Final Program and Abstracts



Tom Goldstein and Stanley Osher, SIAM J. Imaging Sciences, Vol.2, No. 2

May 23 - 26, 2016 Hotel Albuquerque at Old Town Albuquerque, New Mexico, USA

Sponsored by the SIAM Activity Group on Imaging Science. This conference is also being held in cooperation with the American Statistical Association (ASA) Statistics in Imaging Section, the IEEE Signal Processing Society (SPS) and the SPS Computational Imaging Special Interest Group.

The SIAM Activity Group on Imaging Science brings together SIAM members and other scientists and engineers with an interest in the mathematical and computational aspects of imaging.

The reconstruction, enhancement, segmentation, analysis, registration, compression, representation, and tracking of two and three dimensional images are vital to many areas of science, medicine, and engineering. As a result, increasingly sophisticated mathematical, statistical, and computational methods are being employed in these research areas, which may be referred to as "imaging science." These techniques include transform and orthogonal series methods, nonlinear optimization, numerical linear algebra, integral equations, partial differential equations, Bayesian and other statistical inverse estimation methods, operator theory, differential geometry, information theory, interpolation and approximation, inverse problems, computer graphics and vision, stochastic processes, and others.

The activity group organizes the biennial SIAM Conference on Imaging Science, awards the SIAG/IS Best Paper Prize every two years to the authors of the best paper on mathematical and computational aspects of imaging, awards the SIAG/IS Early Career Prize to an outstanding early career researcher in the field of imaging science, and maintains a wiki, a member directory, and an electronic mailing list.



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The SIAM registration desk is located in the Fireplace Room. It is open during the following hours:

> **Sunday, May 22** 5:00 PM - 8:00 PM

> **Monday, May 23** 7:00 AM - 5:00 PM

> **Tuesday, May 24** 7:45 AM - 5:00 PM

Wednesday, May 25 7:45 AM - 5:00 PM

Thursday, May 26 7:45 AM - 2:30 PM

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Funding Agency

SIAM and the Conference Organizing Committee wish to extend their thanks and appreciation to the U.S. National Science Foundation for its support of this conference.



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If you have questions regarding availability of equipment in the meeting room of your presentation, please see a SIAM staff member at the registration desk.

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- Admission to all technical sessions
- Business Meeting (open to SIAG/IS members)
- Coffee breaks daily
- Room set-ups and audio/visual equipment
- Welcome Reception and Poster Session

Job Postings

Please check with the SIAM registration desk regarding the availability of job postings or visit *http://jobs.siam.org*.

Important Notice to Poster Presenters

The poster session is scheduled for Monday, May 23 from 6:30 PM – 8:30 PM. Poster presenters are requested to set up their poster material on the provided 4' x 8' poster boards in the Atrium between the hours of 2:00 PM and 6:30 PM. All materials must be posted by Monday, May 23 at 6:30 PM, the official start time of the session. Posters will remain on display through Thursday, May 26 at 10:00 AM. Poster displays must be removed by this time. Posters remaining after this time will be discarded. SIAM is not responsible for discarded posters.

SIAM Books and Journals

Display copies of books and complimentary copies of journals are available on site. SIAM books are available at a discounted price during the conference. The books booth will be staffed from 9:00 AM through 5:00 PM. If a SIAM books representative is temporarily away from the booth, completed order forms and payment (credit cards are preferred) may be taken to the SIAM registration desk. The books table will close at 2:30 PM on Thursday.

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Audio and video recording of presentations at SIAM meetings is prohibited without the written permission of the presenter and SIAM.

Comments?

Comments about SIAM meetings are encouraged! Please send to:

Cynthia Phillips, SIAM Vice President for Programs (*vpp@siam.org*).

Get-togethers

• Monday, May 23



Welcome Reception and Poster Session

• Tuesday, May 24

6:45 PM - 7:30 PM

6:30 PM - 8:30 PM

SIAG/IS Business Meeting

(open to SIAG/IS members)

Complimentary beer and wine will be served.

Statement on Inclusiveness

As a professional society, SIAM is committed to providing an inclusive climate that encourages the open expression and exchange of ideas, that is free from all forms of discrimination, harassment, and retaliation, and that is welcoming and comfortable to all members and to those who participate in its activities. In pursuit of that commitment, SIAM is dedicated to the philosophy of equality of opportunity and treatment for all participants regardless of gender, gender identity or expression, sexual orientation, race, color, national or ethnic origin, religion or religious belief, age, marital status, disabilities, veteran status, field of expertise, or any other reason not related to scientific merit. This philosophy extends from SIAM conferences, to its publications, and to its governing structures and bodies. We expect all members of SIAM and participants in SIAM activities to work towards this commitment.

Please Note

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SIAM is promoting the use of social media, such as Facebook and Twitter, in order to enhance scientific discussion at its meetings and enable attendees to connect with each other prior to, during and after conferences. If you are tweeting about a conference, please use the designated hashtag to enable other attendees to keep up with the Twitter conversation and to allow better archiving of our conference discussions. The hashtag for this meeting is #SIAMIS16.

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Minitutorials

Monday, May 23 9:30 AM - 11:30 AM

MT1 Applied Harmonic Analysis Methods in Imaging Science Organizers: Gitta Kutyniok, Technische Universität Berlin, Germany Demetrio Labate, University of Houston, USA Alvarado Ballroom D

MT2 Imaging Challenges of Modern Astronomy and Astrophysics Organizer: C. Alex Young, NASA Goddard Space Flight Center, USA Alvarado Ballroom E

MT3 Data Representation: From Signal Processing to Machine Learning Organizer: Lorenzo Rosasco, Massachusetts Institute of Technology, USA Franciscan Ballroom

Invited Plenary Speakers

All Invited Plenary Presentations will take place in Alvarado Ballroom D and E

Monday, May 23

8:15 AM - 9:00 AM

IP1 Nonconformist Image Processing with the Graph Laplacian Operator Peyman Milanfar, *Google Research, USA*

1:00 PM - 1:45 PM

IP2 High Resolution Tactile Sensing for Robotics, Metrology, and Medicine Edward Adelson, *Massachusetts Institute of Technology, USA*

Tuesday, May 24

8:15 AM - 9:00 AM

IP3 Image Processing, Internet-of-Things, and Inverse Problems: Blind Deconvolution Meets Blind Demixing Thomas Strohmer, University of California, Davis, USA

Invited Plenary Speakers

All Invited Plenary Presentations will take place in Alvarado Ballroom D and E

Wednesday, May 25

8:15 AM - 9:00 AM

IP4 Semantic Scene Parsing by Entropy Pursuit Donald Geman, *Johns Hopkins University, USA*

Thursday, May 26

8:15 AM - 9:00 AM

IP5 Recent Advances in Seismic Technology: From Imaging to Inversion Uwe Albertin, *Chevron Energy Technology Company, USA*

1:00 PM - 1:45 PM

IP6 Event-Based Silicon Retina Technology Tobi Delbruck, *University of Zurich and ETH Zurich, Switzerland*

Prize Presentations

All Prize Presentations will take place in Alvarado Ballroom D and E

Tuesday, May 24

1:00 PM - 1:45 PM

 SP1 SIAG/Imaging Science Early Career Prize Lecture – Revisiting Classical Problems of Image Processing:
 Looking for New Ways to Address Longstanding Problems
 Mauricio Delbracio, Duke University, USA

Wednesday, May 25

1:00 PM - 1:45 PM

 SP2 SIAG/Imaging Science Best Paper Prize Lecture – Scale Invariant Geometry for Nonrigid Shapes
 Dan Raviv, Massachusetts Institute of Technology, USA

SIAM Titles of Interest to ISI6 Attendees

These and other SIAM books are available at the conference

Elliptic Problems in Nonsmooth Domains

Pierre Grisvard

Classics in Applied Mathematics 69

This classic text focuses on elliptic boundary value problems in domains with nonsmooth boundaries and on problems with mixed boundary conditions. Its contents are essential for an understanding of the behavior of numerical methods for PDEs on two-dimensional domains with corners. It provides a careful and self-contained development of Sobolev spaces on nonsmooth domains and addresses fourth-order boundary value problems and numerical treatment of singularities. 2011 • xiv + 410 • Softcover • 978-1-611972-02-3 • List \$102.00 • Attendee \$81.60 • Member \$71.40 • CL69

Computational Methods in Geophysical Electromagnetics Eldad Haber

Mathematics in Industry 01

This monograph provides a framework for students and practitioners who are working on the solution of electromagnetic imaging in geophysics. Bridging the gap between theory and practical applied material (for example, inverse and forward problems), it provides a simple explanation of finite volume discretization, basic concepts in solving inverse problems through optimization, a summary of applied electromagnetics methods, and MATLAB® code for efficient computation. 2014 • viii + 143 pages • Softcover • 978-1-611973-79-2 • List \$65.00 • Attendee \$52.00 • Member \$45.50 • MN01

Deblurring Images: Matrices, Spectra, and Filtering

Per Christian Hansen, James G. Nagy, and Dianne P. O'Leary Fundamentals of Algorithms 3

This book's treatment of image deblurring is unique in two ways: it includes algorithmic and implementation details; and by keeping the formulations in terms of matrices, vectors, and matrix computations, it makes the material accessible to a wide range of readers. Students and researchers in engineering will gain an understanding of the linear algebra behind filtering methods, while readers in applied mathematics, numerical analysis, and computational science will be exposed to modern techniques to solve realistic large-scale problems in image processing. 2006 • xiv + 130 pages • Softcover • 978-0-898716-18-4 • List \$73.00 • Attendee \$58.40 • Member \$51.10 • FA03

Mathematical Methods in Image Reconstruction

Frank Natterer and Frank Wübbeling

Mathematical Modeling and Computation 5

The authors survey and provide a unified view of imaging techniques, provide the necessary mathematical background and common framework, and give a detailed analysis of the numerical algorithms. This book not only reflects the theoretical progress and the growth of the field but also serves as an excellent reference. It will provide readers with a superior understanding of the mathematical principles behind imaging.

2001 • xii + 216 pages • Softcover • 978-0-898716-22-1 • List \$93.00 • Attendee \$74.40 • Member \$65.10 • MM05

Conference attendees receive discounts on all displayed titles.

Image Processing and Analysis: Variational, PDE, Wavelet, and Stochastic Methods

The Shapes of Things

Tony F. Chan and Jianhong (Jackie) Shen This book develops the mathematical foundation of modern image processing and low-level computer vision, and presents a general framework from the analysis of image structures and patterns to their processing. The core mathematical and computational ingredients of several important image processing tasks are investigated. The book bridges contemporary mathematics with state-of-the-art methodologies in modern image processing while organizing the vast contemporary literature into a coherent and logical structure.

2005 • xxii + 400 pages • Softcover • 978-0-898715-89-7 • List \$86.50 • Attendee \$69.20 • Member \$60.55 • OT94

The Shapes of Things: A Practical Guide to Differential Geometry and the Shape Derivative

Shawn W. Walker Advances in Design and Control 28

This self-contained overview of differential geometry explains how to differentiate a function (in the calculus sense) with respect to a "shape variable." This approach, which is useful for understanding mathematical models containing geometric partial differential equations, allows readers to obtain formulas for geometric quantities (such as curvature) that are clearer than those usually offered in differential geometry texts.

2015 • x + 152 pages • Softcover • 978-1-611973-95-2 List \$74.00 • Attendee \$59.20 • Member \$51.80 • DC28

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- Special sessions at SIAM Annual Meetings
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A GREAT WAY TO GET INVOLVED!

Collaborate and interact with mathematicians and applied scientists whose work involves imaging science.

SIAM Conference on IMAGING SCIENCE



Tom Goldstein and Stanley Osher, SIAM J. Imaging Sciences, Vol.2, No. 2

May 23 - 26, 2016 Hotel Albuquerque at Old Town Albuquerque, New Mexico, USA

IS16 Program



Tom Goldstein and Stanley Osher, SIAM J. Imaging Sciences, Vol.2, No. 2

May 23 - 26, 2016 Hotel Albuquerque at Old Town Albuquerque, New Mexico, USA

Sunday, May 22

Registration 5:00 PM-8:00 PM Room:Fireplace Room

Monday, May 23

Registration 7:00 AM-5:00 PM Room:Fireplace Room

Welcoming Remarks 8:00 AM-8:15 AM Room:Alvarado Ballroom D and E Monday, May 23

IP1

Nonconformist Image Processing with the Graph Laplacian Operator

8:15 AM-9:00 AM

Room:Alvarado Ballroom D and E Chair: Rebecca Willett, University of Wisconsin, Madison, USA

The key building blocks of modern image processing are two-fold: a measure of affinity between pixels; and an operator that turns these affinities into filters that can accomplish a variety of useful tasks. Examples of the affinity measure are many, including bilateral, NLM, etc. And the standard operator used to construct the filters is the (normalized) weighted average of the affinities. But if we consider the pixels in an image as nodes in a weighted graph, the Laplacian operator on this graph gives us a strikingly versatile tool for building a very general class of filters with a much larger range of applications. A littleappreciated property of the (continuous) Laplacian operator is that it measures the "nonconformity" of a function to its surroundings. This remarkable property and its discrete approximations enable (1) progressive image decomposition from fine to coarse scale, yielding a principled framework for image smoothing, sharpening and local tone manipulation; and (2) a clear framework for building image-adapted priors to solve more general inverse problems such as deblurring. We have used this framework to develop many components of a practical imaging pipeline for mobile and other applications.

Peyman Milanfar Google Research, USA

Coffee Break 9:00 AM-9:30 AM



Room: Alvarado Ballroom Atrium

MT1 Applied Harmonic Analysis Methods in Imaging Science

9:30 AM-11:30 AM

Room:Alvarado Ballroom D

Chair: Demetrio Labate, University of Houston, USA

Chair: Gitta Kutyniok, Technische Universität Berlin, Germany

The aim of this minitutorial is to present the current state-of-the-art on the application of applied harmonic analysis and frame theoretic methods to imaging science problems. The minitutorial will start with an introduction covering the necessary background in wavelet and frame theory. It will then focus on the theory of shearlet frames, a method combining multiscale analysis and high directional sensitivity. The last part of the tutorial will survey several related theoretical and numerical applications including regularization, image restoration and registration, and magnetic resonance imaging.

Speakers:

Part I

Gitta Kutyniok, Technische Universität Berlin, Germany

Part II

Demetrio Labate, University of Houston, USA

Monday, May 23

MT2

Imaging Challenges of Modern Astronomy and Astrophysics

9:30 AM-11:30 AM

Room:Alvarado Ballroom E

Chair: C. Alex Young, NASA Goddard Space Flight Center, USA

Modern astronomy and astrophysics is faced with the excitement and challenge of an ever increasing volume of dynamic image data. In this tutorial, we present a hands-on look at image data from observations of phenomena throughout the universe. We discuss the spatial, temporal, and energy (wavelength) characteristics of available data. We compare and contrast astronomical image data with medical image data looking at physical features, noise, and the availability of a ground truth

Speaker:

C. Alex Young, NASA Goddard Space Flight Center, USA

Monday, May 23

MT3 Data Representation:

From Signal Processing to Machine Learning

9:30 AM-11:30 AM

Room: Franciscan Ballroom

Chair: Lorenzo Rosasco, Massachusetts Institute of Technology, USA

Extracting the right features to represent data is often the key problem in data analysis and signal processing/classification. Classical approaches based on prior information on the data to be represented, can be contrasted to recent approaches to learn representations based on data. In this minitutorial we will give a unified perspective of different ideas, from classical signal processing to compressive sensing, from dictionary learning to recent work in deep learning.

Speaker:

Lorenzo Rosasco, Massachusetts Institute of Technology, USA

Lunch Break 11:30 AM-1:00 PM Attendees on their own

IP2 High Resolution Tactile Sensing for Robotics, Metrology, and Medicine

1:00 PM-1:45 PM

Room:Alvarado Ballroom D and E Chair: Stefano Soatto, University of California, Los Angeles, USA

The interaction of light and matter at a surface is complex. A GelSight sensor overrides the native optics and isolates 3D shape. A clear elastomer slab with a reflective membrane is pressed against the surface. An embedded camera views the membrane; computer vision extracts shape. While conceived as a robot touch sensor, GelSight's micron-scale resolution has spawned commercial applications in 3D surface metrology (profilometry). In robotics, its high resolution, combined with its ability to capture shape, texture, shear, and slip, provides unique tactile capabilities. We are also exploring medical measurements, ranging from blood pressure to tissue pathology.

Edward Adelson

Massachusetts Institute of Technology, USA

Intermission

1:45 PM-2:00 PM

Monday, May 23

MS1

Inversion of Non-linear Image Formation Models -Part I of II

2:00 PM-4:00 PM

Room:Alvarado Ballroom D

For Part 2 see MS11

Several recent breakthroughs in nonsmooth optimisation theory, have made the inversion of non-linear image formation models practical. Such problems arise, for instance, in magnetic resonance imaging, optical and astronomic imaging, and cone-beam tomography. The talks in this minisymposium discuss applications such as these, and state-of-the-art optimisation methods for the inversion of the resulting image formulation models with nonsmooth regularisation terms.

Organizer: Tuomo Valkonen University of Cambridge, United Kingdom

Organizer: Martin Benning University of Cambridge, United Kingdom

2:00-2:25 Variable Metric Line-Search Methods for Nonsmooth Convex and Non-Convex Optimization, with Applications in Imaging *Ignace Loris*, Université Libre de

Bruxelles, Belgium

2:30-2:55 Coordinate Update Methods in Image Processing and Machine Learning

Zhimin Peng and Tianyu Wu, University of California, Los Angeles, USA; Yangyang Xu, Institute for Mathematics and its Applications, USA; Ming Yan, Michigan State University, USA; *Wotao Yin*, University of California, Los Angeles, USA

3:00-3:25 A Primal-Dual Extragradient Method for Nonlinear Forward Models in Function Spaces

Christian Clason, University of Duisburg-Essen, Germany

3:30-3:55 Second Order TV-Type Regularization Methods for Manifold-Valued Images

Ronny Bergmann, University of Kaiserslautern, Germany

Monday, May 23

MS2

Recent Advances in Convex Relaxations -Part I of II

2:00 PM-4:00 PM

Room:Alvarado Ballroom E

For Part 2 see MS12

Variational methods have been one of the most popular and successful techniques in image reconstruction and analysis over the last decades. Unfortunately, many important imaging problems such as image segmentation, stereo matching, and optical flow computation lead to nonconvex cost functions that are inherently difficult to minimize globally. Convex relaxation strategies provide a powerful tool to closely approximate the nonconvex cost function: They avoid problems of the energy landscape having bad local minima and the solution being initialization dependent. This minisymposium brings together experts in the field of convex relaxations to discuss recent advances in theory and applications.

Organizer: Michael Moeller Technische Universität München, Germany

Organizer: Jan Lellmann University of Lübeck, Germany

Organizer: Daniel Cremers Technical University of Munich, Germany

2:00-2:25 Convex Relaxation Methods for Computer Vision

Daniel Cremers, Technical University of Munich, Germany

2:30-2:55 (Discrete-Continuous Optimization² for Computer Vision *Christopher Zach*, Toshiba Research Europe, United Kingdom

3:00-3:25 Partial Optimality in Discrete Problems Based on Their Polyhedral Relaxations

Alexander Shekhovtsov, Graz University of Technology, Austria; Paul Swoboda, Heidelberg University, Germany; Bogdan Savchynskyy, Dresden University of Technology, Germany

3:30-3:55 A Semidefinite Relaxation for Computing Distances Between Metric Spaces

Rachel Ward and *Soledad Villar*, University of Texas at Austin, USA

MS3 Recent Advances in Dictionary Learning -

Dictionary Learning -Part I of II

2:00 PM-4:00 PM

Room:Alvarado Ballroom A

For Part 2 see MS13

Dictionary Learning (DL) aims at finding a frame in which training data admits a sparse representation, allowing more adapted representations than traditional transforms. It has been applied with great success in various image processing tasks, often leading to state of the art results. Recently, a lot of attention has been dedicated to several aspects of DL: learning of fast dictionaries, theory of DL, and new models generalizing DL. This minisymposium gathers a representative sample of renowned speakers, covering the different trends occurring in this dynamic field of research.

Organizer: Yael Yankelevsky Technion Israel Institute of Technology, Israel

Organizer: Jeremias Sulam Technion Israel Institute of Technology, Israel

Organizer: Michael Elad Technion Israel Institute of Technology, Israel

Organizer: Remi Gribonval Inria Rennes, France

Organizer: Luc Le Magoarou Inria Rennes, France

2:00-2:25 Flexible Multi-layer Sparse Approximations of Matrices and Applications

Luc Le Magoarou and Remi Gribonval, Inria Rennes, France

2:30-2:55 Recent Advances in Transform Learning for Blind Compressed Sensing in Imaging

Yoram Bresler, University of Illinois, USA

3:00-3:25 On Fast Transform Optimization

Francois Malgouyres, Universite Paul Sabatier, France; Olivier Chabiron, Jean-Yves Tourn Tourneret, and Herwig Wendt, University of Toulouse, France

3:30-3:55 Trainlets: Dictionary Learning in High-Dimension

Jeremias Sulam and Michael Elad, Technion Israel Institute of Technology, Israel

Monday, May 23

MS4

Statistical Methods for Inverse Problems Involving Partial Differential Equations

2:00 PM-3:30 PM

Room:Alvarado Ballroom B

Applications of statistical methods for inverse problems involving partial differential equations (PDEs) will be the focus of the minisymposium. In recent years, there is tremendous growth in devising new techniques from regularization theory to handle applied inverse problems such as Bayesian inversion using statistical approach, the sparsity regularization, and model reduction etc. Various statistical approaches are becoming more popular for solving inverse problems particularly ill-posed inverse problems due to the growth of computational power in the last several decades. The minisymposium will help bring together experts from inverse problems, computational statistics, and uncertainty quantification to discuss common issues for solving inverse problems for PDEs.

Organizer: Taufiquar R. Khan Clemson University, USA

2:00-2:25 Markov Chain Monte Carlo Methods for Inverse Problems Involving Partial Differential Equations Johnathan M. Bardsley, University of

Montana, USA

2:30-2:55 A Large-Scale Ensemble Transform Method for Bayesian Inverse Problems Governed by PDEs

Tan Bui-Thanh, University of Texas at Austin, USA

3:00-3:25 Statistical Inversion In Electrical Impedance Tomography For Damage Detection In Concrete

Thilo Strauss, University of Washington, USA; Taufiquar R. Khan, Clemson University, USA

MS5 Multi-Modality Imaging and Structural Priors - Part I of II

2:00 PM-4:00 PM

Room:Alvarado Ballroom C

For Part 2 see MS15

Multi-modality imaging has become increasingly interesting in many areas like medical imaging, remote sensing, photography and geophysics to name just a few. A standard approach is to treat the channels separately but as there is an expected correlation between the channels, it became popular to treat them jointly. The channels can be coupled by a prior that takes the structure of the scenery / anatomy / geology into account. In this minisymposium we bring together researchers to present recent theoretical and computational advances in the area of multi-modality imaging and structural priors.

Organizer: Matthias J. Ehrhardt University College London, United Kingdom

Organizer: Simon Arridge University College London, United Kingdom

2:00-2:25 Structural Regularization for fMRI

Ville P. Kolehmainen, University of Eastern Finland, Finland

2:30-2:55 Molecular Particle Imaging: Basic Models, Mathematical Challenges and First Results

Peter Maass and Christine Bathke, University of Bremen, Germany

3:00-3:25 Joint Mr-Pet Reconstruction Using Nuclear Norm Based Multi-Channel Tgv Regularization

Martin Holler, University of Graz, Austria; Florian Knoll, Thomas Koesters, and Ricardo Otazo, New York University, USA; Kristian Bredies, University of Graz, Austria; Daniel K Sodickson, New York University, USA

3:30-3:55 Iterative Joint Regularization in Multichannel Image Reconstruction via Bregman Distances

Eva-Maria Brinkmann, University of Muenster, Germany; Martin Burger, University of Münster, Germany; Michael Moeller, Technische Universität München, Germany; Julian Rasch, University of Muenster, Germany; Tamara Seybold, ARRI Group, Germany

Monday, May 23

MS6 Image Segmentation, Classification and Applications - Part I of II

2:00 PM-4:00 PM

Room:Alvarado Ballroom F

For Part 2 see MS16

Image segmentation/classification has a lot of applications in real life: medical imaging, biology, object tracking and recognition in computer vision, just to name a few. There are however different challenges in different applications. Limitation of the resolution of imaging devices often leads to low contrast that causes objects of interest clump together or no clear boundary between objects. Segmenting such images is thus very difficult and often has no deterministic solutions. High dimensionality of the data makes it even harder. This minisymposium gathers together the latest theoretical and practical development in this topic.

Organizer: Weihong Guo Case Western Reserve University, USA

Organizer: Xiaoqun Zhang Shanghai Jiaotong University, China

2:00-2:25 A Wavelet Frame Method with Shape Prior for Ultrasound Video Segmentation

Jiulong Liu and *Xiaoqun Zhang*, Shanghai Jiao Tong University, China; Bin Dong, Peking University, China; Zuowei Shen, National University of Singapore, Singapore

2:30-2:55 Multiphase Image Segmentation Via Equally Distanced Multiple Well Potential

Sung Ha Kang, Georgia Institute of Technology, USA; Riccardo March, Istituto per le Applicazioni del Calcolo "Mauro Picone", Italy

3:00-3:25 Curvature based Seeded Watershed for Clumped Object Segmentation

Thomas Atta-Fosu and Weihong Guo, Case Western Reserve University, USA

3:30-3:55 Image Segmentation with Dynamic Artifacts Detection and Bias Correction

Dominique Zosso and Andrea L. Bertozzi, University of California, Los Angeles, USA

continued in next column

MS7 Computational Methods for Inverse Problems in Imaging

2:00 PM-4:00 PM

Room:Alvarado Ballroom G

This minisymposium will highlight state-of-the-art methods and computational approaches for solving large-scale inverse problems that arise in imaging applications such as image deconvolution and tomographic reconstruction. There is a great need for regularization schemes that can incorporate prior information and/ or impose realistic constraints on the solution. In addition, fast algorithms must be employed to handle largescale problems. Speakers in this minisymposium will report on recent research developments in the field of inverse problems, including algorithms and computational concerns, as they relate to problems in imaging.

Organizer: Julianne Chung Virginia Tech, USA

Organizer: Eric De Sturler *Virginia Tech, USA*

2:00-2:25 Efficient Hybrid Iterative Methods for Bayesian Inverse Problems

Julianne Chung, Virginia Tech, USA; Arvind Saibaba, North Carolina State University, USA

2:30-2:55 Robust Regression for Mixed Poisson Gaussian Model

Marie Kubinova, Czech Academy of Sciences, Czech Republic; James G. Nagy, Emory University, USA

3:00-3:25 An Incremental Proximal Gradient Method for Spectral Computerized Tomography

Lauri Harhanen, Martin S. Andersen, and Jakob Jorgensen, Technical University of Denmark, Denmark

3:30-3:55 Truncation Methods for Hybrid Regularization

Eric De Sturler, Julianne Chung, and Geoffrey Dillon, Virginia Tech, USA

Monday, May 23

MS8

Non-Gaussian Noise: New Trends and Challenges -Part I of II

2:00 PM-4:00 PM

Room:Alvarado Ballroom H

For Part 2 see MS18

Additive Gaussian noise has been extensively studied since it produces simple and tractable mathematical models. However, in the real applications, the noise is much more complicated and it cannot be well simulated by additive Gaussian noise (for instance, it may be signal dependent, multiplicative, mixed, etc). This minisymposium intends to bring together researchers working with non-Gaussian noise in many different applications: image restoration, image registration, image enhancement, and more.

Organizer: Federica Sciacchitano Technical University of Denmark, Denmark

Organizer: Yiqiu Dong Technical University of Denmark, Denmark

2:00-2:25 A Majorization-Minimization Generalized Krylov Subspace Methods for Lp-Lq Image Restoration

Fiorella Sgallari, Alessandro Lanza, and Serena Morigi, Universita' di Bologna, Italy; Lothar Reichel, Kent State University, USA

2:30-2:55 A Convex Variational Approach for Restoring Blurred Images with Cauchy Noise

Federica Sciacchitano, Technical University of Denmark, Denmark

3:00-3:25 A Gaussian Curvature Based Denoising Model for Non-Gaussian Noise.

Victor Uc-Cetina and Carlos Brito-Loeza, Universidad Autónoma de Yucatán, Mexico; Ke Chen, University of Liverpool, United Kingdom

3:30-3:55 Maximum-A-Posteriori Image Registration for Noisy Data

Sebastian Suhr, University of Münster, Germany

Monday, May 23 MS9

Efficient Algorithms for Large-scale Inverse Problems in Medical Imaging - Part I of II

2:00 PM-4:00 PM

Room:Franciscan Ballroom

For Part 2 see MS19

We address recent advances in algorithms for large-scale inverse problems in the medical imaging sciences. We will also discuss the use of priors to supervise algorithms in order to reduce uncertainties in the solution process and provide more plausible results in particular applications. The associated large-scale inverse problems manifest as formidable, often ill-behaved systems that are difficult to solve in an efficient way. Key algorithmic challenges include computational complexity, memory consumption, a vast number unknowns, as well as model and data uncertainties. We showcase state-of-the-art techniques in scientific computing to tackle these challenges.

Organizer: Andreas Mang University of Texas at Austin, USA

Organizer: George Biros University of Texas at Austin, USA

2:00-2:25 Medical Image Analysis: Applications in Need for High-End Computing

Christos Davatzikos, University of Pennsylvania, USA

2:30-2:55 Anatomically Constrained Large-scale Matrix Decomposition in Neuroimaging

Brian Avants, University of Pennsylvania, USA

3:00-3:25 Joint Methods for Reconstruction and Background Field Removal of QSM

Lars Ruthotto, Emory University, USA

3:30-3:55 Sparse Kaczmarz Methods -Analysis via Bregman Projections for Convex Feasibility Problems

Dirk Lorenz, Technische Universitaet Braunschweig, Germany 18

MS10 Image Analysis Advances

in Dynamic Microscopy and Live Cell Imaging -Part I of II

2:00 PM-4:00 PM

Room: Weavers Room

For Part 2 see MS20

Sophisticated light microscopy modalities (spinning-disk, PALM, STED, SPIM, 3D-TIRF, LSM,...) have been developed in recent years, delivering 2D and 3D time-lapse image sequences, which reveal the behavior of subcellular elements, the entire cell, or groups of cells, with still more details. The correlative light-electron microscopy (CLEM) relates cell dynamics and structure at very high spatial resolution. The specificities of the image series acquired with these modern microscopy setups require new methods to handle all the registration, tracking, dynamics estimation and event detection issues. The proposed minisymposium will include talks presenting novel methods to face these biological imaging challenges.

Organizer: Patrick Bouthemy Inria, France

Organizer: Charles Kervrann Inria, France

2:00-2:25 A Scale-Adaptive Method for Retracing and Registering in Correlative Light-Electron Microscopy

Patrick Bouthemy, Bertha Mayela, Toledo Acosta, and Charles Kervrann, Inria, France

2:30-2:55 Shape-Constrained Tracking with Active Contours

Virginie Uhlmann, Daniel Schmitter, and Michael A. Unser, École Polytechnique Fédérale de Lausanne, Switzerland

3:00-3:25 Enabling Phenotypic Screening Through Image Analysis *Jens Rittscher*, University of Oxford,

United Kingdom

3:30-3:55 Quantitative Cell Morphodynamics

Alexandre Dufour, Aleix Buquet, Nancy Guillen, and *Jean-Christophe Olivo-Marin*, Institut Pasteur, Paris, France

Monday, May 23

CP1 Image Formation

2:00 PM-3:40 PM

Room:Potters Room

Chair: Sanjay Bhatnagar, National Radio Astronomy Observatory, USA

2:00-2:15 Algorithm to Build A Parametrized Model for the Antenna Aperture Illumination for Radio Astronomical Imaging Application

Sanjay Bhatnagar, Preshanth Jagannathan, and Walter Brisken, National Radio Astronomy Observatory, USA

2:20-2:35 Wide-field full-Stokes Radio Interferometric Imaging: The role of the antenna response function

Preshanth Jagannathan, Sanjay Bhatnagar, and Urvashi Rau, National Radio Astronomy Observatory, USA; Russ Taylor, University of Cape Town, South Africa

2:40-2:55 Effect of Micro-CT Scans Resolution and Scale on the Prediction of Transport Properties of Digital Rocks

Vadim Lisitsa, Siberian Branch of the Russian Academy of Sciences, Russia; Nadezhda Arefeva, Novosibirsk State University, Russia; Yaroslav Bazaikin and Tatyana Khachkova, Sobolev Institute of Mathematics, Russia; Dmitriy Kolyukhin, Trofimuk Institute of Petroleum Geology and Geophysics SB RAS, Russia and Uni CIRP, Norway; Vladimir Tcheverda, Sobolev Institute of Mathematics, Russia

3:00-3:15 Compressive Mid-Infrared Spectroscopic Tomography: Label Free and Chemically Specific 3D Imaging.

Luke Pfister, University of Illinois at Urbana-Champaign, USA; Yoram Bresler, University of Illinois, USA; P. Scott Carney, University of Illinois at Urbana-Champaign, USA

3:20-3:35 Sparse View Compton Scatter Tomography with Energy Resolved Data Hamideh Rezaee, Brian Tracey, and Eric Miller, Tufts University, USA

Coffee Break

4:00 PM-4:30 PM



Room:Alvarado Ballroom Atrium

Monday, May 23

MS11

Inversion of Non-linear Image Formation Models -Part II of II

4:30 PM-6:30 PM

Room:Alvarado Ballroom D

For Part 1 see MS1

Several recent breakthroughs in nonsmooth optimisation theory, have made the inversion of non- linear image formation models practical. Such problems arise, for instance, in magnetic resonance imaging, optical and astronomic imaging, and conebeam tomography. The talks in this minisymposium discuss applications such as these, and state-of-the-art optimisation methods for the inversion of the resulting image formulation models with nonsmooth regularisation terms.

Organizer: Tuomo Valkonen University of Cambridge, United Kingdom

Organizer: Martin Benning University of Cambridge, United Kingdom

4:30-4:55 Diffusion Tensor Imaging: Reconstruction Using Deterministic Error Bounds

Yury Korolev, Queen Mary, University of London, United Kingdom; Tuomo Valkonen, University of Cambridge, United Kingdom; Artur Gorokh, Cornell University, USA

5:00-5:25 Primal-Dual Optimization of Phase Retrieval Via Optimization Transfer

Daniel S. Weller, University of Virginia, USA

5:30-5:55 5D Respiratory Motion Model Based Image Reconstruction Algorithm for 4D Cone-Beam Computed Tomography

Jiulong Liu, Xue Zhang, and Xiaoqun Zhang, Shanghai Jiao Tong University, China; Hongkai Zhao, University of California, Irvine, USA; Yu Gao, David Thomas, Daniel Low, and Hao Gao, University of California, Los Angeles, USA

6:00-6:25 Quantitative Ultrasound-Modulated Optical Tomography: Application of Linearised Models in Practical Imaging

Samuel Powell, University College London, United Kingdom; Clément Dupuy and François Ramaz, École Supérieure de Physique et de Chimie Industrielles, France; Terence Leung and Simon Arridge, University College London, United Kingdom

Monday, May 23 MS12

Recent Advances in Convex Relaxations - Part II of II 4:30 PM-6:30 PM

Room:Alvarado Ballroom E

For Part 1 see MS2

Variational methods have been one of the most popular and successful techniques in image reconstruction and analysis over the last decades. Unfortunately, many important imaging problems such as image segmentation, stereo matching, and optical flow computation lead to nonconvex cost functions that are inherently difficult to minimize globally. Convex relaxation strategies provide a powerful tool to closely approximate the nonconvex cost function: They avoid problems of the energy landscape having bad local minima and the solution being initialization dependent. This minisymposium brings together experts in the field of convex relaxations to discuss recent advances in theory and applications.

Organizer: Michael Moeller Technische Universität München, Germany

Organizer: Jan Lellmann University of Lübeck, Germany

Organizer: Daniel Cremers Technical University of Munich, Germany

4:30-4:55 Analysis L1-Minimization in Imaging

Holger Rauhut and *Jonathan Fell*, RWTH Aachen University, Germany

5:00-5:25 Sublabel Accurate Lifting

Emanuel Laude, Technical University of Munich, Germany; Thomas Möllenhoff and Michael Moeller, Technische Universität München, Germany; Jan Lellmann, University of Lübeck, Germany; Daniel Cremers, Technical University of Munich, Germany

5:30-5:55 A Posteriori Error Control for the Binary Mumford-Shah Model

Benjamin Berkels, RWTH Aachen University, Germany; Alexander Effland and Martin Rumpf, University of Bonn, Germany

6:00-6:25 Adaptive Discretization of Liftings for Curvature Regularization Ulrich Hartleif and Benedikt Wirth, Universität Münster, Germany

Monday, May 23

MS13

Recent Advances in Dictionary Learning -Part II of II

4:30 PM-6:30 PM

Room:Alvarado Ballroom A

For Part 1 see MS3

Dictionary Learning (DL) aims at finding a frame in which training data admits a sparse representation, allowing more adapted representations than traditional transforms. It has been applied with great success in various image processing tasks, often leading to state of the art results. Recently, a lot of attention has been dedicated to several aspects of DL: learning of fast dictionaries, theory of DL, and new models generalizing DL. This minisymposium gathers a representative sample of renowned speakers, covering the different trends occurring in this dynamic field of research.

Organizer: Yael Yankelevsky Technion Israel Institute of Technology, Israel

Organizer: Jeremias Sulam Technion Israel Institute of Technology, Israel

Organizer: Michael Elad Technion Israel Institute of Technology, Israel

Organizer: Remi Gribonval Inria Rennes, France

Organizer: Luc Le Magoarou Inria Rennes, France

4:30-4:55 Learning Separable Co-Sparse Analysis Operators -Sample Complexity and Stochastic Gradient Descent

Martin Kleinsteuber and *Julian Woermann*, Technical University of Munich, Germany

MS13 Recent Advances in Dictionary Learning -Part II of II

4:30 PM-6:30 PM Room:Alvarado Ballroom A continued

5:00-5:25 Dictionary Learning for Graph-Structured Data

Yael Yankelevsky and Michael Elad, Technion Israel Institute of Technology, Israel

5:30-5:55 Graph Spectral Dictionary Learning for Distributed Signal Processing

Pascal Frossard and Dorina Thanou, École Polytechnique Fédérale de Lausanne, Switzerland

6:00-6:25 Multiscale Geometric Methods for Statistical Learning and Dictionaries for Data and Images *Mauro Maggioni*, Duke University, USA

Monday, May 23

MS14

PDE-based Image Processing: Reconstruction, Filtering, Segmentation, Compression, and Inpainting

4:30 PM-6:30 PM

Room:Alvarado Ballroom B

In this minisymposium, we focus on up-to-date technologies and algorithms in PDE-based image processing and computer vision. Several topics and practical examples are presented in reconstruction, filtering, segmentation, compression, and inpainting. Unlike to a typical computation domain in image processing, numerical methods on in 3D/4D data and unstructured meshes are reviewed and high performance parallel computation on an optimized decomposed domain is discussed with PDE-based modeling and finite volume methods. With practical examples and applications where it is difficult to use conventional minimization modelings and methods, the advantages of PDE-based approach are illustrated.

Organizer: Jooyoung Hahn AVL List GmbH, Austria

4:30-4:55 Inflow-Based Gradient Finite Volume Method for Level Set Equation Jooyoung Hahn, AVL List GmbH, Austria

5:00-5:25 Mathematical Models and Numerical Methods for Early Embryogenesis Computational Reconstruction

Karol Mikula, Slovak University of Technology, Slovakia

5:30-5:55 Atlas Based Image Segmentation

Jozef Urban, TatraMed Software, Slovakia

6:00-6:25 High Quality Image Compression Using Pde-Based Inpainting with Optimal Data Laurent A. Hoeltgen, Brandenburg

University of Technology, Germany

Monday, May 23

MS15 Multi-Modality Imaging and Structural Priors - Part II of II 4:30 PM-6:30 PM

Room:Alvarado Ballroom C

For Part 1 see MS5

Multi-modality imaging has become increasingly interesting in many areas like medical imaging, remote sensing, photography and geophysics to name just a few. A standard approach is to treat the channels separately but as there is an expected correlation between the channels, it became popular to treat them jointly. The channels can be coupled by a prior that takes the structure of the scenery / anatomy / geology into account. In this minisymposium we bring together researchers to present recent theoretical and computational advances in the area of multi-modality imaging and structural priors.

Organizer: Matthias J. Ehrhardt University College London, United Kingdom

Organizer: Simon Arridge University College London, United Kingdom

4:30-4:55 Joint Hydrogeophysical Inversion Using Structure Similarity Measures

Klara Steklova and Eldad Haber, University of British Columbia, Canada

5:00-5:25 Structural Priors in Image Reconstruction

Virgnia Estellers, University of California, Los Angeles, USA

5:30-5:55 Joint Reconstruction Via Infimal Convolution of Bregman Distances with Applications to PET-MR Imaging

Julian Rasch and Eva-Maria Brinkmann, University of Muenster, Germany; Florian Knoll and Thomas Koesters, New York University, USA; Frank Wuebbeling and Martin Burger, University of Münster, Germany

6:00-6:25 Solution-driven Adaptive Total Variation Regularization

Frank Lenzen, University of Heidelberg, Germany

MS16 Image Segmentation, Classification and Applications - Part II of II

4:30 PM-6:00 PM

Room:Alvarado Ballroom F

For Part 1 see MS6

Image segmentation/classification has a lot of applications in real life: medical imaging, biology, object tracking and recognition in computer vision, just to name a few. There are however different challenges in different applications. Limitation of the resolution of imaging devices often leads to low contrast that causes objects of interest clump together or no clear boundary between objects. Segmenting such images is thus very difficult and often has no deterministic solutions. High dimensionality of the data makes it even harder. This minisymposium gathers together the latest theoretical and practical development in this topic.

Organizer: Weihong Guo Case Western Reserve University, USA

Organizer: Xiaoqun Zhang Shanghai Jiaotong University, China

4:30-4:55 Sparse Representation on Non-Flat Domains with Application in Classifications

Bin Dong, Peking University, China; Ning Hao, University of Arizona, USA

5:00-5:25 Intrinsic Methods for Image Segmentation on Manifolds and Extensions to Data Classification

Rongjie Lai, Rensselaer Polytechnic Institute, USA

5:30-5:55 Fuzzy Image Segmentation Based on Tv Regularization and L1-Norm Fidelity

Li Fang, East China Normal University, China; *Jing Qin*, and Stanley J. Osher, University of California, Los Angeles, USA; Ming Yan, Michigan State University, USA

Monday, May 23

MS17 Large-scale Optimization and Imaging Science 4:30 PM-6:30 PM

Room:Alvarado Ballroom G

Entering the big data era, there is currently emerging interests on largescale optimization algorithms that have both strong theoretical convergence guarantee and superior practical performance. Such algorithms are suitable for solving many big data analysis models that arise from machine learning, compressive sensing and medical imaging. The aim of this minisymposium is on large-scale optimization algorithms and their applications in imaging science. The discussion will address mathematical modelling, algorithm design, and numerical analysis that are related to problems in imaging science.

Organizer: Yuyuan Ouyang Clemson University, USA

Organizer: Yunmei Chen University of Florida, USA

4:30-4:55 Accelerated Stochastic ADMM with Variance Reduction

Chenxi Chen, University of Florida, USA; Yunmei Chen, University of Florida, USA; Yuyuan Ouyang, Clemson University, USA; Eduardo Pasiliao Jr., Air Force Research Laboratory, USA

5:00-5:25 Fast Decentralized Gradient Descent Method and Applications in Seismic Tomography

Xiaojing Ye, Georgia State University, USA

5:30-5:55 Image Reconstruction in Diffuse Optical Tomography Using Sparsity Constraint

Taufiquar R. Khan, Clemson University, USA

6:00-6:25 An Optimal Randomized Incremental Gradient Method

George Lan and Yi Zhou, University of Florida, USA

Monday, May 23

MS18

Non-Gaussian Noise: New Trends and Challenges -Part II of II

4:30 PM-6:30 PM

Room:Alvarado Ballroom H

For Part 1 see MS8

Additive Gaussian noise has been extensively studied since it produces simple and tractable mathematical models. However, in the real applications, the noise is much more complicated and it cannot be well simulated by additive Gaussian noise (for instance, it may be signal dependent, multiplicative, mixed, etc). This minisymposium intends to bring together researchers working with non-Gaussian noise in many different applications: image restoration, image registration, image enhancement, and more.

Organizer: Federica Sciacchitano Technical University of Denmark, Denmark

Organizer: Yiqiu Dong Technical University of Denmark, Denmark

4:30-4:55 Optimal Learning Approaches for the Determination of Noise Models in Image Restoration

Juan Carlos De los Reyes, Escuela Politécnica Nacional, Ecuador; Luca Calatroni and Carola B. Schoenlieb, University of Cambridge, United Kingdom

5:00-5:25 A Convex Variational Model for Restoring Blurred Images with Large Rician Noise

Tieyong Zeng, Hong Kong Baptist University, Hong Kong; *Liyuan Chen*, University of Texas Southwestern Medical Center at Dallas, USA

MS18 Non-Gaussian Noise: New Trends and Challenges -Part II of II

4:30 PM-6:30 PM Room:Alvarado Ballroom H

continued

5:30-5:55 Unbiased Noise Injection in Variance-Stabilized Range

Lucas Borges and Marcelo Vieira, University of Sao Paulo, Brazil; *Alessandro Foi*, Tampere University of Technology, Finland

6:00-6:25 Noise Estimation Based on a Non-Parametric Detection of Homogeneous Image Regions

Camille Sutour, University of Muenster, Germany

Monday, May 23

MS19

Efficient Algorithms for Largescale Inverse Problems in Medical Imaging - Part II of II

4:30 PM-6:30 PM

Room:Franciscan Ballroom

For Part 1 see MS9

We address recent advances in algorithms for large-scale inverse problems in the medical imaging sciences. We will also discuss the use of priors to supervise algorithms in order to reduce uncertainties in the solution process and provide more plausible results in particular applications. The associated large-scale inverse problems manifest as formidable, often ill-behaved systems that are difficult to solve in an efficient way. Key algorithmic challenges include computational complexity, memory consumption, a vast number unknowns, as well as model and data uncertainties. We showcase state-ofthe-art techniques in scientific computing to tackle these challenges.

Organizer: Andreas Mang University of Texas at Austin, USA

Organizer: George Biros University of Texas at Austin, USA

4:30-4:55 Automatic Detection of Heart Anomalies in Cardiac Ultrasound Data

Andrea L. Bertozzi and Stamatios Lefkimmiatis, University of California, Los Angeles, USA

5:00-5:25 Diffeomorphic Image Matching and the Choice of the Metric

Francois-Xavier Vialard, Université Paris Dauphine, France

5:30-5:55 Efficient Lung CT Registration Using Large Deformation Diffeomorphic Metric Mappings

Thomas Polzin, University of Luebeck, Germany

6:00-6:25 A Fast Solver for Constrained Diffeomorphic Image Registration

Andreas Mang and George Biros, University of Texas at Austin, USA

Monday, May 23

MS20

Image Analysis Advances in Dynamic Microscopy and Live Cell Imaging -Part II of II

4:30 PM-6:30 PM

Room: Weavers Room

For Part 1 see MS10

Sophisticated light microscopy modalities (spinning-disk, PALM, STED, SPIM, 3D-TIRF, LSM,...) have been developed in recent years, delivering 2D and 3D time-lapse image sequences, which reveal the behavior of subcellular elements, the entire cell, or groups of cells, with still more details. The correlative lightelectron microscopy (CLEM) relates cell dynamics and structure at very high spatial resolution. The specificities of the image series acquired with these modern microscopy setups require new methods to handle all the registration, tracking, dynamics estimation and event detection issues. The proposed minisymposium will include talks presenting novel methods to face these biological imaging challenges.

Organizer: Patrick Bouthemy Inria, France

Organizer: Charles Kervrann Inria, France

4:30-4:55 Inferring Causality in Molecular Processes Using Live Cell Microscopy

Gaudenz Danuser, University of Texas at Dallas, USA

5:00-5:25 Computational Imaging Methods to Study Cardiac Development and Function

Nikhil Chacko, Kevin G. Chan, Sandeep K. Bhat, and Jungho Ohn, University of California, Santa Barbara, USA; *Michael Liebling*, Idiap Research Institute, Switzerland

5:30-5:55 Tracking and Registration for Analyzing Live Cell Microscopy Images

Karl Rohr, University of Heidelberg and German Cancer Research Center, Germany

6:00-6:25 Quantitative Aspects of the Analysis of Superresolution and Single Molecule Experiments

Raimund J. Ober, University of Texas, Dallas, USA

CP2 Optimization

4:30 PM-6:10 PM

Room:Potters Room

Chair: Johannes Persch, University of Kaiserslautern, Germany

4:30-4:45 Matrix Decompositions Using Sub-Gaussian Random Matrices

Yariv Aizenbud and Amir Averbuch, Tel Aviv University, Israel

4:50-5:05 Iterated Tikhonov with General Penalty Term

Alessandro Buccini, Universita dell'Insubria, Italy; Marco Donatelli, University of Insubria, Italy; Lothar Reichel, Kent State University, USA

5:10-5:25 Parallel Douglas Rachford Algorithm for Restoring Images with Values in Symmetric Hadamard Manifolds

Johannes Persch, Ronny Bergmann, and Gabriele Steidl, University of Kaiserslautern, Germany

5:30-5:45 A New Variable Metric Line-Search Proximal-Gradient Method for Image Reconstruction

Simone Rebegoldi, Universita di Modena e Reggio Emilia, Italy; Silvia Bonettini, Universita' di Ferrara, Italy; Ignace Loris, Université Libre de Bruxelles, Belgium; Federica Porta, Universita' di Ferrara, Italy; Marco Prato, Universita di Modena e Reggio Emilia, Italy

5:50-6:05 Modulus Iterative Methods for Nonnegative Constrained Least Squares Problems Arising from Image Restoration

Ning Zheng, The Graduate University for Advanced Studies, Sokendai, Japan; Ken Hayami, National Institute of Informatics, Japan; Junfeng Yin, Tongji University, China

Monday, May 23

PP1

Welcome Reception and Poster Session

6:30 PM-8:30 PM

Room:Alvarado Ballroom Atrium

A Hybrid Spatio-Frequency Approach for Delineating Subsurface Structures in Seismic Volumes

Yazeed Alaudah, Muhammad Amir Shafiq, and Ghassan AlRegib, Georgia Institute of Technology, USA

Non-Convex Color Image Enhancement Via Manifold Regularization

Freddie Astrom and Christoph Schnoerr, University of Heidelberg, Germany

A Coupled Regularizer for Color Image Enhancement Via Manifold Geometry

Freddie Astrom and Christoph Schnoerr, University of Heidelberg, Germany

Density Modeling of Images Using a Generalized Normalization Transformation

Johannes Ballé, Valero Laparra, and Eero P. Simoncelli, New York University, USA

Applications and Generalization of the (p,q)-Laplace Operator

George Baravdish, Linköping University, Sweden; Freddie Astrom, University of Heidelberg, Germany; Yuanji Cheng, Malmo University, Sweden; Olof Svensson, Linköping University, Sweden

Inverse Reaction-Diffusion Model for Tumor Source Localization

Rym Jaroudi and *George Baravdish*, Linköping University, Sweden; Freddie Astrom, University of Heidelberg, Germany

Connectionist Model of Wavelet Neural Network in Automatic Pattern Recognition

Adel Belayadi and Fawzia Mekideche-Chafa, University of Sciences and Technology Houari, Algeria; Boualem Bourahla, Université Mouloud Mammeri de Tizi Ouzou, Algeria

Learning Metrics to Enhance Morphological Categorization

Serdar Cellat, Washington Mio, and Giray Okten, Florida State University, USA

3D Shape Characterization of Vascular Remodeling in Pulmonary Arterial Hypertension As Depicted in Volumetric Ct Images

Brian E. Chapman, Lynette Brown, John Roberts, and Tom Fletcher, University of Utah, USA

A Unified Hyperelastic Joint Segmentation/registration Model Based on Weighted Total Variation and Nonlocal Shape Descriptors

Carole Le Guyader, INSA Rouen, France; *Noémie Debroux*, INSA de Rouen, France; Carola-Bibiane Schönlieb, University of Cambridge, United Kingdom; Luminita A. Vese, University of California, Los Angeles, USA

A Discretize-Then-Optimize Approach to Coupled Super-Resolution Reconstruction and Motion Estimation

Eric Ng and *Mehran Ebrahimi*, University of Ontario Institute of Technology, Canada

A Flexible Approach to 2D-3D Image Registration

Lorraine Ma and *Mehran Ebrahimi*, University of Ontario Institute of Technology, Canada

On the Asymptotic Optimality of Global Image Denoising

Antoine Houdard and Andrés Almansa, Télécom ParisTech, France; Julie Delon, Université Paris Descartes, France

Radial Symmetric Point Spread Estimation and Uncertainty Quantification

Kevin Joyce, University of Montana, USA

Applying Local Renyi Entropy to Enhance Electron Microscopy Images of the Nucleus

Tsvi Katchalski, Albert Lawrence, and Mark Ellisman, University of California, San Diego, USA

PP1 Welcome Reception and **Poster Session**

6:30 PM-8:30 PM

Room: Alvarado Ballroom Atrium

continued

24

Extracting Science from the Smallest Scales in Solar Imagery

Michael S. Kirk, C. Alex Young, and W. Dean Pesnell, NASA Goddard Space Flight Center, USA

Restoration of Compressed Noisy Images

Francois Malgouyres, Universite Paul Sabatier, France: Thomas Oberlin and Herwig Wendt, University of Toulouse, France

Models and Algorithms for 3D Corneal **Biometry from Optical Coherence** Tomography

Micaela Mendlow and Mansoor Haider, North Carolina State University, USA; Eric Buckland, Leica Microsystems, USA

High-Level Fusion for Multimodal Brain Imaging Data Using Conditional **Probabilities and Directed Information** Flow Between Clustered Feature Spaces

Robyn Miller, The Mind Research Network, USA; Vince Calhoun, University of New Mexico, USA

Stability of Information Theoretic K-Space Trajectories for Model-Based **MR** Thermal Image Reconstruction

Drew Mitchell, Reza Madankan, Samuel Fahrenholtz, Christopher MacLellan, Wolfgang Stefan, Jason Stafford, John Hazle, and David Fuentes, University of Texas MD Anderson Cancer Center, USA

A Stochastic Inverse Method for Highly **Heterogeneous** Aquifers

Daniel O'Malley, Los Alamos National Laboratory, USA

continued in next column

Enhanced Low-Rank Matrix Approximation

Ankit Parekh and Ivan Selesnick, New York University, USA

Efficient Optimal Recovery Based Spatially-Adaptive Multi-Frame Super-Resolution.

Sergio D. Cabrera and Luis Ponce, University of Texas, El Paso, USA

Color Image Processing By Vectorial **Total Variation With Gradient Channels** Coupling

Surva Prasath, University of Missouri, Columbia, USA; Juan C. Moreno, University of Beira Interior, Portugal

Whitening of the Residual for Image Denoising

Paul H. Riot, Yann Gousseau, Florence Tupin, and Andrés Almansa, Telecom Paris, France

Denoising of Images Using Redundant Wavelet Transform and Biorthogonal **Slepian Filterbanks**

Seda Senay, New Mexico Institute of Mining and Technology, USA

Multiphase Segmentation For Simultaneously Homogeneous + Textural Images

Duy H. Thai, Statistical and Applied Mathematical Sciences Institute, USA

Imaging of Contaminant Plumes Using Non-Nonnegative-Matrix Factorization

Velimir V. Vesselinov, Los Alamos National Laboratory, USA

Tuesday, May 24

Registration

7:45 AM-5:00 PM Room: Fireplace Room

Remarks

8:10 AM-8:15 AM Room: Alvarado Ballroom D and E

IP3

Image Processing, Internet-of-Things, and **Inverse Problems: Blind Deconvolution Meets Blind** Demixing

8:15 AM-9:00 AM

Room: Alvarado Ballroom D and E

Chair: Amit Singer, Princeton University, USA

Assume we need to correctly blindly deconvolve and separate (demix) multiple signals at the same time from one single received signal. This challenging problem appears in numerous applications, and is also expected to arise in the future Internetof-Things. We will prove that under reasonable assumptions, it is indeed possible to solve this ill-posed inverse problem and recover multiple transmitted functions f_i and the associated impulse responses g_i robustly and efficiently from just one single received signal via semidefinite programming. We will tip our toes into the mathematical techniques behind our theory and discuss efficient numerical algorithms as well as applications.

Thomas Strohmer University of California, Davis, USA



MS21 Recent Developments in Hybrid Inverse Problems and Imaging - Part I of III

9:30 AM-11:30 AM

Room:Alvarado Ballroom D

For Part 2 see MS31

Hybrid imaging refers to imaging techniques where two modalities with distinct underlying physics are coupled together to achieve the contrast and resolution not attainable separately by each of the modalities involved. Photoacoustic imaging (PAT), thermoacoustic imaging (TAT), ultrasound modulated optical tomography (UMOT) and current density imaging (CDI) are a few examples of hybrid imaging modalities. This minisymposium intends to bring together leading researchers in the field to present recent advances on mathematical, computational, and practical issues of hybrid inverse problems and imaging.

Organizer: Kui Ren University of Texas at Austin, USA

Organizer: Alexander V. Mamonov University of Houston, USA

9:30-9:55 Optoacoustic Tomography of the Breast: Image Reconstruction and Signal Detectability

Mark A. Anastasio, Illinois Institute of Technology, USA; Yuan Lou, Washington University in St. Louis, USA; Alexander Oraevsky, TomoWave Laboratories, USA

10:00-10:25 Thermo-Acoustic Tomography on Bounded Domains *Yang Yang*, Purdue University, USA

10:30-10:55 Photoacoustic Imaging and Thermodynamic Attenuation

Sebastian Acosta, Baylor College of Medicine, USA

11:00-11:25 A Dissipative Time Reversal Technique for Photo-acoustic Tomography in a Cavity

Linh Nguyen, University of Idaho, USA; Leonid A. Kunyansky, University of Arizona, USA Tuesday, May 24

MS22

Convex Signal Recovery from Pairwise Measurements

9:30 AM-11:30 AM

Room:Alvarado Ballroom E

In some signal recovery problems, global structure information is to be inferred from local measurements on pairs of points. For example, one might seek to find the global position of a network of sensors from information on the relative direction between sensors. These signal recovery problems are challenging because locally chaining together pairwise measurements may not be possible or may be prone to accumulation of errors. As a result, recent attention has focused on global techniques such as convex programming. We will hear about multiple convex programs from applications including machine vision, clustering, and a non-unique games problem.

Organizer: Paul Hand Rice University, USA

Organizer: Vladislav Voroninski Massachusetts Institute of Technology, USA

9:30-9:55 Robust Camera Location Estimation by Convex Programming *Onur Ozyesil*, Princeton University and

INTECH LLC, USA; Amit Singer, Princeton University, USA

10:00-10:25 ShapeFit: Exact Location Recovery from Corrupted Pairwise Directions

Paul Hand, Rice University, USA; Choongbum Lee and Vladislav Voroninski, Massachusetts Institute of Technology, USA

10:30-10:55 Probably Certifiably Correct K-Means Clustering

Dustin Mixon, Air Force Institute of Technology, USA

11:00-11:25 Efficient Global Solutions to K-Means Clustering Via Semidefinite Relaxation

Soledad Villar, University of Texas at Austin, USA

Tuesday, May 24

MS23 Topology and Geometry

Across Scales - Part I of III

9:30 AM-11:30 AM

Room:Alvarado Ballroom A

For Part 2 see MS33

Understanding how complex data are organized across spatial and temporal scales is a fundamental problem in shape and image analysis. This minisymposium will provide a forum for discussion and dissemination of recent advances based on topological and geometric methods. The presentations will address foundational questions, modeling and computational advances, as well as applications to the analysis of morphological and imaging data.

Organizer: Facundo Memoli Ohio State University, USA

Organizer: Washington Mio Florida State University, USA

9:30-9:55 Persistence Weighted Gaussian Kernel for Topological Data Analysis

Genki Kusano, Tohoku University, Japan

10:00-10:25 A Matching Algorithm for Reducing Complexes in Multidimensional Persistence

Claudia Landi, Universita degli Studi di Modena e Reggio Emilia, Italy; Madjid Allili, Bishops University, Canada; *Tomasz Kaczynski*, Universite de Sherbrooke, Canada

10:30-10:55 Functorial Metric Clustering with Overlaps: Possibilities and Impossibilities

Dan Guralnik, University of Pennsylvania, USA; Jared Culbertson, Air Force Research Laboratory, USA; Peter F. Stiller, Texas A&M University, USA

11:00-11:25 Multiscale Mapper: Topological Summarization Via Codomain Covers

Facundo Memoli, Ohio State University, USA

MS24

Leveraging Ideas from Imaging Science in PDEconstrained Optimization -Part I of III

9:30 AM-11:30 AM

Room:Alvarado Ballroom B

For Part 2 see MS34

Inverse problems and image processing share the common goal of extracting key features of an image from limited, noisy measurements. However, the data available and the associated mathematical formulation differ dramatically between these areas: inverse problems typically assume access to only indirect measurements, while image processing applications typically assume direct access to a least part of the image. In this minisymposium, we will explore how recent advances in image processing, such as cartoon-texture decomposition, Mumford-Shah segmentation, and image registration, can be used to design more robust algorithms for PDE-constrained optimization. Application areas will include geoscience and medical imaging.

Organizer: Jeremy Brandman ExxonMobil Corporate Strategic Research, USA

Organizer: Huseyin Denli ExxonMobil, USA

9:30-9:55 Low-complexity Semidefinite Programming Methods and Applications in Computer Vision

Tom Goldstein, University of Maryland, USA; Christoph Studer, Cornell University, USA; Sohil Shah and Abhay Kumar, University of Maryland, USA

10:00-10:25 Sparsity in Fluids - Vorticity Estimation via Compressive Sensing

Hui Sun, University of California, San Diego, USA; Christoph Brune, University of Twente, The Netherlands; Andrea L. Bertozzi, University of California, Los Angeles, USA

10:30-10:55 Ingredients for Computationally Efficient Diffuse Optical Tomographic Reconstruction

Misha E. Kilmer, Tufts University, USA; Eric De Sturler, Serkan Gugercin, and Christopher A. Beattie, Virginia Tech, USA; Meghan O'Connell, Tufts University, USA

11:00-11:25 A Direct Reconstruction Method for Anisotropic Electrical Impedance Tomography

Rashmi Murthy, and Jennifer L. Mueller, Colorado State University, USA

Tuesday, May 24

MS25

Statistical Modeling of High-Dimensional Brain Signals and Images

9:30 AM-11:00 AM

Room:Alvarado Ballroom C

In Neuroscience, imaging techniques for recording brain structure and brain function are being collected to study mental and neurological diseases. Statistics, mathematics and computer science play critical roles in the analysis of brain signals and images. The three talks in this session will highlight the challenges in analyzing electrophysiological signals (by Hernando Ombao, UC-Irvine), structural imaging (by Hongtu Zhu, North Carolina) and hemodynamic data (by Stefano Castruccio, University of Newcastle). These talks share the common challenges of high dimensionality and nonstationarity in the spatial and temporal domains.

Organizer: Hernando Ombao University of California, Irvine, USA

9:30-9:55 Modeling and Data Visualization of Electroencephalograms *Hernando Ombao*, University of California, Irvine, USA

10:00-10:25 Structural Connectivity: Challenges and Future Outlook *Hongtu Zhu*, University of North Carolina, USA

10:30-10:55 A Scalable Space-Time Multiresolution Model for Activation and Connectivity in Fmri Data

Stefano Castruccio, Newcastle University, United Kingdom

MS26 Recent Advances in Image Classification and Recognition

9:30 AM-11:30 AM

Room:Alvarado Ballroom F

Image classification and recognition are classical computer vision problems with important applications in science and engineering. In this minisymposium several experts in the area will present new algorithms for image classification and recognition based on optimal transport theory, machine learning, and biologically-inspired ideas.

Organizer: Malena I. Espanol University of Akron, USA

9:30-9:55 How the Brain Represents Images: Biologically Inspired Algorithms for Classification and Recognition

Gabriel Kreiman, Harvard University, USA

10:00-10:25 Scotopic Recognition - The Dark Side of Vision

Pietro Perona, California Institute of Technology, USA

10:30-10:55 Lagrangian Transforms for Signal and Image Classification

Gustavo K. Rohde and *Se Rim Park*, Carnegie Mellon University, USA

11:00-11:25 Adaptive Piecewise Data Representation: Learning Manifolds and Dictionaries

Lorenzo Rosasco, Massachusetts Institute of Technology, USA

Tuesday, May 24

MS27

Parallel and Distributed Data Compression and Reconstruction in Imaging and High Performance Computing - Part I of II

9:30 AM-11:30 AM

Room:Alvarado Ballroom G

For Part 2 see MS37

Recent advances in scientific instruments are challenged by the growing size of datasets that require enormous computational and storage efforts to be reliably collected and processed, thus impeding data exploration, analysis and visualization. Parallel and distributed data compression, storage and reconstruction algorithms are desirable and are being developed to address these data challenges. This minisymposium collects together some new exciting directions of such parallel algorithms with applications in imaging and high performance computing.

Organizer: Ming Yan Michigan State University, USA

Organizer: Maher Salloum Sandia National Laboratories, USA

9:30-9:55 Compressed Sensing and Reconstruction of Unstructured Mesh Datasets: Optimal Compression

Maher Salloum, Nathan Fabian, David Hensinger, and Jeremy Templeton, Sandia National Laboratories, USA; Elizabeth Allendorf, University of California, Los Angeles, USA

10:00-10:25 Compressed Floating-Point Arrays for High-Performance Computing

Peter Lindstrom, Lawrence Livermore National Laboratory, USA

10:30-10:55 Parallel Tensor Compression for Large-Scale Scientific Data

Woody N. Austin, University of Texas at Austin, USA; Grey Ballard and *Tamara G. Kolda*, Sandia National Laboratories, USA

11:00-11:25 Data Refactoring: Using Auditors for Next Generation Storage Systems

Scott Klasky, Oak Ridge National Laboratory, USA

MS28 Recent Developments in Image Reconstruction and Restoration - Part I of III

9:30 AM-11:30 AM

Room:Alvarado Ballroom H

For Part 2 see MS38

Image reconstruction from direct and indirect samples arise in many applications, including radar and medical imaging. We focus on recent computational and modeling development in reconstructing and restoring high quality images from noisy and possibly incomplete measurement. Many of the talks will address methods for reconstruction from nonuniform Fourier data. Regularity plays an essential role in such problem. This minisymposium will include the latest development in various regularization schemes, including 11-regularization using high-order edge maps, total fractional variation, the difference between 11 and 12, and wavelets. Applications problems include synthetic aperture radar (SAR) imaging and medical resonance imaging (MRI).

Organizer: Rodrigo B. Platte Arizona State University, USA

Organizer: Weihong Guo Case Western Reserve University, USA

9:30-9:55 Parsing Local Signal Evolution Directly from Single-shot MRI Data Using a Second Order Approximation in Time

Rodrigo B. Platte, Arizona State University, USA

10:00-10:25 Sparse Sampling Methods for Neutron Tomography

Rick Archibald, Oak Ridge National Laboratory, USA

10:30-10:55 Fast Robust Phase Retrieval from Local Correlation Measurements

Mark Iwen and *Aditya Viswanathan*, Michigan State University, USA

11:00-11:25 Total Fractional-Order Variation Regularisation and Its Applications

Ke Chen, Jianping Zhang, and Bryan Williams, University of Liverpool, United Kingdom

Tuesday, May 24

MS29

Addressing the Computational Challenge of Sparsity-regularized X-ray Tomography

9:30 AM-11:30 AM

Room:Franciscan Ballroom

In X-ray tomography, image reconstruction from reduced data by sparsity- regularized methods has demonstrated great potential for lowdose imaging applications. A major remaining obstacle for use in realscale applications is computational: Typical computing times are orders of magnitudes larger than for existing methods of filtered back-projection type. This minisymposium focuses on advances and experiences in addressing this challenge, including appropriate choice of sparse regularization, optimization and algorithmic aspects and acceleration by hardware such as GPUs.

Organizer: Jakob Jorgensen Technical University of Denmark, Denmark

9:30-9:55 Sparsity-Exploiting Image Reconstruction for Volume Ct Using Algorithms with Truncated Iteration Number

Emil Sidky, Ingrid Reiser, and Xiaochuan Pan, University of Chicago, USA

10:00-10:25 Fast Prototyping of Advanced Tomographic Reconstruction Algorithms

Tristan van Leeuwen, Utrecht University, The Netherlands; Folkert Folkert Bleichrodt and Joost Batenburg, Centrum voor Wiskunde en Informatica (CWI), Netherlands

10:30-10:55 Multi-GPU Strategies for Computing Frame Based 3D Reconstructions in Cone-Beam CT

Nick Henscheid, University of Arizona, USA

11:00-11:25 Iterative Reconstruction for Practical Interior Problems in X-Ray Tomography Using a Dual Grid Method *William Thompson*, Carl Zeiss X-ray

Microscopy Inc., USA

Tuesday, May 24

MS30

Computational Methods for Cryo-electron Microscopy Single Particle Reconstruction - Part I of III

9:30 AM-11:30 AM

Room:Weavers Room

For Part 2 see MS40

The cryo-electron microscopy (EM) single particle reconstruction (SPR) problem is to find the three-dimensional structure of a macromolecule given a large number of noisy samples of its two-dimensional projection images at unknown random orientations and positions. The images are extremely noisy due to the small electron doses that can be applied to the specimen. The variability of the molecule is also a great challenge for achieving high resolution 3D model. This minisymposium focuses on algorithms, computational tools and mathematical theory for solving the problems in cryo-EM SPR.

Organizer: Zhizhen Zhao Courant Institute of Mathematical Sciences, New York University, USA

Organizer: Xiuyuan Cheng Yale University, USA

9:30-9:55 Algorithmic and Computational Challenges in Single Particle Reconstruction *Amit Singer*, Princeton University, USA

Amit Singer, Princeton University, USA

10:00-10:25 Fast Steerble Principal Component Analysis

Zhizhen Zhao, Courant Institute of Mathematical Sciences, New York University, USA

10:30-10:55 Non-Unique Games Over Compact Groups and Orientation Estimation in Cryo-Em

Afonso S. Bandeira, Massachusetts Institute of Technology, USA; *Yutong Chen* and Amit Singer, Princeton University, USA

11:00-11:25 Orthogonal Matrix Retrieval in Cryo-Electron Microscopy *Teng Zhang*, University of Central Florida, USA

CP3 Low-rank Models

9:30 AM-11:30 AM

Room:Potters Room

Chair: Gregory Ongie, University of Iowa, USA

9:30-9:45 A Fast Algorithm for Structured Low-Rank Matrix Recovery with Applications to Mri Reconstruction *Gregory Ongie* and Mathews Jacob,

University of Iowa, USA

9:50-10:05 Enhanced Sparse Low-Rank Matrix Estimation

Ankit Parekh and Ivan Selesnick, New York University, USA

10:10-10:25 Low-Rank Approximation Pursuit for Matrix and Tensor Completion

An-Bao Xu, Hunan University, China; Dongxiu Xie, Beijing Information Science & Technology University, China; Tin-Yau Tam, Auburn University, USA

10:30-10:45 Image Regularization with Structure Tensors - Edge Detection, Filtering, Denoising

Surya Prasath, University of Missouri, Columbia, USA; Dmitry A. Vorotnikov, Universidade de Coimbra, Portugal; Rengarajan Pelapur, Shani Jose, and Kannappan Palaniappan, University of Missouri, Columbia, USA; Guna Seetharaman, Naval Research Laboratory, USA

10:50-11:05 Image Deblurring With An Imprecise Blur Kernel Using a Group-Based Low-Rank Image Prior

Tian-Hui Ma, Ting-Zhu Huang, and Xi-Le Zhao, University of Electronic Science and Technology of China, China; Yifei Lou and Yifei Lou, University of Texas at Dallas, USA

11:10-11:25 Signal Classification Using Sparse Representation on Enhanced Training Dictionary

Naoki Saito and Chelsea Weaver, University of California, Davis, USA

Tuesday, May 24 Lunch Break 11:30 AM-1:00 PM Attendees on their own

SIAM Focus Group (by invitation only)

11:30 AM-1:00 PM

Room:Turquoise

Tuesday, May 24

SP1

SIAG/Imaging Science Early Career Prize Lecture -Revisiting Classical Problems of Image Processing: Looking for New Ways to Address Longstanding Problems

1:00 PM-1:45 PM

Room:Alvarado Ballroom D and E Chair: Eric Miller, Tufts University, USA

Digital images are generated by using physical acquisition devices, such as digital cameras, but also by simulating light propagation through environmental models. In both cases, physical or computational limitations in the image formation process introduce artifacts such as image blur or noise. Thus, developing image processing techniques becomes indispensable to help overcome these barriers. In this talk, I present several image processing applications in which a change of perspective leads to new insight and simpler, yet powerful, algorithms. Examples are: intrinsic camera PSF estimation, burst and video deblurring, Monte Carlo rendering denoising.

Mauricio Delbracio Duke University, USA

Intermission

1:45 PM-2:00 PM

MS31 Recent Developments in Hybrid Inverse Problems and Imaging - Part II of III

2:00 PM-4:00 PM

Room:Alvarado Ballroom D

For Part 1 see MS21 For Part 3 see MS41

Hybrid imaging refers to imaging techniques where two modalities with distinct underlying physics are coupled together to achieve the contrast and resolution not attainable separately by each of the modalities involved. Photoacoustic imaging (PAT), thermoacoustic imaging (TAT), ultrasound modulated optical tomography (UMOT) and current density imaging (CDI) are a few examples of hybrid imaging modalities. This minisymposium intends to bring together leading researchers in the field to present recent advances on mathematical, computational, and practical issues of hybrid inverse problems and imaging.

Organizer: Kui Ren University of Texas at Austin, USA

Organizer: Alexander V. Mamonov

University of Houston, USA

2:00-2:25 Stability and Statistics for Shear Stiffness Imaging

Joyce R. McLaughlin, Rensselaer Polytechnic Institute, USA

2:30-2:55 Lorentz Force Impedance Tomography in 2D

Leonid A. Kunyansky, University of Arizona, USA

3:00-3:25 Quantitative Pat for Molecular Imaging

Yimin Zhong, Kui Ren, and Rongting Zhang, University of Texas at Austin, USA

3:30-3:55 An Inverse Problem of Combined Photoacoustic and Optical Coherence Tomography

Peter Elbau, Leonidas Mindrinos, and Otmar Scherzer, University of Vienna, Austria Tuesday, May 24

MS32

Selected Papers from the SIAM Journal on Imaging Sciences - Part I of II

2:00 PM-4:00 PM

Room:Alvarado Ballroom E

For Part 2 see MS42

This minisymposium presents a selection of recent papers from the SIAM Journal on Imaging Sciences (SIIMS) that have raised a significant interest in the community. SIIMS provides a broad authoritative source for fundamental results in all imaging sciences, with a unique combination of mathematics and applications. Its manuscripts present formal approaches, at the level of mathematics and/or computations, as well as state-of-the-art practical results. Since its inception in 2008 it has quickly established itself as one of the high-impact journals in its field. This minisymposium aims at strengthening the link between SIAM's main imaging science initiatives: this conference and SIIMS.

Organizer: Marcelo Bertalmío Universitat Pompeu Fabra, Spain

Organizer: Naoki Saito University of California, Davis, USA

2:00-2:25 Novel Algorithms for Vectorial Total Variation

Daniel Cremers, Technical University of Munich, Germany; Bastian Goldluecke, University of Bonn, Germany; Evgeny Strekalovskiy, Technical University of Munich, Germany; Michael Moeller, Technische Universität München, Germany; Joan Duran, Universitat de les Illes Balears, Spain; Thomas Möllenhoff, Technical University of Munich, Germany

2:30-2:55 A Generalized Forward-Backward Splitting

Jalal Fadili, Université de Caen, France; Hugo Raguet, Universite Paris Dauphine and CNRS, France; Gabriel Peyre, CEREMADE Universite Paris 9 Dauphine, France

3:00-3:25 Coherence Pattern-Guided Compressive Sensing with Unresolved Grids

Albert Fannjiang, University of California, Davis, USA; Wenjing Liao, Statistical and Applied Mathematical Sciences Institute, USA

3:30-3:55 PhaseLift: Exact Phase Retrieval via Convex Programming

Emmanuel Candes, Stanford University, USA; Yonina C. Eldar, Technion Israel Institute of Technology, Israel and Stanford University, USA; Thomas Strohmer, University of California, Davis, USA; *Vladislav Voroninski*, Massachusetts Institute of Technology, USA

MS33 Topology and Geometry Across Scales - Part II of III

2:00 PM-4:00 PM

Room:Alvarado Ballroom A

For Part 1 see MS23 For Part 3 see MS43

Understanding how complex data are organized across spatial and temporal scales is a fundamental problem in shape and image analysis. This minisymposium will provide a forum for discussion and dissemination of recent advances based on topological and geometric methods. The presentations will address foundational questions, modeling and computational advances, as well as applications to the analysis of morphological and imaging data.

Organizer: Facundo Memoli Ohio State University, USA

Organizer: Washington Mio Florida State University, USA

2:00-2:25 On Geometric Problems in Structure from Motion

Gilad Lerman, University of Minnesota, USA

2:30-2:55 The Unexpected Geometry of "Real" High-Dimensional Data *Mireille Boutin*, Purdue University, USA

3:00-3:25 Layered Diffusion: Towards a Theory of Interconnected Networks

Hamid Krim, Shahin Aghdam, and Han Wang, North Carolina State University, USA; Liyi Dai, Army Research Office, USA

3:30-3:55 A Variational Approach to the Consistency of Spectral Clustering *Nicolas Garcia Trillos* and Dejan Slepcev,

Carnegie Mellon University, USA

Tuesday, May 24

MS34

Leveraging Ideas from Imaging Science in PDEconstrained Optimization -Part II of III

2:00 PM-3:30 PM

Room:Alvarado Ballroom B

For Part 1 see MS24 For Part 3 see MS44

Inverse problems and image processing share the common goal of extracting key features of an image from limited, noisy measurements. However, the data available and the associated mathematical formulation differ dramatically between these areas: inverse problems typically assume access to only indirect measurements, while image processing applications typically assume direct access to a least part of the image. In this minisymposium, we will explore how recent advances in image processing, such as cartoon-texture decomposition, Mumford-Shah segmentation, and image registration, can be used to design more robust algorithms for PDEconstrained optimization. Application areas will include geoscience and medical imaging.

Organizer: Jeremy Brandman ExxonMobil Corporate Strategic Research, USA

Organizer: Huseyin Denli ExxonMobil, USA

2:00-2:25 Phase Tracking: Interpretation of Seismic Records in Terms of Atomic Events

Laurent Demanet and Yunyue Li, Massachusetts Institute of Technology, USA

2:30-2:55 Frozen Gaussian Approximation and Its Applications

Xu Yang, University of California, Santa Barbara, USA

3:00-3:25 Joint Inversion of Gravity Data and Seismic Traveltimes Using a Structural Parametrization

Wenbin Li and Jianliang Qian, Michigan State University, USA

Tuesday, May 24

MS35

Geometry-based Models in Image Processing -Part I of II

2:00 PM-4:00 PM

Room:Alvarado Ballroom C

For Part 2 see MS45

Geometry has played a critical role in mathematical models for image processing for some time now. The geometric structures involved have been evolving, incorporating more abstract tools from differential geometry, and recent work has brought to light novel approaches for utilizing image geometry in ways that are both improving upon current state of the art methods and potentially opening the door to new paradigms in image processing. The aim of this session is to present some of the recent geometrically driven models and applications in the field of image processing, human perception modeling, and computer vision.

Organizer: Thomas Batard Universitat Pompeu Fabra, Spain

Organizer: Stacey Levine Duquesne University, USA

2:00-2:25 On Local and Non Local Covariant Derivatives and Their Applications in Color Image Processing *Thomas Batard* and Marcelo Bertalmío,

Universitat Pompeu Fabra, Spain

2:30-2:55 On the Geometry of Shading and Color

Steven Zucker, Yale University, USA; Benjamin Kunsberg, Brown University, USA; Daniel Holtmann-Rice, Google, Inc., USA

3:00-3:25 Locally Rigid Averaging of stretchable non-rigid shapes

Dan Raviv, Massachusetts Institute of Technology, USA; Eduardo Bayro-Corrochano, CINVESTAV, Mexico; Ramesh Raskar, Massachusetts Institute of Technology, USA

3:30-3:55 Locally Adaptive Frames in the Roto-Translation Group SE(d)

Remco Duits and Michiel Janssen, Eindhoven University of Technology, Netherlands

MS36 Spectral Methods for Nonlocal Diffusion and Segmentation

2:00 PM-4:00 PM

Room:Alvarado Ballroom F

In image denoising and segmentation the following questions arise: What is an optimal nonlinear diffusion filter? What are the underlying shapes (eigenfunctions) that one should enforce as priors? How to deal with multiple scales making use of spectral responses? In view of harmonic analysis and sparse representations, recently theory for nonlinear spectral representations of convex functionals, e.g. the TV transform, has been introduced. This minisymposium promotes interactions between researchers working on 1.) spectral representations for nonlinear diffusion and 2.) spectral methods for nonlocal diffusion on graphs (Cheeger cuts, partitions). It will stimulate innovative ideas in the overlap of both fields.

Organizer: Christoph Brune University of Twente, The Netherlands

Organizer: Dominique Zosso University of California, Los Angeles, USA

2:00-2:25 A Dirichlet Energy Criterion for Graph-Based Image Segmentation *Braxton Osting*, University of Utah,

USA; Dominique Zosso, University of California, Los Angeles, USA

2:30-2:55 Spectral Decompositions Via One-Homogeneous Regularization Functionals

Michael Möller, Technical University of Munich, Germany; Guy Gilboa, Technion Israel Institute of Technology, Israel; Martin Burger, University of Münster, Germany

3:00-3:25 Multiscale Segmentation via Bregman Distances and Spectral TV Analysis

Leonie Zeune, University of Twente, Netherlands; Christoph Brune, University of Twente, The Netherlands

3:30-3:55 Fundamentals of Non-Local Total Variation Spectral Theory

Nicolas Papadakis, CNRS, France; Jean-Francois Aujol, IMB, CNRS, Université Bordeaux 1, France; Guy Gilboa, Technion Israel Institute of Technology, Israel

Tuesday, May 24

Parallel and Distributed Data Compression and Reconstruction in Imaging and High Performance Computing - Part II of II

2:00 PM-4:00 PM

Room:Alvarado Ballroom G

For Part 1 see MS27

Recent advances in scientific instruments are challenged by the growing size of datasets that require enormous computational and storage efforts to be reliably collected and processed, thus impeding data exploration, analysis and visualization. Parallel and distributed data compression, storage and reconstruction algorithms are desirable and are being developed to address these data challenges. This minisymposium collects together some new exciting directions of such parallel algorithms with applications in imaging and high performance computing.

Organizer: Ming Yan Michigan State University, USA

Organizer: Maher Salloum Sandia National Laboratories, USA

2:00-2:25 Arock: an Algorithmic Framework for Asynchronous Parallel Coordinate Updates

Zhimin Peng, University of California, Los Angeles, USA; Yangyang Xu, Institute for Mathematics and its Applications, USA; *Ming Yan*, Michigan State University, USA; Wotao Yin, University of California, Los Angeles, USA

2:30-2:55 Compressed Sensing and Reconstruction of Unstructured Mesh Datasets: Performance and Accuracy

Nathan Fabian, Jina Lee, David Hensinger, and Maher Salloum, Sandia National Laboratories, USA

3:00-3:25 Multi-Node Model-Based Image Reconstruction with GPUs

Madison G. McGaffin and Jeffrey Fessler, University of Michigan, USA

3:30-3:55 Direct Sampling Methods for Electrical Impedance Tomography and Diffusive Optical Tomography

Yat Tin Chow, University of California, Los Angeles, USA; Kazufumi Ito, North Carolina State University, USA; Keji Liu, Shanghai University of Finance and Economics, China; Jun Zou, The Chinese University of Hong Kong, Hong Kong

Tuesday, May 24

MS38 Recent Developments in Image Reconstruction and Restoration - Part II of III

2:00 PM-4:00 PM

Room:Alvarado Ballroom H

For Part 1 see MS28 For Part 3 see MS47

Image reconstruction from direct and indirect samples arise in many applications, including radar and medical imaging. We focus on recent computational and modeling development in reconstructing and restoring high quality images from noisy and possibly incomplete measurement. Many of the talks will address methods for reconstruction from nonuniform Fourier data. Regularity plays an essential role in such problem. This minisymposium will include the latest development in various regularization schemes, including 11-regularization using high-order edge maps, total fractional variation, the difference between 11 and 12, and wavelets. Applications problems include synthetic aperture radar (SAR) imaging and medical resonance imaging (MRI).

Organizer: Rodrigo B. Platte Arizona State University, USA

Organizer: Weihong Guo Case Western Reserve University, USA

2:00-2:25 A Novel Fidelity and Regularity for Image Reconstruction *Weihong Guo* and Yue Zhang, Case

Western Reserve University, USA; Guohui Song, Clarkson University, USA

2:30-2:55 A Novel Backtracking Strategy for Accelerated ADMM and Applications to Image Reconstruction *Xianqi Li*, University of Florida, USA

3:00-3:25 Patch-based Inpainting Using Adaptive Dictionary Lixin Shen, Syracuse University, USA

3:30-3:55 Multiscale Sparse Representations in Variational Image Reconstruction

Julia Dobrosotskaya, Case Western Reserve University, USA

Tuesday, May 24 MS39 Limited-data Tomography -Part I of II

2:00 PM-3:30 PM

Room:Franciscan Ballroom

For Part 2 see MS48

In tomography, one attempts to image the internal structure of a physical body from indirect measurements. An example is the medical CAT-scan, where a 3D volume view of a patient is reconstructed from X-ray radiographs recorded with fine angular sampling using a rotating sourcedetector arrangement. In many practical imaging settings such a comprehensive dataset is not available. Sources for restricted datasets in tomographic modalities include radiation dose concerns, geometric restrictions, speed of data collection, and cost of equipment. Limitations can be compensated for by using sophisticated mathematical reconstruction methods. This minisymposium reports recent advances on limited-data tomography methods based on the use of statistics, compressed sensing, and other techniques.

Organizer: Samuli Siltanen University of Helsinki, Finland

Organizer: Ville P. Kolehmainen University of Eastern Finland, Finland

2:00-2:25 Predicting Performance of Sparsity-Regularized X-Ray Tomography: Experimental Results using Glass-Bead Data

Jakob Jorgensen, Technical University of Denmark, Denmark

2:30-2:55 Development of Reconstruction Algorithms of Practical Utility in Sparse-Data X-Ray Tomographic Imaging

Xiaochuan Pan, University of Chicago, USA

3:00-3:25 fMRI Reconstruction Using a State Estimation Approach

Ville-Veikko Wettenhovi, University of Eastern Finland, Finland

MS40

Computational Methods for Cryo-electron **Microscopy Single Particle Reconstruction - Part II of III**

2:00 PM-4:00 PM

Room:Weavers Room

For Part 1 see MS30 For Part 3 see MS49

The cryo-electron microscopy (EM) single particle reconstruction (SPR) problem is to find the three-dimensional structure of a macromolecule given a large number of noisy samples of its two-dimensional projection images at unknown random orientations and positions. The images are extremely noisy due to the small electron doses that can be applied to the specimen. The variability of the molecule is also a great challenge for achieving high resolution 3D model. This minisymposium focuses on algorithms, computational tools and mathematical theory for solving the problems in cryo-EM SPR.

Organizer: Zhizhen Zhao Courant Institute of Mathematical Sciences, New York University, USA

Organizer: Xiuyuan Cheng Yale University, USA

2:00-2:25 Elucidating Protein Structure at High Resolution by Cryo-EM: **Advances and Challenges**

Alberto Bartesaghi, National Cancer Institute and National Institutes of Health, USA

2:30-2:55 Classification of Cryo-**Em Projections Using Low-Rank Covariance Estimation**

Joakim Anden, Princeton University, USA

3:00-3:25 Wavelet Frame Based Algorithm for 3D Reconstruction in **Electron Microscopy**

Hui Ji, National University of Singapore, Singapore

3:30-3:55 Fast Algorithms for 3D Cryo-**Em Reconstruction**

Marina Spivak, Simons Foundation, USA

Tuesday, May 24

CP4

Sparsity 2:00 PM-3:40 PM

Room:Potters Room

Chair: Sara Loupot, University of Texas MD Anderson Cancer Center, USA

2:00-2:15 Gap Safe Rules for Speeding-Up Sparse Regularization Eugene Ndiaye, Olivier Fercoq, Alexandre Gramfort, and Joseph

Salmon, Télécom ParisTech, France

2:20-2:35 Sparse Approximation of Images by Adaptive Thinning

Armin Iske, University of Hamburg, Germany; Laurent Demaret, Helmholtz Zentrum München, Germany

2:40-2:55 Joint Deconvolution and Blind Source Separation of Hyperspectral Data Using Sparsity

Ming Jiang, Jean-Luc Starck, and Jérome Bobin, CEA Saclay, France

3:00-3:15 Sparse Source **Reconstruction for Nanomagnetic** Relaxometry

Sara Loupot, Wolfgang Stefan, Reza Medankan, Kelsey Mathieu, David Fuentes, and John Hazle, University of Texas MD Anderson Cancer Center, USA

3:20-3:35 Convolutional Laplacian **Sparse Coding**

Xiyang Luo, University of California, Los Angeles, USA; Brendt Wohlberg, Los Alamos National Laboratory, USA

Coffee Break

4:00 PM-4:30 PM



Room:Alvarado Ballroom Atrium

Tuesday, May 24

MS41

Recent Developments in Hybrid Inverse Problems and Imaging - Part III of III

4:30 PM-6:30 PM

Room:Alvarado Ballroom D

For Part 2 see MS31

Hybrid imaging refers to imaging techniques where two modalities with distinct underlying physics are coupled together to achieve the contrast and resolution not attainable separately by each of the modalities involved. Photoacoustic imaging (PAT), thermoacoustic imaging (TAT), ultrasound modulated optical tomography (UMOT) and current density imaging (CDI) are a few examples of hybrid imaging modalities. This minisymposium intends to bring together leading researchers in the field to present recent advances on mathematical, computational, and practical issues of hybrid inverse problems and imaging.

Organizer: Kui Ren University of Texas at Austin, USA

Organizer: Alexander V. Mamonov

University of Houston, USA

4:30-4:55 Stability from Partial Data in Current Density Based Impedance Imaging

Carlos Montalto, University of Washington, USA; Alexandru Tamasan, University of Central Florida, USA

5:00-5:25 Title Not Available Laurent Seppecher, Massachusetts Institute of Technology, USA

5:30-5:55 Inverse Schroedinger Problem with Internal Measurements

Fernando Guevara Vasquez, University of Utah. USA

6:00-6:25 Nonlinear Acoustic Imaging via Reduced Order Model Backprojection

Alexander V. Mamonov, University of Houston, USA; Vladimir L. Druskin, Schlumberger-Doll Research, USA; Andrew E. Thaler, Institute for Mathematics and its Applications, USA; Mikhail Zaslavsky, Schlumberger-Doll Research, USA

MS42

Selected Papers from the SIAM Journal on Imaging Sciences - Part II of II

4:30 PM-6:30 PM

Room:Alvarado Ballroom E

For Part 1 see MS32

This minisymposium presents a selection of recent papers from the SIAM Journal on Imaging Sciences (SIIMS) that have raised a significant interest in the community. SIIMS provides a broad authoritative source for fundamental results in all imaging sciences, with a unique combination of mathematics and applications. Its manuscripts present formal approaches, at the level of mathematics and/or computations, as well as state-of-the-art practical results. Since its inception in 2008 it has quickly established itself as one of the high-impact journals in its field. This minisymposium aims at strengthening the link between SIAM's main imaging science initiatives: this conference and SIIMS.

Organizer: Marcelo Bertalmío Universitat Pompeu Fabra, Spain

Organizer: Naoki Saito University of California, Davis, USA

4:30-4:55 Image Denoising Using Mean Curvature of Image Surface

Wei Zhu, University of Alabama, USA; Tony Chan, Hong Kong University of Science and Technology, Hong Kong

5:00-5:25 Fast Alternating Direction Optimization Methods

Tom Goldstein, University of Maryland, USA; Brendan O'Donoghue, Google DeepMind, United Kingdom; Simon Setzer, Saarland University, Germany; Richard Baraniuk, Rice University, USA

5:30-5:55 Some Recent Advances in Primal-Dual Methods for Saddle-Point Problems

Bingsheng He, Nanjing University, China; *Xiaoming Yuan*, Hong Kong Baptist University, Hong Kong

6:00-6:25 Multistatic Imaging of Extended Targets

Habib Ammari, Ecole Normale Superieure, France; *Josselin Garnier*, Université Paris-Diderot, France; Hyeonbae Kang, Inha University, Korea; Mikyoung Lim, Korea Advanced Institute of Science and Technology, Korea; Knut Solna, University of California, Irvine, USA

Tuesday, May 24

MS43 Topology and Geometry Across Scales - Part III of III

4:30 PM-6:30 PM

Room:Alvarado Ballroom A

For Part 2 see MS33

Understanding how complex data are organized across spatial and temporal scales is a fundamental problem in shape and image analysis. This minisymposium will provide a forum for discussion and dissemination of recent advances based on topological and geometric methods. The presentations will address foundational questions, modeling and computational advances, as well as applications to the analysis of morphological and imaging data.

Organizer: Facundo Memoli Ohio State University, USA

Organizer: Washington Mio Florida State University, USA

4:30-4:55 Effective Algebra and Geometry for Images with Varied Topology

Ezra Miller and Ashleigh Thomas, Duke University, USA

5:00-5:25 Topologically Accurate Digital Image Analysis Using Discrete Morse Theory

Vanessa Robins, Olaf Delgado-Friedrichs, and Adrian Sheppard, Australian National University, Australia

5:30-5:55 Directional Features, Projective Coordinates and Classification

Jose Perea, Michigan State University, USA

6:00-6:25 Local-to-Global Homology and Barcode Fields

Washington Mio and Mao Li, Florida State University, USA

MS44

Leveraging Ideas from Imaging Science in PDEconstrained Optimization -Part III of III

4:30 PM-6:00 PM

Room:Alvarado Ballroom B

For Part 2 see MS34

Inverse problems and image processing share the common goal of extracting key features of an image from limited, noisy measurements. However, the data available and the associated mathematical formulation differ dramatically between these areas: inverse problems typically assume access to only indirect measurements, while image processing applications typically assume direct access to a least part of the image. In this minisymposium, we will explore how recent advances in image processing, such as cartoon-texture decomposition, Mumford-Shah segmentation, and image registration, can be used to design more robust algorithms for PDE-constrained optimization. Application areas will include geoscience and medical imaging.

Organizer: Jeremy Brandman ExxonMobil Corporate Strategic Research, USA

Organizer: Huseyin Denli ExxonMobil, USA

4:30-4:55 Prior Model Identification During Subsurface Flow Data Integration with Adaptive Sparse Representations

Behnam Jafarpour, University of Southern California, USA

5:00-5:25 Geometrical Learning and Cardinal Composition of Shape Elements in Imaging and Vision

Alireza Aghasi, Massachusetts Institute of Technology, USA; Justin Romberg, Georgia Institute of Technology, USA

5:30-5:55 Compressive Conjugate Directions: Linear Theory

Musa Maharramov, ExxonMobil Upstream Research Company, USA; Stewart Levin, Stanford University, USA Tuesday, May 24

MS45

Geometry-based Models in Image Processing -Part II of II

4:30 PM-6:30 PM

Room:Alvarado Ballroom C

For Part 1 see MS35

Geometry has played a critical role in mathematical models for image processing for some time now. The geometric structures involved have been evolving, incorporating more abstract tools from differential geometry, and recent work has brought to light novel approaches for utilizing image geometry in ways that are both improving upon current state of the art methods and potentially opening the door to new paradigms in image processing. The aim of this session is to present some of the recent geometrically driven models and applications in the field of image processing, human perception modeling, and computer vision.

Organizer: Thomas Batard Universitat Pompeu Fabra, Spain

Organizer: Stacey Levine Duquesne University, USA

4:30-4:55 Image Comparison Via Group Invariant Non-Expansive Operators

Patrizio Frosini, University of Bologna, Italy

5:00-5:25 Variational Frequencies – Multiscale Models and the Generation of Nonlinear Eigenfunctions

Raz Nossek and Guy Gilboa, Technion Israel Institute of Technology, Israel 5:30-5:55 A Computational Model of Amodal Completion

Maria Oliver and Gloria Haro, Universitat Pompeu Fabra, Spain; Mariella Dimiccoli, Centre de Visió per Computador, Spain; Baptiste Mazin, DxO Labs, France; Coloma Ballester, Universitat Pompeu Fabra, Spain

6:00-6:25 Fringe Analysis Using Curvature Models

Carlos Brito-Loeza and Ricardo Legarda-Saenz, Universidad Autónoma de Yucatán, Mexico

continued in next column
Tuesday, May 24

MS46

Imaging in the Fast Lane: In Pursuit of Dynamical Information - Part I of II

4:30 PM-6:30 PM

Room:Alvarado Ballroom F

For Part 2 see MS55

When applied in fast dynamic scenarios, conventional image acquisition and reconstruction techniques often suffer from motion blurring and artifacts and cannot yield the high spatio-temporal resolution desired. Novel approaches try to accelerate these applications by combining tailored acquisition systems employing sub-sampling schemes with sophisticated image reconstruction techniques. The latter are usually based on sparsity-constrained spatiotemporal image models such as low rank, kinetic or optimal flow/transport models. A particular challenge of accelerated imaging is to design efficient optimization techniques able to solve the full spatio-temporal complexity of the imaging model.

Organizer: Felix Lucka

University College London, United Kingdom

Organizer: Marta Betcke University College London, United Kingdom

4:30-4:55 Variational Motion Estimation for Cell Migration

Lena Frerking, University of Münster, Germany; Christoph Brune, University of Twente, The Netherlands; Martin Burger, University of Münster, Germany; Dietmar Vestweber, Max Planck Institute for Molecular Biomedicine, Germany

5:00-5:25 Accelerated High-Resolution Photoacoustic Tomography via Compressed Sensing

Felix Lucka, University College London, United Kingdom Jan Lellmann, University of Lübeck, Germany; Emanuel Laude, Thomas Möllenhoff, Daniel Cremers, and Michael Möller, Technical University of Munich, Germany

6:00-6:25 Adaptive Regularization of the Non-Local Means for Video Denoising

Camille Sutour, University of Muenster, Germany

Tuesday, May 24

MS47

Recent Developments in Image Reconstruction and Restoration - Part III of III

4:30 PM-6:30 PM

Room:Alvarado Ballroom H

For Part 2 see MS38

Image reconstruction from direct and indirect samples arise in many applications, including radar and medical imaging. We focus on recent computational and modeling development in reconstructing and restoring high quality images from noisy and possibly incomplete measurement. Many of the talks will address methods for reconstruction from nonuniform Fourier data. Regularity plays an essential role in such problem. This minisymposium will include the latest development in various regularization schemes, including 11-regularization using high-order edge maps, total fractional variation, the difference between 11 and 12, and wavelets. Applications problems include synthetic aperture radar (SAR) imaging and medical resonance imaging (MRI).

Organizer: Rodrigo B. Platte Arizona State University, USA

Organizer: Weihong Guo Case Western Reserve University, USA

4:30-4:55 Image Reconstruction from Non-Uniform Fourier Data

Guohui Song, Clarkson University, USA

5:00-5:25 Sar Moving Target Imaging in Complex Scenes Using Sparse and Low-Rank Decomposition

Kang-Yu Ni and Shankar Rao, HRL Laboratories, LLC, USA

5:30-5:55 Sar Imaging using Special Regularization Methods

Toby Sanders, Rodrigo B. Platte, and Anne Gelb, Arizona State University, USA

6:00-6:25 An L1 Regularization Algorithm for Reconstructing Piecewise Smooth Functions from Fourier Data Using Wavelet Projection Dennis Denker, Arizona State University, USA

continued in next column

Tuesday, May 24

MS48 Limited-data Tomography -Part II of II

4:30 PM-6:30 PM

Room:Franciscan Ballroom

For Part 1 see MS39

In tomography, one attempts to image the internal structure of a physical body from indirect measurements. An example is the medical CAT-scan, where a 3D volume view of a patient is reconstructed from X-ray radiographs recorded with fine angular sampling using a rotating sourcedetector arrangement. In many practical imaging settings such a comprehensive dataset is not available. Sources for restricted datasets in tomographic modalities include radiation dose concerns, geometric restrictions, speed of data collection, and cost of equipment. Limitations can be compensated for by using sophisticated mathematical reconstruction methods. This minisymposium reports recent advances on limited-data tomography methods based on the use of statistics, compressed sensing, and other techniques.

Organizer: Samuli Siltanen University of Helsinki, Finland

Organizer: Ville P. Kolehmainen University of Eastern Finland, Finland

4:30-4:55 Computed Tomography from Limited Data Using a Robust and Automated Discrete Algebraic Reconstruction Technique

Xiaodong Zhuge and Joost Batenburg, Centrum voor Wiskunde en Informatica (CWI), Netherlands

5:00-5:25 Limited Angle Tomography and Discretization of Continuous Inverse Problems

Matti Lassas, University of Helsinki, Finland

5:30-5:55 Tomographic Reconstruction Using Adaptive Mcmc in Terms of Parametric Curves

Zenith Purisha, University of Helsinki, Finland

6:00-6:25 Accelerating Optical Projection Tomography Using Compressed Sensing

Simon Arridge, University College London, United Kingdom

Tuesday, May 24

MS49

Computational Methods for Cryo-electron Microscopy Single Particle Reconstruction - Part III of III

4:30 PM-6:30 PM

Room: Weavers Room

For Part 2 see MS40

The cryo-electron microscopy (EM) single particle reconstruction (SPR) problem is to find the three-dimensional structure of a macromolecule given a large number of noisy samples of its two-dimensional projection images at unknown random orientations and positions. The images are extremely noisy due to the small electron doses that can be applied to the specimen. The variability of the molecule is also a great challenge for achieving high resolution 3D model. This minisymposium focuses on algorithms, computational tools and mathematical theory for solving the problems in cryo-EM SPR.

Organizer: Zhizhen Zhao Courant Institute of Mathematical Sciences, New York University, USA

Organizer: Xiuyuan Cheng Yale University, USA

4:30-4:55 Symmetry Detection by Auto-Correlation Kernels

Xiuyuan Cheng, Yale University, USA; Amit Singer, Princeton University, USA; Yoel Shkolnisky, Tel Aviv University, Israel

5:00-5:25 Denoising and Covariance Estimation of Single Particle Cryo-EM Images

Tejal Bhamre, Princeton University, USA; Teng Zhang, University of Central Florida, USA; Amit Singer, Princeton University, USA

5:30-5:55 Dose Fractionated Cryo-EM Images: Advances and Fundamental Limits in Movie Alignment

Cecilia Aguerrebere, Duke University, USA; Alberto Bartesaghi, National Cancer Institute and National Institutes of Health, USA; Sriram Subramaniam, National Institutes of Health, USA; Guillermo Sapiro, Duke University, USA

6:00-6:25 Angular Reconstitution for Molecules with C_4 Symmetry

Gabi Pragier and Yoel Shkolnisky, Tel Aviv University, Israel

Tuesday, May 24

MS65 The Never-Ending Story of Image Denoising -Part I of II

4:30 PM-6:30 PM

Room:Alvarado Ballroom G

For Part 2 see MS74

Noise removal has been a fundamental field of research for decades. Leading methods rely on powerful image models/ priors, e.g., sparsity of image patches in some domain, self-similarity of patches within and across different scales of the image, graph-based regularization, and more. Recently, machine learning techniques, in particular neural networks, have been utilized to address the image denoising problem. The proposed minisymposium consists of two sessions, covering a series of state-of-the-art methods in this field.

Organizer: Yaniv Romano Technion Israel Institute of Technology, Israel

Organizer: Peyman Milanfar Google Research, USA

Organizer: Michael Elad Technion Israel Institute of Technology, Israel

4:30-4:55 Boosting of Image Denoising Algorithms

Yaniv Romano and Michael Elad, Technion Israel Institute of Technology, Israel

5:00-5:25 Pewa: Patch-Based Exponentially Weighted Aggregation for Image Denoising.

Charles Kervrann, Inria, France

5:30-5:55 Towards Bias Reduction in Image Denoising Algorithms

Charles-Alban Deledalle and Charles-Alban Deledalle, Université Bordeaux, France; Nicolas Papadakis, CNRS, France; Joseph Salmon, Télécom ParisTech, France; *Samuel Vaiter*, CNRS, France

6:00-6:25 A Non-Local Bayesian Method for Video Denoising

Pablo Arias and Jean Michel Morel, CMLA, ENS de Cachan, France Tuesday, May 24

CP5 PDE-Based Methods

4:30 PM-6:30 PM

Room: Potters Room

Chair: Theresa A. Scarnati, Arizona State University, USA

4:30-4:45 Removal of Curtaining Effects by a Variational Model with Directional Forward Differences

Jan Henrik Fitschen, University of Kaiserslautern, Germany; Jianwei Ma, Harbin Institute of Technology, China; Sebastian Schuff, University of Kaiserslautern, Germany

4:50-5:05 Boundary Formulation of Finite Differences: Analysis and Applications

Mahdi S. Hosseini and Konstantinos N. Plataniotis, University of Toronto, Canada

5:10-5:25 Solving Variational Problems and Partial Differential Equations That Map Between Manifolds Via the Closest Point Method

Nathan D. King and Steven Ruuth, Simon Fraser University, Canada

5:30-5:45 Regularization Strategy for Inverse Problem for 1+1 Dimensional Wave Equation

Jussi P. Korpela, University of Helsinki, Finland

5:50-6:05 Exploiting Sparsity in PDEs with Discontinuous Solutions

Theresa A. Scarnati, Arizona State University, USA

6:10-6:25 NonLocal via Local--NonLinear via Linear: A New Part-Coding Distance Field via Screened Poisson Equation

Murat Genctav, Asli Genctav, and Sibel Tari, Middle East Technical University, Turkey

Intermission

6:30 PM-6:45 PM

SIAG/IS Business Meeting

6:45 PM-7:30 PM

Room:Alvarado Ballroom D

Complimentary beer and wine will be served.

Wednesday, May 25

Registration

7:45 AM-5:00 PM Room:Fireplace Room

Remarks

8:10 AM-8:15 AM Room:Alvarado Ballroom D and E

IP4

Semantic Scene Parsing by Entropy Pursuit

8:15 AM-9:00 AM

Room:Alvarado Ballroom D and E Chair: Gilad Lerman, University of Minnesota, USA

The grand challenge of computer vision is to build a machine which produces a rich semantic description of an underlying scene based on image data. Mathematical frameworks are advanced from time to time, but none clearly points the way to closing the performance gap with natural vision. Entropy pursuit is a sequential Bayesian approach to object detection and localization. The role of the prior model is to apply contextual constraints in order to determine, and coherently integrate, the evidence acquired at each step. The evidence is provided by a large family of powerful but expensive high-level classifiers (e.g., CNNs). The order of execution is determined online, and is driven by removing as much uncertainty as possible about the overall scene interpretation given the evidence to date. The goal is to match, or even exceed, the performance obtained with all the classifiers by implementing only a small fraction.

Donald Geman Johns Hopkins University, USA

Coffee Break

9:00 AM-9:30 AM

Room: Alvarado Ballroom Atrium

MS50

Radar Detection and Imaging

9:30 AM-11:30 AM

Room:Alvarado Ballroom D

Radar imaging is a technology that has been developed, very successfully, within the engineering community during the last 50 years. Radar systems on satellites now make beautiful images of regions of our earth and of other planets such as Venus. One of the key components of this impressive technology is mathematics, and many of the open problems are mathematical ones. This minisymposium will address some mathematical problems and advances in the field.

Organizer: Margaret Cheney Colorado State University, USA

Organizer: Kaitlyn Voccola Muller

Colorado State University, USA

9:30-9:55 Emerging Applications for Radar Intelligence, Surveillance, and Reconnaissance

Armin W. Doerry, Sandia National Laboratories, USA

10:00-10:25 Electromagnetic Time Reversal

Jerry Kim, Naval Research Laboratory, USA

10:30-10:55 A Functional Analytic Approach to Sar Image Reconstruction

Kaitlyn Voccola Muller, Colorado State University, USA

11:00-11:25 Design Considerations for Multistatic Radar Imaging

Tegan Webster, Naval Research Laboratory, USA

Wednesday, May 25

MS51

Nonconvex Regularization in Imaging: Theory, Algorithms and Applications - Part I of III

9:30 AM-11:30 AM

Room:Alvarado Ballroom E

For Part 2 see MS61

Regularization techniques play an important role in imaging sciences and other related areas. Recently, nonconvex regularization has attracted enormous attention, due to its great potential with improved result quality and computational challenge. This minisymposium aims to present recent developments in nonconvex regularization and variational models, ranging from theory, algorithms, and applications in imaging sciences. Topics include but are not limited to advanced techniques in nonsmooth and nonconvex optimization, and their applications in real-world imaging problems.

Organizer: Yifei Lou University of Texas at Dallas, USA

Organizer: Jing Qin University of California, Los Angeles, USA

9:30-9:55 Majorization-Minimization for Nonconvex Optimization

Serena Morigi, Alessandro Lanza, and Fiorella Sgallari, Universita' di Bologna, Italy

10:00-10:25 Algorithms for Minimizing Differences of Convex Functions and Applications

Mau Nam Nguyen, Portland State University, USA

10:30-10:55 The Difference of L1 and L2 for Compressive Sensing and Image Processing

Yifei Lou, University of Texas at Dallas, USA; Penghang Yin and Jack Xin, University of California, Irvine, USA

11:00-11:25 Nonconvex Sorted L1 Minimization for Sparse Approximation

Xiaolin Huang, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany; Lei Shi, Fudan University, China; *Ming Yan*, Michigan State University, USA

Wednesday, May 25

MS52

Compressive and Computational Imaging Technologies and Applications - Part I of III

9:30 AM-11:30 AM

Room:Alvarado Ballroom A

For Part 2 see MS62

Compressive and computational imaging offers the potential for radical new sensor designs coupled with a new way to envision the collection of image information. New theories in sparse Image models, sensor architectures, and reconstruction algorithms all play an integrated role in the design of the next generation imaging sensors. This minisymposium will explore some of the latest theoretical developments, application areas that could benefit from a different sensing paradigm, and current results from prototype compressive and computational imaging devices.

Organizer: Robert R. Muise *Lockheed-Martin, USA*

Organizer: Richard G. Baraniuk *Rice University, USA*

9:30-9:55 Automated Target Detection from Compressive Measurements *Robert R. Muise*, Lockheed-Martin, USA

10:00-10:25 Through-the-Wall Radar Imaging Using Discrete Prolate Spheroidal Sequences

Michael B. Wakin and Zhihui Zhu, Colorado School of Mines, USA

10:30-10:55 An Automated Design Scheme for Improved Point Spread Function Engineering

Colin Olson, Naval Research Laboratory, USA

11:00-11:25 Compressive Sensing of Very High-Dimensional Images and Videos

Aswin Sankaranarayanan, Carnegie Mellon University, USA



MS53 New Applications of the Eikonal Equation

9:30 AM-11:30 AM

Room:Alvarado Ballroom B

The eikonal equation appears in many fields, ranging from computer vision, where it is used to track evolution of interfaces, to geoscience where it describes the propagation of the first arrival of a wave in a heterogeneous medium. In this minisymposium we focus on recent approaches for using the eikonal equation and its numerical solvers in practical applications.

Organizer: Eran Treister University of British Columbia, Canada

Organizer: Eldad Haber University of British Columbia, Canada

9:30-9:55 Joint Fwi and Traveltime Tomography

Eran Treister and Eldad Haber, University of British Columbia, Canada

10:00-10:25 Babich's Expansion and the Fast Huygens Sweeping Method for the Helmholtz Wave Equation at High Frequencies

Jianliang Qian, Michigan State University, USA; Robert Burridge, University of New Mexico, USA; Wangtao Lu, Michigan State University, USA

10:30-10:55 Fast Scattered Data Interpolation

Sergey Fomel, University of Texas at Austin, USA

11:00-11:25 Affine Invariant Geodesics and their Applications

Dan Raviv, Massachusetts Institute of Technology, USA; Michael Bronstein, University of Minnesota, Minneapolis, USA; Alex Bronstein and Ron Kimmel, Technion Israel Institute of Technology, Israel; Nir Sochen, Tel Aviv University, Israel

Wednesday, May 25

MS54

Theoretical and Computational Aspects of Geometric Shape Analysis -Part I of III

9:30 AM-11:30 AM

Room:Alvarado Ballroom C

For Part 2 see MS64

The analysis, classification, and processing of geometric shapes is a timely and increasingly important problem at the nexus of engineering, computer science, and mathematics. Modern strategies for shape analysis span several disciplines: statistical cliquing, differential geometry, data processing, and numerical optimization. The aim of this minisymposium is to present stateof-the- art methods for geometric shape analysis, and to discuss open problems, applications, and future directions for research of interest to the imaging science community. This minisymposium brings together researchers from diverse backgrounds to foster collaboration between the fields of computer vision, image processing, and mathematical shape analysis.

Organizer: Gunay Dogan National Institute of Standards and Technology, USA

Organizer: Mario Micheli Université Paris Descartes, France

Organizer: Akil Narayan University of Utah, USA

9:30-9:55 Matrix-Valued Kernels for Shape Deformation Analysis Mario Micheli, Bowdoin College, USA

10:00-10:25 Learning Matrix-Valued Kernels for Shape Classification in the Large Deformation Framework

Joan Glaunès, Université Paris Descartes, France

10:30-10:55 Atrophy-Constrained Longitudinal Registration of Shapes Extracted from Brain Images Laurent Younes, Johns Hopkins

University, USA

11:00-11:25 Statistical Shape Analysis - Heavy Weight and Light Weight Approaches

Ross Whitaker, University of Utah, USA

Wednesday, May 25

MS55

Imaging in the Fast Lane: In Pursuit of Dynamical Information - Part II of II

9:30 AM-11:30 AM

Room:Alvarado Ballroom F

For Part 1 see MS46

When applied in fast dynamic scenarios, conventional image acquisition and reconstruction techniques often suffer from motion blurring and artifacts and cannot yield the high spatio-temporal resolution desired. Novel approaches try to accelerate these applications by combining tailored acquisition systems employing sub-sampling schemes with sophisticated image reconstruction techniques. The latter are usually based on sparsity-constrained spatiotemporal image models such as low rank, kinetic or optimal flow/transport models. A particular challenge of accelerated imaging is to design efficient optimization techniques able to solve the full spatio-temporal complexity of the imaging model.

Organizer: Felix Lucka

University College London, United Kingdom

Organizer: Marta Betcke University College London, United Kingdom

9:30-9:55 Reconstructing Highly Accelerated Dynamic MR Data Using Spatio-Temporal ICTGV Regularization *Kristian Bredies* and Martin Holler,

University of Graz, Austria

10:00-10:25 Tomographic Imaging of Moving Objects: A Space-Time Approach

Samuli Siltanen, University of Helsinki, Finland

MS55

Imaging in the Fast Lane: In Pursuit of Dynamical Information - Part II of II

9:30 AM-11:30 AM Room:Alvarado Ballroom F

continued

10:30-10:55 Joint 4D Reconstruction and Perfusion Estimation via Sparsity and Low-Rank

Christoph Brune, University of Twente, The Netherlands

11:00-11:25 Explorations on Anisotropic Regularisation of Dynamic Inverse Problems by Bilevel Optimisation

Martin Benning, Carola B. Schoenlieb, and Tuomo Valkonen, University of Cambridge, United Kingdom

Wednesday, May 25

MS56 Texture Modeling

9:30 AM-11:30 AM

Room:Alvarado Ballroom G

Texture is a fundamental component of natural images. Its mathematical modeling has been a fruitful stimulation in areas as diverse as harmonic analysis, random fields theory, mathematical morphology, stochastic geometry, variational approaches or fractal models. Such modelings are crucial for numerous applications in the fields of image restoration and enhancement, image synthesis and image analysis. For the imaging industry, developing texture aware tools has became necessary, in particular due to the increasing acquaintance one has with numerical images. In this session, we gather talks addressing modeling issues with the will both to sample the areas covered by this topic and to show some recent challenges in the field.

Organizer: Yann Gousseau Telecom Paris, France

Organizer: Bruno Galerne Université Paris Descartes, France

9:30-9:55 New Multifractal Parameters for Texture Classification Based on P-Exponents and P-Leaders

Stéphane Jaffard, Université Paris-Est, France

10:00-10:25 Processing Textures in the Spectral Total-Variation Domain

Guy Gilboa, Technion Israel Institute of Technology, Israel

10:30-10:55 Local Laplacian Filters: Theory and Applications

Sylvain Paris, Adobe Systems, USA

11:00-11:25 Gaussian Models for Texture Synthesis

Bruno Galerne, Université Paris Descartes, France

Wednesday, May 25

MS57 High Order Regularization and Numerical Methods

9:30 AM-11:30 AM

Room:Alvarado Ballroom H

High Order Regularization models, such as Euler's elastica, are important in the field of image processing and computer vision. By using the geometric feature of the objects, they can provide interesting, often better, results. However, the high order derivative makes the computation challenging. The main goal of this minisymposium is to bring together researchers interested in numerical methods and techniques for solving high order models.

Organizer: Maryam Yashtini Georgia Institute of Technology, USA

Organizer: Sung Ha Kang Georgia Institute of Technology, USA

9:30-9:55 Augmented Lagrangian Method for An Euler's Elastica Based Segmentation Model That Promotes Convex Contours

Wei Zhu, University of Alabama, USA; Egil Bae, Norwegian Defence Research Establishment, Norway; Xue-cheng Tai, University of Bergen, Norway, and Nanyang Technological University, Singapore

10:00-10:25 Multiple Continuum Limits for Discrete Image Inpainting

Rob Hocking, University of Cambridge, United Kingdom

10:30-10:55 Directional Total Variation Regularization for Imaging Problems

Rasmus D. Kongskov, Technical University of Denmark, Denmark

11:00-11:25 A Relaxed Normal Two Split Method and An Effective Weighted TV Algorithm for Euler's Elastica Image Inpainting

Maryam Yashtini and Sung Ha Kang, Georgia Institute of Technology, USA

MS58 Optimization Theory in Medical Imaging

9:30 AM-11:30 AM

Room:Franciscan Ballroom

Purpose: Unification of Optimization Theory and Medical Imaging. Description: Every clinical/translation imaging pipeline consists of four pivotal components: segmentation, registration, reconstruction, and physiology quantification. These multi-flavored components share a common foundation i.e. they can be cast in an optimization framework. This methodology has exploited existing algorithms and also resulted in faster optimization solvers. This minisymposia will present recent developments in these four fields guided by clinical applications. It will also showcase an interplay of tools from machine learning, graph theory, parameter estimation, and optimal control. Applications: Lesion quantification in multi-modality imaging (e.g. lung cancer), Shape-based anatomical registration, accelerated reconstruction (e.g. MRI), and robust physiology quantification (e.g. cardiovascular imaging)

Organizer: Hassan Mohy-Ud-Din Yale University, USA

9:30-9:55 Towards Robust Voxel-Wise Quantification of Perfusion in Low SNR Dynamic Pet Imaging

Hassan Mohy-Ud-Din, Yale University, USA

10:00-10:25 A Fast Algorithm for Structured Low-Rank Matrix Completion with Applications to Compressed Sensing MRI

Mathews Jacob, University of Iowa, USA

10:30-10:55 Advances in Lesion Quantification from PET/CT and PET/MR Scans

Ulas Bagci, University of Central Florida, USA

11:00-11:25 Augmented Lagrangian Methods for Constrained Optimal Control Applied to Shape Registration

Sylvain Arguillere and Laurent Younes, Johns Hopkins University, USA

Wednesday, May 25

MS59

Advances in Phase Retrieval for Diffractive Imaging

9:30 AM-11:30 AM

Room: Weavers Room

Coherent x-ray diffractive imaging is a technique that utilizes phase retrieval and nonlinear optimization methods to image matter at nanometer scales. Recent advances in these methods. such as matrix lifting, semidefinite programming, Fourier ptychography, and compressive phase retrieval, offer more robust performance than previous methods, and allow for the opening up of new experimental imaging regimes and data collection practices. The purpose of this minisymposium is to allow both theorists and experimentalists to meet and exchange ideas to guide further advances.

Organizer: Ashish Tripathi Argonne National Laboratory, USA

Organizer: Stefan Wild Argonne National Laboratory, USA

9:30-9:55 Reconstruction Algorithms for Blind Ptychographic Imaging *Matthew Tam*, University of Goettingen, Germany

10:00-10:25 Survey and Benchmarking of Compressive Sensing Phase Retrieval Methods Ashish Tripathi, Argonne National Laboratory, USA

10:30-10:55 Solving Ptychography with a Convex Relaxation

Roarke Horstmeyer, California Institute of Technology, USA

11:00-11:25 Phase Retrieval with Missing Data

Todd Munson, Argonne National Laboratory, USA

Wednesday, May 25

CP6

Modeling 9:30 AM-11:10 AM

Room:Potters Room

Chair: Jue Wang, Union College, USA

9:30-9:45 Extracting Plane Symmetry Group Information from Tiles with Color Permutations

Venera Adanova and Sibel Tari, Middle East Technical University, Turkey

9:50-10:05 Bidirectional Texture Function Bernoulli-Mixture Compound Texture Model

Michal Haindl, Academy of Sciences of the Czech Republic, Prague, Czech Republic

10:10-10:25 New Techniques for Inversion of Full-Waveform Induced Polarization Data

Patrick T. Belliveau and Eldad Haber, University of British Columbia, Canada

10:30-10:45 Information Theoretic Approach for Accelerated Magnetic Resonance Thermometry in the Presence of Uncertainties

Reza Madankan, Wolfgang Stefan, Christopher MacLellan, Samuel Fahrenholtz, Drew Mitchell, R.J. Stafford, John Hazle, and David Fuenstes, University of Texas MD Anderson Cancer Center, USA

10:50-11:05 BLA: A Weak Form Attenuation Compensation Model for Ultrasonic Imagery

Jue Wang, Union College, USA; Yongjian Yu, University of Virginia, USA

Lunch Break

11:30 AM-1:00 PM Attendees on their own

SP2

SIAG/Imaging Science Best Paper Prize Lecture - Scale Invariant Geometry for Nonrigid Shapes

1:00 PM-1:45 PM

Room:Alvarado Ballroom D and E

Chair: Eric Miller, Tufts University, USA

Animals of the same species frequently exhibit local variations in scale. Taking this into account we would like to develop models and computational tools that answer questions as: How should we measure the discrepancy between a small dog with large ears and a large one with small ears? Are there geometric structures common to both an elephant and a giraffe? What is the morphometric similarity between a blue whale and a dolphin? There have been two schools of thoughts that quantified similarities between surfaces which are insensitive to deformations in size. Namely, scale invariant local descriptors, and global normalization methods. Here, we propose a new tool for shape exploration. We introduce a scale invariant metric for surfaces that allows us to analyze nonrigid shapes, generate locally invariant features, produce scale invariant geodesics, embed one surface into another despite changes in local and global size, and assist in the computational study of intrinsic symmetries where the size of a feature is insignificant.

Yonathan Aflalo

Samsung Research, Israel Ron Kimmel Technion Israel Institute of Technology, Israel Dan Raviv (speaker) Massachusetts Institute of Technology, USA

Intermission

1:45 PM-2:00 PM

Wednesday, May 25

MS60

Recent Advances in Multimodel Approaches for Image Problems - Part I of II 2:00 PM-4:00 PM

Room:Alvarado Ballroom D

For Part 2 see MS69

A recurring challenge in modern imaging problems is how to combine complex data with large-scale models to create better predictions. This challenge branches off every topic in imaging science from imaging processing to computer graphics. Recent advances in integration of different types of models from the perspective of both the data fidelity and modality have been achieved which make the solution of such large-scale, complex problems more tractable and accurate. This minisymposium brings together experts from the areas of optimization, numerical methods, and a wide range of imaging applications to discuss these new multimodel based approaches and identify promising future research directions.

Organizer: Zichao Di Argonne National Laboratory, USA

Organizer: Stefan Wild Argonne National Laboratory, USA

2:00-2:25 Reconstruction of Images from Highly Noisy and Sparse Observations Using Data-driven Priors

George Biros, University of Texas at Austin, USA

2:30-2:55 Optimal Experimental Design for Imaging Subsurface Flow

Jennifer Fohring, University of British Columbia, Canada

3:00-3:25 Multi-Level Accelerated Algorithm for Large-Scale Convex Composite Minimization

Vahan Hovhannisyan, Panos Parpas, and Stefanos Zafeiriou, Imperial College, United Kingdom

3:30-3:55 A Multilevel Solver for the Rada-Chen Selective Segmentation Model and Its Extensions

Mike Roberts and Ke Chen, University of Liverpool, United Kingdom; Klaus Irion, Royal Liverpool and Broadgreen University Hospitals, United Kingdom

Wednesday, May 25

MS61

Nonconvex Regularization in Imaging: Theory, Algorithms and Applications - Part II of III

2:00 PM-4:00 PM

Room:Alvarado Ballroom E

For Part 1 see MS51 For Part 3 see MS70

Regularization techniques play an important role in imaging sciences and other related areas. Recently, nonconvex regularization has attracted enormous attention, due to its great potential with improved result quality and computational challenge. This minisymposium aims to present recent developments in nonconvex regularization and variational models, ranging from theory, algorithms, and applications in imaging sciences. Topics include but are not limited to advanced techniques in nonsmooth and nonconvex optimization, and their applications in realworld imaging problems.

Organizer: Jing Qin University of California, Los Angeles, USA

Organizer: Yifei Lou University of Texas at Dallas, USA

2:00-2:25 Reconstruction of Sparse Images with Emitter-Based Posterior Mean Estimates

Lionel Moisan, Université Paris Descartes, France; Anne-Sophie Macé, BioAxial and Université Paris Descartes, France; Julien Caron, BioAxial, France

2:30-2:55 Transformed Schatten-1 Iterative Thresholding Algorithms for Matrix Rank Minimization

Shuai Zhang, Jack Xin, and Penghang Yin, University of California, Irvine, USA

3:00-3:25 Smoothness and Sparsity Enhanced Electroencephalogram Brain Image Reconstruction

Ying Li, *Jing Qin*, Stanley J. Osher, and Wentai Liu, University of California, Los Angeles, USA

3:30-3:55 Nonconvex Regularization and Satellite Imagery

Rick Chartrand, Descartes Labs, USA

MS62

Compressive and Computational Imaging Technologies and Applications - Part II of III

2:00 PM-4:00 PM

Room:Alvarado Ballroom A

For Part 1 see MS52 For Part 3 see MS71

Compressive and computational imaging offers the potential for radical new sensor designs coupled with a new way to envision the collection of image information. New theories in sparse Image models, sensor architectures, and reconstruction algorithms all play an integrated role in the design of the next generation imaging sensors. This minisymposium will explore some of the latest theoretical developments, application areas that could benefit from a different sensing paradigm, and current results from prototype compressive and computational imaging devices.

Organizer: Robert R. Muise *Lockheed-Martin, USA*

Organizer: Richard G. Baraniuk *Rice University, USA*

2:00-2:25 Fast Reconstruction Methods for Spatiotemporally-Encoded MRI

Alex Gutierrez, Di Xiao, Jarvis Haupt, Albert Jang, Michael Garwood, and Steen Moeller, University of Minnesota, USA

2:30-2:55 Scalable Information Optimal Imaging: Recent Progress - EO/IR to X-Ray

Amit Ashok, University of Arizona, USA

3:00-3:25 Progress on Developing a Computational Imager Using Integrated Photonics

Samuel Thurman, Lockheed Martin Space Systems, USA; Alan Duncan, Richard Kendrick, Chad Ogden, and Danielle Wuchenich, Lockheed Martin Advanced Technology Center, USA; Tiehui Su, Shibnath Pathak, Wei-Cheng Lai, Mathias Prost, Roberto Proietti, Ryan Scott, and S.J.B. Yoo, University of California, Davis, USA

3:30-3:55 Lensfree Imaging

Richard G. Baraniuk, Salman Asif, and Ali Ayremlou, Rice University, USA; Aswin Sankaranarayanan, Carnegie Mellon University, USA; Ashok Veeraraghavan, Rice University, USA

Wednesday, May 25

MS63

Nonlinear Mathematics of Electrical Impedance Imaging - Part I of II

2:00 PM-4:00 PM

Room:Alvarado Ballroom B

For Part 2 see MS72

Electrical Impedance Tomography is an imaging modality where a physical body is probed with electrical currents and the resulting voltages on the surface are measured. The aim is to reconstruct the internal distribution of electrical conductivity. The inverse problem of EIT is nonlinear and extremely sensitive to modelling errors and measurement noise. In recent years, tremendous advances have been made both in practical applications of EIT to medical imaging and nondestructive testing, and in the development of noise-robust nonlinear reconstruction methods for EIT. This minisymposium brings together a representative collection of timely reports on those advances.

Organizer: Jennifer L. Mueller Colorado State University, USA

Organizer: Sarah Hamilton Marquette University, USA

Organizer: Samuli Siltanen University of Helsinki, Finland

2:00-2:25 Incorporating a Spatial Prior into Nonlinear D-Bar Eit Imaging for Complex Admittivities

Sarah Hamilton, Marquette University, USA; Jennifer L. Mueller and Melody Alsaker, Colorado State University, USA

2:30-2:55 Edge detection in Electrical Impedance Tomography

Matteo Santacesaria, Politecnico di Milano, Italy

3:00-3:25 Direct Inversion from Partial Boundary Measurements by Data Extrapolation

Andreas Hauptmann, University of Helsinki, Finland

3:30-3:55 Optimal Ultrasound Frequency for Lung Monitoring Through Ultrasound Informed Electrical Impedance Tomography: Numerical Simulations

Raul G. Lima, University of Sao Paulo, Brazil

MS64

Theoretical and Computational Aspects of Geometric Shape Analysis -Part II of III

2:00 PM-4:00 PM

Room:Alvarado Ballroom C

For Part 1 see MS54 For Part 3 see MS73

The analysis, classification, and processing of geometric shapes is a timely and increasingly important problem at the nexus of engineering, computer science, and mathematics. Modern strategies for shape analysis span several disciplines: statistical cliquing, differential geometry, data processing, and numerical optimization. The aim of this minisymposium is to present stateof-the- art methods for geometric shape analysis, and to discuss open problems, applications, and future directions for research of interest to the imaging science community. This minisymposium brings together researchers from diverse backgrounds to foster collaboration between the fields of computer vision, image processing, and mathematical shape analysis.

Organizer: Gunay Dogan National Institute of Standards and Technology, USA

Organizer: Mario Micheli Université Paris Descartes, France

Organizer: Akil Narayan University of Utah, USA

2:00-2:25 A Fast Iterative Algorithm to Compute Elastic Shape Distance Between Curves

Gunay Dogan, Javier Bernal, and Charles Hagwood, National Institute of Standards and Technology, USA

2:30-2:55 Scale Invariant Metrics of Volumetric Datasets

Dan Raviv, Massachusetts Institute of Technology, USA; Ramesh Raskar, Massachusetts Institute of Technology, USA

3:00-3:25 Irrotational Diffeomorphisms for Image Registration and Density Matching

Sarang Joshi, University of Utah, USA

3:30-3:55 Metamorphoses of Functional Shapes in Sobolev Spaces Nicolas Charon, Johns Hopkins University, USA Wednesday, May 25

MS66

Big Data for Inverse Problems in Imaging -Part I of II

2:00 PM-4:00 PM

Room:Alvarado Ballroom G

For Part 2 see MS75

Improvements in measurement technology have enabled the collection of large datasets imaging problems characterized by complex physics. Processing such data especially in the context of PDE-based parameter-to-data models has proven to be computationally challenging. This minisymposium focuses on advances in computational techniques for handling large data sets and "big" physics during the course of solving inverse problems. It will include applications from a range of Imaging Science application domains.

Organizer: Arvind Saibaba North Carolina State University, USA

Organizer: Misha E. Kilmer *Tufts University, USA*

Organizer: Eric Miller Tufts University, USA

2:00-2:25 Computational Approaches for Massive Multi-Frame Blind Deconvolution

James G. Nagy, Emory University, USA

2:30-2:55 Local Solver for Seismic Full Waveform Inversion

Bram Willemsen, Massachusetts Institute of Technology, USA; Alison Malcolm, Memorial University, Newfoundland, Canada

3:00-3:25 Reduced-Order Models in Large-Scale Seismic Imaging

Mikhail Zaslavsky and Vladimir L. Druskin, Schlumberger-Doll Research, USA; Alexander V. Mamonov, University of Houston, USA

3:30-3:55 Title Not Available

Anna Michalak, Carnegie Institution for Science and Stanford University, USA

MS67 Parameter Selection in Image Reconstruction -Part I of II

2:00 PM-4:00 PM

Room:Alvarado Ballroom H

For Part 2 see MS76

Variational approaches in imaging are usually based on minimizing a functional consisting of one or more data-terms, regularization-terms, and parameters weighting the importance of these terms. The choice of these parameters is delicate, since they have a significant influence on the minimizer. In order to choose proper parameters and learn a suitable noise model recently several strategies including parameter choice rules and spatially adaptive parameter selection in different optimization frameworks have been proposed. This minisymposium aims to bring together researchers from the field of image reconstruction and parameter selection and constitute a platform for exchange of ideas between experts in these fields.

Organizer: Andreas Langer University of Stuttgart, Germany

Organizer: Carola-Bibiane Schönlieb University of Cambridge, United

Kingdom

2:00-2:25 Automatic Parameter Selection for Total Variation Minimization in Image Restoration

Andreas Langer, University of Stuttgart, Germany

2:30-2:55 On the Choice of Loss Functions and Their Estimations for Relevant Parameter Selection in Image Restoration

Charles-Alban Deledalle, Université Bordeaux, France

3:00-3:25 Non-Convex Objectives: Role of the Regularization Parameter in the Local and the Global Minimizers *Mila Nikolova*, ENS Cachan, France

3:25-3:25 Function-driven Data Learning for Image Denoising Valeriya Naumova, Simula Research

Laboratory, Norway

Wednesday, May 25

MS68

New Statistical Developments in Neuroimaging

2:00 PM-4:00 PM

Room:Franciscan Ballroom

For more than a decade we have seen tremendous contributions of the statistics community to neuroimaging research. This minisymposium will focus on active developments of statistical methods for neuroimaging applications, including spatial smoothing of functional magnetic resonance imaging (fMRI) data, Bayesian modeling of fMRI data, topological data analysis for functional neuroimaging data, estimation and variable selection for functional data analysis models, and kernel methods for modeling and testing structural and functional networks in the brain and identifying which networks or regions are associated with the outcome of interest.

Organizer: Inna Chervoneva Thomas Jefferson University, USA

2:00-2:25 Statistical Modeling of Fmri Data for Pre-Surgical Planning *Timothy D. Johnson*, University of Michigan, USA

2:30-2:55 Topological Data Analysis for Functional Neuroimaging *Nicole Lazar*, University of Georgia,

USA

3:00-3:25 Functional and Imaging Data in Precision Medicine

Todd Ogden, Columbia University, USA 3:30-3:55 Local and Global Statistical

Connectomic Testing

Russell Shinohara, University of Pennsylvania, USA

Wednesday, May 25

Image Analysis 2:00 PM-4:00 PM

Room:Potters Room

Chair: Richard N. Lartey, Case Western Reserve University, USA

2:00-2:15 Optical Flow on Evolving Sphere-Like Surfaces

Lukas F. Lang, Austrian Academy of Sciences, Austria; Otmar Scherzer, University of Vienna, Austria

2:20-2:35 Hyperspectral Video Analysis Using Graph Clustering Methods

Gloria Meng, University of California, Los Angeles, USA; Ekaterina Merkurjev, University of California, San Diego, USA; Alice Koniges, Lawrence Berkeley National Laboratory, USA; Andrea L. Bertozzi, University of California, Los Angeles, USA

2:40-2:55 Image Segmentation with a Shape Prior

Jack A. Spencer and Ke Chen, University of Liverpool, United Kingdom

3:00-3:15 A Fractional Order Variational Model for Optical Flow Estimation Based on Sparsity Algorithm

Pushpendra Kumar, Sanjeev Kumar, and Balasubramanian Raman, Indian Institute of Technology Roorkee, India

3:20-3:35 Classification of Hyperspectral Data Using the Besov Norm

Richard N. Lartey, Weihong Guo, and Julia Dobrosotskaya, Case Western Reserve University, USA

3:40-3:55 New Uncertainty Principles for Image Feature Extraction *Ron Levie* and Nir Sochen, Tel Aviv

University, Israel

Coffee Break

4:00 PM-4:30 PM



Room:Alvarado Ballroom Atrium

MS69

Recent Advances in Multimodel Approaches for Image Problems - Part II of II

4:30 PM-6:30 PM

Room:Alvarado Ballroom D

For Part 1 see MS60

A recurring challenge in modern imaging problems is how to combine complex data with large-scale models to create better predictions. This challenge branches off every topic in imaging science from imaging processing to computer graphics. Recent advances in integration of different types of models from the perspective of both the data fidelity and modality have been achieved which make the solution of such large-scale, complex problems more tractable and accurate. This minisymposium brings together experts from the areas of optimization, numerical methods, and a wide range of imaging applications to discuss these new multi-model based approaches and identify promising future research directions.

Organizer: Zichao Di Argonne National Laboratory, USA

Organizer: Stefan Wild Argonne National Laboratory, USA

4:30-4:55 Multi-Contrast MRI Reconstruction with Structure-Guided Total Variation

Matthias J. Ehrhardt and Marta Betcke, University College London, United Kingdom

5:00-5:25 Multigrid-Based Optimization Approach for Multi-Modality Tomographic Reconstruction

Zichao Di, Sven Leyffer, and Stefan Wild, Argonne National Laboratory, USA

5:30-5:55 Integrated Imaging: Creating Images from the Tight Integration of Algorithms, Computation, and Sensors *Charles Bouman*, Purdue University, USA

6:00-6:25 Integration of Photoacoustic and Ultrasound Computed Tomography

Mark A. Anastasio, Illinois Institute of Technology, USA; *Thomas Matthews*, Washington University in St. Louis, USA

Wednesday, May 25

MS70

Nonconvex Regularization in Imaging: Theory, Algorithms and Applications -Part III of III

4:30 PM-6:30 PM

Room:Alvarado Ballroom E

For Part 2 see MS61

Regularization techniques play an important role in imaging sciences and other related areas. Recently, nonconvex regularization has attracted enormous attention, due to its great potential with improved result quality and computational challenge. This minisymposium aims to present recent developments in nonconvex regularization and variational models, ranging from theory, algorithms, and applications in imaging sciences. Topics include but are not limited to advanced techniques in nonsmooth and nonconvex optimization, and their applications in realworld imaging problems.

Organizer: Yifei Lou University of Texas at Dallas, USA

Organizer: Jing Qin University of California, Los Angeles, USA

4:30-4:55 Simultaneous Tomographic Reconstruction and Segmentation with Class Priors

Yiqiu Dong, Per Christian Hansen, Mikhail Romanov, and Anders Bjorholm Dahl, Technical University of Denmark, Denmark

5:00-5:25 Wavelet Frame Based Piecewise Smooth Image Model and It's Relation to Mumford-Shah Functional

Jian-Feng Cai, Hong Kong University of Science and Technology, Hong Kong; *Bin Dong*, Peking University, China; Zuowei Shen, National University of Singapore, Singapore

5:30-5:55 A Universal Variational Framework for Sparsity Based Image Inpainting

Fang Li, East China Normal University, China; *Tieyong Zeng*, Hong Kong Baptist University, Hong Kong

6:00-6:25 A New Multiplicative Denoising Variational Model and its Fixed-point Proximity Algorithm *Jian Lu*, Shenzhen University, China

continued in next column

MS71

Compressive and Computational Imaging Technologies and Applications - Part III of III

4:30 PM-6:30 PM

Room:Alvarado Ballroom A

For Part 2 see MS62

Compressive and computational imaging offers the potential for radical new sensor designs coupled with a new way to envision the collection of image information. New theories in sparse Image models, sensor architectures, and reconstruction algorithms all play an integrated role in the design of the next generation imaging sensors. This minisymposium will explore some of the latest theoretical developments, application areas that could benefit from a different sensing paradigm, and current results from prototype compressive and computational imaging devices.

Organizer: Robert R. Muise *Lockheed-Martin, USA*

Organizer: Richard G. Baraniuk *Rice University, USA*

4:30-4:55 A Fast-Transform-Based, High-Resolution Computational Imager Using Virtual Channels

Matthew A. Herman, Tyler Weston, and Lenore McMackin, InView Technology Corporation, USA

5:00-5:25 Gigapixel Phase Imaging

Laura Waller, University of California, Berkeley, USA

5:30-5:55 Convex Cardinal Shape Composition

Justin Romberg, Georgia Institute of Technology, USA

6:00-6:25 Coherent Camera Arrays

Ashok Veeraraghavan, Rice University, USA

Wednesday, May 25

MS72

Nonlinear Mathematics of Electrical Impedance Imaging - Part II of II

4:30 PM-6:30 PM

Room:Alvarado Ballroom B

For Part 1 see MS63

Electrical Impedance Tomography is an imaging modality where a physical body is probed with electrical currents and the resulting voltages on the surface are measured. The aim is to reconstruct the internal distribution of electrical conductivity. The inverse problem of EIT is nonlinear and extremely sensitive to modelling errors and measurement noise. In recent years, tremendous advances have been made both in practical applications of EIT to medical imaging and nondestructive testing, and in the development of noise-robust nonlinear reconstruction methods for EIT. This minisymposium brings together a representative collection of timely reports on those advances.

Organizer: Samuli Siltanen University of Helsinki, Finland

Organizer: Jennifer L. Mueller Colorado State University, USA

Organizer: Sarah Hamilton Marquette University, USA

4:30-4:55 Convergence and Regularization for Monotonicity-Based EIT Shape Reconstruction

Stratos Staboulis, Technical University of Denmark, Denmark

5:00-5:25 A 3-D Analogue to the 2-D D-Bar Method

Peter Muller, Colorado State University, USA

5:30-5:55 The Use of the Approximation Error Method and Bayesian Inference to Introduce Anatomical and Physiological Prior Information into EIT Reconstruction Algorithms

Talles Batista Rattis Santos and Raul Gonzalez Lima, University of Sao Paulo, Brazil; Erick Dario Leon Bueno de Camar and Fernando Silva de Moura, Universidade Federal do ABC, Brazil

6:00-6:25 On Uniqueness of An Inverse Problem for Time-Harmonic Maxwell's Equations

Ting Zhou, Northeastern University, USA

MS73

Theoretical and Computational Aspects of Geometric Shape Analysis -Part III of III

4:30 PM-6:30 PM

Room:Alvarado Ballroom C

For Part 2 see MS64

The analysis, classification, and processing of geometric shapes is a timely and increasingly important problem at the nexus of engineering, computer science, and mathematics. Modern strategies for shape analysis span several disciplines: statistical cliquing, differential geometry, data processing, and numerical optimization. The aim of this minisymposium is to present stateof-the- art methods for geometric shape analysis, and to discuss open problems, applications, and future directions for research of interest to the imaging science community. This minisymposium brings together researchers from diverse backgrounds to foster collaboration between the fields of computer vision, image processing, and mathematical shape analysis.

Organizer: Gunay Dogan National Institute of Standards and Technology, USA

Organizer: Mario Micheli Université Paris Descartes, France

Organizer: Akil Narayan University of Utah, USA

4:30-4:55 Statistical Modeling of Geometries of Tree-Like Structures

Adam Duncan and Eric Klassen, Florida State University, USA; Xavier Descombes, Inria Sophia Antipolis, France; *Anuj Srivastava*, Florida State University, USA

5:00-5:25 Multiscale Covariance Fields and Shape Characterization in Euclidean Spaces

Facundo Memoli, Ohio State University, USA

5:30-5:55 Multiscale Extremal Points on Plane Curves, With Applications to Shape Matching and Detection *Matt Feiszli*, FiftyThree, Inc., USA

6:00-6:25 Parallel Transport of Distributions on Tangent Spaces on Shape Spaces

Shantanu Joshi, University of California, Los Angeles, USA

Wednesday, May 25

MS74

The Never-Ending Story of Image Denoising - Part II of II 4:30 PM-6:30 PM

Room:Alvarado Ballroom F

For Part 1 see MS65

Noise removal has been a fundamental field of research for decades. Leading methods rely on powerful image models/ priors, e.g., sparsity of image patches in some domain, self-similarity of patches within and across different scales of the image, graph-based regularization, and more. Recently, machine learning techniques, in particular neural networks, have been utilized to address the image denoising problem. The proposed minisymposium consists of two sessions, covering a series of state-of-the-art methods in this field.

Organizer: Yaniv Romano Technion Israel Institute of Technology, Israel

Organizer: Peyman Milanfar Google Research, USA

Organizer: Michael Elad Technion Israel Institute of Technology, Israel

4:30-4:55 Turbo Denoising: Filter, Rinse, Recycle

Tak-Shing Wong and *Peyman Milanfar*, Google Research, USA; Hossein Talebi, Google and University of California, Santa Cruz, USA

5:00-5:25 Understanding Symmetric Smoothing Filters Through Expectation-Maximization

Stanley H. Chan, Purdue University, USA; Todd Zickler and Yue Lu, Harvard University, USA

5:30-5:55 Variance Stabilization for Noisy+Estimate Combinations in Iterative Poisson Denoising

Lucio Azzari and Alessandro Foi, Tampere University of Technology, Finland

6:00-6:25 A Decomposition Framework for Image Denoising Algorithms

Gabriela Ghimpeteanu, Thomas Batard, and Marcelo Bertalmío, Universitat Pompeu Fabra, Spain; *Stacey Levine*, Duquesne University, USA

MS75 Big Data for Inverse Problems in Imaging - Part II of II

4:30 PM-6:30 PM

Room:Alvarado Ballroom G

For Part 1 see MS66

Improvements in measurement technology have enabled the collection of large datasets imaging problems characterized by complex physics. Processing such data especially in the context of PDE-based parameter-to-data models has proven to be computationally challenging. This minisymposium focuses on advances in computational techniques for handling large data sets and "big" physics during the course of solving inverse problems. It will include applications from a range of Imaging Science application domains.

Organizer: Arvind Saibaba North Carolina State University, USA

Organizer: Misha E. Kilmer *Tufts University, USA*

Organizer: Eric Miller *Tufts University, USA*

4:30-4:55 Selection Criterion for Source Encoding Weights in Nonlinear Inverse Problems with Large Data

Benjamin Crestel, University of Texas at Austin, USA; Alen Alexanderian, North Carolina State University, USA; Georg Stadler, Courant Institute of Mathematical Sciences, New York University, USA; Omar Ghattas, University of Texas at Austin, USA

5:00-5:25 A Parametric Level Set Approach to the Airborne Electromagnetic Inverse Problem

Michael S. McMillan, Eldad Haber, Christoph Schwarzbach, and Douglas Oldenburg, University of British Columbia, Canada; Eliot Holtham, Computational Geosciences Inc., Canada

5:30-5:55 A Randomized Misfit Approach for Data Reduction in Large-Scale Inverse Problems

Ellen Le, University of Texas at Austin, USA

6:00-6:25 Fast Algorithms for Hyperspectral Diffuse Optical Tomography with Many Measurements

Arvind Saibaba, North Carolina State University, USA; Misha E. Kilmer and Eric Miller, Tufts University, USA

Wednesday, May 25

MS76

Parameter Selection in Image Reconstruction -Part II of II

4:30 PM-6:30 PM

Room:Alvarado Ballroom H

For Part 1 see MS67

Variational approaches in imaging are usually based on minimizing a functional consisting of one or more data-terms, regularization-terms, and parameters weighting the importance of these terms. The choice of these parameters is delicate, since they have a significant influence on the minimizer. In order to choose proper parameters and learn a suitable noise model recently several strategies including parameter choice rules and spatially adaptive parameter selection in different optimization frameworks have been proposed. This minisymposium aims to bring together researchers from the field of image reconstruction and parameter selection and constitute a platform for exchange of ideas between experts in these fields.

Organizer: Andreas Langer University of Stuttgart, Germany

Organizer: Carola-Bibiane Schönlieb University of Cambridge, United Kingdom

4:30-4:55 Bilevel Parameter Learning for Higher-Order Total Variation Regularisation Models

Juan Carlos De los Reyes, Escuela Politécnica Nacional, Ecuador; Carola B. Schoenlieb and Tuomo Valkonen, University of Cambridge, United Kingdom

MS76

Parameter Selection in Image Reconstruction - Part II of II

4:30 PM-6:30 PM Room:Alvarado Ballroom H

continued

5:00-5:25 Learning Variational Models for Image Reconstruction

Kerstin Hammernik, Graz University of Technology, Austria; Florian Knoll, New York University, USA; Thomas Pock, Graz University of Technology, Austria

5:30-5:55 Computational Regularization in Learning and Inverse Problems

Silvia Villa, Istituto Italiano di Tecnologia, Italy and Massachusetts Institute of Technology, USA; Lorenzo Rosasco, Massachusetts Institute of Technology, USA

6:00-6:25 Should You Derive or Let the Data Drive? An Optimization Framework for Model Mis-specification Correction

Lior Horesh, IBM Research, USA; Remi Lam, Massachusetts Institute of Technology, USA; Haim Avron, Tel Aviv University, Israel; Karen E. Willcox, Massachusetts Institute of Technology, USA

Wednesday, May 25

MS77

Computational Methods for the Processing of Diffusion MRI Data and the Analysis of Brain Connectivity

4:30 PM-6:30 PM

Room:Franciscan Ballroom

Diffusion magnetic resonance imaging (dMRI) provides a visual eye into the complex network of fiber tracts in the brain, *in vivo*. By analyzing connectivity researchers strive to better understand the anatomical nature and progression of neurological diseases. But to reach a clinical analysis, there are many steps to advance: from diffusion weighted image acquisition, to orientation estimation, and fiber tractography. In this symposium we will touch upon computational methods, models and data representations to improve various processes and analyses on the path to a more accurate, robust, and efficient usage of dMRI data for the advancement of neurological disease studies.

Organizer: Evan Schwab Johns Hopkins University, USA

Organizer: Nicolas Charon Johns Hopkins University, USA

Organizer: Rene Vidal Johns Hopkins University, USA

4:30-4:55 Thinking Outside the Voxel: A Joint Spatial-Angular Basis for Sparse Hardi Reconstruction

Evan Schwab, Johns Hopkins University, USA

5:00-5:25 Compressed Sensing of Multi-shell HARDI in Six-dimensional (k,q) Space

Baba C. Vemuri, University of Florida, USA

5:30-5:55 Brain Microstructure Characterization Using Sparse Bayesian Inference and Multicompartment Models Estimation

Christophe Lenglet, University of Minnesota, USA

6:00-6:25 Learning the Structural Organisation of Neural Circuits from Neuroimaging Data

Stanley Durrleman and Pietro Gori, Inria, France

Wednesday, May 25

MS78

Multidimensional Mode Decomposition and Applications - Part I of III

4:30 PM-6:30 PM

Room: Weavers Room

For Part 2 see MS88

This minisymposium introduces new advances in the mode decomposition problem with an emphasis on multidimensional data analysis. This problem aims at identifying and separating pre-assumed data patterns from their superposition. It has motivated new mathematical theory and numerical tools in adaptive and nonlinear time-frequency analysis, data-driven optimization based on variational principles and dictionary learning for sparsity, etc. This three-part minisymposium will mainly focus on real applications including seismic data analysis in geophysics, painting analysis in art investigation, and atomic crystal image analysis in materials science, respectively.

Organizer: Haizhao Yang Duke University, USA

4:30-4:55 Fast Algorithms for Elastic-Wave-Mode Separation and Vector Decomposition

Sergey Fomel and Yangkang Chen, University of Texas at Austin, USA

5:00-5:25 Seismic Imaging with Extrapolated Low Frequencies *Yunyue Li*, Massachusetts Institute of

Technology, USA

5:30-5:55 When Harmonic Analysis Meets Medicine

Chen-Yun Lin and *Hau-Tieng Wu*, University of Toronto, Canada

6:00-6:25 Multidimensional Iterative Filtering Method for the Decomposition of High-Dimensional Non-Stationary Signals

Antonio Cicone, Università degli Studi dell'Aquila, Italy; Haomin Zhou, Georgia Institute of Technology, USA

CP8 **Computational Methods**

4:30 PM-6:30 PM

Room: Potters Room

Chair: Isaac Harris. Texas A\\&M University, USA

4:30-4:45 Error Estimates and **Convergence Rates for Filtered Back** Projection

Matthias Beckmann and Armin Iske. University of Hamburg, Germany

4:50-5:05 Density Compensation Factor Design for Non-Uniform Fast Fourier Transforms

Anne Gelb, Arizona State University, USA

5:10-5:25 The Factorization Method for Imaging Defects in Anisotropic **Materials**

Isaac Harris, Texas A&M University, USA; Fioralba Cakoni, Rutgers University, USA

5:30-5:45 Nonlinear Parametric Inversion Using Randomization

Selin Sariaydin and Eric De Sturler, Virginia Tech, USA; Misha E. Kilmer, Tufts University, USA

5:50-6:05 Stochastic Image Interpolation with Positional Errors

Weitong Ruan, Tufts University, USA; Adam Milstein and William Blackwell, Massachusetts Institute of Technology, USA; Eric Miller, Tufts University, USA

6:10-6:25 Ghosting in Principal **Component Pursuit: An Incremental** Approach

Paul Rodriguez, Pontifical Catholic University of Peru, Peru; Brendt Wohlberg, Los Alamos National Laboratory, USA

SIIMS Editorial Board Dinner Meeting

7:00 PM-9:00 PM Room: Turquoise

Thursday, May 26

Registration 7:45 AM-2:30 PM Room:Fireplace Room

Closing Remarks

8:10 AM-8:15 AM Room:Alvarado Ballroom D and E

IP5

Recent Advances in Seismic Technology: From Imaging to Inversion

8:15 AM-9:00 AM

at Austin, USA

Room:Alvarado Ballroom D and E Chair: Sergey Fomel, University of Texas

The primary goal of seismic imaging is to transform seismic time reflection data recorded at the earth's surface into a reflectivity or impedance image of the subsurface in order to locate hydrocarbon reserves. Historically this has been accomplished in seismic processing through imaging algorithms that are based on the adjoint of acoustic forward Born or Kirchhoff scattering. More recently, however, advances in algorithm development have led to the initial use of nonlinear inversion as an alternative to standard imaging algorithms. In this talk I will briefly review the historical development of seismic imaging, and then discuss the status of nonlinear inversion in the seismic industry, including the use of Full-Waveform Inversion for impedance model estimation, and more recent tomographic extensions that attempt to promote inversion technology into a full-bandwidth model-recovery solution. The various concepts I present will be illustrated with seismic imaging and inversion examples from a number of geologic settings around the world.

Uwe Albertin Chevron Energy Technology Company, USA

Thursday, May 26 **Coffee Break** 9:00 AM-9:30 AM



Room:Alvarado Ballroom Atrium

MS79 Recent Developments and Challenges of Imaging Techniques in Geoscience

9:30 AM-11:30 AM

Room:Alvarado Ballroom D

Imaging techniques have been used as important tools to infer, analyze, and understand Earth properties in geoscience. Because of the complexity and heterogeneous nature of the Earth, various types of measurement can be acquired for representing different aspects of the Earth. Correspondingly, many computational challenges arise and need to be addressed, such as non-linearity and non-convexity, limited data coverage and ill-posedness etc. In this interdisciplinary minisymposium, we will bring together researchers from different areas to present the state-of-the-art analytical and computational imaging approaches for solving problems all arising from geoscience.

Organizer: Youzuo Lin Los Alamos National Laboratory, USA

Organizer: Rosemary A. Renaut Arizona State University, USA

9:30-9:55 Hybrid and Iteratively Reweighted Regularization for Edge Enhancing Reconstructions

Rosemary A. Renaut, Arizona State University, USA; Saeed Vatankhah, University of Tehran, Iran

10:00-10:25 Spatio-Spectral Background Estimation in Remote Sensing Imagery

James Theiler and Brendt Wohlberg, Los Alamos National Laboratory, USA

10:30-10:55 Choice of TV Regularization Parameter for Electrical Resistance Tomography

Jodi Mead and Hank Hetrick, Boise State University, USA

11:00-11:25 A Computationally Efficient Levenberg-Marquardt Algorithm and Its Application to Inverse Modeling

Youzuo Lin, Dan O'Malley, and Velimir V. Vesselinov, Los Alamos National Laboratory, USA Thursday, May 26

MS80

Non-Convex Regularization Methods in Image Restoration - Part I of II

9:30 AM-11:30 AM

Room:Alvarado Ballroom E

For Part 2 see MS89

Non-convex regularization methods have recently gained attentions in imaging sciences, either to enhance the sparsity of intended solutions or to better match the prior information of real images. This minisymposium addresses their recent development in terms of modeling, analysis, and computation.

Organizer: Michael Hintermüller Humboldt University Berlin, Germany

Organizer: Tao Wu Humboldt University Berlin, Germany

9:30-9:55 On the Global Minimizers of a Family of LO Penalized Models *Mila Nikolova*, ENS Cachan, France

10:00-10:25 Bilevel Optimization for a Generalized Total-Variation Model

Michael Hintermüller, Humboldt University Berlin, Germany

10:30-10:55 Nonconvex ADMM: Its Convergence and Applications

Yu Wang, Xi'an Jiaotong University, P.R. China; *Wotao Yin*, University of California, Los Angeles, USA; Jinshan Zeng, Jiangxi Normal University, China

11:00-11:25 The Primal-Dual Hybrid Gradient Method for Semiconvex Splittings

Thomas Möllenhoff, Technische Universität München, Germany; Evgeny Strekalovskiy, Michael Möller, and Daniel Cremers, Technical University of Munich, Germany

Thursday, May 26

MS81

Analysis and Parameterisation of Derivative Based Regularisation - Part I of II

9:30 AM-11:30 AM

Room:Alvarado Ballroom A

For Part 2 see MS90

Derivative based image priors, such as the total variation, Mumford-Shah or total generalised variation functional, are heavily used in variational image processing. They allow to model piecewise regular structures in images and have found many successful applications both in image reconstruction and analysis. In order to better understand the underlying regularising mechanisms and exploit the full potential of derivative based methods independently of discretisation artefacts, the analysis and parameterisation of the corresponding functionals in the continuous setting is of great importance. This minisymposium brings together researchers working in this field and focuses on both classical and recently introduced regularisation models.

Organizer: Martin Holler University of Graz, Austria

Organizer: Kostas Papafitsoros Humboldt University Berlin, Germany

9:30-9:55 What Do Regularisers Do? *Tuomo Valkonen* and Carola-Bibiane Schönlieb, University of Cambridge, United Kingdom; Juan Carlos De los Reyes, Escuela Politécnica Nacional, Ecuador

10:00-10:25 Anisotropic Mumford-Shah Model for Detection of Thin Structures

David Vicente, University of Graz, Austria

10:30-10:55 Retinex by Higher Order TVL1 Decomposition

Jingwei Liang, Université de Caen, France; *Xiaoqun Zhang*, Shanghai Jiao Tong University, China

10:55-10:55 Regularization of Linear Inverse Problems with Total Generalized Variation

Martin Holler, University of Graz, Austria

MS82 Wave-based Imaging in Complex Media - Part I of II

9:30 AM-11:30 AM

Room:Alvarado Ballroom B

For Part 2 see MS91

Imaging with waves in complex environments is an emerging interdisciplinary area in applied mathematics, with roots in wave propagation, random media, statistics, optimization, and numerical analysis. This two-part minisymposium presents some of the latest advances in this area including imaging and estimation with cross correlation techniques, imaging in random media and with synthetic apertures. In the first part the focus is on methods associated with passive and active synthetic aperture imaging. In the second part the focus is on methods associated with random media and when the statistical structures of the medium and sources play an important role.

Organizer: Knut Solna University of California, Irvine, USA

9:30-9:55 Multiscale Approach to Synthetic Aperture Radar

Knut Solna, University of California, Irvine, USA

10:00-10:25 Passive Source Geolocation

Margaret Cheney, Colorado State University, USA

10:30-10:55 Synthetic Aperture Imaging of Direction and Frequency Dependent Reflectivities

Chrysoula Tsogka, University of Crete, Greece

11:00-11:25 Transionospheric Synthetic Aperture Imaging

Semyon V. Tsynkov, North Carolina State University, USA

Thursday, May 26

MS83 Computational Imaging Systems

9:30 AM-11:30 AM

Room:Alvarado Ballroom C

Sponsored by SPS CI SIG

This minisymposium emphasizes the interaction between sensing hardware and computational methods in computational imaging systems. Novel sensing hardware together with algorithms that exploit the unique properties of the data acquired by this hardware has enabled the development of imaging systems with remarkable abilities that could not be achieved via traditional methods. This minisymposium brings together four leaders in the field of computational photography, and provides a cross-section of recent advances in this area.

Organizer: Brendt Wohlberg Los Alamos National Laboratory, USA

Organizer: Oliver Cossairt Northwestern University, USA

9:30-9:55 Macroscopic Fourier Ptychography

Oliver Cossairt, Northwestern University, USA; Jason R. Holloway and Ashok Veeraraghavan, Rice University, USA; Manoj Sharma, Northwestern University, USA; Salman Asif, Rice University, USA; Nathan Matsuda, Northwestern University, USA; Roarke Horstmeyer, California Institute of Technology, USA

10:00-10:25 Lensless Imaging

Ashok Veeraraghavan, Rice University, USA

10:30-10:55 Photon-Efficient Reflectivity and Depth Imaging under Significant Ambient Light Vivek K. Goval, Boston University, USA

11:00-11:25 Harvesting Nature: from Computational Imaging to Optical Computing

Laurent Daudet, Université Paris-Diderot, France

Thursday, May 26

MS84

Imaging and Space Situational Awareness -Part I of II

9:30 AM-11:30 AM

Room:Alvarado Ballroom F

For Part 2 see MS93

Governments, industry, and ordinary people around the world are increasingly dependent on services delivered by space-based platforms. Threats to those services, whether manmade or natural, deliberate or inadvertent, are therefore of great concern. Understanding and predicting the environment and the behavior of objects in space, broadly referred to as Space Situational Awareness (SSA), is essential to assessing and avoiding potential loss of functionality. Imaging research is a critical component of SSA capabilities, and falls into a wide set of areas, including image restoration, multi-frame blind deconvolution, digital superresolution, image data fusion, shape reconstruction, and remote sensing. The purpose of this minisymposium is to highlight new research in this broad array of SSA applications.

Organizer: James G. Nagy Emory University, USA

Organizer: Michael Hart University of Arizona, USA

Organizer: Douglas Hope Air Force Academy, USA

9:30-9:55 Challenges and Opportunities in Space Situational Awareness (SSA): An Air Force Perspective

Thomas Cooley, Air Force Research Laboratory, USA

MS84

Imaging and Space Situational Awareness -Part I of II

9:30 AM-11:30 AM

Room:Alvarado Ballroom F

continued

10:00-10:25 Image Reconstruction using Sparse Aperture Techniques for SSA

Robert Shivitz, James Mason, Greg Feller, and *Sam Thurman*, Lockheed-Martin, USA

10:30-10:55 High-resolution Speckle Imaging Through Strong Atmospheric Turbulence

Stuart Jefferies, Georgia State University, USA; Douglas Hope, Air Force Academy, USA; Michael Hart, University of Arizona, USA; James G. Nagy, Emory University, USA

11:00-11:25 High Resolution Imaging of Geosats at Lowell Observatory

Gerard von Belle, Lowell Observatory, USA

Thursday, May 26

MS85

Mathematical Techniques for Still Photography and Video - Part I of II

9:30 AM-11:30 AM

Room:Alvarado Ballroom G

For Part 2 see MS94

From shooting to display, image processing methods are ubiquitous in photography of still and moving images: there are in-camera algorithms that perform image correction and enhancement operations, algorithms for postproduction which are intended for color grading, image editing and enhancement, algorithms for better image display, etc. This twopart minisymposium presents some state of the art methods that cover a representative, but in no way exhaustive, list of problems in this field, with algorithms whose purpose is to facilitate the users' and artists' work on images that look as good as possible while exploiting all the capabilities of cameras and displays.

Organizer: Andrés Almansa Telecom Paris, France

Organizer: Marcelo Bertalmio Universitat Pompeu Fabra, Spain

9:30-9:55 Nonlocal Image Editing *Hossein Talebi*, Google and University of California, Santa Cruz, USA; Peyman Milanfar, Google Research, USA

10:00-10:25 Texture Synthesis and Transfer Using Convolutional Neural Networks

Leon A. Gatys, Alexander S. Ecker, and Matthias Bethge, Universität Tübingen, Germany

10:30-10:55 Tone Mapping and Gamut Mapping for Cinema

Marcelo Bertalmío, Universitat Pompeu Fabra, Spain

11:00-11:25 Video Temporal Consistency

Sylvain Paris, Adobe Systems, USA; Nicolas Boneel, CNRS, France

Thursday, May 26

MS86

New Models for Image Restoration and Enhancement - Part I of II

9:30 AM-11:30 AM

Room:Alvarado Ballroom H

For Part 2 see MS95

New mathematically-based image processing models are required to go beyond the state of the art for many applications such as image restoration, enhancement, and more generally image reconstruction in inverse problems. This two-part minisymposium will give the opportunity to present several recent models, and to discuss their potential impact for image processing applications.

Organizer: Jean-Francois Aujol IMB, CNRS, Université Bordeaux 1, France

Organizer: Lionel Moisan Université Paris Descartes, France

Organizer: Cecile Louchet University of Orléans, France

9:30-9:55 A Variational Approach for Color Image Enhancement

Jean-Francois Aujol, IMB, CNRS, Université Bordeaux 1, France

10:00-10:25 Semi-Inner-Products for Convex Functionals and Their Use in Image Decomposition

Guy Gilboa, Technion Israel Institute of Technology, Israel

10:30-10:55 Image Restoration with Shannon Total Variation

Rémy Abergel and Lionel Moisan, Université Paris Descartes, France

11:00-11:25 Image Deblurring Via Total Variation Based Structured Sparse Model Selection

Tieyong Zeng, Hong Kong Baptist University, Hong Kong

MS87 Computational Methods in Multimodal Neuroimaging, Genetics, and Data Modeling

9:30 AM-11:30 AM

Room:Franciscan Ballroom

Incorporation of time-varying connectivity (the chronnectome) plus integration (or fusion) of multimodal brain imaging and genomics data have become emerging topics. Invited talks from experts on critical aspects of cutting-edge neuroimaging will be given, including assessing brain development across multiple time scales, capitalizing on technique complementarity, investigating the role of neural oscillations, and approaches for combining multi-modal imaging and genetics data. In particular, we will emphasize statistical and computational models relevant to the fusion of multimodal imaging and genomics data with a focus on time-varying connectivity. A number of applications based on large data sets will also be discussed.

Organizer: Yu-Ping Wang *Tulane University, USA*

Organizer: Vince Calhoun University of New Mexico, USA

9:30-9:55 Analytic Approaches to Study the Chronnectome (time-Varying Brain Connectivity)

Vince Calhoun, University of New Mexico, USA

10:00-10:25 Using Complementary Assessments of Structural and Functional Brain Connectivity to Gain Insights into Neurodevelopment

Julia Stephen, The Mind Research Network, USA

10:30-10:55 Neural Oscillations and Dynamic Functional Connectivity Analysis with MEG

Tony W. Wilson, University of Nebraska Medical Center, USA

11:00-11:25 Modeling and Integration of Imaging and Genomics Data *Yu-Ping Wang*, Tulane University, USA

Thursday, May 26

MS88

Multidimensional Mode Decomposition and Applications - Part II of III

9:30 AM-11:30 AM

Room: Weavers Room

For Part 1 see MS78 For Part 3 see MS97

This minisymposium introduces new advances in the mode decomposition problem with an emphasis on multidimensional data analysis. This problem aims at identifying and separating pre-assumed data patterns from their superposition. It has motivated new mathematical theory and numerical tools in adaptive and nonlinear time-frequency analysis, datadriven optimization based on variational principles and dictionary learning for sparsity, etc. Various real applications including seismic data analysis in geophysics, atomic crystal image analysis in materials science, oscillatory data analysis in medical study, and painting analysis in art investigation, will be presented.

Organizer: Haizhao Yang Duke University, USA

9:30-9:55 Conceft: Concentration of Frequency and Time Via a Multitapered Synchrosqueezed Transform

Ingrid Daubechies, Duke University, USA; *Yi Wang*, Syracuse University, USA; Hau-Tieng Wu, University of Toronto, Canada

10:00-10:25 On the Analysis of Multicomponent Images

Thomas Oberlin, University of Toulouse, France

10:30-10:55 Canvas Texture Analysis for Art Investigation

Haizhao Yang, Bruno Cornelis, and Jianfeng Lu, Duke University, USA; Lexing Ying, Stanford University, USA; Ingrid Daubechies, Duke University, USA

11:00-11:25 Source Separation in Art Analysis: Digital Cradle Removal in X-Ray Images of Art Paintings

Rujie Yin and Bruno Cornelis, Duke University, USA; Gabor Fodor, Vrije Universiteit Brussel, Belgium; Ingrid Daubechies and David Dunson, Duke University, USA

continued in next column

CP9 Medical Imaging

9:30 AM-11:10 AM

Room:Potters Room

Chair: Wolfgang Stefan, University of Texas MD Anderson Cancer Center, USA

9:30-9:45 Linear Inverse Mri Approximation from Nonlinear Mri Zikuan Z. Chen, The Mind Research

Network, USA; Vince Calhoun, University of New Mexico, USA

9:50-10:05 The Partial Volume Problem in Magnetic Resonance Fingerprinting from a Bayesian Perspective

Debra F. McGivney, Anagha Deshmane, Yun Jiang, Dan Ma, and Mark Griswold, Case Western Reserve University, USA

10:10-10:25 MIND Demons: Symmetric Diffeomorphic Deformable Registration of MR and CT Images

Sureerat Reaungamornrat, Tharindu De Silva, and Ali Uneri, Johns Hopkins University, USA; Sebastian Vogt and Gerhard Kleinsz, Siemens Healthcare XP, Germany; Akhil Khanna, Jean-Paul Wolinsky, Jerry L. Prince, and Jeffrey Siewerdsen, Johns Hopkins University, USA

10:30-10:45 Non-Linear Optical Flow for Lung Ct Registration

Anthony M. Thompson and Ke Chen, University of Liverpool, United Kingdom; Colin Baker and John Fenwick, Clatterbridge Cancer Centre, United Kingdom

10:50-11:05 Background Signal Suppression for Magnet Resonance (mr) Phase Images

Wolfgang Stefan and David Fuentes, University of Texas MD Anderson Cancer Center, USA; Erol Yeniaras, Halliburton, USA; Ken-Pin Hwang, John D. Hazle, and R. Jason Stafford, University of Texas MD Anderson Cancer Center, USA

Lunch Break

11:30 AM-1:00 PM Attendees on their own

Thursday, May 26

IP6

Event-Based Silicon Retina Technology

1:00 PM-1:45 PM

Room:Alvarado Ballroom D and E

Chair: Vivek K. Goyal, Boston University, USA

This talk will be about the development of asynchronous "silicon retina" vision sensors that offer a spike-event output like biological retinas. These neuromorphic sensors offer advantages for real-world vision problems in terms of latency, dynamic range, temporal resolution, and post-processing cost. These event-based sensors offer opportunities for theoretical and practical developments of new classes of algorithms aimed at many dynamic vision applications. The presentation will include a demonstration of a recentvintage sensor.

URL: http://sensors.ini.uzh.ch

Tobi Delbruck

University of Zurich and ETH Zurich, Switzerland

Intermission

1:45 PM-2:00 PM

Thursday, May 26

MS89

Non-Convex Regularization Methods in Image Restoration - Part II of II

2:00 PM-3:30 PM

Room:Alvarado Ballroom E

For Part 1 see MS80

Non-convex regularization methods have recently gained attentions in imaging sciences, either to enhance the sparsity of intended solutions or to better match the prior information of real images. This minisymposium addresses their recent development in terms of modeling, analysis, and computation.

Organizer: Michael Hintermüller Humboldt University Berlin, Germany

Organizer: Tao Wu Humboldt University Berlin, Germany

2:00-2:25 Proximal Iterative Hard Thresholding Methods for Wavelet Frame Based Image Restoration

Chenglong Bao, National University of Singapore, Singapore; Bin Dong, Peking University, China; Zuowei Shen, University of Wisconsin, USA; *Xiaoqun Zhang* and Xue Zhang, Shanghai Jiao Tong University, China

2:30-2:55 On the Well-Posedness of Non-Convex Total Variation

Tuomo Valkonen, University of Cambridge, United Kingdom

3:00-3:25 Bilevel Optimization of Nonconvex ℓ q-Models in Image Processing

Tao Wu and Michael Hintermüller, Humboldt University Berlin, Germany

MS90

Analysis and Parameterisation of Derivative Based Regularisation - Part II of II

2:00 PM-4:00 PM

Room:Alvarado Ballroom A

For Part 1 see MS81

Derivative based image priors, such as the total variation, Mumford-Shah or total generalised variation functional, are heavily used in variational image processing. They allow to model piecewise regular structures in images and have found many successful applications both in image reconstruction and analysis. In order to better understand the underlying regularising mechanisms and exploit the full potential of derivative based methods independently of discretisation artefacts, the analysis and parameterisation of the corresponding functionals in the continuous setting is of great importance. This minisymposium brings together researchers working in this field and focuses on both classical and recently introduced regularisation models.

Organizer: Martin Holler University of Graz, Austria

Organizer: Kostas Papafitsoros Humboldt University Berlin, Germany

2:00-2:25 Analytical Aspects of Spatially Adapted Total Variation Type Regularisation

Kostas Papafitsoros, Michael Hintermüller, and Carlos Rautenberg, Humboldt University Berlin, Germany

2:30-2:55 Second-Order Edge-Penalization in the Ambrosio-Tortorelli Functional

Teresa Esposito, University of Muenster, Germany; Martin Burger and Caterina Ida Zeppieri, University of Münster, Germany

3:00-3:25 Optimal Selection of the Regularisation Function in a Localised TV-Model

Michael Hintermüller, Humboldt University Berlin, Germany

3:30-3:55 Cosparse Image Recovery from Few Tomographic Projections

Stefania Petra, University of Heidelberg, Germany

Thursday, May 26

MS91

Wave-based Imaging in Complex Media -Part II of II

2:00 PM-4:00 PM

Room:Alvarado Ballroom B

For Part 1 see MS82

Imaging with waves in complex environments is an emerging interdisciplinary area in applied mathematics, with roots in wave propagation, random media, statistics, optimization, and numerical analysis. This two-part minisymposium presents some of the latest advances in this area including imaging and estimation with cross correlation techniques, imaging in random media and with synthetic apertures. In the first part the focus is on methods associated with passive and active synthetic aperture imaging. In the second part the focus is on methods associated with random media and when the statistical structures of the medium and sources play an important role.

Organizer: Knut Solna University of California, Irvine, USA

2:00-2:25 Imaging with Intensity Cross Correlations and Application to Ghost Imaging

Josselin Garnier, Université Paris-Diderot, France

2:30-2:55 Crack Detection in Thin Plates

Laure Giovangigli, University of California, Irvine, USA

3:00-3:25 Fluorescence Optical Tomography with Poisson noise

Lasith Adhikari, *Arnold D. Kim*, and Roummel F. Marcia, University of California, Merced, USA

3:30-3:55 Imaging Point Sources in Unknown Environments

Kui Ren and Yimin Zhong, University of Texas at Austin, USA

Thursday, May 26

MS92

Splitting Methods and Their Applications in Computational Imaging

2:00 PM-4:00 PM

Room:Alvarado Ballroom C

Sponsored by SPS CI SIG

This session focuses on the recent numerical optimization methods that reduce a difficult to simpler subproblems, as well as their applications in computational imaging. This is part II of a minisymposium in cooperation with the Computational Imaging SIG of the IEEE/ SPS.

Organizer: Wotao Yin University of California, Los Angeles, USA

2:00-2:25 Accelerated Douglas-Rachford Methods for Convex-Concave Saddle-Points Problems and Applications in Imaging

Kristian Bredies, University of Graz, Austria; Hongpeng Sun, Renmin University of China, China

2:30-2:55 A Three-Operator Splitting Scheme and its Optimization Applications

Damek Davis and Wotao Yin, University of California, Los Angeles, USA

3:00-3:25 Gradient Sliding for Saddle Point Problems

Guanghui Lan, University of Florida, USA; Yuyuan Ouyang, Clemson University, USA

3:30-3:55 Convergence Analysis for a Randomized Multiblock ADMM and Its Applications

Yangyang Xu, Institute for Mathematics and its Applications, USA; Xiang Gao and Shuzhong Zhang, University of Minnesota, USA

MS93 Imaging and Space

Situational Awareness -Part II of II

2:00 PM-4:00 PM

Room:Alvarado Ballroom F

For Part 1 see MS84

Governments, industry, and ordinary people around the world are increasingly dependent on services delivered by spacebased platforms. Threats to those services, whether manmade or natural, deliberate or inadvertent, are therefore of great concern. Understanding and predicting the environment and the behavior of objects in space, broadly referred to as Space Situational Awareness (SSA), is essential to assessing and avoiding potential loss of functionality. Imaging research is a critical component of SSA capabilities, and falls into a wide set of areas, including image restoration, multi-frame blind deconvolution, digital super-resolution, image data fusion, shape reconstruction, and remote sensing. The purpose of this minisymposium is to highlight new research in this broad array of SSA applications.

Organizer: James G. Nagy Emory University, USA

Organizer: Michael Hart University of Arizona, USA

Organizer: Douglas Hope Air Force Academy, USA

2:00-2:25 Multiframe Blind Deconvolution for Imaging Through Strong Atmospheric Turbulence

Brandoch Calef, The Boeing Company, USA

2:30-2:55 3D Snapshot Imaging Via Rotating Psf for Space Surveillance Sudhakar Prasad, University of New

Mexico, USA

3:00-3:25 High-Resolution Imaging of Satellites with and Without Adaptive Optics

Szymon Gladysz, Fraunhofer Institute of Optronics, Germany

3:30-3:55 Reconstruction & Enhancement of Astronomical & Satellite Images Obtained Using Adaptive Optics

Robert Johnson and Lee Kann, Air Force Research Laboratory, USA

Thursday, May 26

MS94

Mathematical Techniques for Still Photography and Video - Part II of II

2:00 PM-4:00 PM

Room:Alvarado Ballroom G

For Part 1 see MS85

From shooting to display, image processing methods are ubiquitous in photography of still and moving images: there are in-camera algorithms that perform image correction and enhancement operations, algorithms for postproduction which are intended for color grading, image editing and enhancement, algorithms for better image display, etc. This twopart minisymposium presents some state of the art methods that cover a representative, but in no way exhaustive, list of problems in this field, with algorithms whose purpose is to facilitate the users' and artists' work on images that look as good as possible while exploiting all the capabilities of cameras and displays.

Organizer: Andrés Almansa Telecom Paris, France

Organizer: Marcelo Bertalmio Universitat Pompeu Fabra, Spain

2:00-2:25 Removing Camera Shake Via Fourier Burst Accumulation *Mauricio Delbracio* and Guillermo Sapiro, Duke University, USA

2:30-2:55 Revisiting Total Variation Blind Deconvolution

Paolo Favaro and Daniele Perrone, University of Bern, Switzerland

3:00-3:25 Single Shot HDR Imaging Using A Hyperprior Bayesian Approach

Cecilia Aguerrebere, Duke University, USA; Andrés Almansa, Julie Delon, and Yann Gousseau, Telecom Paris, France; *Pablo Musé*, Universidad de la República, Uruguay

3:30-3:55 Energy-Optimized Imaging

Kiriakos Kutulakos, University of Toronto, Canada; Matthew O'Toole, University of Toronto, Canada; Supreeth Achar and Srinivasa Narasimhan, Carnegie Mellon University, USA

MS95

New Models for Image Restoration and Enhancement - Part II of II

2:00 PM-4:00 PM

Room:Alvarado Ballroom H

For Part 1 see MS86

New mathematically-based image processing models are required to go beyond the state of the art for many applications such as image restoration, enhancement, and more generally image reconstruction in inverse problems. This two-part minisymposium will give the opportunity to present several recent models, and to discuss their potential impact for image processing applications.

Organizer: Jean-Francois Aujol IMB, CNRS, Université Bordeaux 1, France

Organizer: Lionel Moisan Université Paris Descartes, France

Organizer: Cecile Louchet University of Orléans, France

2:00-2:25 Inverse Problems with TV-ICE regularization

Cecile Louchet, University of Orléans, France; Lionel Moisan, Université Paris Descartes, France

2:30-2:55 Path Optimization with limited sensing ability

Sung Ha Kang, *Seong Jun Kim*, and Haomin Zhou, Georgia Institute of Technology, USA

3:00-3:25 An Affine Invariant Similarity Measure for Non-Local Image Restoration

Vadim Fedorov and Coloma Ballester, Universitat Pompeu Fabra, Spain

3:30-3:55 Edge Preserving Image Reconstruction for 3D Magnetic Particle Imaging

Christina Brandt, University of Eastern Finland, Finland; Martin Storath, École Polytechnique Fédérale de Lausanne, Switzerland; Martin Hofmann and Tobias Knopp, University Medical Center Hamburg-Eppendorf, Germany; Andreas Weinmann, Helmholtz Zentrum München, Germany Thursday, May 26

MS96 Inverse Problems in Neuroimaging

2:00 PM-4:00 PM

Room:Alvarado Ballroom D

Neuroimaging is the study of the structural organization and functional operation of the nervous system by direct or indirect imaging techniques. Many significant challenges remain in this field, particularly: (1) the development of hybrid modalities, combining complementary imaging techniques to provide superior image reconstructions; (2) the development and calibration of models for brain structure and activity, for multiple spatial and/or temporal scales and across patients; and (3) the need for efficient, robust, and scalable algorithms to solve the high-dimensional, computationally intensive inverse problems characteristic to this field. This minisymposium will discuss advances in mathematical and statistical challenges in neuroimaging.

Organizer: Sarah Vallelian Statistical and Applied Mathematical Sciences Institute, USA

Organizer: Arvind Saibaba North Carolina State University, USA

2:00-2:25 Reduced Order Modeling in Photoacoustic Tomography

Sarah Vallelian, Statistical and Applied Mathematical Sciences Institute, USA; Arvind Saibaba, North Carolina State University, USA

2:30-2:55 Nonlinear Quantitative Photoacoustic Tomography with Twophoton Absorption

Kui Ren and Rongting Zhang, University of Texas at Austin, USA

3:00-3:25 A hierarchical Krylov-Bayes iterative inverse solver for MEG with physiological preconditioning

Daniela Calvetti, Case Western Reserve University, USA; Annalisa Pascarella, Istituto per le Applicazioni del Calcolo "Mauro Picone", Italy; Francesca Pitolli, University of Rome La Sapienza, Italy; Erkki Somersalo, Case Western Reserve University, USA; Barbara Vantaggi, University of Rome La Sapienza, Italy

3:30-3:55 On Preconditioning Newton Method For PDE Constrained Optimization Problems

Amir Gholaminejad and George Biros, University of Texas at Austin, USA

continued in next column

MS97 Multidimensional Mode Decomposition and Applications - Part III of III

2:00 PM-4:00 PM

Room: Weavers Room

For Part 2 see MS88

This minisymposium introduces new advances in the mode decomposition problem with an emphasis on multidimensional data analysis. This problem aims at identifying and separating pre-assumed data patterns from their superposition. It has motivated new mathematical theory and numerical tools in adaptive and nonlinear time-frequency analysis, data-driven optimization based on variational principles and dictionary learning for sparsity, etc. Various real applications including seismic data analysis in geophysics, atomic crystal image analysis in materials science, oscillatory data analysis in medical study, and painting analysis in art investigation, will be presented.

Organizer: Haizhao Yang Duke University, USA

2:00-2:25 Joint Denoising and Distortion Correction of Scanning Transmission Electron Microscopy Images of Crystalline Structures

Benjamin Berkels, RWTH Aachen University, Germany; Benedikt Wirth, Universität Münster, Germany

2:30-2:55 2D-TV-VMD: Two-Dimensional Compact Variational Mode Decomposition

Dominique Zosso, Konstantin Dragomiretskiy, Andrea L. Bertozzi, and Paul S. Weiss, University of California, Los Angeles, USA

3:00-3:25 2D Empirical Wavelets

Jerome Gilles, San Diego State University, USA; Giang Tran, University of Texas at Austin, USA; Stanley J. Osher, University of California, Los Angeles, USA

3:30-3:55 Sparse Time-Frequency Decomposition for Signals with Multiple Measurements

Zuoqiang Shi, Tsinghua University, China; Thomas Hou, California Institute of Technology, USA Thursday, May 26

CP10

Registration, Denoising, Super-Resolution

2:00 PM-3:40 PM

Room:Franciscan Ballroom

Chair: Amanda K. Ziemann, Los Alamos National Laboratory, USA

2:00-2:15 CITRUS: Cueing Image Target Regions by Unmixing Spectra

Amanda K. Ziemann and James Theiler, Los Alamos National Laboratory, USA

2:20-2:35 Non-Stationary Blind Super-Resolution

Gongguo Tang, Dehui Yang, and Michael B. Wakin, Colorado School of Mines, USA

2:40-2:55 A Locally Adaptive Wiener Filter in Graph Fourier Domain for Improved Image Denoising

M. Tankut Ozgen and *Ali Can Yagan*, Anadolu University, Turkey

3:00-3:15 A Vectorial Total Generalized Variational Model for Multichannel Sar Image Speckle Suppression

Tan Xintong, Yu Qi, Wang Zelong, Liu Jiying, and Zhu Jubo, National University of Defense Technology, China

3:20-3:35 On Diffeomorfic Image Registration Models and Their Effective Solution Algorithms

Daoping Zhang and Ke Chen, University of Liverpool, United Kingdom

Thursday, May 26

CP11

Microscopy and Geosciences

2:00 PM-3:40 PM

Room:Potters Room

Chair: Jonghyun Lee, Stanford University, USA

2:00-2:15 A Max-Cut Approach to the Heterogeneity Problem in Cryo-Electron Microscopy

Yariv Aizenbud and Yoel Shkolnisky, Tel Aviv University, Israel

2:20-2:35 Single Particle Tracking of Blinking Particles

Stephen M. Anthony, Sandia National Laboratories, USA; Kejia Chen, University of Illinois, USA; Steve Granick, Ulsan National Institute of Science and Technology, South Korea

2:40-2:55 The Role of Visual Saliency in Seismic Interpretation with An Application to Salt Dome Delineation

Muhammad Amir Shafiq, Tariq Alshawi, Zhiling Long, and Ghassan AlRegib, Georgia Institute of Technology, USA

3:00-3:15 Stochastic Methods on Geophysical Inverse Problems

Sanna K. Tyrvainen and Eldad Haber, University of British Columbia, Canada

3:20-3:35 Multiscale Imaging of Carbonate Rocks and 3D Stochastic Reconstruction for Digital Rock Physics Hongkyu Yoon, Sandia National

Laboratories, USA; *Jonghyun Lee*, Stanford University, USA; Thomas Dewers, Sandia National Laboratories, USA

Abstracts



Tom Goldstein and Stanley Osher, SIAM J. Imaging Sciences, Vol.2, No. 2

May 23 - 26, 2016 Hotel Albuquerque at Old Town Albuquerque, New Mexico, USA

Abstracts are printed as submitted by the authors.

Notes

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Tom Goldstein and Stanley Osher, SIAM J. Imaging Sciences, Vol.2, No. 2

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Labate, Demetrio, MT1, 9:30 Mon Labate, Demetrio, MT1, 9:30 Mon Lai, Rongjie, MS16, 5:00 Mon Lang, Lukas F., CP7, 2:00 Wed Langer, Andreas, MS67, 2:00 Wed Langer, Andreas, MS67, 2:00 Wed Langer, Andreas, MS76, 4:30 Wed Lartey, Richard N., CP7, 3:20 Wed Lassas, Matti, MS48, 5:00 Tue Laude, Emanuel, MS12, 5:00 Mon Lazar, Nicole, MS68, 2:30 Wed Le, Ellen, MS75, 5:30 Wed Le Magoarou, Luc, MS3, 2:00 Mon Le Magoarou, Luc, MS3, 2:00 Mon Le Magoarou, Luc, MS13, 4:30 Mon Lee, Jonghvun, CP11, 3:20 Thu Lellmann, Jan, MS2, 2:00 Mon Lellmann, Jan, MS12, 4:30 Mon Lellmann, Jan, MS46, 5:30 Tue Lenglet, Christophe, MS77, 5:30 Wed Lenzen, Frank, MS15, 6:00 Mon Lerman, Gilad, MS33, 2:00 Tue Levie, Ron, CP7, 3:40 Wed Levine, Stacey, MS35, 2:00 Tue Levine, Stacey, MS45, 4:30 Tue Levine, Stacey, MS74, 6:00 Wed Li, Wenbin, MS34, 3:00 Tue Li, Xiangi, MS38, 2:30 Tue Li, Yunyue, MS78, 5:00 Wed Liebling, Michael, MS20, 5:00 Mon Lima, Raul G., MS63, 3:30 Wed Lin, Youzuo, MS79, 9:30 Thu Lin, Youzuo, MS79, 11:00 Thu Lindstrom, Peter, MS27, 10:00 Tue Lisitsa, Vadim, CP1, 2:40 Mon Liu, Jiulong, MS11, 5:30 Mon Lorenz, Dirk, MS9, 3:30 Mon Loris, Ignace, MS1, 2:00 Mon Lou, Yifei, MS51, 9:30 Wed Lou, Yifei, MS51, 10:30 Wed Lou, Yifei, MS61, 2:00 Wed Lou, Yifei, MS70, 4:30 Wed Louchet, Cecile, MS86, 9:30 Thu Louchet, Cecile, MS95, 2:00 Thu Louchet, Cecile, MS95, 2:00 Thu Loupot, Sara, CP4, 3:00 Tue Lu, Jian, MS70, 6:00 Wed Lucka, Felix, MS46, 4:30 Tue Lucka, Felix, MS46, 5:00 Tue Lucka, Felix, MS55, 9:30 Wed Luo, Xiyang, CP4, 3:20 Tue

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Ma, Tian-Hui, CP3, 10:50 Tue Maass, Peter, MS5, 2:30 Mon Madankan, Reza, CP6, 10:30 Wed Maggioni, Mauro, MS13, 6:00 Mon Maharramov, Musa, MS44, 5:30 Tue Malgouyres, Francois, MS3, 3:00 Mon Malgouyres, Francois, PP1, 6:30 Mon Mamonov, Alexander V., MS21, 9:30 Tue Mamonov, Alexander V., MS31, 2:00 Tue Mamonov, Alexander V., MS41, 4:30 Tue Mamonov, Alexander V., MS41, 6:00 Tue Mang, Andreas, MS9, 2:00 Mon Mang, Andreas, MS19, 4:30 Mon Mang, Andreas, MS19, 6:00 Mon Matthews, Thomas, MS69, 6:00 Wed McGaffin, Madison G., MS37, 3:00 Tue McGivney, Debra F., CP9, 9:50 Thu McLaughlin, Joyce R., MS31, 2:00 Tue McMillan, Michael S., MS75, 5:00 Wed Mead, Jodi, MS79, 10:30 Thu Memoli, Facundo, MS23, 9:30 Tue Memoli, Facundo, MS23, 11:00 Tue Memoli, Facundo, MS33, 2:00 Tue Memoli, Facundo, MS43, 4:30 Tue Memoli, Facundo, MS73, 5:00 Wed Mendlow, Micaela, PP1, 6:30 Mon Meng, Gloria, CP7, 2:20 Wed Michalak, Anna, MS66, 3:30 Wed Micheli, Mario, MS54, 9:30 Wed Micheli, Mario, MS54, 9:30 Wed Micheli, Mario, MS64, 2:00 Wed Micheli, Mario, MS73, 4:30 Wed Mikula, Karol, MS14, 5:00 Mon Milanfar, Peyman, IP1, 8:15 Mon Milanfar, Peyman, MS65, 4:30 Tue Milanfar, Peyman, MS74, 4:30 Wed Milanfar, Peyman, MS74, 4:30 Wed Miller, Eric, MS66, 2:00 Wed Miller, Eric, MS75, 4:30 Wed Miller, Ezra, MS43, 4:30 Tue Miller, Robyn, PP1, 6:30 Mon

Mio, Washington, MS23, 9:30 Tue Mio, Washington, MS33, 2:00 Tue Mio, Washington, MS43, 4:30 Tue Mio, Washington, MS43, 6:00 Tue Mitchell, Drew, PP1, 6:30 Mon Mixon, Dustin, MS22, 10:30 Tue Moeller, Michael, MS2, 2:00 Mon Moeller, Michael, MS12, 4:30 Mon Mohy-Ud-Din, Hassan, MS58, 9:30 Wed Mohy-Ud-Din, Hassan, MS58, 9:30 Wed Moisan, Lionel, MS61, 2:00 Wed Moisan, Lionel, MS86, 9:30 Thu Moisan, Lionel, MS95, 2:00 Thu Möllenhoff, Thomas, MS80, 11:00 Thu Möller, Michael, MS36, 2:30 Tue Morigi, Serena, MS51, 9:30 Wed Mueller, Jennifer L., MS63, 2:00 Wed Mueller, Jennifer L., MS72, 4:30 Wed Muise, Robert R., MS52, 9:30 Wed Muise, Robert R., MS52, 9:30 Wed Muise, Robert R., MS62, 2:00 Wed Muise, Robert R., MS71, 4:30 Wed Muller, Kaitlyn Voccola, MS50, 9:30 Wed Muller, Kaitlyn Voccola, MS50, 10:30 Wed Muller, Peter, MS72, 5:00 Wed Munson, Todd, MS59, 11:00 Wed Murthy, Rashmi, MS24, 11:00 Tue Musé, Pablo, MS94, 3:00 Thu

Ν

Nagy, James G., MS66, 2:00 Wed Nagy, James G., MS84, 9:30 Thu Nagy, James G., MS93, 2:00 Thu Narayan, Akil, MS54, 9:30 Wed Narayan, Akil, MS64, 2:00 Wed Narayan, Akil, MS73, 4:30 Wed Naumova, Valeriya, MS67, 4:30 Wed Nguyen, Linh, MS21, 11:00 Tue Nguyen, Mau Nam, MS51, 10:00 Wed Ni, Kang-Yu, MS47, 5:00 Tue Nikolova, Mila, MS67, 3:00 Wed Nikolova, Mila, MS80, 9:30 Thu Nossek, Raz, MS45, 5:00 Tue

O Ober, Raimund J., MS20, 6:00 Mon Oberlin, Thomas, MS88, 10:00 Thu Ogden, Todd, MS68, 3:00 Wed Oliver, Maria, MS45, 5:30 Tue Olivo-Marin, Jean-Christophe, MS10, 3:30 Mon

Olson, Colin, MS52, 10:30 Wed O'Malley, Daniel, PP1, 6:30 Mon *Ombao, Hernando, MS25, 9:30 Tue* Ombao, Hernando, MS25, 9:30 Tue Ongie, Gregory, CP3, 9:30 Tue Osting, Braxton, MS36, 2:00 Tue *Ouyang, Yuyuan, MS17, 4:30 Mon* Ouyang, Yuyuan, MS92, 3:00 Thu Ozyesil, Onur, MS22, 9:30 Tue

Ρ

Pan, Xiaochuan, MS39, 2:30 Tue Papadakis, Nicolas, MS36, 3:30 Tue Papafitsoros, Kostas, MS81, 9:30 Thu Papafitsoros, Kostas, MS90, 2:00 Thu Papafitsoros, Kostas, MS90, 2:00 Thu Parekh, Ankit, PP1, 6:30 Mon Parekh, Ankit, CP3, 9:50 Tue Paris, Sylvain, MS56, 10:30 Wed Paris, Sylvain, MS85, 11:00 Thu Park, Se Rim, MS26, 10:30 Tue Perea, Jose, MS43, 5:30 Tue Perona, Pietro, MS26, 10:00 Tue Persch, Johannes, CP2, 5:10 Mon Petra, Stefania, MS90, 3:30 Thu Pfister, Luke, CP1, 3:00 Mon Platte, Rodrigo B., MS28, 9:30 Tue Platte, Rodrigo B., MS28, 9:30 Tue Platte, Rodrigo B., MS38, 2:00 Tue Platte, Rodrigo B., MS47, 4:30 Tue Polzin, Thomas, MS19, 5:30 Mon

Ponce, Luis, PP1, 6:30 Mon Powell, Samuel, MS11, 6:00 Mon Pragier, Gabi, MS49, 6:00 Tue Prasad, Sudhakar, MS93, 2:30 Thu Prasath, Surya, PP1, 6:30 Mon Prasath, Surya, CP3, 10:30 Tue Purisha, Zenith, MS48, 5:30 Tue

Q

Qian, Jianliang, MS53, 10:00 Wed Qin, Jing, MS16, 5:30 Mon *Qin, Jing, MS51, 9:30 Wed Qin, Jing, MS61, 2:00 Wed* Qin, Jing, MS61, 3:00 Wed *Qin, Jing, MS70, 4:30 Wed*

R

Rasch, Julian, MS15, 5:30 Mon Raviv, Dan, SP2, 1:00 Wed Raviv, Dan, MS35, 3:00 Tue Raviv, Dan, MS53, 11:00 Wed Raviv, Dan, MS64, 2:30 Wed Reaungamornrat, Sureerat, CP9, 10:10 Thu Rebegoldi, Simone, CP2, 5:30 Mon Ren, Kui, MS21, 9:30 Tue Ren, Kui, MS31, 2:00 Tue Ren, Kui, MS41, 4:30 Tue Ren, Kui, MS96, 2:30 Thu Ren, Kui, MS91, 3:30 Thu Renaut, Rosemary A., MS79, 9:30 Thu Renaut, Rosemary A., MS79, 9:30 Thu Rezaee, Hamideh, CP1, 3:20 Mon Riot, Paul H., PP1, 6:30 Mon Rittscher, Jens, MS10, 3:00 Mon Roberts, Mike, MS60, 3:30 Wed Robins, Vanessa, MS43, 5:00 Tue Rodriguez, Paul, CP8, 6:10 Wed Rohr, Karl, MS20, 5:30 Mon Romano, Yaniv, MS65, 4:30 Tue Romano, Yaniv, MS65, 4:30 Tue Romano, Yaniv, MS74, 4:30 Wed Romberg, Justin, MS71, 5:30 Wed

Rosasco, Lorenzo, MT3, 9:30 Mon *Rosasco, Lorenzo, MT3, 9:30 Mon* Rosasco, Lorenzo, MS26, 11:00 Thu Ruan, Weitong, CP8, 5:50 Wed Ruthotto, Lars, MS9, 3:00 Mon

S

Saibaba, Arvind, MS66, 2:00 Wed Saibaba, Arvind, MS75, 4:30 Wed Saibaba, Arvind, MS75, 6:00 Wed Saibaba, Arvind, MS96, 2:00 Thu Saito, Naoki, CP3, 11:10 Tue Saito, Naoki, MS32, 2:00 Tue Saito, Naoki, MS42, 4:30 Tue Salloum, Maher, MS27, 9:30 Tue Salloum, Maher, MS27, 9:30 Tue Salloum, Maher, MS37, 2:00 Tue Salmon, Joseph, CP4, 2:00 Tue Sanders, Toby, MS47, 5:30 Tue Sankaranarayanan, Aswin, MS52, 11:00 Wed Santacesaria, Matteo, MS63, 2:30 Wed Sariaydin, Selin, CP8, 5:30 Wed Scarnati, Theresa A., CP5, 5:50 Tue Schönlieb, Carola-Bibiane, MS67, 2:00 Wed Schönlieb, Carola-Bibiane, MS76, 4:30 Wed Schwab, Evan, MS77, 4:30 Wed Schwab, Evan, MS77, 4:30 Wed Sciacchitano, Federica, MS8, 2:00 Mon Sciacchitano, Federica, MS8, 2:30 Mon Sciacchitano, Federica, MS18, 4:30 Mon Senay, Seda, PP1, 6:30 Mon Seppecher, Laurent, MS41, 5:00 Tue Sgallari, Fiorella, MS8, 2:00 Mon Shafiq, Muhammad Amir, CP11, 2:40 Thu Shekhovtsov, Alexander, MS2, 3:00 Mon Shen, Lixin, MS38, 3:00 Tue Shi, Zuoqiang, MS97, 3:30 Thu Shinohara, Russell, MS68, 3:30 Wed Sidky, Emil, MS29, 9:30 Tue

Siltanen, Samuli, MS39, 2:00 Tue Siltanen, Samuli, MS48, 4:30 Tue Siltanen, Samuli, MS55, 10:00 Wed Siltanen, Samuli, MS63, 2:00 Wed Siltanen, Samuli, MS72, 4:30 Wed Singer, Amit, MS30, 9:30 Tue Solna, Knut, MS82, 9:30 Thu Solna, Knut, MS82, 9:30 Thu Solna, Knut, MS91, 2:00 Thu Song, Guohui, MS47, 4:30 Tue Spencer, Jack A., CP7, 2:40 Wed Spivak, Marina, MS40, 3:30 Tue Srivastava, Anuj, MS73, 4:30 Wed Staboulis, Stratos, MS72, 4:30 Wed Stefan, Wolfgang, CP9, 10:50 Thu Steklova, Klara, MS15, 4:30 Mon Stephen, Julia, MS87, 10:00 Thu Strauss, Thilo, MS4, 3:00 Mon Strohmer, Thomas, IP3, 8:15 Tue Suhr, Sebastian, MS8, 3:30 Mon Sulam, Jeremias, MS3, 2:00 Mon Sulam, Jeremias, MS3, 3:30 Mon Sulam, Jeremias, MS13, 4:30 Mon Sun, Hui, MS24, 10:00 Tue Sutour, Camille, MS18, 6:00 Mon Sutour, Camille, MS46, 6:00 Tue

T Talebi, Hossein, MS85, 9:30 Thu Tam, Matthew, MS59, 9:30 Wed Tamasan, Alexandru, MS41, 4:30 Tue Tang, Gongguo, CP10, 2:20 Thu Thai, Duy H., PP1, 6:30 Mon Theiler, James, MS79, 10:00 Thu Thompson, Anthony M., CP9, 10:30 Thu Thompson, William, MS29, 11:00 Tue Thurman, Sam, MS84, 10:00 Thu Thurman, Samuel, MS62, 3:00 Wed *Treister, Eran, MS53, 9:30 Wed* Treister, Eran, MS53, 9:30 Wed *Tripathi, Ashish, MS59, 9:30 Wed* Tripathi, Ashish, MS59, 10:00 Wed Tsogka, Chrysoula, MS82, 10:30 Thu Tsynkov, Semyon V., MS82, 11:00 Thu Tyrvainen, Sanna K., CP11, 3:00 Thu

U

Uc-Cetina, Victor, MS8, 3:00 Mon Uhlmann, Virginie, MS10, 2:30 Mon Urban, Jozef, MS14, 5:30 Mon

V

Vaiter, Samuel, MS65, 5:30 Tue Valkonen, Tuomo, MS1, 2:00 Mon Valkonen, Tuomo, MS11, 4:30 Mon Valkonen, Tuomo, MS81, 9:30 Thu Valkonen, Tuomo, MS89, 2:30 Thu Vallelian, Sarah, MS96, 2:00 Thu Vallelian, Sarah, MS96, 2:00 Thu Vallelian, Sarah, MS96, 2:00 Thu Van Leeuwen, Tristan, MS29, 10:00 Tue Veeraraghavan, Ashok, MS71, 6:00 Wed Veeraraghavan, Ashok, MS83, 10:00 Thu Vemuri, Baba C., MS77, 5:00 Wed Vesselinov, Velimir V., PP1, 6:30 Mon Vialard, Francois-Xavier, MS19, 5:00 Mon

Vicente, David, MS81, 10:00 Thu Vidal, Rene, MS77, 4:30 Wed Villa, Silvia, MS76, 5:30 Wed Villar, Soledad, MS2, 3:30 Mon Villar, Soledad, MS22, 11:00 Tue Viswanathan, Aditya, MS28, 10:30 Tue von Belle, Gerard, MS84, 11:00 Thu Voroninski, Vladislav, MS22, 9:30 Tue Voroninski, Vladislav, MS32, 3:30 Tue

W

Wakin, Michael B., MS52, 10:00 Wed
Waller, Laura, MS71, 5:00 Wed
Wang, Jue, CP6, 10:50 Wed
Wang, Yi, MS88, 9:30 Thu *Wang, Yu-Ping, MS87, 9:30 Thu*Wang, Yu-Ping, MS87, 11:00 Thu
Webster, Tegan, MS50, 11:00 Wed
Weller, Daniel S., MS11, 5:00 Mon

Wettenhovi, Ville-Veikko, MS39, 3:00 Tue

Whitaker, Ross, MS54, 11:00 Wed *Wild, Stefan, MS59, 9:30 Wed Wild, Stefan, MS60, 2:00 Wed Wild, Stefan, MS69, 4:30 Wed*Willemsen, Bram, MS66, 2:30 Wed
Wilson, Tony W., MS87, 10:30 Thu
Woermann, Julian, MS13, 4:30 Mon *Wohlberg, Brendt, MS83, 9:30 Thu*Wu, Hau-Tieng, MS78, 5:30 Wed *Wu, Tao, MS80, 9:30 Thu Wu, Tao, MS89, 2:00 Thu*Wu, Tao, MS89, 3:00 Thu

Х

Xintong, Tan, CP10, 3:00 Thu Xu, An-Bao, CP3, 10:10 Tue Xu, Yangyang, MS92, 3:30 Thu

Υ

Yagan, Ali Can, CP10, 2:40 Thu Yan, Ming, MS27, 9:30 Tue Yan, Ming, MS37, 2:00 Tue Yan, Ming, MS37, 2:00 Tue Yan, Ming, MS51, 11:00 Wed Yang, Haizhao, MS78, 4:30 Wed Yang, Haizhao, MS88, 9:30 Thu Yang, Haizhao, MS88, 10:30 Thu Yang, Haizhao, MS97, 2:00 Thu Yang, Xu, MS34, 2:30 Tue Yang, Yang, MS21, 10:00 Tue Yankelevsky, Yael, MS3, 2:00 Mon Yankelevsky, Yael, MS13, 4:30 Mon Yankelevsky, Yael, MS13, 5:00 Mon Yashtini, Maryam, MS57, 9:30 Wed Yashtini, Maryam, MS57, 11:00 Wed Ye, Xiaojing, MS17, 5:00 Mon Yin, Rujie, MS88, 11:00 Thu Yin, Wotao, MS1, 2:30 Mon Yin, Wotao, MS80, 10:30 Thu Yin, Wotao, MS92, 2:00 Thu Younes, Laurent, MS54, 10:30 Wed

Young, C. Alex, MT2, 9:30 Mon Young, C. Alex, MT2, 9:30 Mon Yuan, Xiaoming, MS42, 5:30 Tue

Ζ

Zach, Christopher, MS2, 2:30 Mon Zaslavsky, Mikhail, MS66, 3:00 Wed Zeng, Tieyong, MS70, 5:30 Wed Zeng, Tieyong, MS86, 11:00 Thu Zeune, Leonie, MS36, 3:00 Tue Zhang, Daoping, CP10, 3:20 Thu Zhang, Shuai, MS61, 2:30 Wed Zhang, Teng, MS30, 11:00 Tue Zhang, Xiaoqun, MS6, 2:00 Mon Zhang, Xiaoqun, MS6, 2:00 Mon Zhang, Xiaoqun, MS16, 4:30 Mon Zhang, Xiaoqun, MS81, 10:30 Thu Zhang, Xiaoqun, MS89, 2:00 Thu Zhao, Zhizhen, MS30, 9:30 Tue Zhao, Zhizhen, MS30, 10:00 Tue Zhao, Zhizhen, MS40, 2:00 Tue Zhao, Zhizhen, MS49, 4:30 Tue Zheng, Ning, CP2, 5:50 Mon Zhong, Yimin, MS31, 3:00 Tue Zhou, Ting, MS72, 6:00 Wed Zhou, Yi, MS17, 6:00 Mon Zhu, Hongtu, MS25, 10:00 Tue Zhu, Wei, MS42, 4:30 Tue Zhu, Wei, MS57, 9:30 Wed Zhuge, Xiaodong, MS48, 4:30 Tue Ziemann, Amanda K., CP10, 2:00 Thu Zosso, Dominique, MS6, 3:30 Mon Zosso, Dominique, MS36, 2:00 Tue Zosso, Dominique, MS97, 2:30 Thu Zucker, Steven, MS35, 2:30 Tue



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IS16 Budget

Conference Budget SIAM Conference on Imaging Science May 23-26, 2016 Albuquerque, NM)		
Expected Paid Attendance	360		
Revenue			
Registration Income		\$136,895	
	Total	\$136,895	
Expenses			
Printing		\$5,900	
Organizing Committee		\$3,000	
Invited Speakers		\$11,750	
Food and Beverage		\$19,500	
AV Equipment and Telecommunication		\$18,500	
Advertising		\$7,900	
Conference Labor (including benefits)		\$44,748	
Other (supplies, staff travel, freight, misc.)		\$7,450	
Administrative		\$12,578	
Accounting/Distribution & Shipping		\$6,749	
Information Systems		\$12,508	
Customer Service		\$4,553	
Marketing		\$7,113	
Office Space (Building)		\$4,625	
Other SIAM Services		\$4,702	
	Total	\$171,576	
Net Conference Expense		(\$34,681)	
Support Provided by SIAM		\$34,681	
		\$0	

Estimated Support for Travel Awards not included above:

Early Career and Student	32	\$25,375
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