions.

We received 70 submissions from 23 countries, which were reviewed by the members of the program committee. Based on the reviews, 24 papers were accepted for oral presentation and 18 for poster presentation. In this volume, no distinction is made between papers that were presented orally or as posters. The book is organized into five sections, whose topics coincide with the five sessions of the workshop: “Probabilistic Models and Estimation”, “Image Modelling and Synthesis”, “Clustering, Grouping, and Segmentation”, “Optimization and Graphs”, and “Shapes, Curves, Surfaces, and Templates”.

In addition to the contributed presentations, EMMCVPR 2001 had the privilege of including keynote talks by three distinguished scientists in the field: Donald Geman, Geoffrey Hinton, and David Mumford. These invited speakers have played seminal roles in the development of modern computer vision and pattern recognition, and continue to be involved in cutting-edge research.

We would like to thank a number of people who have helped us in making EMMCVPR 2001 a successful workshop. We thank Marcello Pelillo and Edwin Hancock for allowing us to take care of the EMMCVPR series, which they started, and for the important advice that made our organizational tasks easier. We also want to acknowledge all the program committee members for carefully reviewing papers for EMMCVPR.

Finally, we thank the various organizations that have provided support for EMMCVPR: the International Association for Pattern Recognition, who sponsored the workshop and provided publicity, the INRIA Sophia Antipolis, who hosted the workshop and provided financial support.

June 2001

Mário Figueiredo, Josiane Zerubia, and Anil K. Jain
Organization

Program Co-Chairs

Mário Figueiredo  Instituto Superior Técnico, Lisboa, Portugal
Josiane Zerubia  INRIA Sophia Antipolis, France
Anil K. Jain  Michigan State University, East Lansing, MI, USA

Program Committee

Yali Amit  University of Chicago, USA
Joachim Buhmann  University of Bonn, Germany
Roland Chin  University of Science and Technology, Hong Kong
Byron Dom  IBM Almaden Research Center, USA
Marie Pierre Dubuisson-Jolly  Siemens Corp. Research, USA
Davi Geiger  New York University, USA
Christine Graffigne  Université René Descartes, France
Edwin Hancock  University of York, UK
Tin Ho  Bell Laboratories, USA
Kanti Mardia  University of Leeds, UK
Marcello Pelillo  University of Venice, Italy
Eugene Pechersky  Institute of Information Transmission Problems, Russia
Anand Rangarajan  Yale University, USA
Kaleem Siddiqi  McGill University, Canada
Richard Szeliski  Microsoft Research, USA
Alan Yuille  Smith-Kettlewell Eye Research Institute, USA
Ramin Zabih  Cornell University, USA
Song-Chun Zhu  Ohio State University, USA

Sponsoring Institutions

INRIA Sophia Antipolis
International Association for Pattern Recognition
Conseil General des Alpes-Maritimes
# Table of Contents

## I  Probabilistic Models and Estimation

A Double-Loop Algorithm to Minimize the Bethe Free Energy .......... 3  
 Alan Yuille

A Variational Approach to Maximum a Posteriori Estimation  
for Image Denoising .................................................. 19  
 A. Ben Hamza and Hamid Krim

Maximum Likelihood Estimation of the Template  
of a Rigid Moving Object ........................................... 34  
 Pedro M.Q. Aguiar and José M.F. Moura

Metric Similarities Learning through Examples:  
An Application to Shape Retrieval .................................. 50  
 Alain Trouvé and Yong Yu

A Fast MAP Algorithm for 3D Ultrasound  ....................... 63  
 João M. Sanches and Jorge S. Marques

Designing the Minimal Structure of Hidden Markov Model  
by Bisimulation ......................................................... 75  
 Manuele Bicego, Agostino Dovier, and Vittorio Murino

Relaxing Symmetric Multiple Windows Stereo  
Using Markov Random Fields ........................................... 91  
 Andrea Fusiello, Umberto Castellani, and Vittorio Murino

Matching Images to Models – Camera Calibration  
for 3-D Surface Reconstruction ..................................... 105  
 Robin D. Morris, Vadim N. Smelyanskiy, and Peter C. Cheeseman

A Hierarchical Markov Random Field Model  
for Figure-Ground Segregation ...................................... 118  
 Stella X. Yu, Tai Sing Lee, and Takeo Kanade

Articulated Object Tracking via a Genetic Algorithm ............... 134  
 Jairo Rocha and Arnau Mir

## II  Image Modelling and Synthesis

Learning Matrix Space Image Representations  ...................... 153  
 Anand Rangarajan
Supervised Texture Segmentation by Maximising Conditional Likelihood
Georgy Gimel’farb

Designing Moiré Patterns
Guy Lebanon and Alfred M. Bruckstein

Optimization of Paintbrush Rendering of Images
by Dynamic MCMC Methods
Tamás Szirányi and Zoltán Tóth

Illumination Invariant Recognition of Color Texture Using Correlation
and Covariance Functions
Mohammed Al-Rawi and Yang Jie

III Clustering, Grouping, and Segmentation

Path Based Pairwise Data Clustering with Application
to Texture Segmentation
Bernd Fischer, Thomas Zöller, and Joachim M. Buhmann

A Maximum Likelihood Framework for Grouping and Segmentation
Antonio Robles-Kelly and Edwin R. Hancock

Image Labeling and Grouping by Minimizing Linear Functionals
over Cones
Christian Schellewald, Jens Keuchel, and Christoph Schnörr

Grouping with Directed Relationships
Stella X. Yu and Jianbo Shi

Segmentations of Spatio-Temporal Images
by Spatio-Temporal Markov Random Field Model
Shunsuke Kamijo, Katsushi Ikeuchi, and Masao Sakauchi

Highlight and Shading Invariant Color Image Segmentation
Using Simulated Annealing
Paul Fieguth and Slawo Wesolkowski

Edge Based Probabilistic Relaxation for Sub-pixel Contour Extraction
Toshiro Kubota, Terry Huntsberger, and Jeffrey T. Martin

Two Variational Models for Multispectral Image Classification
Christophe Samson, Laure Blanc-Féraud, Gilles Aubert,
and Josiane Zerubia
IV Optimization and Graphs

An Experimental Comparison of Min-cut/Max-flow Algorithms for Energy Minimization in Vision ........................................... 359

Yuri Boykov and Vladimir Kolmogorov

A Discrete/Continuous Minimization Method in Interferometric Image Processing ........................................... 375

José M.B. Dias and José M.N. Leitão


Kar-Ann Toh

Global Feedforward Neural Network Learning for Classification and Regression ........................................... 407

Kar-Ann Toh, Juwei Lu, and Wei-Yun Yau

Matching Free Trees, Maximal Cliques, and Monotone Game Dynamics ... 423

Marcello Pelillo

Efficiently Computing Weighted Tree Edit Distance Using Relaxation Labeling ........................................... 438

Andrea Torsello and Edwin R. Hancock

Estimation of Distribution Algorithms: A New Evolutionary Computation Approach for Graph Matching Problems .............. 454

Endika Bengoetxea, Pedro Larrañaga, Isabelle Bloch, and Aymeric Perchant

A Complementary Pivoting Approach to Graph Matching .............. 469

Alessio Massaro and Marcello Pelillo

Application of Genetic Algorithms to 3-D Shape Reconstruction in an Active Stereo Vision System ........................................... 480

Sanghyuk Woo, Albert Dipanda, and Franck Marzani

V Shapes, Curves, Surfaces, and Templates

A Markov Process Using Curvature for Filtering Curve Images ......... 497

Jonas August and Steven W. Zucker

Geodesic Interpolating Splines ........................................... 513

Vincent Camion and Laurent Younes

Averaged Template Matching Equations ................................... 528

Anil N. Hirani, Jerrold E. Marsden, and James Arvo
A Continuous Shape Descriptor by Orientation Diffusion .................. 544
   Hsing-Kuo Pao and Davi Geiger

Multiple Contour Finding and Perceptual Grouping as a Set
   of Energy Minimizing Paths ........................................ 560
   Laurent D. Cohen and Thomas Deschamps

Shape Tracking Using Centroid-Based Methods ......................... 576
   Arnaldo J. Abrantes and Jorge S. Marques

Optical Flow and Image Registration: A New Local Rigidity Approach
   for Global Minimization .............................................. 592
   Martin Lefebure and Laurent D. Cohen

Spherical Object Reconstruction Using Star-Shaped Simplex Meshes ...... 608
   Pavel Matula and David Svoboda

Gabor Feature Space Diffusion via the Minimal Weighted Area Method ... 621
   Chen Sagiv, Nir A. Sochen, and Yehoshua Y. Zeevi

3D Flux Maximizing Flows ............................................. 636
   Kaleem Siddiqi and Alexander Vasilevskiy

Author Index ........................................................... 651