Xinran Yu

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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

Projects

Analysis of US Mortality Data, Internship network in the mathematical sciences, UIUC Feb 2025
- Performed data cleaning, exploratory analysis, and visualization to highlight mortality trends using **Python**.
- Built predictive models (decision trees, random forests, KMeans, neural networks) to explore causes of death.

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**.

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.

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)

Honors & Awards

Ruth V Shaff & Genevie I. Andrews Fellowship, UIUC Spring 2024

Teachers Ranked as Excellent by their Students, UIUC Spring and Fall 2021

Wills Prize in Mathematics, University of Liverpool Jul 2017

IMA Prize, University of Liverpool Jul 2017

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 — 2024–2025
Project: Documenting Historical Mathematical Models
- Collaborated with the University Library to catalog one of the worlds largest mathematical model collections.
- Created detailed descriptions for the math librarys digital catalog using Mathematica to support public online exhibits and long-term accessibility.
- Developing educational materials and 3D print files for an outreach initiative aimed at promoting mathematical visualization.

Graduate Team Leader, Illinois Geometry Lab, UIUC — Fall 2019
Project: Simulating Multi-Soliton Solutions to NLS and KdV and Studying Interactions
- Simulated multi-soliton solutions to the nonlinear Schrdinger (NLS) equation with nonzero boundary conditions
- Used **Python** for data visualization and model creation.
- Supervised mid-semester presentation and open house event and led final report.

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.

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

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.