Yunpeng Shi

CONTACT INFORMATION

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RESEARCH INTERESTS

3-D Imaging, 3-D Computer Vision, Robust Estimation, Computational Methods, Mathematics of Data Science

EDUCATION

Ph.D. in Mathematics, University of Minnesota Aug 2020
- Advisor: Prof. Gilad Lerman
- Thesis topic: Robust Synchronization and Its Applications in 3D Computer Vision
- Minor in Computer Science

M.S. in Mathematics, University of Minnesota May 2018

B.A. in Mathematics, Honors Program, University of Minnesota May 2015
- Minor in Statistics
- Summa Cum Lauder

POSITIONS

- **Assistant Professor**, Jul 2023 - present
  Department of Mathematics,
  UC Davis
- **Postdoctoral Research Associate**, Sep 2020 - Sep 2023
  Program in Applied & Computational Mathematics (PACM),
  Princeton University,
  Supervised by Prof. Amit Singer
- **Graduate Research Assistant**, June 2019 - May 2020
  School of Mathematics, University of Minnesota
- **MnDrive Graduate Assistant**, June 2018 - May 2019
  Informatics Institute, University of Minnesota
- **Graduate Teaching Assistant**, Sep 2016 - May 2018
  School of Mathematics, University of Minnesota

PUBLICATIONS

"(***α*-*β***)" represents alphabetical order
" * " represents equal contributions

1. (***α*-*β***) Nicholas Marshall, Oscar Mickelin, **Y. Shi** and Amit Singer, Fast Principal Component Analysis for Cryo-EM Images, *Biological Imaging*, 2023.
2. **Y. Shi***, Cole Wyeth* and Gilad Lerman, Robust Group Synchronization via Quadratic Programming. *International Conference on Machine Learning (ICML)*, 2022.
3. **Y. Shi** and Amit Singer, Ab-initio Contrast Estimation and Denoising of Cryo-EM Images. *Computer Methods and Programs in Biomedicine*, 2022.
4. Shaohan Li, **Y. Shi** and Gilad Lerman, Fast, Accurate and Memory Efficient Partial Permutation Synchronization. *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2022.

5. **Y. Shi**, Shaohan Li, Tyler Maunu and Gilad Lerman, Scalable Cluster Consistency Statistics for Robust Multi-object Matching. *International Conference on 3D Vision (3DV)*, **Oral Presentation**, 2021.

6. **(α-β)** Gilad Lerman and **Y. Shi**, Robust Group Synchronization via Cycle-Edge Message Passing. *Foundations of Computational Mathematics*, 2021.

7. **Y. Shi**, Shaohan Li and Gilad Lerman, Robust Multi-object Matching via Iterative Reweighting of the Graph Connection Laplacian. *Conference on Neural Information Processing Systems (NeurIPS)*, 2020.

8. **Y. Shi** and Gilad Lerman, Message Passing Least Squares Framework and its Application to Rotation Synchronization. *International Conference on Machine Learning (ICML)*, 2020.

9. **Y. Shi** and Gilad Lerman, Estimation of camera locations in highly corrupted scenarios: All about that base, no shape trouble. *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2018.

10. **(α-β)** Gilad Lerman, **Y. Shi** and Teng Zhang, Exact camera location recovery by least unsquared deviations. *SIAM Journal on Imaging Sciences*, 2018.

Invited Talks

- *Fast and Robust Methods for Solving Group Synchronization*,
  The Pacific Northwest Seminar
  on Topology, Algebra, and Geometry in Data Science, Nov 2022
  University of Washington & Pacific Northwest National Laboratory, Online
- *3-D Reconstruction in Macro- and Micro-worlds: Challenges and Solutions*,
  IMA Data Science Seminar, University of Minnesota, Minneapolis, MN Oct 2022
- *Ab-initio Contrast Estimation and Denoising of Cryo-EM Images*,
  Flatiron Institute, Online Apr 2022
- *Joint Denoising and Contrast Estimation for Cryo-EM Images*,
  IDeAS Seminar, PACM, Princeton University, Princeton, NJ Dec 2021
- *Robust Group Synchronization via Cycle-Edge Message Passing*,
  IDeAS Seminar, PACM, Princeton University, Princeton, NJ Feb 2020
- *Robust Synchronization via Cycle Consistency Inference*,
  Probability Seminar, University of Minnesota, Minneapolis, MN Nov 2019
- *Exact Camera Location Recovery by Least Unsquared Deviations*,
  Probability Seminar, University of Minnesota, Minneapolis, MN Dec 2017

Conference Presentations

- *Robust Group Synchronization and Iteratively Reweighted Least Squares: How to Escape Local Minima?* (oral presentation),
  SIAM Conference on Optimization, May 2023
  Seattle, WA
- *Robust Rotation Averaging via Quadratic Programming* (oral presentation),
  SIAM Conference on Computational Sciences and Engineering, Mar 2023
  Amsterdam, Netherland
- *Fast Covariance Estimation and Denoising of Cryo-EM Images.*
  (poster presentation)
  IPAM Workshop: *Cryo-Electron Microscopy and Beyond* Nov 2022
  University of California, Los Ageles, CA

- *Fast Covariance Estimation and Denoising of Cryo-EM Images.*
  (flash talk and poster presentation)
  2nd Frontiers in Electron Microscopy for Physical and Life Science — Sep 2022
  Organized by Princeton University, Nature, Nature Methods, Nature Communications and Nature Materials,
  Princeton, NJ

- *Robust Group Synchronization via Quadratic Programming* (spotlight talk),
  International Conference on Machine Learning (ICML), — July 2022
  Baltimore, MD

- *Fast, Accurate and Memory Efficient Partial Permutation Synchronization* (poster presentation),
  IEEE Conference on Computer Vision and Pattern Recognition (CVPR), New Orleans, LA — Jun 2022

- *Joint Denoising and Contrast Estimation for Cryo-EM Images* (oral presentation),
  SIAM Conference on Imaging Sciences, Online — Mar 2022

- *Ab-initio Contrast Estimation and Denoising of Cryo-EM Images* (poster presentation),
  4th International Symposium on Cryo-3D Image Analysis — Mar 2022

- *Scalable Cluster Consistency Statistics for Robust Multi-object Matching* (oral presentation)
  International Conference on 3D Vision (3DV) — Dec 2021

- *Robust Multi-object Matching via Iterative Reweighting of the Graph Connection Laplacian. (poster presentation)*
  Conference on Neural Information Processing Systems (NeurIPS) — Dec 2020

- *Message Passing Least Squares Framework and its Application to Rotation Synchronization. (poster presentation)*
  International Conference on Machine Learning (ICML) — July 2020

- *Estimation of camera locations in highly corrupted scenarios: All about that base, no shape trouble* (poster presentation),
  IEEE Conference on Computer Vision and Pattern Recognition (CVPR), Salt Lake City, UT — Jun 2018

Teaching Experiences

Department of Mathematics, **Princeton University**, NJ, USA

- **Instructor** of Math Alive (APC-199) — Spring 2022
  - ⋆ *Responsibility:*
    teach basic concepts and applications of probability, statistics, epidemiology, cryptography, game theory and machine learning
  - ⋆ *Audience:*
    undergraduates from both humanity and STEM majors, from freshman to senior

School of Mathematics, **University of Minnesota**, MN, USA

- Graduate Teaching Assistant — Sep 2016 - May 2018
  - Linear Algebra with Applications to Differential Equations — Spring 2018
  - Short Calculus — Fall 2017
  - Calculus II — Spring 2017
  - Calculus I — Fall 2016

Patent

- Corruption detection for digital three-dimensional environment reconstruction, US patent — 2020

Professional Services

- **Minisymposium Organizer**:
  Problems and Solutions of 3-D Reconstruction, co-organized with Prof. Gilad Lerman
  SIAM Conference on Computational Science and Engineering, Amsterdam, Netherland, Mar 2023
- **Journal Reviewer**:
  IEEE Transactions on Circuits and Systems for Video Technology (TCSVT)
  IEEE Robotics and Automation Letters (RA-L)
- **Program Committee Member**:
  ICLR 2023, NeurIPS 2022, ICML 2022, AISTATS 2022, ICLR 2022, NeurIPS 2021, AISTATS 2021

Awards

- Travel Award, International Conference on Machine Learning (ICML) — July 2022
- Top Reviewer, International Conference on Artificial Intelligence and Statistics (AISTATS) — Feb 2022
- Vanky Men Fellowship, School of Mathematics, University of Minnesota — Sep 2019
- MnDrive Graduate Research Fellowship in Robotics, Informatics Institute, University of Minnesota — June 2018
- Outstanding Graduate (7 out of 200+), School of Mathematics, University of Minnesota — May 2015
- Top 1, Mathematical Association of America North Central Section Team Competition — Oct 2013

Professional Trainings

- Short Course (two parts) on Inclusion and Diversity:
  Leveraging Race, Equity and Diversity in Higher Education,
  Princeton University — Oct 2022
- NSF/NIH Grant Writing Workshop:
  Pitching Your Project,
  Princeton Writing Program, Princeton University — Sep 2022
- MSRI Summer School:
  Mathematics of Machine Learning,
  University of Washington & Microsoft Research, Seattle, WA — Aug 2019

Open Source Software Contributions

- ASPIRE package for 3-D imaging of protein molecules (in Python)
- Package for the fast expansion into Fourier-Bessel basis (in Python)

Programming Skills

Python, Matlab, Mathematica, R