

PROCEEDINGS OF SPIE

MIPPR 2015: Pattern Recognition and Computer Vision

Tianxu Zhang
Jianguo Liu
Editors

31 October–1 November 2015
Enshi, China

Organized by
Huazhong University of Science and Technology (China)
Hubei University for Nationalities (China)

Sponsored by
National Key Laboratory of Science and Technology on Multi-spectral Information Processing
(China)
Huazhong University of Science and Technology (China)
Hubei University for Nationalities (China)
Hubei Association of Automation (China)

Published by
SPIE

Volume 9813

Proceedings of SPIE 0277-786X, V. 9813

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

MIPPR 2015: Pattern Recognition and Computer Vision, edited by Tianxu Zhang, Jianguo Liu,
Proc. of SPIE Vol. 9813, 981301 · © 2015 SPIE · CCC code: 0277-786X/15/\$18
doi: 10.1117/12.2230498

Proc. of SPIE Vol. 9813 981301-1

The papers in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIDigitalLibrary.org.

The papers reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from these proceedings:

Author(s), "Title of Paper," in *MIPPR 2015: Pattern Recognition and Computer Vision*, edited by Tianxu Zhang, Jianguo Liu, Proceedings of SPIE Vol. 9813 (SPIE, Bellingham, WA, 2015) Six-digit Article CID Number.

ISSN: 0277-786X
ISSN: 1996-756X (electronic)
ISBN: 9781510600546

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445
SPIE.org

Copyright © 2015, Society of Photo-Optical Instrumentation Engineers.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/15/\$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.

SPIE. DIGITAL LIBRARY
SPIDigitalLibrary.org

Paper Numbering: *Proceedings of SPIE* follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article at the time of publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online and print versions of the publication. SPIE uses a six-digit CID article numbering system structured as follows:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc. The CID Number appears on each page of the manuscript.

Contents

- vii *Authors*
- ix *Symposium Committee*
- xiii *Introduction*

PATTERN RECOGNITION AND COMPUTER VISION

- 9813 02 **Modeling optical pattern recognition algorithms for object tracking based on nonlinear equivalent models and subtraction of frames [9813-68]**
- 9813 03 **Computer vision research with new imaging technology [9813-52]**
- 9813 04 **A low-cost and portable realization on fringe projection three-dimensional measurement [9813-46]**
- 9813 05 **UAV multiple image dense matching based on self-adaptive patch [9813-1]**
- 9813 06 **Image preprocessing study on KPCA-based face recognition [9813-6]**
- 9813 07 **Latent subspace sparse representation based unsupervised domain adaptation [9813-58]**
- 9813 08 **An independent sequential maximum likelihood approach to simultaneous track-to-track association and bias removal [9813-50]**
- 9813 09 **Novel image fusion methods using intuitionistic index [9813-29]**
- 9813 0A **mEdgeBoxes: objectness estimation for depth image [9813-63]**
- 9813 0B **High dimensional data clustering by partitioning the hypergraphs using dense subgraph partition [9813-65]**
- 9813 0C **Relative position and pose measurement approach of specific operation site of space non-cooperative target [9813-21]**
- 9813 0D **An image feature data compressing method based on product RSOM [9813-71]**
- 9813 0E **A modified density-based clustering algorithm and its implementation [9813-23]**
- 9813 0F **Drug-related webpages classification using images and text information based on multi-kernel learning [9813-35]**
- 9813 0G **Fusion of infrared and visible images based on saliency scale-space in frequency domain [9813-33]**
- 9813 0H **A hybrid features based image matching algorithm [9813-42]**

- 9813 0I **Contour detection combined with depth information** [9813-47]
- 9813 0J **Infrared image recognition based on structure sparse and atomic sparse parallels** [9813-7]
- 9813 0K **A real-time FPGA-based architecture for OpenSURF** [9813-54]
- 9813 0L **An algorithm of slant correction for billet characters using height feature of characters** [9813-53]
- 9813 0M **Posture estimation of a space object base on line reconstruction from stereo images** [9813-60]
- 9813 0N **Super-resolved all-refocused image with a plenoptic camera** [9813-72]
- 9813 0O **An enhanced MIML algorithm for natural scene image classification** [9813-14]
- 9813 0P **Acquisition and extraction of embedded steel billet character based on structured light** [9813-16]
- 9813 0Q **Based on line scan CCD print image detection system** [9813-34]
- 9813 0R **Orthogonal combination of local binary patterns for dynamic texture recognition** [9813-38]
- 9813 0S **Research on image matching method of big data image of three-dimensional reconstruction** [9813-74]
- 9813 0T **One high-accuracy camera calibration algorithm based on computer vision images** [9813-10]
- 9813 0U **Image classification based on region of interest detection** [9813-11]
- 9813 0V **Maximum constrained sparse coding for image representation** [9813-31]
- 9813 0W **Research on three-dimensional positioning method of big data image under bag of words model guidance** [9813-73]
- 9813 0X **Point matching based on non-parametric model** [9813-40]
- 9813 0Y **Multi-view indoor human behavior recognition based on 3D skeleton** [9813-41]
- 9813 0Z **A new double views motion deblurring method** [9813-75]
- 9813 10 **Research on Bayes matting algorithm based on Gaussian mixture model** [9813-80]
- 9813 11 **Multi-features association-based local HOG description for image matching** [9813-84]
- 9813 12 **Face detection in complex background based on Adaboost algorithm and YCbCr skin color model** [9813-85]
- 9813 13 **Application of S-transform profilometry in train wheel surface three dimensional measurement** [9813-87]

- 9813 14 **Height correction based on multiple subimage correlation** [9813-88]
- 9813 15 **Error analysis in stereo vision for location measurement of 3D point** [9813-4]
- 9813 16 **Study on local Gabor binary patterns for face representation and recognition** [9813-86]
- 9813 17 **Facade model refinement by fusing terrestrial laser data and image** [9813-89]
- 9813 18 **Binarization algorithm for document image with complex background** [9813-81]
- 9813 19 **Backward Euler-Maruyama method for a class of stochastic Markovian jump neural networks** [9813-94]
- 9813 1A **Improved branch-cut method algorithm applied in phase unwrapping** [9813-100]

Authors

Numbers in the index correspond to the last two digits of the six-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first four digits reflect the volume number. Base 36 numbering is employed for the last two digits and indicates the order of articles within the volume. Numbers start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B...0Z, followed by 10-1Z, 20-2Z, etc.

Ban, Zhihua, 0E
Cai, Chao, 0I
Cao, Zhiguo, 0A
Chen, Chaoxiu, 0K
Chen, Feng, 0C
Chen, Hongyang, 0L
Chen, Yanfei, 0G
Chen, Yin, 0R
Dan, Zhiping, 0G
Ding, Yazhou, 05
Dou, Hao, 0H
Fan, Rong, 14
Fang, Zhiwen, 0A
Ge, Wei, 12, 16
Guo, Bingxuan, 05
Guo, Xuejun, 0R
Han, Cheng, 10
Han, Chunling, 12, 16
Hong, Hanyu, 0L, 0P, 0Z
Hou, Guangqi, 03, 0N
Hu, Jiayuan, 13, 1A
Hu, Ruiguang, 0F
Hua, Xia, 0Z
Huang, Jianming, 0C, 0T
Huang, Xiangxiang, 05
Ji, Kefeng, 11
Jiang, Shan, 10
Jiang, Zhengang, 10
Jiang, Zhiguo, 0V
Klein, Dominik A., 0R
Krasilenko, Vladimir G., 02
Lazarev, Alexander A., 02
Lei, Lin, 11
Li, Dehua, 06
Li, Deren, 05
Li, Jinlong, 13, 1A
Li, Lin, 0N
Li, Linhui, 05
Li, Ronghua, 0C
Li, Ruilong, 0J
Li, Tong, 0Q
Li, Xuan, 06
Li, Yunting, 15
Lin, Tao, 0H
Liu, Dang, 08
Liu, Fei, 03
Liu, Jianguo, 0E, 19
Liu, Lihua, 0D
Liu, Renfeng, 0X
Liu, Yawen, 17
Liu, Yi, 19
Lu, Hao, 0A
Lu, Tongwei, 0Y, 18
Lu, Yonggang, 0B
Miao, Shaojun, 18
Min, Feng, 0Y, 18
Ming, Delie, 0H, 0M
Nikolskyy, Aleksandr I., 02
Pan, Fei, 05
Peng, Ling, 0Y
Peng, Zhe, 05
Qin, Sushun, 17
Qiu, Zhenguo, 0S, 0W
Quan, Wei, 10, 12, 16
Sang, Nong, 0G
Shang, Ke, 0M
Shi, Yu, 0Z
Shuai, Liu, 07
Song, Qiong, 08
Sun, Hao, 07
Sun, Xiao, 0H, 0M
Sun, Xili, 0B
Sun, Zhenan, 03
Tao, Wei, 04
Tian, Jinwen, 0M, 0X, 15
Tian, Shoucai, 0B
Tu, Zhenbiao, 0H
Wang, Haiqing, 13, 1A
Wang, Jianming, 0D
Wang, Liping, 0J
Wang, Xiang, 0N
Wang, Xiqi, 0S, 0W
Wang, Ying, 0T
Wang, Yuehuan, 08, 14
Wang, Zhihui, 09
Wang, Zirui, 09
Wei, Xiangquan, 0T
Wu, Bingbing, 11
Wu, Jianle, 1A
Wu, Wei, 0O
Wu, Yalu, 0J
Xia, Shengping, 0D
Xiao, Jie, 0I
Xiao, Liping, 0F
Xiao, Suzhi, 04
Xiao, Xiongwu, 05
Xiao, Yang, 0A
Xie, Kai, 0Q

Xu, Xiaolei, 0S, 0W
Xu, Yi, 0J
Yan, Luxin, 0K
Yan, Xiaoyun, 08
Yang, Hua, 0E, 19
Yang, Nan, 05
Yang, Suyan, 0O
Yi, Jiansong, 0L
Yong, Huang, 0K
Yu, Zhenghong, 0U
Yuan, Lulu, 0E
Yue, Xiaofeng, 19
Zhang, Chao, 10
Zhang, Chunsen, 0S, 0W
Zhang, Cong, 0X
Zhang, Hui, 0O
Zhang, Jie, 0V
Zhang, Jun, 15
Zhang, Lifeng, 0Q
Zhang, Weilong, 05
Zhang, Wenmo, 0Z
Zhang, Xiuhua, 0P
Zhang, Yanduo, 0U
Zhang, Yu, 13, 1A
Zhao, Danpei, 0V
Zhao, Fumin, 07
Zhao, Hui, 04
Zheng, Wenjuan, 0F
Zhong, Qing, 0P
Zhong, Sheng, 0K
Zhong, Sidong, 0S, 0W
Zhou, Huabing, 0U
Zhou, Shilin, 07, 11
Zhou, Ying, 0C
Zhu, Jin, 05
Zhu, Lei, 0A
Zhu, Shihuan, 0S, 0W

Symposium Committee

Symposium Chairs

M. V. Srinivasan, The University of Queensland (Australia)
Deren Li, Wuhan University (China)

Symposium Honorary Chair

Bo Zhang, Tsinghua University (China)

Session Chairs

- 1 Pattern Recognition and Computer Vision
Qiang Li, The University of Chicago (United States)
- 2 Automatic Target Recognition and Navigation
Hanyu Hong, Wuhan Institute of Technology (China)
- 3 Remote Sensing Image Processing and Geographic Information Systems
Weichao Xu, Guangdong University of Technology (China)
- 4 Multispectral Image Processing and Analysis & Multispectral Image Acquisition
Jiangqun Ni, Sun Yat-sen University (China)
- 5 Pattern Recognition and Computer Vision & Parallel Processing of Images and Optimization Techniques & Medical Imaging and Processing
J. K. Udupa, University of Pennsylvania (United States)
- 6 Pattern Recognition and Computer Vision
Bir Bhanu, University of California, Riverside (United States)
- 7 Remote Sensing Image Processing and Geographic Information Systems
Bruce Hirsch, Drexel University (United States)
- 8 Other Applications
Irwin King, The Chinese University of Hong Kong (Hong Kong China)

Program Committee

Christian Bauckhage, Fraunhofer IAIS (Germany)
Bir Bhanu, University of California, Riverside (United States)
Zhiguo Cao, Huazhong University of Science and Technology (China)
Chunqi Chang, Shenzhen University (China)
C. H. Chen, University of Massachusetts Dartmouth (United States)
Xinjian Chen, Soochow University (China)
Jinkui Chu, Dalian University of Technology (China)
Melba M. Crawford, Purdue University (United States)
Armin B. Cremers, Universität Bonn (Germany)
Mingyue Ding, Huazhong University of Science and Technology (China)
Jufu Feng, Beijing University (China)
Aaron Fenster, The University of Western Ontario (Canada)
Wei Guo, Hebei Normal University (China)
Bruce Hirsch, Drexel University (United States)
Xinhan Huang, Huazhong University of Science and Technology (China)
Horace H. S. Ip, City University of Hong Kong (Hong Kong China)
Jun Jo, Griffith University (Australia)
Irwin King, The Chinese University of Hong Kong (Hong Kong China)
Lihua Li, Hangzhou Dianzi University (China)
Deren Li, Wuhan University (China)
Xuelong Li, University of London (United Kingdom)
Qiang Li, The University of Chicago (United States)
Stan Z. Li, Chinese Academy of Sciences (China)
Xingde Li, Johns Hopkins University (United States)
Jianguo Liu, Huazhong University of Science and Technology (China)
Qinghuo Liu, Institute of Automation (China)
Hanqing Lu, Institute of Automation (China)
Henri Maître, Télécom ParisTech (France)
Jiangqun Ni, Sun Yat-sen University (China)
Laszlo Nyul, University of Szeged (Hungary)
Jonathan Roberts, Commonwealth Scientific and Industrial Research Organisation (Australia)
Punam K. Saha, The University of Iowa (United States)
Nong Sang, Huazhong University of Science and Technology (China)
Xubang Shen, Chinese Academy of Sciences (China)
M. V. Srinivasan, The University of Queensland (Australia)
Hong Sun, Wuhan University (China)
Katarina Svanberg, Lund University (Sweden)
Jianjun Tan, Hubei University for Nationalities (China)
Dacheng Tao, Nanyang Technological University (Singapore)
Hengqing Tong, Wuhan University of Technology (China)
J. K. Udupa, University of Pennsylvania (United States)
Jinxue Wang, SPIE
Baoming Wu, Third Military Medical University (China)
Weichao Xu, Guangdong University of Technology (China)
Pingkun Yan, Philips Research North America (United States)
Yuan Yuan, Aston University (United Kingdom)

Liangpei Zhang, Wuhan University (China)
Jun Zhang, Waseda University (Japan)
Qieshi Zhang, Waseda University (Japan)
Tianxu Zhang, Huazhong University of Science and Technology (China)
Kaichun Zhao, Tsinghua University (China)
Sheng Zheng, China Three Gorges University (China)
Yanfei Zhong, Wuhan University (China)
Jie Zhou, Tsinghua University (China)

Organizing Committee Chair

Jianguo Liu, Huazhong University of Science and Technology (China)

Co-organizing Committee Chairs

Jinxue Wang, SPIE
Jianjun Tan, Hubei University for Nationalities (China)

General Secretary

Faxiong Zhang, Huazhong University of Science and Technology (China)

Associated General Secretaries

Yongdan Zhu, Hubei University for Nationalities (China)
Lulu Yuan, Huazhong University of Science and Technology (China)

Secretaries

Cheng Zhang, Yufeng Huang, Bin Zhu, Fuyao Ling, Bo Huang, Jieyu Li, Mengzhou Ma, Li Cao, Fan Liu, Yang Huang, Wei Jiang, Huazhong University of Science and Technology (China)

Introduction

Welcome to proceedings from the 9th International Symposium on Multispectral Image Processing and Pattern Recognition (MIPPR 2015), which was held in Enshi, Hubei, China, 31 October to 1 November 2015.

MIPPR 2015 is a biennial symposium which focuses mainly on the latest research in multispectral image processing and pattern recognition. The symposium had a broad charter. Multispectral was interpreted as not just multiple-wavelength in a narrow sense but also multi-sensor, multi-modal, and multimedia. The symposium covered many disciplines such as sensing, image processing, computer vision, and pattern recognition and involved the development of efficient processing algorithms and their optimization and implementation. The wide range of applications considered included automatic target recognition, autonomous navigation, medical image processing, remote sensing, geographic information systems, and many others.

The symposium provided a forum for scientists, professors, engineers, and graduate students from universities, industries, and government laboratories to meet and exchange ideas and discuss theories, techniques, algorithms, and applications in multispectral image processing and pattern recognition. As expected, there were ample discussions both inside and outside the lecture halls, and it was an exciting meeting.

In response to our call for papers, we received 326 submissions. Based on the reviews provided by an excellent program committee we accepted 245 papers covering many aspects of multispectral image processing and pattern recognition. To ensure a high-quality conference, all abstracts and proceedings of SPIE manuscripts were reviewed by peers for technical merit and English expression. The proceedings from MIPPR 2015 consist of the following five volumes, which are all included in the SPIE Digital Library:

- *MIPPR 2015: Multispectral Image Acquisition, Processing and Analysis (SPIE Volume 9811)*
- *MIPPR 2015: Automatic Target Recognition and Navigation (SPIE Volume 9812)*
- *MIPPR 2015: Pattern Recognition and Computer Vision (SPIE Volume 9813)*
- *MIPPR 2015: Parallel Processing of Images and Optimization; and Medical Imaging Processing (SPIE Volume 9814)*
- *MIPPR 2015: Remote Sensing Image Processing, Geographic Information Systems; and Other Applications (SPIE Volume 9815).*

The realization of a conference depends upon the hard work of many dedicated people. We thank all the members of the organizing committee who put together

MIPPR 2015 for the benefit of all the researchers and for making this conference a success. We hope the papers and the research results presented at this symposium will inspire new research in all the areas related to multispectral image processing and pattern recognition.

Bir Bhanu