BASP Frontiers 2019

International Workshop on
Biomedical & **A**stronomical **S**ignal **P**rocessing

BASP
Biomedical and Astronomical
Signal Processing
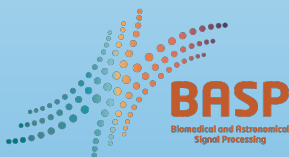
Feb 3-8, 2019

www.baspfrontiers.org

Chair

Prof. Yves Wiaux   Heriot-Watt University, UK

Area Chairs

Dr. Boris Leistedt   New York University, USA

Prof. Jason McEwen   University College London, UK

Prof. Michael Lustig   UC Berkeley, USA

Prof. Jong Chul Ye   KAIST, South Korea

Dr. Marcelo Pereyra   Heriot-Watt University, UK

Prof. Philip Schniter   Ohio State University, USA

Session Organizers

Astronomical Imaging

Dr. Jo Bovy   University of Toronto, Canada

Dr. Michelle Lochner   African Institute for Mathematical Sciences, SA

Dr. Stefan Wijnholds   ASTRON, The Netherlands

Biomedical Imaging

Prof. Ulugbek Kamilov   Washington University, St. Louis, USA

Dr. Florian Knoll   New York University, USA

Prof. Ricardo Otazo   Memorial Sloan Kettering Cancer Center, USA

Dr. Laura Waller   UC Berkeley, USA

Signal Processing

Prof. Peyman Milanfar   Google Research, USA

Prof. Thomas Pock   Technische Universität Graz, Austria

Prof. Jean-Yves Tourneret   ENSEEIHT, France

Logistics

Dr. Arwa Dabbech	Heriot-Watt University, UK
Dr. Pierre-Antoine Thouvenin	Heriot-Watt University, UK
Dr. Audrey Repetti	Heriot-Watt University, UK
Prof. Jean-Philippe Thiran	EPFL, Switzerland
Dr. Adrien Besson	EPFL, Switzerland
Mr. Roberto Duarte	Heriot-Watt University, UK
Dr. Ming Jiang	EPFL, Switzerland

Venue

Chalet Royalp Hotel and Spa	1884 Villars-sur-Ollon, Switzerland
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	http://www.royalp.ch/

Sponsor

HASLERSTIFTUNG

Sunday Feb 3, 15:00 – 17:30

Welcome Drink

15:00 - 15:45

Workshop Opening

15:45 - 16:00

Conference Introduction Talk

16:00 - 17:00

Prof. Rebecca Willett

Learning from Highly Correlated Features using Graph Total Variation

Coffee

17:00 - 17:30

Sunday Feb 3, 17:30 – 20:30

The Mathematics of Deep Learning

Chair: Prof. Thomas Pock

17:30 **Keynote**	Thomas Pock	*Learning with Structured Models*
18:05 **Talk**	Gitta Kuttyniok	Learning the Invisible
18:30 **Talk**	Peter Ochs	Lifting Layers: Analysis and Applications
18:55 **Talk**	Daniel Cremers	Bayesian Inference in the Age of Deep Learning
19:20 **Talk**	Martin Benning	Monotone Variational Networks

19:45 **Poster***	Matthew Trager	Pullbacks and Gradient Flows: a Geometric Perspective on Implicit Bias
19:45 **Poster***	Christopher Metzler	Unsupervised Learning with Stein's Unbiased Risk Estimator with Applications to Denoising and Compressive Sensing
19:45 **Poster***	Matthieu Terris	Stochastic MM Subspace Algorithms

20:45 Dinner

* With aperitif

Monday Feb 4, 8:00 – 11:00

Machine Learning for Astrophysics

Chair: Dr. Michelle Lochner

08:00 **Keynote**	**Michelle Lochner**	**Probabilistic Machine Learning**
08:35 **Talk**	Shirley Ho	Modeling Structure Formation of the Universe
09:00 **Talk**	François Lanusse	Deep Generative Models on Graphs for Emulating Galaxy Alignments in Cosmological Simulations
09:25 **Talk**	Marc Huertas-Company	Investigating Galaxy Evolution with Deep Learning
09:50 **Talk**	Kai Polsterer	Machine Learning in Astronomy: Accessing Complex Structures with Unsupervised and Deep Learning Techniques

10:15 **Poster***	Luisa Lucie-Smith	Machine Learning Cosmological Structure Formation
10:15 **Poster***	Justin Alsing	Fast Likelihood-Free Inference with Neural Density Estimators and Deep Network Data Compression
10:15 **Poster***	Tarek Allam	Optimising the LSST Observing Strategy for Supernova Light Curve Classification with Machine Learning
10:15 **Poster***	Maggie Lieu	Emulator Networks, Hierarchical Models and Cluster Cosmology

11:00 Free Time
17:00 Coffee

* With coffee

Monday Feb 4, 17:30 – 20:30

Machine Learning for Medical Image Reconstruction

Chair: Dr. Florian Knoll

17:30 Keynote	Daniel Rueckert	Towards Application-Driven MR Imaging
18:05 Talk	Mehmet Akçakaya	Accelerated MRI Using Scan-Specific SPIRiT-RAKI Interpolation with Sparsity Regularization
18:30 Talk	Jonas Adler	Deep Posterior Sampling
18:55 Talk	Frank Ong	Learning from Undersampled k-Space Datasets for Reconstruction
19:20 Talk	Ricardo Otazo	Variational Network Learning for Reconstruction of Low-Dose CT Data

19:45 Poster*	Kerstin Hammernik	Variational Networks for MRI Reconstruction
19:45 Poster*	Chen Qin	Convolutional Recurrent Neural Networks for Dynamic MR Image Reconstruction
19:45 Poster*	Thomas Moreau	Multivariate Convolutional Sparse Coding for Electromagnetic Brain Signals
19:45 Poster*	Jong Chul Ye	k-Space Deep Learning for Compressed Sensing Imaging

20:45 Dinner

* With aperitif

Tuesday Feb 5, 8:00 – 11:00

In the Service of Regularization: Denoisers, Laplacians, Proximal Mappings, and More

Chair: Prof. Philip Schniter

08:00 **Keynote**	**Matthias Zwicker**	**Image Priors using Denoising Autoencoders**
08:35 **Talk**	Alex Bronstein	Tradeoffs between Speed and Accuracy in Inverse Problems
09:00 **Talk**	Mário Figueiredo	From General-Purpose to Class-Specific to Scene-Adapted Regularization
09:25 **Talk**	Paolo Favaro	Blind Deconvolution: a Journey from Model-Based to Deep Learning Methods
09:50 **Talk**	Ivan Dokmanić	Regularization by Random Mesh Projections

10:15 **Poster***	Ulugbek Kamilov	Plug-In Stochastic Gradient Method
10:15 **Poster***	Siavash Arjomand Bigdeli	Image Denoising via MAP Estimation using Deep Neural Networks
10:15 **Poster***	Philip Schniter	Score-Matching by Denoising
10:15 **Poster***	Amirafshar Moshtaghpour	Single Pixel Hyperspectral Imaging using Fourier Transform Interferometry

11:00 Free Time
17:00 Coffee

* With coffee

Tuesday Feb 5, 17:30 – 20:30

Next-Generation Radio-Interferometric Imaging

Chair: Prof. Oleg Smirnov

17:30 **Keynote**	Oleg Smirnov	**Modern Interferometric Imaging Challenges: from MeerKAT to SKA**
18:05 **Talk**	Nithyanandan Thyagarajan	Designing Extremely Fast, All-Sky Radio Cameras using Massive Radio Telescopes
18:30 **Talk**	Luke Pratley	Wide-Field Interferometric Imaging via Distributed Sparse Image Reconstruction
18:55 **Talk**	Jean-Luc Starck	Radio Image Deconvolution with Shape Constraint
19:20 **Talk**	Audrey Repetti	Uncertainty Quantification in Astro-Imaging by Optimisation

19:45 **Poster***	Shahrzad Naghibzadeh	Bayesian-Inspired Regularization using Prior-Conditioning for Fast Radio-Interferometric Imaging
19:45 **Poster***	Arwa Dabbech	Self Direction-Dependent Calibration for Wideband Radio-Interferometric Imaging
19:45 **Poster***	Rémy E. Joseph	An Ill-Posed Linear Inverse Problem as a Separation Criteria for a Source Separation Problem
19:45 **Poster***	Landman Bester	Dimensionality Reduction for Wide-Field Imaging in the Presence of Direction Dependent Effects
19:45 **Poster***	Ming Jiang	Fourier Dimensionality Reduction for Fast Radio Transients

20:30 Workshop Picture
21:00 Dinner

* With aperitif

Wednesday Feb 6, 8:00 – 11:00

Bayesian Methods in Imaging

Chair: Prof. Jean-Yves Tourneret

08:00 Keynote	Jean-Yves Tourneret	Bayesian Methods in Imaging Sciences
08:35 Talk	Jean-Christophe Pesquet	MM Adapted MH Methods
09:00 Talk	Herwig Wendt	Bayesian Estimation for the Multifractal Analysis of Multivariate Images
09:25 Talk	Jean-François Giovannelli	Hierarchical Model and Bayesian Strategy for Unsupervised Deconvolution-Segmentation of Image with Oriented Textures
09:50 Talk	David Dunson	Bayesian Nonparametric Subspace Learning with Applications to Imaging
10:15 Poster*	Konstantinos Zygalakis	Explicit Stabilised Methods and Efficient Bayesian Computation by Proximal Markov Chain Monte Carlo
10:15 Poster*	Marcelo Pereyra	Maximum Likelihood Estimation of Regularisation Parameters in Imaging Problems - an Empirical Bayesian Approach
10:15 Poster*	Jason McEwen	Radio-Interferometric Imaging with Uncertainties

11:00 Free Time
17:00 Coffee

* With coffee

Wednesday Feb 6, 17:30 – 20:30

Comprehensive and Multimodality Medical Imaging

Chair: Prof. Ricardo Otazo

17:30 Keynote	**Marc Kachelrieß**	**The New Era of Computed Tomography**
18:05 **Talk**	Li Feng	Extra-Dimensional (XD) MRI: how can we GRASP more?
18:30 **Talk**	Peder Larson	Technical Advances in Simultaneous PET/MR Imaging
18:55 **Talk**	Cornelis van den Berg	MRI-Guided Radiotherapy: Seeing What to Treat!
19:20 **Talk**	Rebecca Ramb	On the Strength of Academic-Industrial Collaboration and the Translation of Academic Methods into Clinical Practice
19:45 **Poster***	Ida Häggström	DeepPET: a Deep Encoder-Decoder Network for Directly Solving the PET Image Reconstruction Inverse Problem
19:45 **Poster***	Bjorn Stemkens	MRI Methods to Achieve Real-Time 3D Tracking in MRI-Guided Radiotherapy
19:45 **Poster***	Philippe Ciuciu	Z-Variable-Density Stack of 2D SPARKLING for Isotropic High Resolution T_2* MRI at 7 Tesla
19:45 **Poster***	Roberto Duarte	Self-Calibration for Magnetic Resonance Fingerprinting

20:45 Dinner

* With aperitif

Thursday Feb 7, 8:00 – 11:00

Astrostatistics in the Era of Large Surveys

Chair: Prof. Michael Hobson

08:00 **Keynote**	**Andrew Casey**	**Inferring Stellar Multiplicity from Noise**
08:35 **Talk**	Michael Hobson	Nested Sampling: New Methods and Applications
09:00 **Talk**	Sébastien Fabbro	Deep Learning for Stellar Spectroscopy Surveys
09:25 **Talk**	Peter Melchior	Pixel Fusion: Modeling the Sky with All Available Data
09:50 **Talk**	Lauren Anderson	Inferring the 3D Dust Map of the Milky Way using a Gaussian Process
10:15 **Poster***	Boris Leistedt	Hierarchical SED Modeling and Self-Calibration for Photometric Redshifts
10:15 **Poster***	Florian Führer	Bayesian Reconstruction of the Cosmological Dark Matter Flow
10:15 **Poster***	Matthew A. Price	Sparse Bayesian Mass-Mapping with Uncertainties

11:00 Free Time
17:00 Coffee

* With coffee

Thursday Feb 7, 17:30 – 20:30

Computational Biomedical Imaging

Chair: Prof. Ulugbek Kamilov

17:30 Keynote	Demetri Psaltis	*Learning, Neural Networks and Optics*
18:05 Talk	Laurent Jacques	Structured Illumination and Variable Density Sampling for Compressive Fourier Transform Interferometry
18:30 Talk	Arrate Muñoz Barrutia	Fully Automatic Segmentation of Exosomes in Transmission Electron Microscopy Images
18:55 Talk	Audrey K. Bowden	Computing Attenuation with OCT
19:20 Talk	Jean-Philippe Thiran	Inverse Problems in Ultrasound Imaging: Efficient Modeling, Sparse Regularization and Neural Networks
19:45 Poster*	Denis Fortun	Multiview Reconstruction with Unknown Poses for 3D Fluorescence Microscopy
19:45 Poster*	Emrah Bostan	Learning-Optimized Imaging Models for Optical Phase Retrieval
19:45 Poster*	Adrien Besson	An Echo-Nomic Approach to Localization
19:45 Poster*	Alin Achim	Super-Resolution OCT Based on α-Stable Distributions and Sparse Representations

20:30 Best Contribution Awards
21:00 Workshop Dinner

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