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 Einsteins 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

Articles

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.

Stratified Morse-Bott inequalites, with Gayana Jayasinghe and Hadrian Quan 2025

We used Witten deformation of deRham complex to prove a Morse inequality for Morse-Bott functions on Thom-Mather stratified spaces.

Talks

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

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

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

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

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

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

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

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

Honors & Awards

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

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

Wills Prize in Mathematics, University of Liverpool, Liverpool, UK Jul 2017

IMA Prize, University of Liverpool, Liverpool, UK Jul 2017

University Academic Achievement Award, Xi'an Jiaotong-Liverpool University, Suzhou, China 2014–2015

Technical Skills

Programming Languages: Python (NumPy, Pandas, Scikit-learn, PyTorch), Mathematica

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

Languages: English (fluent), German (intermediate), Japanese (intermediate), Chinese (native)

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

Teaching & Mentoring

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

- Delivered stand-alone lectures for Calculus II, managing course content and assessments.
- Led discussions for introductory and advanced Calculus courses, providing individualized support to students.
- Tutored Differential Equations, offering guidance 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

- Participated in workshop covering **Python**, statistical analysis, machine learning, and career preparation.
- 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.
- Employed statistical analysis and Bayesian inference to assess and enhance AV reliability.
- Utilized data parsing, visualization, and probabilistic analysis techniques.

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, Champaign, IL 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, Liverpool, UK 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.