

# Fangfei (Fei) Lan

Salt Lake City, UT, USA | Norrköping, Sweden

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## EDUCATION

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University of Utah, Salt Lake City, UT  
Ph.D. in Computer Science

Aug. 2019 – present

American University (AU), Washington, DC, Magna Cum Laude  
B.S. in Mathematics with a second major in Computational Science (Minor: Dance)

Aug. 2014 – Dec. 2017

## RESEARCH INTEREST

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Topological data analysis, data visualization, scientific visualization, explainable AI.

## RELEVANT COURSEWORK

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Advanced Algorithms, Parameterized Algorithms and Complexity, Data Visualization, Machine Learning, Data Mining, Information Retrieval, Computer Vision, Computational Topology

## SELECTED ACADEMIC PROJECTS

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Fangfei Lan, Malin Ejdbö, Joachim Moeyens, Bei Wang, Anders Ynnerman, Alexander Bock. **NEOviz: Uncertainty-Driven Visual Analysis of Asteroid Trajectories.** *under review, 2024.*

- Propose a 3D tube structure to characterize the uncertainty of an ensemble of asteroid trajectories
- Implemented interactive visualizations in OpenSpace to facilitate scientific discoveries

Fangfei Lan, Brandi Gamelin, Lin Yan, Jiali Wang, Bei Wang, Hanqi Guo. **Topological Characterization and Uncertainty Visualization for Atmospheric Rivers.**

*Accepted at Eurographics Conference on Visualization (EuroVis), 2024. Computer Graphics Forum, 2024.*

- Propose a topological summary for a catalog Atmospheric River (AR)
- Visualize the uncertainty of an ensemble of ARs using a novel MetroSets-inspired visual encoding

Fangfei Lan, Salman Parsa, Bei Wang. **Labeled Interleaving Distance for Reeb Graphs.**

*Journal of Applied and Computational Topology (APCT), under review, 2024.*

- Define labeled interleaving distance between Reeb graphs
- Prove that the ordinary interleaving distance between Reeb graphs equals the infimum of the labeled interleaving distance over all labelings
- Provide an efficient algorithm to compute the interleaving distance between two contour trees, a special type of Reeb graphs

Fangfei Lan, Sourabh Palande, Michael Young, Bei Wang. **Uncertainty Visualization for Randomized Graph Reduction.**

*IEEE International Conference on Big Data (IEEE BigData), GTA<sup>3</sup>, 2022.*

- Develop uncertainty measures to quantify the uncertainty associated to graph coarsening algorithms
- Visualize the uncertainty in multi-run scenarios of various graph reduction algorithms
- Extract analytical insights from several datasets using our technique and visualization framework

Fangfei Lan, Michael Young, Lauren Anderson, Anders Ynnerman, Alexander Bock, Michelle A. Borkin, Angus G. Forbes, Juna A. Kollmeier, Bei Wang. **Visualization in Astrophysics: Developing New Methods, Discovering Our Universe, and Educating the Earth.**

*Eurographics Conference on Visualization (EuroVis), 2021. Computer Graphics Forum, 2021.*

- Classify visualization in astronomy research from the past decade and summarize the major progress
- Motivate future direction by identifying the research challenges and opportunities

Fangfei Lan, Claudia Landi, Kevin Knudson, Bei Wang. **Multivariate Discrete Stratified Morse Theory.** In preparation, 2024.

- Extend the current framework in multivariate discrete Morse theory and develop discrete stratified Morse theory in the multivariate scenario
- Develop algorithms to efficiently perform multivariate topological data analysis

Fangfei Lan, Youjia Zhou, Stephen Zhang, Bei Wang. **Uncertainty Visualization and Barycenter of Hypergraphs.** In preparation, 2024.

He Chen, Fangfei Lan, Bei Wang, Julien Tierny. **Inverse Merge Tree.** In preparation, 2024.

## RESEARCH EXPERIENCE

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**University of Utah**, Salt Lake City, UT

Graduate Research Assistant

Jan. 2020 – present

Advisor: Bei Wang

Research Interests: Topological data analysis and data visualization

**Linköping University**, Norrköping, Sweden.

Visiting PhD Student

Sept. 2023 – present

Supervisor: Alexander Bock

- Collaborated with the B612 Foundation and the National Museum of Natural History
- Worked on the uncertainty visualization of asteroid orbits

**Argonne National Lab**, Lemont, IL

PhD Research Intern

May 2022 – Aug. 2022

- Worked with climate scientists on quantifying and visualizing the uncertainty of atmospheric rivers
- Proposed topological data analysis and visualization techniques for climate science applications

**AU Department of Mathematics**, Washington, DC

Undergraduate Research Assistant

May 2017 – Oct. 2018

Advisor: Michael Robinson

Project: Acoustics simulation and analysis

- Incorporated advanced physical and mathematical concepts, designed and built software simulations for acoustic instruments in Python
- Analyzed both simulated and real data with dimensionality reduction and clustering techniques
- Presented research results at the February Fourier Talks and the Robyn Rafferty Mathias conference

**SAMSI Statistics Workshop**, Durham, NC

May 2016

- Constructed a variety of statistical models on a MS patient dataset in R (linear, Poisson, quasi-Poisson, Bayesian), compared the results and presented to a panel of postdocs and professors

## PROFESSIONAL EXPERIENCE

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### Medstar Health Research Institute, Hyattsville, MD

Bioinformatics Analyst

Oct. 2018 – Jul. 2019

- Worked with doctors in numerous disciplines to identify valuable research questions and related patient cohorts
- Extracted EHR data from complex medical databases with various SQL languages
- Performed extensive data wrangling in R for datasets up to 13 GB

### Green Connections Media, Washington, DC

Software Developer

Feb. 2018 – Nov. 2018

- Regularly communicated technical principles and design concepts with client
- Designed and normalized a relational database schema, built a web application with HMTL, CSS, the Django REST framework and AJAX

### AU Department of Mathematics, Washington, DC

Mathematics and Statistics Tutor & Grader

Aug. 2015 – Dec. 2017

- Tutored students from Finite Mathematics, Precalculus to Calculus II and Basic Statistics
- Graded homework for Basic Statistics with Calc, Calc II, Calc III, Differential Equations and Number Theory

## TALKS

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Topological Characterization and Uncertainty Visualization of Atmospheric Rivers.

*Summer School on Topological Data Analysis in Visualization. Linköping University, Sweden, 2023.*

Topological Characterization of Atmospheric Rivers.

*AMS Special Session on Applied Topology: Theory and Implementation. Joint Mathematics Meetings, Boston, 2023.*

Uncertainty Visualization for Randomized Graph Reduction.

*SCI Visualization Seminar, University of Utah, 2023.*

## ORGANIZED WORKSHOPS

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AMS Special Session on Models and Methods for Sparse (Hyper) Network Science (a Mathematics Research Communities Session).

*Joint Mathematics Meetings, Boston 2023.*

## SERVICE

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Member of the School of Computing Graduate Student Advisory Committee (GradSAC)

Reviewer for IEEE VIS 2021

Reviewer for IEEE TVCG

## HONARS & AWARDS

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Participant of AMS MRC 2022 on Models and Methods for Sparse (Hyper)Network Science

Participant of 2021 GRA-WP Grad Cohort for Women Workshop

Member of Upsilon Pi Epsilon (international honor society for the computing and information disciplines)

## SKILLS

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*Programming Languages:*

Proficient: Python, R, HTML & CSS, JavaScript (d3.js)

Basic: SQL, Java

*Languages:* Mandarin (native), English (fluent)