

Springer Proceedings in Mathematics & Statistics

Xue-Cheng Tai
Suhua Wei
Haiguang Liu *Editors*

Mathematical Methods in Image Processing and Inverse Problems

Beijing, China, April 21–24, 2018

 Springer

Springer Proceedings in Mathematics & Statistics

Volume 360

This book series features volumes composed of selected contributions from workshops and conferences in all areas of current research in mathematics and statistics, including operation research and optimization. In addition to an overall evaluation of the interest, scientific quality, and timeliness of each proposal at the hands of the publisher, individual contributions are all refereed to the high quality standards of leading journals in the field. Thus, this series provides the research community with well-edited, authoritative reports on developments in the most exciting areas of mathematical and statistical research today.

More information about this series at <http://www.springer.com/series/10533>

Xue-Cheng Tai · Suhua Wei · Haiguang Liu
Editors

Mathematical Methods in Image Processing and Inverse Problems

IPIP 2018, Beijing, China, April 21–24

 Springer

Editors

Xue-Cheng Tai
Department of Mathematics
Hong Kong Baptist University
Kowloon Tong
Kowloon, Hong Kong

Suhua Wei
Institute of Applied Physics
and Computational Mathematics
Beijing, China

Haiguang Liu
Beijing Computational Science
Research Center
Beijing, China

ISSN 2194-1009 ISSN 2194-1017 (electronic)
Springer Proceedings in Mathematics & Statistics
ISBN 978-981-16-2700-2 ISBN 978-981-16-2701-9 (eBook)
<https://doi.org/10.1007/978-981-16-2701-9>

Mathematics Subject Classification (2010): 68U10, 94A08, 35R30, 68-XX, 35-XX

© Springer Nature Singapore Pte Ltd. 2021

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd. The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

Preface

This book contains eleven original and survey scientific research articles that arose from invited talks given at International Workshop on Image Processing and Inverse Problems, held in Beijing Computational Science Research Center, Beijing, China, April 21–24, 2018.

The purpose of the conference was to bring together international researchers to exchange ideas, recent achievements on various aspects of image processing and inverse problems. Conference topics cover image reconstruction, image restoration, image registration and inverse problems and so on. Deep learning, PDE, Statistics based methods and techniques were discussed. The newest developments on mathematical analysis, numerical algorithm and applications were presented. This book aims to collect presentation papers which introduce new research trends and show improved results. It should be a good reference for people working on related problems, as well as for people working on computer vision and visualization, inverse problems, image processing and medical imaging.

To ensure the scientific quality of the book, each contributed paper was carefully reviewed. Special thanks go to all contributors and referees. Without their efforts, this book would not be possible.

Finally, we wish to thank the conference organizers and supports which were partially given by the National Nature Science Foundation of China. Many thanks also go to Springer-Verlag colleagues, Daniel Wang, Banu Dhayalan and Zongren Peng. Their help and collaboration are kind and effective.

Kowloon Tong, Hong Kong
Beijing, China
Beijing, China

Xue-Cheng Tai
Suhua Wei
Haiguang Liu

Program Chairs

Xue-Cheng Tai: General Chair, Hong Kong Baptist University

Suhua Wei: Organizing Chair, Institute of Applied Physics and Computational Mathematics

Haiguang Liu: Organizing Chair, Beijing Computational Science Research Center

Program Committee

Raymond H. Chan, City University of Hong Kong, Hong Kong

Ke Chen, University of Liverpool, United Kingdom

Serena Morigi, University of Bologna, Italy

Michael Ng, The University of Hong Kong, China

Fiorella Sgallari, University of Bologna, Italy

Youwei Wen, Hunan Normal University, China

Haomin Zhou, Georgia University, USA

Contents

Point Spread Function Engineering for 3D Imaging of Space Debris Using a Continuous Exact ℓ_0 Penalty (CEL0) Based Algorithm	1
Chao Wang, Raymond H. Chan, Robert J. Plemmons, and Sudhakar Prasad	
An Adjoint State Method for An Schrödinger Inverse Problem	13
Siyang Wei and Shingyu Leung	
Multi-modality Image Registration Models and Efficient Algorithms	33
Daoping Zhang, Anis Theljani, and Ke Chen	
Fast Algorithms for Surface Reconstruction from Point Cloud	61
Yuchen He, Martin Huska, Sung Ha Kang, and Hao Liu	
A Total Variation Regularization Method for Inverse Source Problem with Uniform Noise	81
Huan Pan and You-Wei Wen	
Automatic Parameter Selection Based on Residual Whiteness for Convex Non-convex Variational Restoration	95
Alessandro Lanza, Serena Morigi, and Fiorella Sgallari	
Total Variation Gamma Correction Method for Tone Mapped HDR Images	113
Michael K. Ng and Motong Qiao	
On the Optimal Proximal Parameter of an ADMM-like Splitting Method for Separable Convex Programming	139
Bingsheng He and Xiaoming Yuan	
A New Initialization Method for Neural Networks with Weight Sharing	165
Xiaofeng Ding, Hongfei Yang, Raymond H. Chan, Hui Hu, Yaxin Peng, and Tiejong Zeng	

The Shortest Path AMID 3-D Polyhedral Obstacles 181
Shui-Nee Chow, Jun Lu, and Hao-Min Zhou

**Multigrid Methods for Image Registration Model Based
on Optimal Mass Transport** 197
Yangang Chen and Justin W. L. Wan

Author Index 223