MARIUM YOUSUF

Curriculum Vitae

Email | LinkedIn | Webpage

RESEARCH VISION

Develop efficient methods to infer large-scale complex and dynamical systems using probabilistic graphical approaches for a better understanding of the role of hippocampus in memory consolidation and anticipation.

EDUCATION

Ph.D. in Applied Mathematics (Ph.D. Candidate) expected Spring 2026
University of Arizona, Tucson AZ
Research Keywords: Replay, Effective Connectivity, Causal Discovery, Decision-Flow Diffusion Models

M.S. in Applied Mathematics Fall 2022 - Summer 2023
University of Arizona, Tucson AZ

M.S. in Computer Science Fall 2019 - Spring 2022
University of Arizona, Tucson AZ

B.S. in Mathematical Sciences, *summa cum laude* Fall 2015 - Fall 2017
Northern Illinois University, DeKalb IL

ACADEMIC APPOINTMENTS

PhD Student, University of Arizona (UArizona)

Research

Department of Mathematics Fall 2022 - Present
Explore causal discovery methods to extract functional connectivity between neurons from spike train data containing hippocampal replay instances, using data generated from NEURON.
Advisors: Jean-Marc Fellous, Michael Chertkov

Department of Computer Science Fall 2019 - Spring 2022
Implemented an approximation of the marginal likelihood for a G-Wishart distribution. The project focused on a Bayesian approach to statistical learning of sparse graphical structures using G-Wishart distribution to model different levels of functional brain connectivity.

Instructor

Elements of Calculus, Dept. of Mathematics Summer 2024, Summer 2025
College Algebra, Dept. of Mathematics Spring 2024, Spring 2025
Calculus Preparation, Dept. of Mathematics Fall 2023

Teaching Assistant

Understanding Data, Dept. of Mathematics Spring 2023
College Algebra, Dept. of Mathematics Fall 2022
Discrete Data Structures, Dept. of Computer Science Fall 2019, Yr. of 2021

Graduate Research Aide, Argonne National Laboratory Summers 2021-2023
Project Title: Robust Automation for Connectomics
Developed methods for automated image processing of high-throughput TEM and X-ray mouse brain images in Python, as well as efficient integration with external visualization systems (such as WebKnossos and NeuroGlancer) with the goal of improvement over existing tool chains such as TrakEM2 that require human intervention.

Graduate Research Assistant, Missouri University of Science and Technology
Department of Computer Science Fall 2018 - Summer 2019
Pre-processed and analyzed data collected from dementia patients at Phelps Health, MO to infer the role of sedentary body movements in early diagnosis of dementia.

Pre-Doctoral Intern, Argonne National Laboratory
Leadership Computing Facility April - August 2018
Research Aide
Built Python tools for efficient visualization of real-time data from sensors located in Chicago for an Array of Things project.
Lecturer, Big Data Visualization Camp
Prepared materials on Big-Data visualization using Python and Jupyter Notebook and lectured in a three-day camp for rising high-school seniors.

Undergraduate Research Aide, Argonne National Laboratory
Leadership Computing Facility Summer 2017
Configured Apache Spark in Jupyter Notebook to analyze real-time simulated data for visualization tasks.

Undergraduate Teaching Assistant, Northern Illinois University (NIU)
UNIX and Networking, Dept. of Computer Science Fall 2017

CONFERENCE ACCEPTANCES

Poster Presentation, *National Institute for Theory and Mathematics in Biology* August 2025
Marium Yousuf, Laurent Pagnier, Misha Chertkov, Jean-Marc Fellous (2025, August 11-18). Causality in Replay: Detecting Effective Connectivity from Spike Trains. NITMB MathBio Convergence Conference 2025, The Drake Hotel, Chicago, USA URL

Poster Presentation, *Society for Neuroscience* October 2024
Marium Yousuf, Misha Chertkov, Jean-Marc Fellous (2024, October 5-9). Hippocampal Replay and Sleep's Hidden Language: Methods for Detecting Functional Connectivity from Spike Trains. Neuroscience 2024, Society for Neuroscience, McCormick Place in Chicago, USA URL

Contributed Talk, *Arizona Women's Symposium in Mathematics* September 2024
Marium Yousuf, Misha Chertkov, Jean-Marc Fellous (2024, September 20-21). Hippocampal Replay and Sleep's Hidden Language: Methods for Detecting Functional Connectivity from Spike Trains. AWSiM 2024, Arizona Women's Symposium in Mathematics, Flagstaff, AZ, USA URL

Poster Presentation, *Arizona Women's Symposium in Mathematics* November 2023
Marium Yousuf, Misha Chertkov, Jean-Marc Fellous (2023, November 17-19). Detecting replay in multi-unit spiking data: Bayesian networks. AWSiM 2023, Arizona Women's Symposium in Mathematics, Flagstaff, AZ, USA URL

Poster Presentation, *Society for Neuroscience* November 2023
Marium Yousuf, Misha Chertkov, Jean-Marc Fellous (2023, November 11-15). Detecting replay in multi-unit spiking data: Bayesian networks. Neuroscience 2023, Society for Neuroscience, Washington D.C., USA URL

ADDITIONAL ACADEMIC TRAINING

UArizona Research Training Group Fall 2024, Fall 2025
Funded through NSF-supported research group focused on modern computational methods for data-driven modeling and applications.
Simons Laufer Mathematical Sciences Institute Summer 2025
Selected to attend a summer graduate workshop on Local Limits of Random Graphs held at Université Paris-Saclay Mathematics Institute in France.
Center for the Integration of Research, Teaching, and Learning (CIRTL) Fall 2021 - Present
Completed Level I (*Associate*) and Level II (*Practitioner*) designations in the CIRTL's three-tiered teaching certificate program, with training in evidence-based undergraduate STEM teaching.

PROFESSIONAL DEVELOPMENT

Vice President, SIAM UArizona Chapter 2025-2026
Presenter (invited) Human Augmented Analytics Group, Georgia Institute of Technology April 2025

Presenter (invited), Graduate Interdisciplinary Programs Student Research Showcase, UArizona 2024
Treasurer, SIAM UArizona Chapter 2024-2025
Secured 490 USD funds from the SIAM board and assisted in planning chapter events
Co-organized SIAM mini-conference for graduate students from diverse disciplines
Mentor, STAR Lab, UArizona Fall 2024
Mentoring a high school senior on conducting a research project involving neural data simulation
Panelist, Graduate Teaching Assistants' Orientation and Training, UArizona August 2024
GTA training for incoming graduate students in the Dept. of Mathematics
Mentor, Undergraduate Mathematical Modeling, UArizona Spring 2024
Mentoring undergraduate team for a capstone project on learning language models using Markov Chains
Volunteer, Outreach Program BASIS Oro Valley High School, Oro Valley AZ March 2023, 2024
Brain- and memory-inspired educational activities for 6th-graders
Presenter, Annual Graduate Research Symposium, Intelligent Systems Center, Rolla MO 2019
Volunteer, Hopper for Grace Hopper Conference 2018

AWARDS, HONORS, AND SCHOLARSHIPS

Grogan Scholarship Award (6000 USD), Dept. of Mathematics, UArizona Fall 2025
Herbert E. Carter Travel Award (600 USD, 100 USD), Graduate College UArizona October 2024, 2023
TA of the Month, Dept. of Computer Science, University of Arizona October 2021
Grace Hopper Student Scholar October 2019
Norma K. Stelford Mathematics Endowment, NIU December 2017
(graduating senior in mathematics with the highest GPA)
The Clarence Ethel Hardgrove Mathematics Scholarship, NIU 2015-2016
(incoming transfer with excellent prior record in mathematics)
International Undergraduate Scholarship, NIU Fall 2015 - Fall 2017