Ahmad Mousavi

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Positions

- **American University** Washington, DC
  Assistant Professor, Department of Mathematics and Statistics 2024-Present
  Affiliate Faculty, Institute of Artificial Intelligence, Kogod School of Business 2024-Present
  Faculty Fellow, Center for Data Science, School of Public Affairs 2026-Present
  Professorial Lecturer, Department of Mathematics and Statistics 2023-2024
- **University of Florida** Gainesville, FL
  Postdoctoral Associate, Informatics Institute 2021-2023
- **University of Minnesota** Minneapolis, MN
  Industrial Postdoctoral Fellow, Institute for Mathematics and its Applications 2019-2021

Research Summary

I am an Assistant Professor of Data Science in the Department of Mathematics and Statistics at American University, where my recent research focuses on large language models, multimodal learning, and NLP applications in social media analysis and healthcare. I also have a strong background in sparse optimization and machine learning, including kernel-free quadratic classifiers and penalty decomposition algorithms, as well as in mathematical finance and decentralized bilevel programming.

A unifying theme of my research is the development of scalable, interpretable, and robust algorithms that bridge theoretical optimization with real-world data science challenges. My publications span both methodological contributions and domain-specific applications, reflecting a commitment to advancing data science across theory, practice, and interdisciplinary collaboration.

For more details, please see my Google Scholar profile: https://scholar.google.com/citations?user=IStw0S4AAAAJ&hl=en

Research Interests

- General: Natural Language Processing, Machine Learning, Deep Learning, Sparse Optimization, Large Scale Optimization, Mathematical Finance, Mathematical Modeling, Quantum Computing, and Numerical Linear Algebra.

- Specific (not restricted to): Support Vector Machines, Penalty Decomposition Method, ℓ_1-Minimization, Greedy Algorithms, Semidefinite Programming, ADMM, Inexact Newton's Methods, Matrix Decomposition, Linear Programming, and so on.

Education

- **University of Maryland, Baltimore County** Baltimore, MD
  Ph.D. in Applied Mathematics 2013-2019
  - Advisor: Prof. Jinglai Shen
  - Thesis topic: Topics in Sparse Recovery via Constrained Optimization: Least Sparsity, Solution Uniqueness, and Constrained Exact Recovery
- **University of Maryland, Baltimore County** Baltimore, MD
  M.Sc. in Applied Mathematics 2013-2015
- **Sharif University of Technology** Tehran, Iran
  M.Sc. in Applied Mathematics 2008-2011
  - Advisor: Prof. Nazam Mahdavi-Amiri
  - Thesis topic: An Inexact Newton Method for Nonconvex Equality Constrained Optimization
- **University of Guilan** Rasht, Iran
  B.Sc. in Applied Mathematics 2004-2008

Selected Papers

Journal Articles

15. Yeganeh Abdollahinejad, Sayed Mohsin Reza, B. Ashwini, and **Ahmad Mousavi**. "Systematic Literature Review of Machine Learning Methods for Emotion Recognition Using EEG and Physiological Signals in Healthcare." *IEEE Access* (2026). `https://ieeexplore.ieee.org/document/11475400`.

14. Hossein Moosaei, Milan Hladík, **Ahmad Mousavi**, Zheming Gao, and Haojie Fu. "Quadratic Surface Twin Support Vector Machine for Imbalanced Data." *International Journal of Machine Learning and Cybernetics* 17, no. 5 (2026): 250. `https://link.springer.com/article/10.1007/s13042-026-03059-8`.

13. **Ahmad Mousavi**, Maziar Salahi, and Zois Boukouvalas. "Sparse Extended Mean-Variance-CVaR Portfolios with Short-Selling." *Japan Journal of Industrial and Applied Mathematics* 43, no. 1 (2026): 12. `https://link.springer.com/article/10.1007/s13160-025-00760-z`.

12. Yeganeh Abdollahinejad, **Ahmad Mousavi**, P. Siaplaouras, Zois Boukouvalas, and Roberto Corizzo. "EMO-CARE: EEG Multi-Scale Temporal Modeling with Channel-Aware Feature Attention for Robust Subject-Independent Emotion Recognition." *IEEE Open Journal of the Computer Society* (2026). `https://ieeexplore.ieee.org/document/11348088`.

11. **Ahmad Mousavi** and George Michailidis. "Cardinality Constrained Mean-Variance Portfolios: A Penalty Decomposition Algorithm." *Computational Optimization and Applications* (2025). https://doi.org/10.1007/s10589-025-00653-4.

10. Parvin Nazari, **Ahmad Mousavi**, Davoud Ataee Tarzanagh, and George Michailidis. "A Penalty-Based Method for Communication-Efficient Decentralized Bilevel Programming." *Automatica* 173 (2024): 112039. https://doi.org/10.1016/j.automatica.2024.112039.

9. **Ahmad Mousavi** and George Michailidis. "Statistical Proxy Based Mean-Reverting Portfolios with Sparsity and Volatility Constraints." *International Transactions in Operational Research* (2024). https://doi.org/10.1111/itor.13442.

8. Hossein Moosaei, **Ahmad Mousavi**, Milan Hladík, and Zheming Gao. "Sparse Universum Quadratic Surface Support Vector Machine Models for Binary Classification." *Soft Computing* (2023). https://doi.org/10.1007/s00500-023-07860-3.

7. Hassan Rezapour, Ramin Nasiri, and **Ahmad Mousavi**. "The Hyper-Zagreb Index of Trees and Unicyclic Graphs." *Iranian Journal of Mathematical Sciences and Informatics* 18, no. 1 (2023): 41–54. https://ijmsi.ir/browse.php?a_id=1356.

6. **Ahmad Mousavi**, Zheming Gao, Lanshan Han, and Alvin Lim. "Quadratic Surface Support Vector Machine with L_1 Norm Regularization." *Journal of Industrial and Management Optimization* 18, no. 3 (2022): 1835–1861. https://doi.org/10.3934/jimo.2021046.

5. **Ahmad Mousavi** and Jinglai Shen. "A Penalty Decomposition Algorithm with Greedy Improvement for Mean-Reverting Portfolios with Sparsity and Volatility Constraints." *International Transactions in Operational Research* (2022). https://doi.org/10.1111/itor.13123.

4. Sai Popuri, Nagaraj Neerchal, Amita Mehta, and **Ahmad Mousavi**. "Density Estimation Using Entropy Maximization for Semi-Continuous Data." *Digital Signal Processing* 116 (2021): 103107. https://doi.org/10.1016/j.dsp.2021.103107.

3. **Ahmad Mousavi**, Mohammad Mehdi Rezaee Taghiabadi, and Ramin Ayanzadeh. "A Survey on Compressive Sensing: Classical Results and Recent Advancements." *Journal of Mathematical Modeling* 8, no. 3 (2020): 309–344. https://jmm.guilan.ac.ir/article_4155.html.

2. **Ahmad Mousavi** and Jinglai Shen. "Solution Uniqueness of Convex Piecewise Affine Functions Based Optimization with Applications to Constrained ℓ_1 Minimization." *ESAIM: Control, Optimisation and Calculus of Variations* 25 (2019): 56. https://doi.org/10.1051/cocv/2019007.

1. Jinglai Shen and **Ahmad Mousavi**. "Least Sparsity of p-Norm Based Optimization Problems with $p > 1$." *SIAM Journal on Optimization* 28, no. 3 (2018): 2721–2751. https://doi.org/10.1137/17M1140066.

Conference Papers

1. Javad Rajabi, Sunday Okechukwu, **Ahmad Mousavi**, Roberto Corizzo, Charles C. Cavalcante, Zois Boukouvalas. Event-Based Multi-Modal Fusion for Online Misinformation Detection in High-Impact Events. Proceedings of the IEEE International Conference on Big Data, 2024. https://ieeexplore.ieee.org/abstract/document/10826054

Non-Peer-Reviewed Manuscripts

7. Yeganeh Abdollahinejad, **Ahmad Mousavi**, Naeemul Hassan, Kai Shu, Nathalie Japkowicz, Shahriar Khosravi, and Amir Karami. "MOMENTA: Mixture-of-Experts Over Multimodal Embeddings with Neural Temporal Aggregation for Misinformation Detection." arXiv preprint arXiv:2604.16172 (2026). https://arxiv.org/abs/2604.16172

6. **Ahmad Mousavi**, Morteza Kimiaei, Saman Babaie-Kafaki, Vyacheslav Kungurtsev. An Efficient Penalty Decomposition Algorithm for Minimization over Sparse Symmetric Sets. arXiv, 2026. https://arxiv.org/abs/2601.12383

5. **Ahmad Mousavi**, Yeganeh Abdollahinejad, Roberto Corizzo, Nathalie Japkowicz, Zois Boukouvalas. E-CaTCH: Event-Centric Cross-Modal Attention with Temporal Consistency and Class-Imbalance Handling for Misinformation Detection. arXiv, 2025. https://arxiv.org/pdf/2508.11197

4. **Ahmad Mousavi**, Ramin Zandvakili, Zheming Gao. Sparse ℓ_0-Norm Kernel-Free Quadratic Surface Support Vector Machines. arXiv, 2025. https://arxiv.org/pdf/2501.11268

3. Ramin Ayanazadeh, **Ahmad Mousavi**, Narges Alavisamani, Moinuddin Qureshi. Enigma: Privacy-Preserving Execution of QAOA on Untrusted Quantum Computers. arXiv, 2024. https://arxiv.org/abs/2311.13546

2. Jinglai Shen, **Ahmad Mousavi**. Exact Support and Vector Recovery of Constrained Sparse Vectors via Constrained Matching Pursuit. arXiv, 2019. https://arxiv.org/abs/1903.07236

1. Ramin Ayanzadeh, **Ahmad Mousavi**, Milton Halem, Tim Finin. Quantum Annealing Based Binary Compressive Sensing with Matrix Uncertainty. arXiv, 2019. https://arxiv.org/abs/1901.00088

Books

- Hassan Rezapour and **Ahmad Mousavi**. Probability and Statistics (A Comprehensive Book for M.S. Nationwide Examination in Economics and Management Fields, Sobhan-e Mehr Publication, 2013, In Farsi).

Honors and Awards

- Associate Postdoctoral Fellowship, Informatics Institute, University of Florida.
- Industrial Postdoctoral Fellowship, Institute for Mathematics and its Applications (IMA), University of Minnesota.
- Outstanding Graduate Research Award in Mathematics, College of Natural and Mathematical Sciences, UMBC, 2019.
- Lodging Support to Attend Foundation of Data Science Summer School, Georgia Institute of Technology, 2019.
- Full Graduate Assistantship from Department of Mathematics and Statistics, University of Maryland, Baltimore County, 2013-2019.
- ICERM Travel and Lodging Support to Attend Optimization Methods in Computer Vision and Image Processing Workshop, Providence, Rhode Island, USA, 2019.

- ICERM Lodging Support to Attend Computational Imaging Workshop, Providence, Rhode Island, USA, 2019.
- SIAM Student Travel Award to Attend SIAM Annual Meeting, Portland, Oregon, USA, 2018.
- UMBC Graduate School Professional Development Grant to Attend SIAM Annual Meeting, 2018, Portland, Oregon, USA.
- UMBC Graduate School Professional Development Grant to Attend Optimization Methods in Computer Vision and Image Processing Workshop, Providence, Rhode Island, USA, 2019.
- Ranked 13th in Nationwide Entrance Examination for Ph.D. Program in Mathematics, Iran, April 2011.
- Ranked 16th among 10763 Participants in the Nationwide Entrance Examination for M.S. Program in Mathematics, Iran, February 2008.
- Ranked 4th among Fellow M.S. Students in Applied Mathematics, Department of Mathematical Sciences, Sharif University of Technology.
- Ranked 1st among Fellow B.S. Students, Faculty of Mathematical Sciences, The University of Guilan.
- Accepted with Full Reimbursement for Autumn School Algorithmic Optimization, Trier University, 2016 (However, I could not attend).

Work Experience

- Research and Development Intern, Precima, R&D division, Chicago, IL, Summer 2019.

Teaching Experience

- DATA 441/641: Applied Natural Language Processing, spring 2025.
- DATA 442/642: Advanced Machine Learning, Fall 2024.
- STAT 427/627: Machine Learning, Spring 2024, Fall 2024, Spring 2025
- DATA 412/612: Statistical Programming in R, Fall 2023, Spring 2024.
- MATH 225: Introduction to Differential Equations, Summer and Winter 2018, and Winter 2019.

Supervising Experience

- **Data Science Practicum:**
  - *Fall 2024:* Yen-Chun Lin, Sean Hsu, Ting Yi Chuang, and Po-Yu Lai.
    Fairness in Imbalanced Data — Guided students in exploring Universum-based quadratic and linear SVM models to address bias in imbalanced datasets, with applications such as fraud and disease detection.
  - *Spring 2025:* Meet Patel, Dwanith Venkat Girish.
    Neural Network Pruning — Supervised the development and evaluation of structured and unstructured pruning methods to improve the efficiency and scalability of deep learning models.

  - *Fall 2025:* Peter Ozo-Ogueji, Kaitlin Works-Figueroa, Aidan Hennesey.
    Multimodal Misdiagnosis Detection — Led students in designing an AI system integrating clinical notes, laboratory data, and medical imaging using deep learning and reinforcement learning to proactively identify diagnostic errors.
  - *Spring 2026-Present:* Kennya Jiles, Kaitlin Works-Figueroa, Aidan Hennesey.
    Chronic Disease Detection — Led students in designing an AI system integrating clinical notes, laboratory data, and medical imaging using deep learning methods to detect chronic diseases at early stages.

- **Capstone:**
  - *Fall 2024:* Spencer Grewe.
    Understanding U-Net Architecture — Supervised a detailed architectural and empirical analysis of U-Net for biomedical image segmentation.

- **External and Cross-Institutional Supervision:**
  - *Spring 2026-Present:* Katherine Lessard (American University), Yanjia Zhang (George Mason University), Pooja Jitendra Shah (George Mason University), Sai Praneet Reddy Chinthala (George Mason University), co-supervised with Dr. Lindi Liao (George Mason University).
    Fair Bilevel Optimization with Synthetic Data for Collaborative Classification — Guiding students in developing and implementing an efficient bilevel optimization algorithm for fairness-aware collaborative learning using synthetic data generation.
  - *Spring 2025-Present:* Yeganeh Abdollahinejad (Pennsylvania State University).
    Robust Multi-Modal and Multi-Scale Learning under Distribution Shift — Leading and mentoring the development of advanced attention-based architectures for subject-independent EEG emotion recognition (EMO-CARE) and event-centric cross-modal misinformation detection (E-CaTCH). Provided conceptual guidance on multi-scale temporal modeling, channel-aware and cross-modal attention mechanisms, temporal consistency regularization, and class-imbalance handling. Supervised theoretical framing, algorithm design, experimental validation under rigorous evaluation protocols, and manuscript preparation for peer-reviewed publication.
  - *Fall 2025–Present:* Mohammed Toufikuzzaman (Pennsylvania State University), co-supervised with Dr. Dongwon Lee (Pennsylvania State University).
    Sparse Bilevel Augmented Lagrangian for Unlearning — Mentoring the student in understanding, implementing, and extending the Sparse Bilevel Augmented Lagrangian framework for machine unlearning with theoretical and computational analysis.

Review Experience

- Review for the following journals and conferences: Neural Networks, NeurIPS, IEEE Signal Processing, Journal of Optimization Theory and Applications, Mathematical Methods of Operations Research, Optimization Methods and Software, Digital Signal Processing, Physica A: Statistical Mechanics and its Applications, Numerical Algorithms, Set-Valued and Variational Analysis, Mathematical Problems in Engineering, Infor: Information Systems and Operational Research, Complex and Intelligent Systems, and so on.

Conference/Workshops Presentation and Attendance

- (Attendance) StatConnect@AI, Georgetown University, Washington, DC, USA, 2026.
- (Attendance) NeurIPS 2025, San Diego, CA, USA, 2025.
- (Attendance) IEEE International Conference on Data Mining (ICDM 2025), Washington, DC, USA, 2025.
- (Attendance) Workshop on Intersections between Control, Learning, and Optimization, UCLA, Los Angeles, CA, USA, 2019.
- (Poster Presentation) Solution Uniqueness of Convex Piecewise Affine Functions Based Optimization with Applications to Constrained ℓ_1 Minimization, Princeton Day of Optimization, 2018; ICERM Computational Imaging Workshop, 2019; ICERM Optimization Methods in Computer Vision and Image Processing Workshop, 2019.
- (Presentation) Some Topics in Sparse Optimization, `http://www.norbertwiener.umd.edu/seminars/`, The Norbert Wiener Center, University of Maryland, College Park, MD, USA, 2018.
- (Presentation) Solution Uniqueness of Convex Piecewise Affine Functions Based Optimization with Applications to Constrained ℓ_1 Minimization, `http://meetings.siam.org/sess/dsp_programsess.cfm?SESSIONCODE=65264`, SIAM Annual Meeting, Portland, OR, USA, 2018.
- (Attendance) SIAM Annual Meeting, Pittsburgh, PA, USA, 2017.
- (Presentation) A Mathematical Introduction to Compressive Sensing, University of Maryland, Baltimore County, Optimization Seminar, Baltimore, MD, USA, 2016.
- (Attendance) American Mathematical Society Spring Eastern Sectional Meeting, Baltimore, MD, USA, 2014.
- (Attendance) 3rd and 4th Workshop on Optimization and its Applications, Tehran, Iran, 2011 and 2012.
- (Attendance) 3rd and 4th International Conference of Iranian Operations Research Society, Tehran and Rasht, Iran, May 2010 and 2011.
- (Attendance) 40th Annual Iranian Mathematics Conference, Tehran, Iran, 2009.

Service

- Member, CAS AI Steering Committee, American University, Fall 2025 – Present.
  - I also serve as a member of both the Student Engagement and Scholarship Group and the Responsible AI Group within the committee.
- Member, Student Research Committee, Department of Mathematics and Statistics, American University, Fall 2025 – Present.
- Judge, *Smith Analytics Consortium Datathon*, Robert H. Smith School of Business, University of Maryland (UMD-American University student analytics competition sponsored by Deloitte), 2025 and 2026.
- Vice President, Mathematics and Statistics Graduate Student Association (MSGSA), University of Maryland, Baltimore County, 2015.
- Orientation Advisor, University of Maryland, Baltimore County, Summer 2017.

Miscellaneous

- **Computer Skills**
  - R
  - Python
  - MATLAB
  - LaTeX
  - Microsoft Office
- **Memberships**
  - Society for Industrial and Applied Mathematics (SIAM)
  - IEEE (Regular Member)