

Karen Medlin

PH.D. CANDIDATE IN APPLIED MATHEMATICS

University of North Carolina at Chapel Hill
Mathematics Department
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SUMMARY

- Applied math Ph.D. candidate with experience developing and applying new methods for ML models. Expected graduation in May 2025.
- Seasoned professional who has worked with data across multiple realms including an R1 research university, a national lab, and a world-renowned arts organization.
- Coding experience in Java, Python (including PyTorch), and R; with Git version control. Demonstrated ability to learn and teach myself.
- Record of accomplishment: Awarded fellowships at top Ph.D. programs, a U.S. Department of Energy Graduate Student Research (SCGSR) grant; and a National Science Foundation Mathematical Sciences Graduate Internship (MSGI).

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 Raghavan¹

- Dissertation research: Developing a new ML algorithm that addresses imbalanced data challenges. As a first application and with the support of a SCGSR award from Department of Energy, customizing the algorithm to predict rare subatomic events detected by the ATLAS particle accelerator at Argonne National Laboratory. Unique in its approach to sampling while standard in its deep neural network model for training and testing, the algorithm will be made public on GitHub.
- Master's project: Deployed a numerical model of the human respiratory tract to investigate how airborne viruses, including variants of Covid-19, travel and grow inside our nasal passages. Worked in Python and ran simulations on a Linux-based supercomputer.
- Courses: data structures, machine learning, numerical linear algebra, optimization, probability, scientific computing, and statistical modeling

IBM Research/Math Sciences Research Institute (MSRI) Summer School, San Jose
Mathematics of Big Data: Sketching and (Multi-) Linear Algebra 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

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

PAPERS

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

Leyi Zhang, Han Cao, Karen Medlin, Jason Pearson, Andreas Aristotelous, Alexander Chen, Timothy Wessler, and M. Gregory Forest. "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 *Viruses*, 2023 (in review).

Nathan Davidov, Amanda Hernandez, Justin Jian, Karen Medlin, Megan Owen, Andrew Quijano, Katherine St John, Katherine Thai, et al. "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.

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| AWARDS & CERTIFICATES | U.S. Department of Energy Office of Science SCGSR Award | 2023 - 2024 |
| | UNC ARPA Graduate Degree Completion Grant | 2021 - 2022 |
| | Introduction to High Performance Computing (HPC) Certificate Super Computing Conference (SC22) | Nov. 2022 |
| | Data Science Certificate Principal Analytics Prep <i>Harvard Business School Startup Studio</i> | Summer 2018 |
| | <ul style="list-style-type: none"> 200+ hours of in-person instruction from 20 senior industry professionals with expertise in: Python, R, SQL, AWS, A/B testing; statistical reasoning and modeling; data wrangling and visualization; and business strategy. | |
| | Minority Science Education Improvement Program Grant | 2017, 2018 |

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| WORK EXPERIENCE | Graduate Research Assistant | 2019 - present |
| | UNC Chapel Hill Mathematics Department | |
| | <ul style="list-style-type: none"> Currently developing algorithms to address the challenges of classifying imbalanced data. Working in Python and Git and running code on a Linux-based supercomputer. | |
| | National Science Foundation Math Sciences Graduate Intern | Summers 2022 & 2023 |
| | Argonne National Laboratory | |
| | <ul style="list-style-type: none"> Began what became my dissertation research as a NSF MSGI fellow in Argonne's Mathematics and Computer Science Division. Developed code in Python with PyTorch library. | |
| | Senior Grants Manager | 2012 - 2017 |
| | The Joyce Theater Foundation, Inc., New York, NY | |
| | <ul style="list-style-type: none"> Exceeded fundraising targets year over year for an operational budget of \$10+ million. Increased annual contributed income by \$1 million (50%) over five years. Daily workflow and donor pipeline in a SQL-based database. | |

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| 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 |
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| CONFERENCES, TALKS & POSTERS | National Science Foundation's MSGI Virtual Symposium | Aug. 2023 |
| | Talk: Classifying Imbalanced Data | |
| | 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 | |
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| COMMUNITY 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 | |
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| 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 Luttmann, 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. | |

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| REFERENCE CONTACT INFORMATION | <p>Dr. M. Gregory Forest University of North Carolina at Chapel Hill forest@unc.edu</p> <p>Dr. David Adalsteinsson University of North Carolina at Chapel Hill david@unc.edu</p> <p>Dr. Shahar Kovalsky University of North Carolina at Chapel Hill shaharko@unc.edu</p> <p>Dr. Richard McLaughlin University of North Carolina at Chapel Hill rmm@email.unc.edu</p> <p>Dr. Krishnan Raghavan Argonne National Laboratory kraghavan@anl.gov</p> |
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