

Lecture Notes in Computer Science

1035

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

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

S.Z. Li D.P. Mital E.K. Teoh H. Wan (Eds.)

Recent Developments in Computer Vision

Second Asian Conference on Computer Vision,
ACCV '95

Singapore, December 5-8, 1995

Invited Session Papers



Springer

Series Editors

Gerhard Goos, Karlsruhe University, Germany

Juris Hartmanis, Cornell University, NY, USA

Jan van Leeuwen, Utrecht University, The Netherlands

Volume Editors

Stan Z. Li

Dinesh P. Mital

Eam Khwang Teoh

Han Wang

Nanyang Technological University

School of Electrical and Electronic Engineering

Nanyang Avenue, Singapore 639 798, Singapore

Cataloging-in-Publication data applied for

Die Deutsche Bibliothek - CIP-Einheitsaufnahme

Recent developments in computer vision : invited session papers / Second Asian Conference on Computer Vision, ACCV '95, Singapore, December 5 - 8, 1995. S. Li ... (ed.). - Berlin ; Heidelberg ; New York ; Barcelona ; Budapest ; Hong Kong ; London ; Milan ; Paris ; Santa Clara ; Singapore ; Tokyo : Springer, 1996

(Lecture notes in computer science ; 1035)

ISBN 3-540-60793-5

NE: Li, Stan Z. [Hrsg.]; Asian Conference on Computer Vision <2, 1995, Singapore>; GT

CR Subject Classification (1991): I.3, I.5, I.2.9-10, I.4

Cover Illustration taken from the contribution by Papachristou, Petrou, and Kittler on page 392.

ISBN 3-540-60793-5 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 1996

Printed in Germany

Typesetting: Camera-ready by author

SPIN 10512499 06/3142 - 5 4 3 2 1 0 Printed on acid-free paper

Foreword

Collected in this volume are 56 invited session papers presented at the Second Asia Conference on Computer Vision (ACCV) held in Singapore, 5–8 December 1995. The theme of the conference was “Computer Vision for the Twenty First Century”. Fifteen leading researchers, whose names are listed below, were invited as session organizers to solicit and review these papers. The papers cover various areas in computer vision and address both theoretical and practical issues. In my view, they reflect the state-of-the-art developments in computer vision.

As the invited sessions’ chair, I would like to thank the organizers and paper contributors for their efforts in making the ACCV’95 invited sessions a successful event. Many thanks also to the team of the conference organizing committee for their excellent work in running the conference.

December 1995

S.Z. Li

Invited Session Organizers

J. Aggarwal	University of Texas, TX
K. Baker	University of Reading, UK
P. Bouthemy	IRISA/INRIA, France
T.S. Huang	University of Illinois, IL
Y.P. Hung	Academia Sinica, Taipei
A.K. Jain	Michigan State University, MI
J. Kittler	University of Surrey, UK
S. Lakshmanan	University of Michigan, MI
S.D. Ma	Chinese Academy of Sciences, Beijing
K.V. Mardia	University of Leeds, UK
M. Mohiuddin	IBM Almaden Research Center, CA
R.W. Picard	MIT, Cambridge, MA
J. Thijssen	University Hospital, Netherlands
S. Ullman	Weizmann Institute of Science, Israel
A. Zisserman	Oxford University, UK

Contents

New Directions

Chair: *J. Aggarwal*

Digital Libraries: Meeting Place for Low-Level And High-Level Vision	3
<i>R. Picard</i>	
Computer Vision in Next Generation Image and Video Coding	13
<i>T.S. Huang, R. Lopez</i>	
Video Annotation: Computers Watching Video	23
<i>A. Bobick</i>	
Video Representations	33
<i>R. Bolle, Y. Aloimonos, C. Fermüller</i>	
Analysis of Left Ventricular Motion	43
<i>W.-H. Liao, S.J. Aggarwal, J.K. Aggarwal</i>	
Applications of Computer Vision in Space Robotics	59
<i>C.-H. Chien</i>	

Motion Estimation and Segmentation

Chair: *P. Bouthemy*

Optical-Flow Estimation while Preserving Its Discontinuities: A Variational Approach	71
<i>R. Deriche, P. Kornprobst, G. Aubert</i>	
Space- and Time-Variant Estimation Approaches and the Segmentation of the Resulting Optical Flow Fields	81
<i>H.-H. Nagel, A. Gehrke, M. Haag, M. Otte</i>	
Combining the Hough Transform and Multiresolution MRF's for the Robust Motion Estimation	91
<i>M. Bober, J. Kittler</i>	
Direct Model-Based Image Motion Segmentation for Dynamic Scene Analysis	101
<i>J.-M. Odobez, P. Bouthemy</i>	

Structure from Motion

Chair: *T.S. Huang*

Modeling Structured Environments Using Robot Vision	113
<i>S. Shah, J.K. Aggarwal</i>	

Design Trade-Offs for Real-Time Block Matching Motion Estimation Algorithms	129
<i>Z. He, M.L. Liou</i>	
Pixel Matching and Motion Segmentation in Image Sequences	139
<i>N. Ahuja, R. Charan</i>	
On the Motion Problem of a Rigid Planar Patch and its Invariance	149
<i>C.-H. Lee</i>	
Virtual-Space Teleconferencing – Real-Time Detection and Reproduction of 3D Face and Body Images	159
<i>F. Kishino, K. Ebihara, J. Ohya</i>	

Active Vision

Chair: *Y.P. Hung*

High-Performance Tracking with TRICLOPS	171
<i>A. Wavering, H. Schneiderman, J.C. Fiala</i>	
Developing an Active Observer	181
<i>J.-O. Eklundh, T. Uhlin, P. Nordlund, A. Maki</i>	
Active Stereo Vision System with Foveated Wide Angle Lenses	191
<i>Y. Kuniyoshi, N. Kita, S. Rougeaux, T. Suehiro</i>	
A Control Theoretical Approach to Active Vision	201
<i>H.I. Christensen, J. Horstmann, T. Rasmussen</i>	
Active Rangefinding and Recognition with Cubicscope	211
<i>Y. Sato</i>	
Real-Time Vision Is Not Frame-Rate Image Analysis	219
<i>L. Kitchen, T.-K. Cheng, Z.-Q. Liu</i>	

Stereo Vision

Chair: *S.D. Ma*

Active Vision Based Stereo Vision	231
<i>C. Wang, Z. Hu, S.D. Ma</i>	
Motion of a Stereo Rig: Strong Weak and Self Calibration	241
<i>Z. Zhang</i>	
Color Stereo Vision: Use of Appearance Constraint and Epipolar Geometry for Feature Matching	255
<i>M. Xie, L.Y. Liu</i>	

Unifying Stereo, Motion and Object Recognition via Epipolar Geometry	265
<i>G. Xu</i>	

Constructing a Visual Memory in Terms of Uniqueness	275
<i>J.-Y. Zheng</i>	

Statistics and Image Analysis

Chair: *K. V. Mardia*

Statistical Models and Algorithms for Tomography	289
<i>M. Hudson</i>	

Shape Statistics and Image Analysis	297
<i>K. V. Mardia</i>	

Cluster Monte Carlo Algorithms and Their Applications	307
<i>J.-S. Wang</i>	

Image Estimation

Chair: *S. Lakshmanan*

Gibbs Sampler and Maximum Likelihood Estimation for Unsupervised Image Segmentations	319
<i>C.S. Won</i>	

Lane Boundary Detection Using Deformable Templates: Effects of Image Subsampling on Detected Lane Edge	329
<i>K. Kluge, S. Lakshmanan</i>	

Contextual Pattern Interpretation

Chair: *J. Kittler*

Clique Finding Relaxation Labeling Networks	343
<i>M. Pelillo</i>	

Rectifying Structural Matching Errors	353
<i>E.R. Hancock, R.C. Wilson</i>	

Parallel Distributed Relaxation Labeling	363
<i>S.Z. Li</i>	

Subgraph Isomorphism Detection in Polynomial Time on Preprocessed Model Graphs	373
<i>B.T. Messmer, H. Bunke</i>	

Line Postprocessing Using Probabilistic Relaxation and Relative Measurements	383
<i>P. Papachristou, M. Petrou, J. Kittler</i>	

Geometric Invariance

Chair: *A. Zisserman*

Multiple-View Geometry and Photometry	395
<i>A. Shashua</i>	
Euclidean 3D Reconstruction from Stereo Sequences with Variable Focal Lengths	405
<i>M. Pollefeys, L. Van Gool, T. Moons</i>	
Characterizing the Stability of 3D Invariants Derived from 3D Translational Symmetry	415
<i>J. Liu, E. Walker, J. Mundy</i>	
MORSE: An Architecture for 3D Object Recognition Based on Invariants	425
<i>J. Mundy, R. Curwen, J. Liu, C. Rothwell, A. Zisserman, D. Forsyth</i>	

Object Recognition

Chair: *S. Ullman*

Finding Human Faces with a Gaussian Mixture Distribution- Based Face Model	437
<i>T. Poggio, K.-K. Sung</i>	
Handwriting Recognition	447
<i>T.M. Breuel</i>	
An Integrated Model for Evaluating the Amount of Data Required for Reliable Recognition	457
<i>M. Lindenbaum</i>	
3D Object Recognition Using Bidirectional Modular Networks	467
<i>H. Ando</i>	

Outdoor Computer Vision

Chair: *K. Baker*

A Region Extension Method for Natural Outdoor Scene Interpretation	479
<i>M. Hild, Y. Shirai</i>	

Image Processing Techniques for Crowd Density Estimation Using a Reference Image	489
<i>J.H. Yin, S.A. Velastin, A.C. Davies</i>	
Autonomous Road Vehicle Guidance in Normal Traffic	499
<i>F. Thomanek, E.D. Dickmanns</i>	
Evaluation of Image Sequences from Outdoor Scenes: Selected Problems and Solutions	509
<i>H.-H. Nagel, H. Kollnig</i>	
Vehicle Localisation and Discrimination in Outdoor Traffic Scene	519
<i>T.N. Tan, G.D. Sullivan, K. Baker</i>	

Content-Based Retrieval

Chair: *R.W. Picard*

SWIM: A Prototype Environment for Visual Media Retrieval	531
<i>H.-J. Zhang</i>	
Video Segment Indexing through Classification and Interactive View-Based Query	541
<i>J.C.M. Lee, W. Xiong, D.G. Shen, R.H. Ma</i>	
View-Based Techniques for Searching for Objects and Textures	551
<i>M.J. Swain, C.H. Frankel, M. Lu</i>	
Graph Grammar Based Object Recognition for Image Retrieval	561
<i>C. Klauck</i>	
Similarity Matching	571
<i>S. Santini, R. Jain</i>	

Document Image Analysis

Chair: *M. Mohiuddin*

A Document Image Analysis and Recognition System for Japanese Family Registration	583
<i>T. Amano, K. Toyokawa, T. Mano, S. Toriyama</i>	
Applying Handwriting Recognition to US Census Forms	593
<i>T.M. Breuel</i>	

Author Index	603
--------------------	-----