Abiy Tasissa

Department of Mathematical Sciences
Tufts University
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Education

Ph.D. in Mathematics
Rensselaer Polytechnic Institute, August 2019
Advisor: Professor Rongjie Lai
Thesis: Convex Relaxations: Theory and algorithms, Euclidean distance geometry problem and beyond

M.S. in Aeronautics and Astronautics
Massachusetts Institute of Technology, June 2014
Advisor: Professor Raul Radovitzky
Thesis: On the formation of Friedlander waves in a compressed gas driven shock tube

B.S. in Mathematics
Massachusetts Institute of Technology, June 2012

Research interests

My research focuses on developing scalable and reliable algorithms for challenges in data science and machine learning. I work at the intersection of optimization, high-dimensional probability, numerical linear algebra, and applied harmonic analysis, often leveraging low-dimensional structures in high-dimensional data. Applications of my work include protein structure prediction, sensor localization, and image processing. My current research interests include integrating experimental constraints into AI models and designing robust algorithms for tracking the trajectories of moving targets.

Academic Employment

Assistant Professor — September 2021 - Present
Department of Mathematics, Tufts University

Assistant Professor — September 2023 - Present
Department of Computer Science (Secondary), Tufts University

Visiting Scholar — February 15, 2025 – Present
Department of Industrial and Systems Engineering, University of Southern California

Norbert Wiener Assistant Professor — September 2019 - August 2021
Department of Mathematics, Tufts University

Affiliation

Affiliate — March 2023 - Present
MIT NSF AI Institute for Artificial Intelligence and Fundamental Interactions (IAIFI)

Journal Articles

1. Waltenegus Dargie, Christian Poellabauer, and **Abiy Tasissa**. "Prediction of the Power of Low-Power Networks Using Inertial Sensors". In: *IEEE Transactions on Instrumentation and Measurement* 74 (2025), pp. 1–10

2. Marshall Mueller, Murphy James M, and **Abiy Tasissa**. "Locality Regularized Reconstruction: Structured Sparsity and Delaunay Triangulations". In: *Sampling Theory, Signal Processing, and Data Analysis* (2024)

3. Ahmed Ali Abbasi, Shuchin Aeron, and **Abiy Tasissa**. "Alternating Minimization algorithm for unlabeled sensing and linked linear regression". In: *Signal Processing* 232 (2025), p. 109927

4. Ipsita Ghosh, **Abiy Tasissa**, and Christian Kümmerle. "Sample-Efficient Geometry Reconstruction from Euclidean Distances using Non-Convex Optimization". In: *NeurIPS 2024*. 2024

5. **Abiy Tasissa**, Emmanouil Theodosis, Bahareh Tolooshams, and Demba Ba. "Discriminative reconstruction via simultaneous dense and sparse coding". In: *Transactions on Machine Learning Research* (2024)

6. Samuel Lichtenberg and **Abiy Tasissa**. "Localization from structured distance matrices via low-rank matrix recovery". In: *IEEE Transactions on Information Theory* (2024)

7. Samuel Lichtenberg and **Abiy Tasissa**. "A dual basis approach to multidimensional scaling". In: *Linear Algebra and its Applications* 682 (2024), pp. 86–95.

8. **Abiy Tasissa**, Pranay Tankala, James M Murphy, and Demba Ba. "K-Deep Simplex: Manifold Learning via Local Dictionaries". In: *IEEE Transactions on Signal Processing* (2023).

9. Demba Ba, Akshunna S Dogra, Rikab Gambhir, **Abiy Tasissa**, and Jesse Thaler. "SHAPER: Can You Hear the Shape of a Jet?" In: *Journal of High Energy Physics* (2023).

10. Ahmed Ali Abbasi, **Abiy Tasissa**, and Shuchin Aeron. "R-local unlabeled sensing: A novel graph matching approach for multiview unlabeled sensing under local permutations". In: *IEEE Open Journal of Signal Processing* 2 (2021), pp. 309–317.

11. **Abiy Tasissa** and Rongjie Lai. "Low-rank matrix completion in a general non-orthogonal basis". In: *Linear Algebra and its Applications* 625 (2021), pp. 81–112.

12. **Abiy Tasissa** and Rongjie Lai. "Exact reconstruction of euclidean distance geometry problem using low-rank matrix completion". In: *IEEE Transactions on Information Theory* 65.5 (2018), pp. 3124–3144.

13. **Abiy F Tasissa**, Martin Hautefeuille, John H Fitek, and Raúl A Radovitzky. "On the formation of Friedlander waves in a compressed-gas-driven shock tube". In: *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences* 472.2186 (2016), p. 20150611.

Peer-Reviewed Conference Proceedings

1. Waltenegus Dargie, Sajad Farrokhi, **Abiy Tasissa**, and Christian Poellabauer. "Identification of Deployment Environments Based on Link Quality Fluctuation Patterns". In: *International Conference on Computer Communications and Networks 2025*. IEEE. May 2025

2. Chandra Kundu, **Abiy Tasissa**, and HanQin Cai. "Structured Sampling for Robust Euclidean Distance Geometry". In: *2025 59th Annual Conference on Information Sciences and Systems (CISS)*. 2025, pp. 1–6

3. Scott Fullenbaum, Marshall Mueller, **Abiy Tasissa**, and James M. Murphy. "Nonlinear unmixing of hyperspectral images via regularized Wasserstein dictionary learning." In: *IGARSS*. 2024, pp. 8289–8294

4. Scott Fullenbaum, Marshall Mueller, **Abiy Tasissa**, and James M. Murphy. "Hyperspectral Image Clustering Via Learned Representation In Wasserstein Space". In: *IGARSS 2024 - 2024 IEEE International Geoscience and Remote Sensing Symposium*. 2024, pp. 8791–8796

5. Marshall Mueller, Shuchin Aeron, James M Murphy, and **Abiy Tasissa**. "Geometrically Regularized Wasserstein Dictionary Learning". In: *Topological, Algebraic and Geometric Learning Workshops 2023*. PMLR. 2023, pp. 384–403

6. Mattthew E Werenski, Ruijie Jiang, **Abiy Tasissa**, Shuchin Aeron, and James M Murphy. "Measure Estimation in the Barycentric Coding Model". In: *International Conference on Machine Learning*. PMLR. 2022, pp. 23781–23803

7. Ahmed Ali Abbasi, **Abiy Tasissa**, and Shuchin Aeron. "r-Local Unlabeled Sensing: Improved Algorithm and Applications". In: *ICASSP 2022-2022 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*. IEEE. 2022, pp. 5593–5597

8. **Abiy Tasissa**, Pranay Tankala, and Demba Ba. "Weighed l1 on the Simplex: Compressive Sensing Meets Locality". In: *2021 IEEE Statistical Signal Processing Workshop (SSP)*. IEEE. 2021, pp. 476–480

9. **Abiy Tasissa**, Duc Nguyen, and James M Murphy. "Deep diffusion processes for active learning of hyperspectral images". In: *2021 IEEE International Geoscience and Remote Sensing Symposium IGARSS*. IEEE. 2021, pp. 3665–3668

Abstract-Reviewed Conference Proceedings

1. Samuel Lichtenberg and **Abiy Tasissa**. "Nystrom-based Localization in Precision Agriculture Sensors". In: *16-th International Conference on Precision Agriculture*. 2024

2. Lukai Li, James M Murphy, and **Abiy Tasissa**. "Sparse Coding for Classification via a Locality Regularizer with Applications to Agriculture". In: *16-th International Conference on Precision Agriculture*. 2024

Peer-Reviewed Workshop Papers

1. Jonathan Huml, **Abiy Tasissa**, and Demba Ba. "Sparse, Geometric Autoencoder Models of V1". In: *NeurIPS 2022 Workshop on Symmetry and Geometry in Neural Representations*. 2022

2. Chandler Mack Smith, Samuel P Lichtenberg, HanQin Cai, and **Abiy Tasissa**. "Riemannian Optimization for Euclidean Distance Geometry". In: *OPT 2023: Optimization for Machine Learning*. 2023

Preprints under Review

1. Chandler Smith, HanQin Cai, and **Abiy Tasissa**. "Riemannian Optimization for Non-convex Euclidean Distance Geometry with Global Recovery Guarantees". In: *IEEE Transactions of Information Theory* (2024). In review.

Seminar and Conference Presentations

- **Localization from Structured Distance Matrices Via Low-rank Matrix Recovery**
  NSF CompMath Meeting 2025. University of Utah, Utah. May 8, 2025.
- **From missing distances to structures: Theory, algorithms and applications**
  Probability and Statistics Seminar. University of Southern California, CA. April 11, 2024.
- **From missing distances to structures: Theory, algorithms and applications**
  CAM Colloquium. Cornell University, NY. November 22, 2024.

- **Localization from Structured Distance Matrices Via Low-rank Matrix Recovery**
  SIAM Conference on Mathematics of Data Science. Atlanta, GA. October 25, 2024.
- **Nyström-based Localization in Precision Agriculture Sensors**
  International Conference on Precision Agriculture. Manhattan, KS. July 23, 2024.
- **A dual basis approach to classical multidimensional scaling**
  NSF CompMath PI Meeting 2024. University of Washington, WA. July 15, 2024.
- **Nyström Method with Missing Distances**
  Conference for African-American Researchers in the Mathematical Sciences. Tufts University, MA. June 27, 2024.
- **A Nyström Method with Missing Distances**
  SIAM Conference on Imaging Science. Atlanta, GA. May 29, 2024.
- **A dual basis approach to classical multidimensional scaling**
  CodEx Seminar. Virtual. February 20, 2024.
- **Local sparse coding on a Delaunay triangulation: structured sensing and stability analysis using distance geometry**
  Stat Seminar. University of Central Florida, FL. Virtual. February 9, 2024.
- **Local sparse coding on a Delaunay triangulation: structured sensing and stability analysis using distance geometry**
  Applied Math Seminar. Worcester Polytechnic Institute, MA. December 7, 2023.
- **Local sparse coding on a Delaunay triangulation: structured sensing and stability analysis using distance geometry**
  Mathematics of Machine Learning Seminar. UMass Amherst, MA. October 13, 2023.
- **Local Sparse coding via a Delaunay triangulation**
  Workshop on Computational and Data Science. Duke University, NC. August 17, 2023.
- **Locally Sparse Representations via Structured Triangulations**
  International Conference on Approximation Theory. Vanderbilt University, TN. May 15, 2023.
- **Sparse coding via a Delaunay triangulation.**
  MIDO seminar. Rensselaer Polytechnic Institute, NY. April 26, 2023.
- **Learning from anchors using graph smoothness**
  Joint Mathematics Meetings. Boston, MA. January 4, 2023.
- **Geometric Sparse Coding with Learned Archetypes: Theory and applications**
  IAIFI seminar. Massachusetts Institute of Technology, MA. October 28, 2022.
- **Active Learning via Learned Local Exemplars**
  SIAM Conference on Mathematics of Data Science. San Diego, CA. Virtual. September 30, 2022.
- **Matrix Sensing under Structured Deterministic Measurements**
  SIAM Annual Meeting. Pittsburgh, PA. July 13, 2022.
- **K-Deep Simplex: Structured Manifold Learning with Simplex Constraints**
  - NE Tripods event. Tufts University, MA. March 25, 2022.
  - AMS sectional meeting. Tufts University, MA. Virtual. March 19, 2022.
  - Tufts Computational and Applied Math Seminar. Tufts University, MA. November 1, 2021.
  - ECE Seminar. University of California, Santa Barbara, CA. Virtual. May 28, 2021.
  - Mathematics of Data & Decisions Seminar. University of California, Davis, CA. Virtual. May 11, 2021.

- **General Matrix Completion: Theory and Applications**
  SIAM Conference on Applied Linear Algebra. Virtual. May 21, 2021.
- **A Low-rank Matrix Completion Approach for the Euclidean Distance Geometry Problem**
  SIAM Conference on Mathematics of Data Science. Virtual. June 1, 2020.
- **Reconstructing Point Sets using Low-rank Regularization**
  Tufts Computational and Applied Math Seminar. Tufts University, MA. October 1, 2019.
- **A Matrix Completion Framework for the Euclidean Distance Geometry Problem**
  CRISP seminar. Harvard University, MA. September 18, 2019.
- **A Matrix Completion Framework for the Euclidean Distance Geometry Problem**
  DIMACS Workshop on Optimization in Distance Geometry. Rutgers University, NJ. June 26, 2019.
- **Convex Relaxations for the Graph Matching Problem**
  Dynamical systems Seminar. Rensselaer Polytechnic Institute, NY. April 2, 2019.
- **Exact Reconstruction of Euclidean Distance Geometry Problem using Low-rank Matrix Completion**
  - SIAM Annual Meeting. Portland, OR. July 10, 2018.
  - Applied Mathematics Days. Rensselaer Polytechnic Institute, NY. April 8, 2017.
- **An Analysis of Local Coordinates Reconstruction of an Incomplete Manifold using Matrix Completion Theory**
  SIAM Annual Meeting. Portland, OR. July 11, 2018.
- **Modeling and Optimization of Reach and Exposure in Television Advertisements**
  Mathematical Problems in Industry Workshop. New Jersey Institute of Technology, NJ. June 23, 2017.

Grants

- **NSF DMS 2208392 (PI)**
  Nonconvex Models for Structured Sensing: Theory, Algorithms, and Applications, $199,368.

Awards and honors

- Merrin Fund for Faculty Excellence.
  School of Arts and Sciences, Tufts University, 2021-2022.
- Joaquin B. Diaz Prize for ability and research in Mathematics.
  Rensselaer Polytechnic Institute, May 2019.
- Richard and Maureen DiPrima Graduate Research Award in Mathematics.
  Rensselaer Polytechnic Institute, Summer 2017 & Summer 2018.
- Excellence in Undergraduate teaching, Experimental Studies Group.
  Massachusetts Institute of Technology, 2012.
- Best in Mathematics, Bilingual language and Exemplary Effort.
  United World College of South East Asia, Singapore, 2008.

Teaching

Department of Mathematics, Tufts University

- MATH 32 (Calculus I). Fall 2019.

- MATH 70 (Linear Algebra). Fall 2020 (instructor). Practicum lead: Spring 2022 and Fall 2023.
- MATH 123 (Mathematical Aspects of Data Analysis). Summer 2020, Summer 2021, Fall 2020, Spring 2020, Fall 2021.
- MATH 125 (Numerical Analysis). Fall 2022, Fall 2025.
- MATH 126 (Numerical Linear Algebra). Spring 2020, Fall 2021.
- MATH 190 (Topics in Linear Algebra). Spring 2020.
- MATH 190 (Nonlinear optimization). Spring 2023.
- MATH 225 (Numerical analysis). Spring 2024.
- MATH 290 (Matrix analysis and applications). Fall 2023.

Department of Mathematics, Rensselaer Polytechnic Institute

- TA for PDEs of Mathematical Physics. Spring 2019.
- TA for Advanced Calculus. Fall 2018.
- TA for Complex Variables with Applications. Spring 2016.
- TA for Foundations of Applied Mathematics. Fall 2015.
- TA for Introduction to Differential Equations. Spring 2015.
- TA for Multivariable Calculus and Matrix Algebra. Fall 2014.

Massachusetts Institute of Technology

- TA for Mechanics and Structures, Department of Aeronautics and Astronautics. Fall 2013.
- TA for Multivariable Calculus, Experimental Studies Group. Fall 2009 - Spring 2012.
- Instructor for Introduction to Existentialism, Educational Studies Program. Summer 2010.

Mentorship

Ph.D. Student Supervision
Tong Xue, Tufts University. January 2025 - present.
Chandler Smith, Tufts University. September 2022 - present.
Marshall Mueller, Tufts University, co-advised with James Murphy. September 2021 - May 2024.

Masters Student Supervision
Woojoo Na, Tufts University. September 2022 - January 2024.
Samuel Lichtenberg, Tufts University. May 2022 - May 2023.
Abigail Kojoian, Tufts University. September 2022 - May 2023.
Ahmed Ali Abbasi, Tufts University, co-advised with Shuchin Aeron. Summer 2020 - August 2022.
Samuel Rabinowitz, Tufts University, co-advised with Xiaozhe Hu. August 2021 - May 2022.

Senior Honors thesis
Matthew Hudes, Senior Honors Thesis, Tufts University. April 2022 - May 2023.
Lukai Li, Senior Honors Thesis, Tufts University. September 2023 - May 2024.

Undergraduate Research Mentor
Brian Yang, Diamonds Summer Scholar, Tufts University, Summer 2024.
Lukai Li, Tufts University. Spring 2022 - Summer 2023.

Bora Calis, Diamonds Summer Scholar, Tufts University. Summer 2022.
Dashiell Lipsey, Pomona College. Summer 2022.
Rosie Rong, DISC Summer Intern, co-mentored with Anna Haensch. Summer 2022.
Kevin Gao, Tufts University, co-mentored with Shuchin Aeron. Summer 2021.
Thomas Liam, Tufts Summer Scholars, Tufts University. Summer 2020.
Duc Nguyen, Tufts University, co-mentored with James Murphy. Fall 2019, Spring 2020.

Thesis Defense Committees
Fan Tian, Tufts. Ph.D Thesis Defense. 2025.
Luca Grossman. Senior Honors Undergraduate Thesis Defense. 2024.
Scott Fullenbaum. Senior Honors Undergraduate Thesis Defense. 2024.
Samuel Polk, Tufts. Ph.D Thesis Defense. 2022.
Maximilian Mattessich, Tufts. MS Thesis Defense. 2022.
Yongqi Zhang, Tufts. Senior Honors Undergraduate Thesis Defense. 2022.

Committee

Member, AMS Data Committee, January 2022 - January 2025.

Conference & Seminar Organizer

- SIAM Conference on Mathematics of Data Science. Co-organizer of special session "Computational and Statistical Aspects of Distance-Based Dimension Reduction". October 2024.
- SIAM Conference on Imaging Science. Co-organizer of special session "Advances in Low-dimensional Representations in Data and Imaging Science". May 2024.
- AMS Sectional Meeting. Co-organizer of special session "Mathematics of Data Science". March 2022.
- Statistics, Information and Learning Seminar, Tufts University. Co-organizer. September 2021 - May 2022.
- SIAM Conference on Mathematics of Data Science. Co-organizer of special session "Statistics and Machine Learning for the Euclidean Distance Geometry Problem". May 2020.
- Tufts University Applied Mathematics Seminar. Co-organizer. January 2019- present.

Editorship

Guest Associate Editor, special issue on "Low-rank Priors Meet Optimization: Theory, Algorithms and Applications", Frontiers in Applied Mathematics and Statistics, 2023.

Referee Service

IEEE Transactions of Signal Processing, IEEE Transactions of Neural Networks, Foundations of Data Science, IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), International Conference on Artificial Intelligence and Statistics (AISTATS), IEEE Transactions on Neural Networks and Learning Systems, Signal Processing, Algorithmica, Big Data, Mathematical and Scientific Machine Learning (MSML), IEEE International Workshop on Machine Learning for Signal Processing, La Matematica, IEEE Access, International Conference on Computer Vision

Panel Service and Outreach

Mathematical Moments from the AMS. This program aims at communicating mathematics and science to K-12 students. Video title: Smashing Particles up Against Mathematics. Spring 2024.
Link: `https://www.youtube.com/watch?v=8pnfC-v1g7A`

Tufts Institute for AI (TIAI) Scientific ML Panel, Tufts University. April 2022.
Science, Technology, and Society Lunch Seminar, Tufts University. November 2019.

Grant Review Panel Service

US National Science Foundation (2023, 2024, 2025)

Tufts Service

- Member of Graduate Committee Department of Mathematics
  Tufts University. September 2025 - Present.
- Member of Curriculum Committee Department of Mathematics
  Tufts University. September 2022 - May 2024.
- Member of Graduate Committee
  Department of Mathematics, Tufts University. September 2021 - May 2022.
- Member of the Outreach Committee
  Department of Mathematics, Tufts University. September 2019 - August 2020.

Membership

Society of Applied and Industrial Mathematics (SIAM)
American Mathematical Society (AMS)

Professional Experience

Graduate Intern — Summer 2019
GE Global Research, Niskayuna, NY

Research Assistant — Janurary 2015 - June 2019
Department of Mathematics, Rensselaer Polytechnic Institute

Graduate Intern — Summer 2015
Aramco Services Company, Cambridge, MA

Research Assistant — June 2012 - June 2014
MIT Institute for Soldier Nanotechnologies

Undergraduate Research Assistant — Summer 2011
MIT Institute for Soldier Nanotechnologies

Undergraduate Research Assistant — Summer 2010
Department of Mathematics, MIT