# Karen Medlin

Ph.D. Candidate in Applied Mathematics

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## Education

**University of North Carolina at Chapel Hill**, Chapel Hill, NC
Ph.D. Applied Mathematics (M.S. in Mathematics in 2022) 2019 - 2025 (expected)
Co-advisors: M. Gregory Forest, Krishnan Raghavan[1]

- Dissertation research: Drawing on ideas from probability theory, developing new ML tools to extract predictive capabilities from a type of data common to today's datasets – called "imbalanced data." As a U.S. Department of Energy Office of Science Graduate Student Research (SCGSR) Awardee and in collaboration with physicists at Argonne National Laboratory, customizing these tools to predict rare subatomic events detected by the ATLAS particle accelerator.
- Master's project: Deployed a numerical model of the human respiratory tract to investigate how airborne viruses, including variants of Covid-19, travel and reproduce inside our nasal passages. Worked with Python source code and ran simulations on a supercomputer.
- Courses: data structures, machine learning, numerical linear algebra, optimization, probability, scientific computing, and statistical modeling

**IBM Research Summer School on Sketching and Tensor Algebra**, San Jose, CA
Collaboration between IBM and Mathematical Sciences Research Institute (MSRI) July 2023

**University of Washington**, Seattle, WA
Masters degree coursework in pure mathematics 2018 - 2019

**City University of New York**, New York, NY
Post-baccalaureate coursework in pure mathematics 2014 - 2018

## Research Interests

Computational mathematics, algorithms, statistics/probability, medical applications

## Papers

"PLEUM: Performance-driven Learning and Exploratory Undersampling," to be submitted to *Computational Statistics and Data Analysis* (in progress).

"Global Sensitivity Analysis of the Onset of Nasal Passage Infection by SARS-CoV-2 With Respect to Heterogeneity in Host Physiology and Host Cell-Virus Kinetic Interactions," in *Virus,* General Virology: Mathematical Modeling of Viral Infection (in review).

"Maximum Covering Subtrees for Phylogenetic Networks," in *IEEE/ACM Transactions on Computational Biology and Bioinformatics,* 18(6): 2823-2827, December 2021, DOI: 10.1109/TCBB.2020.3040910.

## Awards

U.S. Department of Energy Office of Science Graduate Student Research Program 2023 - 2024

UNC ARPA Graduate Degree Completion Grant 2021 - 2022

Minority Science Education Improvement Program Grant 2017, 2018

1 Assistant Computational Mathematician Dr. Krishnan Raghavan works at Argonne National Laboratory.

## Work Experience

**Graduate Research and Teaching Assistant** 2019 - present
UNC Chapel Hill Mathematics Department

- Currently developing algorithms to improve the classification of imbalanced data, a prevalent problem in machine learning and in the context of many scientific applications such as detecting rare subatomic events, toxicology, and medical diagnostics.

**National Science Foundation Math Sciences Graduate Intern** Summers 2022 & 2023
Argonne National Laboratory

- Began what became my dissertation research during a summer internship in the Mathematics and Computer Science Division at Argonne National Laboratory.

**Senior Grants Manager** 2012 - 2017
The Joyce Theater Foundation, Inc., New York, NY

- Exceeded fundraising targets year over year for an operational budget of $10+ million. Increased annual contributed income by $1 million (50%) over five years.
- Developed business proposals with metrics and narratives for The Joyce's major donors including The Ford Foundation, the Andrew W. Mellon Foundation, National Endowment for the Arts, New York State Council on the Arts, and NYC Department of Cultural Affairs.

## Teaching Experience

**Recitation Leader**

- Math 233: Calculus III, UNC Chapel Hill — Fall 2023
- Math 232: Calculus II, UNC Chapel Hill — Spring 2023
- Math 125: Calculus with Analytic Geometry II, Univ. of Washington — Fall 2018, Winter 2019, Spring 2019

**Assistant**

- Math 347: Linear Algebra for Applications, UNC Chapel Hill — Fall 2020, 2021, 2022
- Math 383: First Course in Differential Equations, UNC Chapel Hill — Fall 2021, 2022
- Math 566: Introduction to Numerical Analysis, UNC Chapel Hill — Fall 2020
- Math 381: Discrete Mathematics, UNC Chapel Hill — Spring 2019

## Conferences, Talks & Posters

**Triangle Computational and Applied Mathematics Symposium(TriCAM)** Sept. 2022
North Carolina State University
Lightning Talk and Poster: To Classify Imbalanced Data Correctly, Find the Best ~~Model~~ Data

**Underrepresented Students in Topology and Algebra Research Symposium (USTARS)** Apr. 2018
Reed College
Poster: Neural Networks and the Shape of Data

**BMCC/CUNY Annual Research Symposium (BARS)** May 2017
Borough of Manhattan Community College
Talk: The Perceptron: An Introduction to Machine Learning

**Joint Mathematics Meeting** Jan. 2017
Atlanta
Poster: The Perceptron: An Introduction to Machine Learning

## Membership & Involvement

**Graduate Mathematics Association** 2019 - present
UNC Chapel Hill Mathematics Department
- Treasurer, 2021-2022

**Society for Industrial and Applied Mathematics** 2019 - present

**Association for Women in Mathematics** 2018 - present
- Local UNC chapter Treasurer, 2021-2022

**Anti-Racism Community Group (ARC)** 2020 - 2022
UNC Chapel Hill Mathematics Department
- Founder and Organizer

## Service

**Super Computing Conference** Nov. 2022 & 2023
Student Volunteer at SC22 in Dallas and SC23 in Denver

**Invited Speaker** Nov. 2021
UNC Chapel Hill Mathematics Department
Facilitated a workshop on unconscious bias as part of the Graduate Teaching Seminar for first-year graduate students.

**National Math Festival** Apr. 2021
Society for Industrial and Applied Mathematics
Assistant for break-out sessions led by Tim Chartier, Aaron Luttman, and Genetha Gray

**Prospective Graduate Student Weekend** Feb. 2021, 2022
UNC Chapel Hill Mathematics Department
Spoke about UNC Math Dept.'s ARC group to prospective students.

## Reference Contact Information

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