Majid Farhadloo

Contact Information

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Research Interest

Machine Learning, Data Mining, Graph Neural Networks, Computer Vision, Natural Language Processing, Spatial Data Mining, Bioinformatics, Computational Biology, Spatial-Enabled AI

Education

University of Minnesota, Twin Cities (UMN) Aug. 2019 - Expected May 2025
Ph.D. Candidate in Computer Science
Advised by Prof. Shashi Shekhar

University of Minnesota, Twin Cities (UMN) Sept. 2019 - May 2022
MS in Computer Science
Advised by Prof. Shashi Shekhar

California State University, Fresno (Cal State Fresno) Sept. 2017 - May 2019
BS in Computer Science

Appointments

Graduate Research Assistant Jan. 2021 - Present
Department of Computer Science and Engineering, UMN

Graduate Teaching Assistant Sept. 2019 - May 2021
Department of Computer Science and Engineering, UMN

Technical Skills

- **Languages:** Python, Java, C++, R, SQL, Android.
- **Machine Learning:** PyTorch, OpenCV, Matlab Deep Learning Tools, Google Colab.
- **Big Data:** Apache Spark, Hadoop, Hive, HDFS, PySpark.
- **DevOps:** Git, Agile Methodologies, WordPress.

Research & Work Experience

Graduate Research Assistant, UMN, Twin Cities May 2023 - Present
Towards Spatially-Lucid AI Approach in Non-Euclidean Space

- Developed a novel spatial ensemble framework for spatially-lucid classification, extending spatially-explainable classification by incorporating modeling of spatial variability.
- Developed a spatial domain adaptation sub-network to address insufficient learning samples and inherent heterogeneity across spatial domains in oncology.
- A case study highlights the impact of spatial variability on tumor classification, with cellular interactions ranging from location-independent to location-specific.

Graduate Research Assistant, UMN, Twin Cities Jan. 2021 - Present
Towards Spatially-Explainable AI Classification for Biomedical Data

- Developed a novel spatially-explainable deep neural network architecture for classifying cellular maps (e.g., MxIF), yielding substantial accuracy and interpretability compared to SOTA methods.
- Developed a dynamic point pair prioritization sub-network to learn the most discriminative features in N-way spatial relationships effectively.
- Discovered previously unknown spatial patterns linked to tumor progression and treatment response on a large-scale cancer dataset.

Graduate Research Assistant, UMN, Twin Cities March 2020 - Sept. 2020
Understanding COVID-19 Effects on Mobility Patterns

- Investigated the impact of COVID-19 on travel distance, the number of visitors to points of interest, and time spent at home, along with discovering hangout hotspots and monitoring policy intervention compliance.

- Collaborated on designing an Entity Relationship diagram, system architecture, and implementation to support queries on long-duration visits in addition to fine-resolution device count maps to understand spatial bias.
- Collaborated on the design of a community-engaged decision support platform based on a collaboration with end-users and policymakers and evaluated the system by providing custom summary reports and time-series visualizations.

Undergraduate Thesis Research, Cal State Fresno Jan. 2019 - May 2019
Machine Vision for Grape Detection in Vineyard

- Improve crop production monitoring and optimization by tackling the challenges of image segmentation in viticulture.
- Investigated the efficacy of 11 pre-trained deep neural network architectures in retraining a new classifier for grape detection.
- Evaluated the extent to which data augmentation impacts the performance of a DNN architecture.
- Investigated the impact of the input feature space (e.g., color images, histograms of the colors) using Transfer Learning.

Granville Homes LLC, Fresno May 2018 - May 2019
Developer intern

- Developed portfolios for business partners with the focus on integrating advanced custom fields (ACF) into WordPress content management to reduce the necessity of front-end developers to maintain and update web pages regularly.
- Explored ArcGIS toolkit integrated with data science, developed custom maps to efficiently display and render statistical quantification of tracts and fields for housing construction.

Publications

SAMCNet: Towards a Spatially Explainable AI Approach for Classifying MxIF Oncology Data. Farhadloo, M., Molnar, C., Luo, G., Li, Y., Shekhar, S., Maus L. R., Markovic, S., Moore, R., and Leontovich A. In Proceedings of KDD '2022: The 28th ACM SIGKDD International Conference on Knowledge Discovery Data Mining (SIGKDD 2022).

Contrasting Spatial Co-location Discovery: A Case Study for Analyzing MxIF Oncology Imagery. Li, Y., *, **Farhadloo, M.,***, Krishnan. S., Xie, Y., Frankel, T.L., Shekhar, S., and Rao, A. 2022. In Proceedings of the (BigSpatial '22): 10th ACM SIGSPATIAL International Workshop on Analytics for Big Geospatial Data (***equal contribution**) **(Best Paper Award)**

SRNet: A spatial-relationship aware point-set classification method for multiplexed pathology images. Li, Y., **Farhadloo, M.**, Krishnan, S., Frankel, T. L., Shekhar, S., and Rao, A. In Proceedings of the (DeepSpatial '21): 2nd ACM SIGKDD Workshop on Deep Learning for Spatiotemporal Data, Applications, and Systems. Vol. 10. 2021.

Eco-PiNN: A Physics-informed Neural Network for Eco-toll Estimation. Li, Y., Yang, M., Eagon, M., **Farhadloo, M.**, Xie, Y., Northrop, W., and Shekhar, S. SIAM International Conference on Data Mining (SDM'23), 2023.

Understanding COVID-19 Effects on Mobility: A Community-Engaged Approach. Sharma, A., **Farhadloo, M.**, Li, Y., Kulkarni., A., Gupta., Y., and Shekhar S. AGILE GIScience 2022.

An Introduction to Spatial Data Mining. Golmohammadi, J., Xie, Y., Gupta, J., **Farhadloo, M.**, Li, Y., Cai, Y., Detor, S., Roh, A., & Shekhar, S. The Geographic Information Science & Technology Body of Knowledge. 2020.

Grape detection with Convolutional Neural Networks. Cecotti, H., Rivera, A., **Farhadloo, M.** , and Villarreal, M. Expert Systems with Applications., 113588., 2020.

A Relational Database for the National Turfgrass Evaluation Program. Xie, Y., **Farhadloo, M.** Guo, N., Shekhar, S., Watkins, E., Kne, L., Bao, H., Patton, A., and Morris, K. International Turfgrass Society Research Journal 14.1 (2022): 316-332.

Ongoing Works

Spatial Computing Opportunities in Biomedical Decision Support: The Atlas-EHR Vision. Farhadloo, M., Sharma, A., Markovic, S., and Shekhar, S. ACM Transactions on Spatial Algorithms and Systems (Under review). **SAMCNet: Towards A Spatially-Explainable AI Classification. Farhadloo, M.**, Shekhar, S., Rao, A., Moore, R., Leontovich A., and Markovic, S. ACM Transactions on Intelligent Systems and Technology (Under review).

Towards Spatially Lucid AI Classification in Non-Euclidean Space: An Application for MxIF Oncology Data.
Farhadloo, M., Gupta, J., Leontovich, A., Markovic, S., and Shekhar, S. (Under review).

Teaching Experience

CSCI 4041 Data Structures and Algorithms — **Spring 2021**
CSCI 5715 Spatial Data Science — **Fall 2020**
CSCI 5708 Advanced Database Systems — **Spring 2020**
CSCI 2011 Discrete Structure — **Fall 2019**
Graduate Teaching Assistant

- Guest Lecturer on topics: Physical Database Design, Trends in Spatial Data Mining
- Designed homework, labs, and exams for classes of over 110+ students.
- Instructed and proctored weekly recitation sessions with over 40+ students.
- Held office hours and answered questions via effective remote and in-person sessions with 4.5 student satisfaction.

Leadership / Volunteership

International Ambassador (IA) | *Cal State Fresno* Aug. 2018 - May 2019

- Assisted in facilitating the adjustment of new international students to the U.S. culture and life at Fresno State.
- Organized monthly fun and informative events for international students with over 50-150 students at each event.

Chevron STEM Zone Instructor | *Chevron, Fresno* Oct. 2018

- Assisted in organizing an interactive space for students, teachers, and parents to learn how science, technology, engineering, and mathematics (STEM) relate to sports and everyday life.

Services and Leadership

Session Chair
SIAM International Conference on Data Mining, 2023.
Reviewer
SIAM DM, SIGSPATIAL, SIGKDD, SSTD, Fragile Earth: Data Science for a Sustainable Planet, Journal of Data & Knowledge Engineering, Journal of IEEE Transactions on Big Data, Geoinformatica.

Awards & Scholarships

Scholarships:

- **Dean Scholarship,** August 2018
  College of Science and Mathematics, Cal State Fresno
- **International Ambassador Scholarship,** August 2018 & January 2018
  International Office, Cal State Fresno
- **Ronald McDonald House Charities,** June 2016

NSF Travel Award: SIAM DM 2023, SIGKDD 2022, SIGSPATIAL 2019