

Yunpeng Shi

CONTACT INFORMATION	Program in Applied & Computational Mathematics Princeton University Email: yunpengs@princeton.edu Personal Homepage
RESEARCH INTERESTS	3-D Imaging, 3-D Computer Vision, Robust Estimation, 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	<ul style="list-style-type: none">• Postdoctoral Research Associate, Sep 2020 - present 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	“★” represents alphabetical order <ol style="list-style-type: none">1. ★ Nicholas Marshall, Oscar Mickelin, Y. Shi and Amit Singer, Fast Principal Component Analysis for Cryo-EM Images, <i>arXiv preprint</i>, 2022.2. Y. Shi, Cole Wyeth and Gilad Lerman, Robust Group Synchronization via Quadratic Programming. <i>International Conference on Machine Learning (ICML)</i>, 2022.3. Y. Shi and Amit Singer, Ab-initio Contrast Estimation and Denoising of Cryo-EM Images. <i>Computer Methods and Programs in Biomedicine</i>, 2022.4. Shaohan Li, Y. Shi and Gilad Lerman, Fast, Accurate and Memory Efficient Partial Permutation Synchronization. <i>IEEE Conference on Computer Vision and Pattern Recognition (CVPR)</i>, 2022.5. Y. Shi, Shaohan Li, Tyler Maunu and Gilad Lerman, Scalable Cluster Consistency Statistics for Robust Multi-object Matching. <i>International Conference on 3D Vision (3DV)</i>, Oral Presentation, 2021.6. ★ Gilad Lerman and Y. Shi, Robust Group Synchronization via Cycle-Edge Message Passing. <i>Foundations of Computational Mathematics</i>, 2021.7. Y. Shi, Shaohan Li and Gilad Lerman, Robust Multi-object Matching via Iterative Reweighting of the Graph Connection Laplacian. <i>Conference on Neural Information Processing Systems (NeurIPS)</i>, 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. ★ 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 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*.
(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 Jun 2022
(CVPR), New Orleans, LA
- *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	<ul style="list-style-type: none"> • 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 • Honorable Mention, The Mathematical Contest in Modeling (MCM) Feb 2014 • Top 1, Mathematical Association of America North Central Section Team Competition Oct 2013
PROFESSIONAL TRAININGS	<ul style="list-style-type: none"> • IPAM Workshop: <i>Cryo-Electron Microscopy and Beyond</i> University of California, Los Angeles, CA Nov 2022 • Short Course (two parts) on Inclusion and Diversity: <i>Leveraging Race, Equity and Diversity in Higher Education</i>, Princeton University Oct 2022 • NSF/NIH Grant Writing Workshop: <i>Pitching Your Project</i>, Princeton Writing Program, Princeton University Sep 2022 • MSRI Summer School: <i>Mathematics of Machine Learning</i>, University of Washington & Microsoft Research, Seattle, WA Aug 2019
OPEN SOURCE SOFTWARE CONTRIBUTIONS	<ul style="list-style-type: none"> • 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