Gregory J. Ongie

CONTACT INFORMATION

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RESEARCH INTERESTS

Exploring the interface of machine learning and compressed sensing for large-scale problems arising in imaging, especially in the case of missing, noisy, or corrupted data. Learning low-complexity models for image reconstruction, and the design, analysis, and implementation of efficient optimization algorithms to do so.

Applications to image reconstruction in biomedical imaging, including accelerated dynamic and functional magnetic resonance imaging, limited angle and low-dose computed tomography, and super-resolution microscopy.

EDUCATION

University of Iowa, Iowa City, IA

Ph.D., Applied Mathematical and Computational Sciences, July 2016

- Thesis Topic: *Off-the-grid Compressive Imaging*
- Advisor: Mathews Jacob, Ph.D.

M.S., Mathematics, Aug 2011

Coe College, Cedar Rapids, IA

B.S., Mathematics and Physics, May 2008

RESEARCH EXPERIENCE

Postdoctoral Scholar Aug. 2018 to present
Department of Statistics,
University of Chicago
Supervisor: Rebecca Willett, Ph.D

- Machine learning for inverse problems
- Applied algebraic geometry for data science

Postdoctoral Scholar Sept. 2016 to July 2018
Department of Electrical Engineering and Computer Science,
University of Michigan
Supervisors: Laura Balzano, Ph.D & Jeff Fessler, Ph.D.

- Learning non-linear models with missing data
- Algebraic variety models for matrix completion
- Online algorithms for image reconstruction in MRI
- Adaptive sampling for low-rank plus sparse models
- Efficient optimization algorithms for large-scale imaging problems

Research Assistant Jan 2013—July 2016
Department of Electrical and Computer Engineering,
University of Iowa
Supervisor: Mathews Jacob, Ph.D.

- Continuous domain compressed sensing with applications in MRI
- Multi-dimensional super-resolution imaging
- Efficient algorithms for structured low-rank matrix completion
- Extensions of total variation image regularization for inverse problems in imaging
- Non-convex optimization methods for image reconstruction in medical imaging

Teaching Experience

Guest Lecturer Nov 2017

University of Michigan

- Gave two lectures in a graduate-level matrix methods course for engineers on the topic of low-rank matrix completion.

Research Experience for Undergraduates (REU) Mentor June–Aug 2011

University of Iowa

Supervisor: Palle Jorgensen, Ph.D.

- Led a group of four upper-level undergraduate students on an image processing research project

Teaching Assistant

Calculus I for Biology Students	Fall 2009
Calculus I	Spring 2010
Honors Calculus II	Fall 2010
Multivariable Calculus for Engineers	Spring 2011
Calculus II	Fall 2013

Journal Publications

1. **G. Ongie**, L. Balzano, D. Pimentel-Alarcon, R. Willett, & R. Nowak. "Tensor Methods for Non-linear Matrix Completion." 2018. IEEE Journal of Selected Topics in Signal Processing. *Under review.*

2. **G. Ongie** and M. Jacob. "Convex Recovery of Continuous Domain Piecewise Constant Images from Non-Uniform Fourier samples." IEEE Transactions on Signal Processing, 66(1), 236-250, 2018.

3. **G. Ongie** and M. Jacob. "A Fast Algorithm for Convolutional Structured Low-Rank Matrix Recovery." IEEE Transactions on Computational Imaging, 3(4), 535-550. 2017.

4. **G. Ongie** and M. Jacob. "Off-the-grid Recovery of Piecewise Constant Images from Few Fourier Samples." SIAM Journal of Imaging Sciences, 9(3), 1004–1041. 2016.

5. **G. Ongie** and M. Jacob. "Recovery of Discontinuous Signals Using Group Sparse Higher Degree Total Variation." Signal Processing Letters, 22(9), 1414-1418. 2015.

6. Y. Moshin, **G. Ongie**, and M. Jacob, "Iterative Shrinkage Algorithm for Patch Smoothness Regularized Medical Image Recovery." IEEE Transactions on Medical Imaging. 2015.

7. **G. Ongie***, Y. Hu*, S. Ramani, M. Jacob."Generalized Higher Degree Total Variation." IEEE Transactions on Image Processing, 23(6), 2423-2435. 2014. **equal authorship*

Conference Publications

1. **G. Ongie**, D. Hong, D. Zhang, L. Balzano. "Online Estimation of Coherent Subspaces with Adaptive Sampling." IEEE Statistical Signal Processing Workshop. Freiburg, Germany. 2018.

2. **G. Ongie**, N. Murthy, L. Balzano, J. Fessler. "A Memory-efficient Algorithm for Large-scale Sparsity Regularized Image Reconstruction." The Fifth International Conference on Image Formation in X-Ray Computed Tomography. Salt Lake City, Utah. 2018.

3. **G. Ongie**, D. Hong, D. Zhang, L. Balzano. "Enhanced Online Robust PCA via Adaptive Sensing" Asilomar Conference on Signals, Systems, and Computers. Pacific Grove, CA. 2017.

4. D.L. Pimentel-Alarcon, **G. Ongie**, L. Balzano, R. Willett, R. Nowak. "Low Algebraic Dimension Matrix Completion" Allerton Conference on Communication, Control, and Computing. Urbana-Champaign, IL. 2017.

5. **G. Ongie**, S. Dewangan, J. Fessler, L. Balzano. "Online Dynamic MRI Reconstruction via Robust Subspace Tracking." IEEE Global Conference on Signal and Information Processing (GlobalSIP). Montreal, Canada. 2017.

6. **G. Ongie**, R. Willett, R. Nowak, L. Balzano. "Algebraic Variety Models for High-Rank Matrix Completion." International Conference on Machine Learning (ICML). Syndey, Australia. 2017.

7. **G. Ongie**, J. Shi, & J. Fessler. "Efficient Computation of Regularized Field Map Estimates in 3D." IEEE International Symposium on Biomedical Imaging (ISBI). Melbourne, Australia. 2017.

8. **G. Ongie**, S. Biswas, & M. Jacob. "Structured Low-rank Recovery of Piecewise Constant Signals with Performance Guarantees." IEEE International Conference on Image Processing (ICIP). Phoenix, AZ. 2016.

9. A. Balachandrasekaran, **G. Ongie**, & M. Jacob. "Accelerated Dynamic MRI Using Structured Low Rank Matrix Completion." IEEE International Conference on Image Processing (ICIP). Phoenix, AZ. 2016.

10. **G. Ongie** and M. Jacob. "A Fast Algorithm for Structured Low-Rank Matrix Recovery with Applications to Undersampled MRI Recovery." IEEE International Symposium on Biomedical Imaging (ISBI). Prague, Czech Republic. 2016.

11. **G. Ongie** and M. Jacob. "Recovery of Piecewise Smooth Images from Few Fourier Samples." Sampling Theory and Applications (SampTA). Washington, D.C. 2015.

12. **G. Ongie** and M. Jacob. "Super-resolution MRI Using Finite Rate of Innovation Curves." IEEE International Symposium on Biomedical Imaging (ISBI). Brooklyn, NY. *Best student paper award winner.*

13. **G. Ongie**, Y. Hu, M. Jacob. "Higher Degree Total Variation for 3-D Image Recovery." International Symposium on Biomedical Imaging (ISBI). Beijing, China. 2014.

14. Y. Moshin, **G. Ongie**, M. Jacob. Accelerated MRI Using Iterative Non-local Shrinkage. Annual Conference of the Engineering in Medicine and Biology Society (EMBC). Chicago, IL. 2014.

Awards

- D.C. Spriestersbach Outstanding Dissertation Prize in the Mathematical, Physical Sciences and Engineering, University of Iowa, 2018.
- Small Groups funding at the Alan Turing Institute: "Theoretical and computational aspects of super-resolution in higher dimensions," with A. Eftekhari, J. Tanner, and H. Tyagi, 2017.
- Travel Grant for IEEE International Conference on Image Processing (ICIP), 2016.
- Best Student Paper Award: "Super-resolution MRI using finite rate of innovation curves," IEEE/EMBS International Symposium on Biomedical Imaging, 2015.
- Presidential Fellowship, University of Iowa. 2008–2013
  - Five year fellowship, including three full years of financial support.
- Phi Beta Kappa Membership, Coe College. 2008.

Presentations

Invited Talks

- "Matrix Completion with Non-Linear Models,"
  CMO-BIRS workshop: "Beyond Convexity", Oaxaca, Mexico. Oct 2017
- "Learning Non-linear Models with Missing Data"
  Alan Turing Institute, London, UK. Sept 2017
- "Low Algebraic Dimension Matrix Completion"
  Numerical Analysis Seminar, Oxford University, Oxford, UK. Sept 2017
- "Off-the-grid Compressive Imaging,"
  Applied Math Seminar, Michigan State University, East Lansing, MI. Aug 2016
- "Improved Multi-dimensional MRI with Co-prime Sampling,"
  Co-Prime Sensing Basic Research Challenge Program Review. May 2015
  George Mason University, Fairfax, Virginia.
- "Off-the-grid Compressive Imaging,"
  CSP Seminar, University of Michigan, Ann Arbor, MI. April 2016
- "Off-the-grid Compressive Imaging,"
  ICES Seminar, University of Texas, Austin, TX. March 2016

Conference Talks

- SIAM Annual Meeting (SIAM AN18),
  Portland, Oregon. July 2018
- International Symposium on Mathematical Programming (ISMP),
  Bordeaux, France. July 2018
- Global Conference on Signal and Information Processing (GlobalSIP).
  Montreal, Quebec. Nov 2017
- Asilomar Conference on Signals, Systems, and Computers Oct 2017
- International Conference on Machine Learning (ICML).
  Sydney, Australia. Aug 2017
- International Conference on Image Processing (ICIP).
  Phoenix, AZ. Sept 2016
- SIAM Imaging Sciences (SIAM IS16).
  Albuquerque, NM. May 2016
- International Symposium on Biomedical Imaging (ISBI).
  Prague, Czech Republic. April 2016
- Sampling Theory and Applications (SampTA),
  Washington, D.C. May 2015
- International Symposium on Biomedical Imaging (ISBI).
  Brooklyn, NY. May 2015
- International Symposium on Biomedical Imaging (ISBI).
  Beijing, China. May 2014

Poster Presentations

- SAMSI Workshop on the Interface of Optimization and Statistics Feb 2017
  Duke University.
- IMA Workshop on Optimization and Parsimonious Modeling. Jan 2016
  University of Minnesota.
- Co-Prime Sensing Basic Research Challenge Program Review. May 2015
  George Mason University, Fairfax, Virginia.

Public Outreach Talks

- Lindsay Seminar. Coe College, Cedar Rapids, IA. May 2012 & 2013.

Professional Activities

Conference special sessions:

- Co-organizer with S. Ravishankar & J. Fessler: "Smart Imaging Systems". International Symposium on Biomedical Imaging (ISBI), 2018.
- Co-organizer with L. Balzano: "Structured and Covariance Matrix Recovery". Asilomar Conference on Signals and Systems, 2017.

Technical paper reviewer:

- Applied and Computational Harmonic Analysis
- IEEE Transactions on Signal Processing
- IEEE Transactions on Pattern Analysis and Machine Intelligence
- IEEE Transactions on Medical Imaging
- IEEE Transactions on Computational Imaging
- IEEE Selected Topics in Signal Processing
- IEEE Signal Processing Letters
- IEEE Access
- Magnetic Resonance in Medicine,
- Information Processing Letters, Elsevier
- Journal of Computational and Graphical Statistics
- PLOS ONE
- Proceedings of the International Symposium on Biomedical Imaging, 2015–2018.

Service

Heartland Talks Liaison — Oct 2011—Feb 2012

- Coordinated graduate student talks at nearby universities.

Graduate and Undergraduate Student Seminar Co-chair — Jan 2011 – Dec 2011

- Organized a student-run seminar to engage undergraduates in advanced mathematics.