Emma R. Cobian

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EDUCATION

PhD, Applied and Computational Mathematics and Statistics — Expected May 2024
University of Notre Dame, Notre Dame, IN

- Advisor: Jonathan Hauenstein
- Thesis: "Optimization Techniques for Inference and Parameter Recovery"

Master of Science, Applied and Computational Mathematics and Statistics — May 2021
University of Notre Dame, Notre Dame, IN

- Overall GPA: 4.00/4.00

Bachelor of Science, Mathematics and Economics — August 2018
University of Wisconsin - River Falls (UWRF), River Falls, WI

- Overall GPA: 3.992/4.000
- Graduated Summa Cum Laude

PUBLICATIONS

1. **Emma R. Cobian**, Jonathan D. Hauenstein, Fang Liu, and Daniele E. Schiavazzi, "AdaAnn: Adaptive Annealing Scheduler for Probability Density Approximation." *International Journal of Uncertainty Quantification, 13(3), 39-69, 2023.*

2. Jonathan D. Hauenstein, Alan Huebner, John P. Wagle, **Emma R. Cobian**, Joseph Cummings, Caroline Hills, Megan McGinty, Mandy Merritt, Sam Rosengarten, Kyle Skinner, Michael Szemborski, and Leigh Wojtkiewicz. "Assesing reliability of movement screenings using a markerless motion capture system." To appear in *Orthopedic Journal of Sports Medicine.*

3. Yu Wang, **Emma R. Cobian**, Jubilee Lee, Fang Liu, Jonathan D. Hauenstein, and Daniele E. Schiavazzi. "LINFA: A Python Library for Variational Inference with Normalizing Flow and Annealing." *Submitted.*

4. **Emma R. Cobian**, Jonathan D. Hauenstein, and Charles W. Wampler. "Robust Numerical Irreducible Decomposition." *In preparation.*

TEACHING EXPERIENCE

Instructor of Record — January 2023 - May 2023
University of Notre Dame, Notre Dame, IN

- Teaching ACMS 20750 Applied Mathematical Methods II to 22 undergraduate students

Teaching Assistant — August 2019 - December 2019
University of Notre Dame, Notre Dame, IN

- Graded exams, held office hours, and conducted review sessions prior to exams for an undergraduate applied linear algebra course

RESEARCH EXPERIENCE

Graduate Research Assistant January 2020 - Present
University of Notre Dame, Notre Dame, IN

- Working with normalizing flows, specifically planar flow and RealNVP, in approximating multimodal posterior distributions
- Implementing adaptive annealing with normalizing flow for more robust approximations and computational savings
- Building a Python package for computationally expensive models and geometrically complicated structures underlying a distribution
- Recovering parameters of an exceptional set giving the desired numerical irreducible decomposition in the solution space when solving systems of polynomials

COMAP Mathematical Contest in Modeling February 2018
Advised by Kathy Tomlinson, UWRF, River Falls, WI
Team Members: Roman Alvarado, Emma Cobian, Austin Wilcox

- Awarded Honorable Mention
- Submitted "It's All Greek To Me: An Investigation of the Diffusion of Languages Based on Dynamic Influences"
- Applied differential equations and matrix theory to model the spread of languages

COMAP Mathematical Contest in Modeling February 2017
Advised by Kathy Tomlinson, UWRF, River Falls, WI
Team Members: Emma Cobian, Jake Minor, Austin Wilcox

- Awarded Meritorious
- Submitted "Any Way You Want It, That's the Way We'll Merge It"
- Provided a solution modeling the best way for cars to merge together within a toll plaza
- Applied nondeterministic finite cellular automata to model time efficiency, geometry and summation to model cost, and created a simualtion coded in Java to model accident prevention

SESSIONS ORGANIZED

- *Applications of Numerical Algebraic Geometry* Special Session. April 2024, AMS Spring Central Sectional Meeting, University of Wisconsin - Milwuakee, Milwaukee, Wisconsin.
- *Numerical Methods in Algebraic Geometry* Minisymposium. July 2023, SIAM Conference on Applied Algebraic Geometry, Eindhoven University of Technology, Eindhoven, The Netherlands.

PRESENTATIONS

- *Optimization Techniques in Variational Inference.* January 2024, Joint Mathematical Meetings, Moscone Center, San Francisco, California.
- *Homotopy Continuation Techniques for Optimization in Variational Inference.* December 2023, Beyesian Statistics and Statistical Learning Workshop, Institute for Mathematical and Statistical Innovation, Chicago, Illinois.
- *Application of Adaptive Annealing (AdaAnn) to Approximate Multimodal Posterior Distribution for Parameter Estimation.* July 2023, SIAM Conference on Applied Algebraic Geometry, Eindhoven University of Technology, Eindhoven, The Netherlands.

- *Application of Adaptive Annealing (AdaAnn) to Approximate Multimodal Posterior for Parameter Estimation.* January 2023, (Virtual) Joint Mathematical Meetings, John B. Hynes Veterans Memorial Convention Center, Boston Marriott Hotel, and Boston Sheraton Hotel, Boston, Massachusetts.
- *Approximating Probability Density Functions Via Adaptive Annealing and Optimization of Normalizing Flows.* April 2022, (Virtual) SIAM Conference on Uncertainty Quantification, Westin Peachtree Plaza, Atlanta, Georgia.
- *Application of AdaAnn to Approximate Multimodal Posterior for Parameter Estimation.* March 2022, (Virtual) AMS Spring Central Virtual Sectional Meeting.
- *Approximating Probability Density Functions via Optimizing Planar Flows.* August 2021, (Virtual) SIAM Conference on Applied Algebraic Geometry, Texas A&M University, College Station, TX.
- *Anyway You Want It, That's the Way We'll Merge It.* April 2017, Pi Mu Epsilon Conference, St. John's University, Collegeville, MN.

POSTER PRESENTATIONS

- *Variational Inference Via Normalizing Flows and Adaptive Annealing.* December 2021, COSE-JAM, University of Notre Dame, Notre Dame, IN.
- *Approximating Probability Densities Via Normalizing Flows and Adaptive Annealing.* October 2021, Lucy Fall Symposium, University of Notre Dame, Notre Dame, IN.
- *It's All Greek To Me: An Investigation of the Diffusion of Languages Based on Dynamic Influences.* April 2018, Research in the Rotunda, University of Wisconsin - Madison, Madison, WI.
- *Anyway You Want It, That's the Way We'll Merge It.* December 2017, Undergraduate Research, Scholarly and Creative Activity Fall Gala, UWRF, River Falls, WI.

OUTREACH

President for AWM Student Chapter September 2023 - Present
University of Notre Dame
- Re-establishing the Association for Women in Mathematics (AWM) student chapter at the University of Notre Dame
- Recruit members to join the student chapter and organize events

President for SIAM Student Chapter May 2022 - May 2023
University of Notre Dame, Notre Dame, IN
- Organize events for Society of Industrial and Applied Mathematics (SIAM) members at the University of Notre Dame

Departmental Representative for AWIS Chapter September 2021 - May 2023
University of Notre Dame, Notre Dame, IN
- Applied and Computational Mathematics and Statistics representative for the Association for Women in Science (AWIS) chapter

- Serving on STEMentorship Board which organizes monthly events for paired graduate mentors and undergraduate mentees in STEM majors

Panelist for Alumni Panel on Graduate School September 2022
UWRF, River Falls, WI
- Discussed application process, life as a graduate student, and answered student questions

Mentor for AWIS STEMentorship Program October 2021 - May 2022
University of Notre Dame, Notre Dame, IN
- Graduate mentor for an undergraduate STEM student at the University of Notre Dame through the Association for Women in Science (AWIS) STEMentorship program

Treasurer for SIAM Student Chapter September 2021 - May 2022
University of Notre Dame, Notre Dame, IN
- Organize events for Society of Industrial and Applied Mathematics (SIAM) members at the University of Notre Dame

Panelist for Graduate School Application Process Panel April 2019
UWRF, River Falls, WI
- Discussed the application process for graduate school

Abstract Algebra Learning Assistant January 2018 - May 2018
Professor Dr. Laurel Langford, UWRF, River Falls, WI
- Engaged with students during class through answering questions and guiding the students in the correct direction when thinking through abstract problems and proofs to successfully learn the subject material
- Worked with the professor to determine where students may need additional clarification when working through homework exercises

Tutoring High School/College Mathematics Students October 2016 - March 2018
- Provided students an opportunity for additional help with mathematics to be successful within the classes they were taking
- Worked with a college student through the Honors Program at UWRF
- Provided help for students taking algebra, geometry, statistics, and calculus

Differential Equations Learning Assistant September 2017 - December 2017
Professor Dr. Kathy Tomlinson, UWRF, River Falls, WI
- Engaged with students during class through answering questions and guiding the students in the correct direction when solving problems for successful learning of the material
- Held review sessions before tests for students to ask questions, learn study strategies, and promote confidence within the subject material for the test

HONORS AND AWARDS

SIAM Travel Award July 2023
Society for Industrial and Applied Mathematics (SIAM)
- $650 and lodging to attend SIAM Conference on Applied Algebraic Geometry in Eindhoven, The Netherlands

Chancellor's Scholar September 2014 - May 2018
UWRF, River Falls, WI
- Half tuition scholarship, yearly

Academic Excellence Scholarship September 2014 - May 2018
State of Wisconsin Higher Education Aids Board, WI
- $2,500 scholarship, yearly

Honors Program September 2014 - May 2018
UWRF, River Falls, WI

Dean's List September 2014 - May 2018
UWRF, River Falls, WI

Mary McMillian Burt Scholarship September 2016 - May 2017
UWRF, River Falls, WI
- Promising mathematics major in their junior year

PROFESSIONAL MEMBERSHIPS

- American Mathematical Society (AMS)
- Association for Women in Mathematics (AWM)
- Association for Women in Science (AWIS)
- Society for Industrial and Applied Mathematics (SIAM)