Xinran Yu

University of Illinois Urbana-Champaign, Champaign, IL
xinran4@illinois.edu ⋄ +1 (217) 550-2664 ⋄ https://xinrany.github.io/home/

Education

University of Illinois Urbana-Champaign (UIUC), Champaign, IL   2019–2026
Ph.D in Mathematics: Expected May 2026
Research Focus: Conformal geometry, Modifying Einstein's Theory of General Relativity.

University of Liverpool, Liverpool, UK   2015–2017
BSc in Mathematics with Honors
Thesis: Analytic Continuation and Riemann Surfaces. Supervisor: Dr. Jon Woolf.

Xi'an Jiaotong-Liverpool University, Suzhou, China   2013-2015
BSc in Applied Mathematics

Preprints

Properties of Conformally compact Lovelock metrics   2025

This paper explores the properties of conformally compact Lovelock metrics, confirming through elliptic regularity that a formal polyhomogeneity expansion is achieved for metrics close to the hyperbolic ball. It also examines obstructions to polyhomogeneity, the singular Yamabe-$2q$ problem, and the metric filling problem for spin manifolds.

Witten instanton complex and Morse-Bott inequalities on stratified pseudomanifolds   2024
with Gayana Jayasinghe and Hadrian Quan, arxiv 2412.12003

Talks

Dirichlet-to-Neumann map for conformally compact Einstein metrics   Oct 2024
Graduate Student Geometry and Topology Seminar at UIUC

Conformal geometry in Lovelock gravity theories   Apr 2024
AWM Graduate Student Colloquium at UIUC

The fractional Laplacian through Dirichlet problem formulation   Feb 2024
Graduate Geometry and Analysis Seminar at UIUC

The ambient obstruction tensor   Feb 2023
Graduate Geometry and Analysis Seminar at UIUC

Introduction to Einstein-Maxwell equations   Oct 2022
Graduate Geometric Analysis Seminar at UIUC

The renormalized volume of conformally compact Einstein manifolds   Oct 2022
Graduate Geometric Analysis Seminar at UIUC

Einstein filling on hyperbolic ball   Feb 2022
Graduate Analysis Seminar at UIUC

The Yamabe problem   Apr 2021
Graduate Geometry and Topology Seminar at UIUC

Technical Skills

Programming Languages: **Python** (NumPy, Pandas, Matplotlib, Scikit-learn, PyTorch, Statsmodels, Seaborn),
                                 Mathematica

Data Analysis & Modeling: statistical analysis, Partial Differential Equations, machine learning

Languages: **English** (fluent), **German** (translation project experience),
                                 Japanese (intermediate), **Chinese** (native)

Related Courses: PDEs, differential geometry, functional analysis, machine learning, data science analytics

Teaching & Mentoring

Instructor, Calculus II, UIUC   Spring 2025 & 2022
- Delivered three weekly lectures, covering integral calculus, sequences, and series.
- Designed and managed course materials, including syllabus, assignments, quizzes, and exams.
- Provided student support through office hours, in-class discussions, and supplementary resources.

Translation Project, Mathematics Library, UIUC   Winter 2024
- Revised and edited translations of the early 20th-century M. Schilling catalog from German to English.
- Collaborated with library staff to validate the documentation of mathematical models in Altgeld Hall.

Graduate Team Leader, Illinois Math Lab, UIUC   Fall 2024
Project: Documenting Historical Mathematical Models
- Collaborated with the University Library to catalog one of the largest mathmodel collections globally.
- Developing a digital catalog using **Mathematica** for public exhibit and future access.

Teaching Assistant, UIUC   2019–present
- Led discussion sections for introductory and advanced Calculus courses.
- Offered individualized support to students and tutored Differential Equations with a focus on problem-solving.

Projects

Bird-Aircraft collision, Internship network in the mathematical sciences, UIUC   Nov 2024
- Conducted statistical analysis, including multi-linear regression, log regression, and hypothesis testing.
- Modeled damage cost versus altitude and number of strikes using **Python**.

Redfin housing analysis, Internship network in the mathematical sciences, UIUC   Sep 2024
- Analyzed and visualized Redfin housing data using **Python**.

Safety Analysis of Autonomous Vehicles, ECE471 mini project, UIUC   Sep 2024
- Analyzed AV safety using simulated data from Carla and real-world data from the California DMV.
- Used statistical analysis, Bayesian inference, and data visualization to assess and improve AV reliability.

Goodreads data analysis, PI4 Bootcamp, UIUC   June 2020
- Analyzed reading patterns and book rating trends in **Python**.
- Revealed insights into user behavior and preferences.

Multi-soliton wave simulation, Illinois Geometry Lab, UIUC   Fall 2019
Led a team simulating multi-soliton interactions and created graphics and reports in **Python**.

Services & Enrichment

Microlocal Analysis and Quantum Dynamics 2024   Summer 2024
Northwestern summer school

International TA Panel Panelist, UIUC   Aug 2022
- Shared strategies for overcoming language barriers and improving communication as an international TA.
- Compared teaching practices between the U.S. and other countries, emphasizing adaptability.
- Offered advice on navigating cultural differences in academic expectations and classroom management.

Staff-Student Liaison Committee Member, University of Liverpool   2016–2017
- Provided student feedback to improve the Mathematics departments curriculum and resources.
- Acted as a liaison between students and staff, collaborating with faculty to address student concerns.

Honors & Awards

Ruth V Shaff & Genevie I. Andrews Fellowship, UIUC   Spring 2024
Teachers Ranked as Excellent by their Students, UIUC   Spring and Fall 2021