Sanah Suri

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Education

Washington University in St. Louis **St. Louis, MO**
Ph.D. in Mathematics | Advisor: Dr. Ari Stern *Expected graduation: May 2025*
Thesis Title: Functional Equivariance of Modified Vector Fields and Conjugate Integrators

Washington Univeristy in St. Louis **St. Louis, MO**
A.M. in Mathematics *May 2022*

Grinnell College **Grinnell, IA**
B.A. in Mathematics (with honors) and Computer Science *May 2020*

Research Interests

Numerical Analysis, Geometric Numerical Integration, Machine Learning, Climate Models, Explainable AI

Publications

A. Stern, and **S. Suri** (2023), Functional Equivariance and Modified Vector Fields, *Journal of Computational Dynamics*, 11 (4), 409-426.

D. Rim, **S. Suri**, S. Hong, K. Lee, R. J. LeVeque (2023), A Stability Analysis of Neural Networks and Its Application to Tsunami Early Warning. Preprint. [EarthArXiv]

M. Chamberland, S. Jing, **S. Suri** (2020), A Generalization of the One-Seventh Ellipse, *Mathematics Magazine*, 93:4, 271-275.

Research Experience

Graduate Researcher (under the guidance of Dr. Ari Stern) **St. Louis, MO**
Washington University in St. Louis *August 2022-Present*

- Progressed theory of F-functional equivariance by developing it for modified vector fields and backward error analysis
- Discovered algebraic characterizations for F-functionally equivariant B-series numerical integrators
- Developed and formalized theory of conjugate F-functional equivariance

Graduate Researcher (under the guidance of Dr. Maike Sonnewald) **Davis, CA**
Computational Climate and Ocean Group, UC Davis *June 2023-Present*

- Explored how effectively ML models learn underlying physics of dynamical systems through the Stommel model for Atlantic Meridional Ocean Circulation (AMOC)
- Implemented numerical integrator to generate theoretical data and trained multilayer perceptron in Keras to predict AMOC direction
- Quantified, using layerwise relevance propagation and SHAP, how physics was learned by model as circulation direction changes

Graduate Researcher (under the guidance of Dr. Donsub Rim) **St. Louis, MO**
Washington Univeristy in St. Louis *August 2022-Present*

- Developed novel low rank expansion of neural networks by linearizing ReLU activation using Householder reflectors thereby greatly reducing the dimension of the input data
- Generated adversarial examples comparable to those found using gradient based state-of-the art algorithms
- Applied expansion to tsunami early warning model to obtain real time prediction of tsunamis from off shore earthquakes

Machine Learning Intern (under the guidance of Dr. Daniel Van Hoesen) **St. Louis, MO**
Impossible Sensing (aerospace startup) *Summer 2022*

- Implemented regression models, support vector machines, and ensemble learning models in PyTorch for exploratory tasks on extracted data from the RRUFF database
- Established novel connection between Raman spectrum of minerals and their oxide composition via convolutional and fully connected neural networks
- The model was deployed in the startup's deep ocean mission, and we are currently working on a manuscript

Teaching Experience

Teaching Assistant **St. Louis, MO**
Washington University in St. Louis *August 2021-May 2024*

- Guided weekly subsections for Calculus 1 and Calculus 3, and facilitated group work for class sizes of 30 students
- Designed interactive worksheets weekly, prepared examination questions and assisted instructional team with grading and extensive feedback
- Coached students through homework problems and exam preparation in calculus, differential equations and statistics on a weekly walk-in basis

Instructor **St. Louis, MO**
Directed Reading Program *Spring 2023, Spring 2024*

- Organized the reading courses 'Introduction to B-Series' and 'Mathematical Machine Learning'
- Mentored undergraduate students interested in graduate level mathematics by assigning course material, giving presentations and facilitating weekly advising style meetings

Presentations

Missouri S&T Applied Math and Statistics Student Seminar **October 2024**
Invited talk

SciCADE 2024 **July 2024**
Invited talk in minisymposium 'Recent Advances in Structure Preserving Numerical Methods'

Midwest Numerical Analysis Day **April 2024**
Invited talk in minisymposium 'Numerical Time Integration'

8th Annual Meeting of SIAM Central States Section **October 2023**
Invited talk on 'Modified Vector Fields and Funtional Equivariance'

Szego Seminar **March 2023**
Expository talk on 'B-Series' in a graduate student seminar

Joint Math Meetings (JMM) **January 2020**
Poster presentation on 'Colorings of Algebraic Structures'

Nebraska Conference for Undergraduate Women in Math (NCUWM) **January 2019**
Talk on 'The One-Seventh Ellipse Problem'

Joint Math Meetings (JMM) **January 2019**
Poster presentation on 'The One-Seventh Ellipse Problem'

Conferences and Workshops

Simons Laufer Mathematical Sciences Institute (formerly MSRI) **Summer 2023**
Graduate summer school on machine learning and topological data analysis at UCSD

Midstates Consortium for Math and Science (MCMS) Undergraduate Research Symposium **November 2022**
Graduate student panelist

7th Annual Meeting of SIAM Central States Section **October 2022**
Attended

SIAM Annual Meeting **July 2022**
Attended

Internship Network in the Mathematical Sciences (INMAS) **October 2021-May 2022**
Workshop spanning academic year 2021-22 training PhD students in Mathematics to develop strong programming, statistics, machine learning and data analysis skills

SAMSI Workshop on Data-Driven Mathematical and Statistical Modeling **Summer 2021**
Intensive workshop held annually on statistical and mathematical modeling using real data culminating in a focused project on Bayesian inference

Midstates Consortium for Math and Science (MCMS) Undergraduate Research Symposium **November 2020**
Graduate student panelist

Honors and Awards

Second Place, WashU Graduate Research Symposium — March 2024
Brian Blank Award for Outstanding Third Year Graduate Student — May 2023
Outstanding Poster at Joint Math Meetings — January 2020
Grinnell College Dean's List — Fall/Spring 2017-2020
Third Place, Iowa Intercollegiate Math Competition — Spring 2018

Skills

Programming: Python, Java, Julia, C, C++, Scheme
Mathematical Software: Mathematica, Maple, Magma, MATLAB
Language: Bilingual in English and Hindi, Limited Working Japanese

Service

President, SIAM Student Chapter at WashU — Fall 2023-Present
Department Representative, Arts and Sciences Graduate Student Association — Fall 2023-Present
Member, Diversity, Equity and Inclusion Committee — 2022-23
Peer Mentor, Department of Mathematics — 2022-2023

Professional Memberships

Member, American Mathematical Society (AMS)
Member, Association for Women in Mathematics (AWM)
Member, Society for Industrial and Applied Mathematics (SIAM)