# Jonathan Mei


**Contact** Phone: (617) 820-8493 Email: jonathanmei@gmail.com


**Research Interests** Computer Vision, Signal and Image Processing, Computational Sensing, Sparse Optimization, Spectral Graph Theory, Statistical Machine Learning

**Education**

### Carnegie Mellon University

**PhD,** Electrical and Computer Engineering Aug 2013 – May 2018
Adviser: José M. F. Moura
Thesis: "Principal Network Analysis"
GPA: 3.9/4.0

### Massachusetts Institute of Technology

**MEng,** Electrical Engineering Aug 2012 – May 2013
Adviser: Vivek K. Goyal
Thesis: "Algorithms for 3D Time-of-Flight Imaging"
GPA: 5.0/5.0

**BS,** Electrical Engineering Aug 2009 – May 2013
GPA: 4.8/5.0

**Research and Professional Experience**

### Visby Camera Corp.

*Research Engineer* Sept 2018 – Current

- Photorealistic encoding of holographic video
  - Developing compressed representation of light field time series data via computer vision and image processing
  - Applying temporal denoising techniques that respect geometric priors
  - Deploying containerized processing pipeline on cloud
  - Optimizations leading to a 6x reduction in encoding computation time (and thus cost in cloud) with no loss of fidelity

### CMU, Moura Lab Group

*Research Assistant* Sept 2013 – June 2018

- Developed models to describe complex network processes, efficient algorithms for learning the models, and theoretical performance results on learned models
  - Application to Discrete Signal Processing on Graphs with theoretical analysis of high-dimensional statistical performance
  - Estimation results for convex formulation of non-parametric (non-linear) and low-rank (latent variable) processes
  - Novel formulation and algorithms to discover Time-Varying network structure via extension of regularized Principal Component Analysis (PCA)
  - Empirical performance on various graph topologies in real applications to: neuroimaging, US temperature and weather, NYC taxis, Pittsburgh bicycles
- Supervised undergraduate student project implementing and using my algorithms to analyze large datasets

### Google, Daydream

*Software Engineering Intern* May 2017 – Sept 2017
Dec 2017 – Current

- Virtual Reality
  - Neural Network Engineering: demonstrated compressibility of memory footprint, leading to 10x reduced computation complexity; visualized and interpreted encoding of the hidden layers using domain knowledge
  - Controller tracking: Used non-parametric machine learning to improve performance of position estimation; developed sensor fusion framework to incorporate novel sensing architecture with traditional denoising and outlier detection/correction

  - Headset tracking: Designed tracking algorithm on simple, cheap, and compact sensing architecture for world positioning
- Computational Sensing: Analyzed theoretical noise performance of novel 3D camera hardware architecture and reconstruction algorithm

### Northrop Grumman, Aerospace Sector, Basic Research Group
*Technical Intern* May 2016 – Aug 2016

- Learning and planning for multi-vehicle search and rescue scenario
  - Implemented fast sparse tree-search planning for approximately solving POMDPs
  - Extended deep Q-learning architecture to partially observable domain, incorporating deep predictive modeling

### NYU, Center for Urban Science and Progress
*Research Intern* June 2014 – Aug 2014

- Automatically discover anomalous NYC traffic events using Discrete Signal Processing on Graphs

### MIT Lincoln Laboratory, Wideband Tactical Networking Group
*Research Intern* June 2013 – Aug 2013

- Created robust JPEG watermarking scheme using Compressed Sensing for lossy wireless communications networks

### MIT, Signal Transformation and Information Representation Group
*Research Assistant* June 2012 – June 2013

- Created framework for estimating features directly from planar scenes with Sub-Nyquist sampling
- Developed algorithm for jointly unwrapping and denoising time-of-flight images using Generalized Approximate Message Passing

*Undergraduate Researcher* Jan 2012 – June 2012

- Implemented forward modeling simulations for diffuse imaging architecture

## Teaching Experience

### CMU, Signals and Systems Course
*Teaching Assistant* Sept 2016 – Dec 2016

- Head TA: Designed recitations for all TAs, worked with instructors to write exam, held exam review sessions
- General duties: Taught two weekly recitations, held weekly tutorials and office hours, graded exams

### CMU, Fundamentals of Mathematics for ECE Course
*Teaching Assistant* Sept 2015 – Dec 2015

- Head TA: Designed recitations for all TAs, coordinated HW solutions from graders, worked with instructors to write exam
- General duties: Taught two weekly recitations, held weekly tutorials and two weekly office hours, graded exams

### MIT, Signals, Systems, and Information Technology Course
*Head Teaching Assistant* Jan 2012 – May 2012

- Taught graduate students as an undergraduate
- Wrote weekly homework sets and solutions, edited and revised exams
- Prepared and led weekly recitation discussions

## Publications

### Journal Articles

1) **J. Mei**, J. M. F. Moura. "Principal Network Analysis." *In Preparation for IEEE Transactions on Signal Processing.*
2) **J. Mei**, J. M. F. Moura, "SILVar: Single Index Latent Variable Models." *IEEE Transactions on Signal Processing 66 (11) 2790-2803. Jun 11, 2018.*

3) **J. Mei**, J. M. F. Moura. "Signal Processing on Graphs: Causal Modeling for Unstructured Data." *IEEE Transactions on Signal Processing 65 (8), 2077-2092. April 15, 2017.*

## Conference Proceedings

1) **J. Mei**, J. M. F. Moura. "Signal Processing on Graphs: Performance of Graph Structure Estimation." *IEEE International Conference on Acoustics, Speech and Signal Processing, Mar. 2016.*
2) **J. Mei**, J. M. F. Moura. "Fitting Graph Models to Data with structure." *Asilomar Conference on Signals, Systems and Computers, Nov. 2015.*
3) **J. Mei**, J. M. F. Moura. "Signal Processing on Graphs: Estimating the Structure of a Graph." *IEEE International Conference on Acoustics, Speech and Signal Processing, Apr. 2015.*
4) **J. Mei**, A. Colaço, A. Kirmani, V. K. Goyal. "Compact, Low-Power 3D Imaging of Simple Planar Scenes Using Parametric Signal Processing." *Asilomar Conference on Signals, Systems and Computers, Nov. 2013.*
5) **J. Mei**, A. Kirmani, A. Colaço, V. K. Goyal. "Phase Unwrapping and Denoising for Time-of-Flight Imaging Using Generalized Approximate Message Passing." *IEEE International Conference on Image Processing, Sept. 2013.*

**Invited Talks and Lectures**

1) "Causal Graph Processes." Lecture for EE 693: Special Topics, University of Hawaii-Manoa, April 2017.
2) "Causal Graph Processes." Barbados Workshop on Graph Signal Processing, Barbados, Feb. 2017.
3) "Signal Processing on Graphs: Estimating the Structure of a Graph." Zhe Jiang University, China, Jun. 2015.
4) "Signal Processing on Graphs: Estimating the Structure of a Graph." Ningbo University, China, Jun. 2015.

**Skills and Courses**

**Graduate Level Coursework**:
Advanced Intro to Machine Learning[1]; Statistical Machine Learning[1]; Convex Optimization[1]; Information Theory[2]; Estimation Detection and Identification[2]; Real Analysis and Lebesgue Integration[3]; Dynamic Systems and Control[4]; Algorithms for Inference[4]; Discrete Stochastic Processes[4]; Discrete Time Signal Processing[4]

**Languages and Frameworks**:
Python, Matlab, R, Java, Docker, AWS, Spark, Keras/TensorFlow

**Awards and Memberships**

- CMU ECE Graduate Organization
  - President (2016 – 2017)
  - Treasurer (2014 – 2016)
- CMU ECE EIS Seminar Student Organizer (2015 – 2016)
- Pittsburgh Chinese School Chorus – Orchestra concertmaster (violin) (2015)
- David and LaVerne Owen-Barakat Graduate Research Fellowship (2014)
- David Adler Memorial Best Thesis Award (2nd Place) – M. Eng. Thesis (2013)
- Eta Kappa Nu Honor Society – Correspondence Secretary (2013)
- IEEE Association – Student Member (2013 – Current)
- Tau Beta Pi Honor Society (2012)
- Florida Sunshine State Scholar – Winner (2009)

[1]CMU Machine Learning Dept
[2]CMU ECE Dept
[3]CMU Math Dept
[4]MIT EECS Dept