Changes on the following Minisymposia:

- MS01 Part I,
- MS18 Part I,
- MS28,
- MS54 Part II,
- MS02 Part II,
- MS19 Part I,
- MS35 Part II,
- MS57 Part III,
- MS05 Part II,
- MS22 Part II,
- MS52 Part I,
- MS14 Part II,
- MS25 Part II,
- MS54 Part I,
### Monday May 12

#### MS14 Part II
**Manifolds, Shapes and Topologies in Imaging**

2:45 PM - 4:45 PM  
WLB204

The detection, quantification or comparison of geometrical structures plays a central role in many imaging tasks. Particular examples are related to tomographic shape/topology reconstruction, shape recognition and statistics, based, e.g., on Riemannian geometry, or deformation analysis. In this minisymposium, recent analytical as well as computational approaches to aforementioned problems are addressed. In particular, techniques based on shape and topological sensitivity analysis, level set methods, adaptive geometric approximation, shape geodesics, and problems requiring efficient handling of Riemannian manifolds are emphasized.

*Organizer:* Günay Doğan, Theiss Research, National Institute of Standards and Technology, USA  
*Organizer:* Michael Hintermüller, Institut für Mathematik, Humboldt-Universität zu Berlin, Germany

**14:45-15:15 Computational Metric Geometry in the Natural Space**  
Ron Kimmel, Computer Science Department, Technion, Israel Institute of Technology, Israel

**15:15-15:45 Affine-Invariant Shape Models for Contours and Their Discoveries in Images**  
Anuj Srivastava, Department of Statistics, Florida State University, USA

**15:45-16:15 Smooth or Singular Metamorphoses for Images and Measures**  
Laurent Younes, Johns Hopkins University, USA

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#### MS25 Part II
**Mathematical Modeling and Related Inverse Problems in Medical Applications**

2:45 PM - 4:45 PM  
DLB712

Mathematical methods for modeling and signal analysis have become important tools in medical area. In particular, these require multidisciplinary collaboration accompanied with physics and bio-based modeling, imaging system design, signal image processing, high performance computing as well as experimental validation. In this mini-symposium, mathematical problems and challenges in biomedical problems will be discussed, and current research activities in modeling and inverse problems arising from such problems will be reviewed. Special emphasis will be given on blood flow modeling and signal recovery, sparse image reconstruction and convex optimization in MR, CT, and various imaging modalities. Audiences are expected to learn how sophisticated mathematics can be used for real world applications.

*Organizer:* Jong Chul Ye, Department of Bio and Brain Engineering, KAIST, Korea  
*Organizer:* Yoon Mo Jung, Computational Science and Engineering, Yonsei University, Korea  
*Organizer:* Kiwan Joon, National Institute for Mathematical Sciences, Korea

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#### TALK CANCELED
**14:45-15:15 Phase Retrieval for Sparse Signals**  
Zhiqiang Xu, LSEC; Inst. Comp. Math., Academy of Mathematics and System Science, Chinese Academy of Sciences, China

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#### CHANGE OF TIME
**14:45-15:15 Vortex Flow Imaging Technique Using Echocardiography**  
Chi Young Ahn, National Institute for Mathematical Sciences, Korea
UPDATED INFORMATION
18:45-19:15 Image Reconstruction in Fluorescence Diffuse Optical Tomography Using Patch-based Anisotropic Diffusion Regularisation
Teresa Correia, University College London, UK

Monday
May 12

MS28
Image Denoising: Trends, Connections, and Limitations
5:15 PM - 7:15 PM
WLB103

Image denoising has undergone significant advances since the 80s. For example, local stencils have led to non-local patch based techniques, anisotropic diffusion has inspired a well developed line of research in the nonlinear PDE community, and statistics and kernel methods have provided tools for improving all of these techniques. The newest models appear to be closing in on an optimal state, yet new algorithms continue to demonstrate advances. This minisymposium addresses new denoising approaches, what improvements (if any) we can expect to achieve, and connections between these methods that give insight into their potential as well as their limitations.

Organizer: Marcelo Bertalmío, Universitat Pompeu Fabra, Spain
Organizer: Stacey Levine, Duquesne University, USA

17:15-17:45 Denoising an Image by Denoising its Curvature Image
Marcelo Bertalmío, Departamento de Tecnologías de la Información y las Comunicaciones, Universitat Pompeu Fabra, Spain

17:45-18:15 A Spatially Consistent Collaborative Filtering
Alessandro Foi, Department of Signal Processing, Tampere University of Technology, Finland

Maria Zontak, Department of Computer Science and Applied Mathematics, Weizmann Institute, Israel

NEW TALK
18:45-19:15 On Covariant Derivatives and Their Applications to Image Regularization
Thomas Batard, Department of Information and Communication Technologies, University Pompeu Fabra, Barcelona, Spain
### Tuesday May 13

#### MS52 Part I

**Non-Convex Models in Image Recovery and Segmentation**

10:30 AM - 12:30 PM  
WLB208

In image recovery and segmentation, non-convex variational models are often closer to the real problems and turn out to perform better numerical results comparing the convex models. But at the same time, non-convexity poses significant challenges with respect to both the existence of solutions and the development of efficient algorithms. This minisymposium aims at bringing together experts in this area to present a series of talks on modeling, theoretical analysis, efficient numerical algorithms and applications.

_Organizer: Yiqiu Dong, Technical University of Denmark, Denmark_  
_Organizer: Tieyong Zeng, Hong Kong Baptist University, Hong Kong_

**10:30-11:00 Non-convex Multiple-objective Image Modeling**  
Alfred Hero, Dept. of Electrical Engineering and Computer Science, The University of Michigan, USA

**11:00-11:30 Multiclass Segmentation by Iterated ROF Thresholding**  
Xiaohao Cai, Department of Mathematics, University of Kaiserslautern, Kaiserslautern, Germany

**11:30-12:00 Restoration of Images Corrupted by Multiplicative Noise**  
Tieyong Zeng, Department of Mathematics, Hong Kong Baptist University, Hong Kong

### Tuesday May 13

#### MS54 Part I

**Optimization in Imaging: Algorithms, Applications and Theory**

10:30 AM - 12:30 PM  
WLB210

Optimization has been playing an important role in various imaging processing areas; and we have witnessed very active interaction between these two disciplines. This mini-symposium aims to bring together experts to exchange ideas and discuss the most recent advances in optimization techniques for image processing problems. Relevant progresses on algorithmic design, application and theory at the interface of optimization and imaging are all welcome.

_Organizer: Xiaojun Chen, The Hong Kong Polytechnic University, Hong Kong_  
_Organizer: Xiaoming Yuan, Hong Kong Baptist University, Hong Kong_

**10:30-11:00 Implicit Filtering**  
C. T. Kelley, North Carolina State University, USA

**11:00-11:30 A Semismooth Newton-CG Augmented Lagrangian Algorithm for Convex Minimization Problems with Non-separable \( \ell_1 \)-regularization**  
Kim-Chuan Toh, National University of Singapore, Singapore

**11:30-12:00 The Augmented-Lagrangian-Type Methods for Low Multilinear-Rank Tensor Recovery**  
Lei Yang, Tianjin University, China

**Updated Information**

**CHANGE OF TIME**

12:00-12:30 Exact Recovery for Sparse Signal via Weighted L1 Minimization

_Naihua Xiu, Department of Applied Mathematics, Beijing Jiaotong University, China_

_Move to Wednesday May 14, MS54 Part II, 11:00-11:30, DLB712_

**NEW TALK**

12:00-12:30 An Algorithm for Variable Density Sampling with Block-constrained Acquisition

_Pierre Weiss, University of Toulouse, France_
In recent years mainland China has many new developments in modeling and algorithms in imaging sciences. The objectives of this mini-symposium are to bring mainland China researchers in this field together to present their recent research work, to exchange ideas, and explore future collaborations. The topics of this mini-symposium were the latest development of modeling, algorithms and their applications in real-world imaging problems such as image denoising, deblurring, inpainting, decomposition, segmentation, and super-resolution reconstruction, etc. This minisymposium can provide a forum to stimulate discussions and establish collaborations between young Chinese researchers for further developments in this emerging imaging sciences research.

Organizer: Fang Li, Department of Mathematics, East China Normal University, China
Organizer: Huanfeng Shen, School of Resource and Environmental Science, Wuhan University, China
Organizer: Wei Wang, Department of Mathematics, Tongji University, China
Organizer: Xile Zhao, School of Mathematical Sciences, University of Electronic Science and Technology of China, China

TALK CANCELED
10:30-11:00 Hyperspectral Anisotropic Diffusion for Image Denoising Based on a Novel Diffusion Tensor
Yi Wang, China University of Geosciences, China

NEW TALK
10:30-11:00 Spatially Adaptive Total Variation Model: From Pixel to Regional Perspective
Qiangqiang Yuan, School of Geodesy and Geomatics, Wuhan University, China

TALK CANCELED
11:00-11:30 Separable Tensor Compressive Sensing and Application in Hyperspectral Imaging
Yongqiang Zhao, Northwestern Polytechnical University, China

11:30-12:00 An Online Coupled Dictionary Learning Approach for Remote Sensing Image Fusion
Hongyan Zhang, Wuhan University, China

12:00-12:30 Joint Blind Unmixing and Sparse Representation for Anomaly Detection in Hyperspectral Image
Yuancheng Huang, Xi’an University of Science and Technology, China

TALK CANCELED
14:15-14:45 Computational Aspects of Dynamic Photoacoustics
Simon Arridge, University College London, UK

NEW TALK
14:15-14:45 Compressed Sensing for High Resolution 3D Photoacoustic Tomography Using Data Sparsity
Marta Betcke, University College London, UK
### MS22 Part II
Variational PDE and Multi-scale Multi-directional Sparse Representation in Imaging
1:45 PM - 3:45 PM
WLB207

After decades of intensive studies, modern image analysis is still facing the challenges of recovering images from their noisy, blurry, and/or incomplete measurements. The precise recovery is especially valuable for images containing important details (including but not limited to medical images). High order regularity and multi-scale multi-directional sparse representation play important roles in these problems and have shown to be very successful. This mini-symposium brings together leading researchers to discuss the state-of-the-art theoretical developments in this two research directions as well as their applications in image denoising, image reconstruction, compressive sensing, image segmentation and compressive feature detection etc.

Organizer: Weihong Guo, Department of Mathematics, Case Western Reserve University, USA
Organizer: Julia Dobrosotskaya, Department of Mathematics, Case Western Reserve University, USA

13:45-14:15 Variational Image Reconstruction Using Composite Wavelets
Benjamin Manning, Department of Mathematics, University of Maryland, College Park, USA

14:15-14:45 α-Molecules: Wavelets, Shearlets, and Beyond
Gitta Kutyniok, Technische Universität Berlin, Germany

14:45-15:15 Compressive Support Detection based on Multiple Hypothesis Testing
Yi (Grace) Wang, Duke University and SAMSI, USA

TALK CANCELED
15:15-15:45 Empirical Wavelet Transforms

### MS35 Part II
Theoretical and Computational Aspects of Geometric Shape Analysis
1:45 PM - 3:45 PM
WLB103

The analysis, classification, and processing of geometric shapes is a timely and increasingly important problem in 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 state-of-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: Sergey Kushnarev, Singapore University of Technology and Design, Singapore
Organizer: Mario Micheli, Department of Mathematics, University of Washington, USA
Organizer: Akil Narayan, University of Massachusetts Dartmouth, USA

13:45-14:15 Matrix-valued Kernels for Shape Deformation Analysis
Mario Micheli, Department of Mathematics, University of Washington, USA

14:15-14:45 Some Computations Related to Barycenters on Riemannian Manifolds
Facundo Mémoli, Department of Mathematics, The Ohio state University, USA

CHANGE OF TIME
14:15-14:45 Shape Analysis of Cardiac Images
Laurent Younes, Department of Applied Mathematics and Statistics,
<table>
<thead>
<tr>
<th>Tuesday</th>
<th>May 13</th>
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<tbody>
<tr>
<td><strong>CT01</strong></td>
<td>Contributed Talk I</td>
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<tr>
<td>4:15 PM - 6:15 PM</td>
<td>WLB103</td>
</tr>
<tr>
<td>16:15-16:35 Meteorological Data Analysis with Diffeomorphic Demons</td>
<td>Dominique Brunet, Cloud Physics and Severe Weather Research Section, Environment Canada, Government of Canada, Canada</td>
</tr>
<tr>
<td>16:35-16:55 Modelling and Analysing Oriented Fibrous Structures</td>
<td>Maaria Rantala, Department of Mathematics and Statistics, University of Helsinki, Finland</td>
</tr>
<tr>
<td>16:55-17:15 Fast Optimized Harmonic Registration of Genus-0 Closed Surfaces with Landmark Constraints</td>
<td>Pui Tung Choi, Department of Mathematics, The Chinese University of Hong Kong, Hong Kong</td>
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**UPDATED INFORMATION**

<table>
<thead>
<tr>
<th>Tuesday</th>
<th>May 13</th>
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<tbody>
<tr>
<td>17:15-17:35 Image Inpainting for 3D Conversion</td>
<td>Rob Hocking, Department of Applied Mathematics and Theoretical Physics, University of Cambridge, UK</td>
</tr>
<tr>
<td>17:35-17:55 Surface Reconstruction from Parallel Contours with Exact Contour Constraints</td>
<td>Sangun Kim, Department of Mathematical Sciences, KAIST, Korea</td>
</tr>
<tr>
<td>17:55-18:15 A Convex Approach to Sparse Shape Composition</td>
<td>Alireza Aghasi, School of Electrical and Computer Engineering, Georgia Institute of Technology, GA, USA</td>
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**TALK CANCELED**

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<tr>
<td>16:55-17:15 Non-local Retinex, A Unifying Framework and Beyond</td>
<td>Giang Tran, Department of Mathematics, UCLA, USA</td>
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<th>Tuesday</th>
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<tr>
<td>16:55-17:15 Optimal Filters for General-Form Tikhonov Regularization</td>
<td>Malena I. Español, Department of Mathematics, The University of Akron, USA</td>
</tr>
<tr>
<td>17:15-17:35 Drift-Diffusion Equations in Image Processing</td>
<td>Martin Schmidt, Department of Mathematics and Computer Science, Saarland University, Germany</td>
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<tr>
<td>17:35-17:55 Near Optimal Parameter Choice for General Spectral Filters</td>
<td>Viktoria Taroudaki, Applied Mathematics and Scientific Computation Program, University of Maryland, USA</td>
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<td>16:15-16:35</td>
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<th>Time</th>
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<tr>
<td>16:15-16:35</td>
<td>CT06</td>
<td>Creating and Utilising Prior Anatomical Information for Preclinical Brain Imaging with Fluorescence Molecular Tomography</td>
<td>Athanasios Zacharopoulos, Institute for Electronic Structure and Laser, Foundation for Research and Technology- Hellas, Greece</td>
</tr>
<tr>
<td>16:35-16:55</td>
<td></td>
<td>Detection of Bone Profiles in CT Images by Means of the Hough Transform</td>
<td>Cristina Campi, CNR-SPIN, Genova, Italy</td>
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<td>16:55-17:15</td>
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<td>Physiological Clustering: A noise-reduction approach in Quantitative Myocardial Perfusion PET</td>
<td>Hassan Mohy-ud-Din, Department of Electrical and Computer Engineering, Department of Applied Mathematics and Statistics, and Department of Radiology and Radiological Sciences, Johns Hopkins University, USA</td>
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<td>17:15-17:35</td>
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<td>Quantification of Glucose Metabolism with Nuclear Imaging PET Data</td>
<td>Sara Garbarino, Dipartimento di Matematica, Università degli Studi di Genova, Italy</td>
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<td>17:35-17:55</td>
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<td>Spontaneous Brain Activity Detection in Functional Magnetic Resonance Imaging Using Finite Rate of Innovation</td>
<td>Zafer Dogan, Institute of Bioengineering EPFL, Switzerland</td>
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<th>Time</th>
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<tr>
<td>17:35-17:55</td>
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<td>Recovering Rank-One Matrices via Rank-r Matrices Relaxation</td>
<td>Pengwen Chen, National Chung Hsing University, Taiwan</td>
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<tr>
<td>17:55-18:15</td>
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<td>Fourier-Bessel Rotational Invariant Eigenimages</td>
<td>Zhizhen Zhao, Courant Institute of Mathematical Sciences, New York University, USA</td>
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<td>Time</td>
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<td>Tuesday</td>
<td>CT08 Contributed Talk 8</td>
<td>WLB206</td>
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<td>16:15-16:35</td>
<td>Removing Simultaneous Gaussian and Salt-and-pepper Noise by Minimizing a Combined $L^1-L^2$-TV Functional</td>
<td></td>
<td>Andreas Langer, Institute of Mathematics and Scientific Computing, University of Graz, Austria</td>
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<tr>
<td>16:35-16:55</td>
<td>Efficient Smoothing Method for Image Restoration Using Nonsmooth Regularization</td>
<td></td>
<td>Chao Zhang, Department of Applied Mathematics, Beijing Jiaotong University, China</td>
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<tr>
<td>16:55-17:15</td>
<td>Total Variation based Speckle Reduction Method</td>
<td></td>
<td>Hyenkyun Woo, School of Computational Sciences, Korea Institute for Advanced Study, Korea</td>
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<td>UPDATED INFORMATION</td>
<td>Denoising Results Using Image Reconstruction Techniques Based on Legendre Polynomials Approximation of Continuous Prolate Spheroidal Functions (CPSF)</td>
<td>WLB206</td>
<td>Maria C. Gonzalez, Department of Mathematics, University of California, Davis, USA</td>
</tr>
<tr>
<td>17:35-17:55</td>
<td>Exploiting Sparsity in Remote Sensing for Earth Observation</td>
<td></td>
<td>Xiaoziang Zhu, Remote Sensing Technology, German Aerospace Center (DLR) &amp; Technical University of Munich, Germany</td>
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<tr>
<td>Wednesday</td>
<td>MS01 Part I Beyond Single Shot Imaging: Academic and Industrial Points of View</td>
<td>WLB210</td>
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<tr>
<td>10:30 AM</td>
<td>Simultaneous HDR Image Reconstruction and Denoising for Dynamic Scenes</td>
<td></td>
<td>Pablo Musé, Universidad de la República, Uruguay</td>
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<tr>
<td>11:00-11:30</td>
<td>How to Trade Signal Sparsity for Outlier Resistance in Convex Reconstruction from Linear Measurements?</td>
<td></td>
<td>Said Ladjal, LTCI, Télécom ParisTech, France</td>
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<tr>
<td>11:30-12:00</td>
<td>Foreground and Background Reconstruction in High-Speed Photon-Limited Motion Imagery</td>
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<td>Rebecca Willett, University of Wisconsin-Madison, USA</td>
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<td>CHANGE OF TIME</td>
<td>10:30-11:00 Color Transfer Between Close Views of the Same Scene</td>
<td>WLB210</td>
<td>Stacey Levine, Duquesne University, USA</td>
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### Wednesday
#### May 14

**MS18 Part I**  
**Super-Resolution: Theoretical and Numerical Aspects**  
**10:30 AM - 12:30 PM**  
**WLB211**

The goal of this mini-symposium (split into two parts) is to present state of the art results, on both theoretical guarantees and numerical algorithms, for inverse problems regularization using low complexity models (sparsity, bounded variation, low rank, etc.). These results attempt to bridge the gap between the surprising efficiency of recent regularization methods, and our theoretical understanding of their super-resolution effectiveness. While many theoretical guarantees rely on uniform analysis with with hypotheses requiring randomness or global incoherence of the measurements, real-life problems in imaging sciences (e.g. deconvolution, tomography, MRI, etc.) require more intricate theoretical tools and algorithms to capture the geometry of signals and images that can be stably recovered. This includes for instance variational methods over spaces of measures (e.g. sum of Dirac measures, bounded variation functions, etc.) and the development of novel recovery algorithms that can cope with the strong coherence of the measurement operator. The mini-symposium will gather talks by leading experts in the field.

**Organizer:** Jalal Fadili, CNRS-ENSICaen, Caen, France  
**Organizer:** Gabriel Peyré, CNRS and Université Paris-Dauphine, France

- **10:30-11:00 Inverse Problems in Spaces of Measures**  
  Kristian Bredies, University of Graz, Austria

- **11:00-11:30 Super-Resolution from Noisy Data**  
  Carlos Fernandez-Granda, University of Stanford, USA

- **11:30-12:00 Exact Support Recovery for Sparse Spikes Deconvolution**  
  Vincent Duval, University Paris-Dauphine, France

**TALK CANCELED**  
**12:00-12:30 Going off the Grid**  
Gongguo Tang, Colorado School of Mines, USA

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**MS19 Part I**  
**Wave-based Imaging**  
**10:30 AM - 12:30 PM**  
**WLB207**

Wave-based imaging is an interdisciplinary area in applied mathematics, with roots in hyperbolic partial differential equations, probability theory, statistics, optimization, and numerical analysis. This minisymposium will present some of the latest advances in this area including source and reflector imaging in random media with arrays, imaging with cross correlation techniques, imaging through the turbulent atmosphere, and imaging methods based on spectral decompositions of the scattering operator.

**Organizer:** Knut Sølna, University of California at Irvine, USA  
**Organizer:** Josselin Garnier, Paris Diderot University, France

- **10:30-11:00 Generalized Row-Action Methods for Tomographic Imaging**  
  Knut Sølna, University of California at Irvine, USA

- **11:00-11:30 Interferometric Waveform Inversion**  
  Laurent Demanet, MIT, USA

- **11:30-12:00 Shape Identification and Classification in Echolocation**  
  Han Wang, ENS Paris, France

**TALK CANCELED**  
**12:00-12:30 Geometric Distortion Correction and Deblurring by Fourier Deconvolution**  
Jérôme Gilles, UCLA, USA

**NEW TALK**  
**12:00-12:30 Wave Luminescence Imaging**  
Kui Ren, Department of Mathematics, University of Texas at Austin, USA
Optimization has been playing an important role in various imaging processing areas; and we have witnessed very active interaction between these two disciplines. This mini-symposium aims to bring together experts to exchange ideas and discuss the most recent advances in optimization techniques for image processing problems. Relevant progresses on algorithmic design, application and theory at the interface of optimization and imaging are all welcome.

Organizer: Xiaojun Chen, The Hong Kong Polytechnic University, Hong Kong
Organizer: Xiaoming Yuan, Hong Kong Baptist University, Hong Kong

10:30-11:00 Functional-Analytic and Numerical Issues in Splitting Methods for Total Variation-based Image Reconstruction
Michael Hintermüller, Humboldt-Universität zu Berlin, Germany

CHANGE OF TIME
11:00-11:30 An Algorithm for Variable Density Sampling with Block-constrained Acquisition
Pierre Weiss, University of Toulouse, France
Move to Tuesday May 13, MS54 Part I, 12:00-12:30, WLB210

NEW TALK
11:00-11:30 Exact Recovery for Sparse Signal via Weighted L1 Minimization
Naihua Xiu, Department of Applied Mathematics, Beijing Jiaotong University, China

11:30-12:00 A Nonmonotone Approximate Sequence Algorithm for Unconstrained Nonlinear Optimization
Maryam Yashtini, Department of Mathematics, University of Florida, USA
12:00-12:30 Proximal Linearized Alternating Direction Method for Image Restoration
Sangwoon Yun, Sungkyunkwan University, Korea
Abstracts of Minisymposia Talks

MS01 Part I
Foreground and Background Reconstruction in High-Speed Photon-Limited Motion Imagery

Image foreground and background separation is an essential step in a variety of image processing, video analysis, and computer vision tasks. Typically, these methods accept streaming video data, compute an estimate of the background, and subtract this from the observed frames to generate a foreground scene. While such methods are very effective in high SNR regimes, they face serious limitations in low-light settings occurring in night vision surveillance and astronomy. Existing methods cannot be easily modified to yield good results. Therefore, new methods must be created to specifically deal with the low light setting. This work specifically addresses the problem of foreground and background separation and reconstruction in the case of Poisson distributed observations. The proposed approach builds upon recent advances in both the online learning community and sparse reconstruction methods for Poisson images. To aid in the reconstruction and separation tasks, the method learns and incorporates the dynamics of objects in both the background and foreground in real time. This is joint work with Eric Hall.

Rebecca Willett Department of Electrical and Computer Engineering, University of Wisconsin, Madison, USA
rmwillett@wisc.edu

MS02 Part II
Compressed Sensing for High Resolution 3D Photoacoustic Tomography Using Data Sparsity

We present a new compressed sensing photoacoustic scanner based on optically addressed Fabry-Perot interferometer. Instead of slow raster acquisition the new scanner interrogates the whole sensor with a series of independent illumination patterns, each individual measurement being a scalar product of the illumination pattern and the acoustic field on the sensor. We discuss various aspects of compressed data acquisition and image reconstruction for this novel device on both simulated and real data.

Marta Betcke Department of Computer Science, University College London, UK M.Betcke@cs.ucl.ac.uk
Ben Cox Department of Medical Physics, University College London, UK B.Cox@ucl.ac.uk
Nam Huynh
Edward Zhang
Paul Beard
Simon Arridge Department of Computer Science, University College London, UK S.Arridge@cs.ucl.ac.uk

MS14 Part II
Shape and Topology Optimization Methods for Inverse Problems

In numerous image processing problems, the objects to be reconstructed have a nonsmooth structure. Typically, they may present piecewise constant or piecewise smooth features. Many well-established reconstruction algorithms rely on smooth functions for the approximation of the solution. In the past few years, reconstruction algorithms based on nonsmooth techniques to treat such cases have allowed to obtain more accurate reconstructions and therefore have drawn a considerable interest. In this talk, we propose a general shape optimization approach for the resolution of severely ill-posed inverse problems in tomography. For instance, in the case of Electrical Impedance Tomography, we reconstruct a piecewise constant electrical conductivity while in the case of Fluorescence Diffuse Optical Tomography, the unknown is a fluorophore concentration.

Antoine Laurain TU Berlin, Germany
laurain@math.tu-berlin.de

MS19 Part I
Wave Luminescence Imaging

In wave-luminescence imaging (WLI), we use waves such as ultrasound and microwaves to generate luminescent light inside a scattering medium. We then measure on the surface of the medium outgoing photon density. From this measurement, we intend to image the distribution of the luminescence source inside the medium. We present here some recent theoretical and numerical results on WLI in various simplified settings. We show how to construct “good” probing waves for stable reconstructions.

Kui Ren Department of Mathematics, University of Texas at Austin ren@math.utexas.edu

MS28
On Covariant Derivatives and Their Applications to Image Regularization

We present a generalization of the Euclidean and Riemannian gradient operators to a vector bundle, a geometric structure generalizing the concept of manifold. One of the key ideas is to replace the standard differentiation of a function by the covariant differentiation of a section. Dealing with covariant derivatives satisfying the property of compatibility with vector bundle metrics, we construct generalizations of existing mathematical models for image regularization that involve the Euclidean gradient operator, namely the linear scale-space and the Rudin-Osher-Fatemi denoising model. For well-chosen covariant derivatives, we show that our denoising model outperforms state-of-the-art (local) variational denoising methods both in terms of PSNR and Q-index.

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MS52 Part I
Restoration of Images Corrupted by Multiplicative Noise

In this talk, a new variational model for restoring blurred images with multiplicative noise is proposed. Based on the statistical property of the noise, a quadratic penalty function technique is utilized in order to obtain a strictly convex model under a mild condition, which guarantees the uniqueness of the solution and the stabilization of the algorithm. For solving the new convex variational model, a primal-dual algorithm is proposed, and its convergence is studied. The talk ends with a report on numerical tests for the simultaneous deblurring and denoising of images subject to multiplicative noise. A comparison with other methods is provided as well.

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MS54 Part II
Exact Recovery for Sparse Signal via Weighted L1 Minimization

Numerical experiments have indicated that the reweighted L1 minimization perform exceptionally well in recovering sparse signal. In this talk, we want to develop new exact recovery conditions and algorithm for sparse signal via weighted L1 minimization. We first introduce the concept of WNSP (weighted null space property) and reveal that it is a necessary and sufficient condition for weighted L1 exact recovery. We then show that the RIC (restricted isometry...
constant) bound by weighted L1 minimization trends to 1 under some situations which is greater than the existing RIC bound 0.4343. Finally, we propose a modified iterative reweighted L1 minimization (MIRL1) algorithm based on our selection principle of weight, and the numerical experiments demonstrate that our algorithm MIRL1 behaves much better than the existing weighted L1 minimization algorithms.

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MS57 Part III  
Spatially Adaptive Total Variation Model: From Pixel to Regional Perspective

Total variation is a popular and effective image prior model. However, as it favors a piecewise constant solution, the result under high noise intensity is often poor. Therefore, we develop a regional adaptive total variation (RATV) model, in which the spatial information weight is constructed and classified with k-means clustering, and the regularization strength in each is controlled regionally. Experimental results, on both image denoising and super-resolution, verified its effectiveness.

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Abstracts of Contributed Talks

CT01  
Image Inpainting for 3D Conversion

Despite the explosion in popularity of 3D movies over the past five years, many directors prefer to shoot in 2D and convert after the fact. “Conversion” means the construction of the right eye view given the left (or vice versa), and involves inpainting the background behind occluding objects. This inpainting problem is unique in that one boundary of the inpainting domain must be handled differently, necessitating the development of specialized algorithms.

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CT05  
Artificial Intelligence and Traffic: Problems, Devices, Methods, Theorems

We present problems and models discussed recently. Pattern recognition problems first of all are connected with necessity of model parameter identification and verification. Next problems include real-time methods for traffic. Main goal of these methods is to provide traffic safety. In this direction we define recognition methods of wide range of traffic violations, leading to road accidents or creating critical situations. Also problems of development of mobile monitoring system of urban road network in seasons (winter-summer), including pavement, traffic control signs, are considered.

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CT06  
Manifold Embedding Model of Image Patches and Its Application

Recently, the patch ordering method has been introduced in image processing. In this method, the patches of an image are sorted to a sequence so that the relatively simple 1-D operators can be applied for image processing. In this talk, we introduce a 1-D manifold embedding model for the image patches. In the model, the patches of an image is considered to reside on a 1-D manifold in a high dimensional space. Then image procession can be realized by operators on the manifold. Since the metric relation among the patched is well established in the model, interpolation, filtering, and other operators will perform more accurately. Several examples in image inpainting are presented to show the validity of the model.

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CT07  
Recovering Rank-One Matrices via Rank-r Matrices Relaxation

PhaseLift, proposed by E.J. Candes et al is one convex relaxation approach for phase retrieval. The relaxation enlarges the solution set from rank one matrices to positive semidefinite matrices. In this talk, we study a novel relaxation applied to non convex minimization approaches, for instance, alternating minimization methods. A generic measurement matrix is standardized to consist of orthogonal columns. The standardized frames are employed to recover
the rank-one matrix among the rank-r matrices, and the desired rank one matrix is the one with the maximal leading eigenvalue. Besides, with sufficient amount of nearly orthogonal sensing vectors, we show that the corresponding singular vector is close to the unknown signal and thus it can be a good initialization. Some empirical studies are conducted to illustrate the effectiveness of this relaxation approach.

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CT08
Denoising Results Using Image Reconstruction Techniques Based on Legendre Polynomials Approximation of Continuous Prolate Spheroidal Functions (CPSF)

Performance of images denoising techniques varies depending on noise type. A general assumption is that the noise spectrum is uniformly distributed while image spectrum is not. Imaging filtering permits discards part of the noise localized at high frequencies. For images with transitions, this approach causes blurring, which can be information loss. Our work uses a set of CPSF to represent the image and evaluate the denoising capabilities for salt & pepper, Gaussian, speckle, and Rician noise.

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