Perrin Ruth

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Education

University of Maryland, College Park: GPA 4.00 — College Park, MD
- *PhD in Applied Mathematics* — *Aug. 2021 – Present*
  - **NSF GRFP Fellow**

University of Colorado at Boulder: GPA 3.89 — Boulder, CO
- *B.S. in Applied Mathematics* — *Aug. 2017 – May 2021*
- *B.S. in Electrical Engineering* — *Aug. 2017 – May 2021*
  - **Magna Cum Laude**

Research Experience

Graduate Research Assistant, Advisor: Maria K. Cameron — College Park, MD
University of Colorado — *Jan. 2023 - present*
- **Molecule Sizes in Hydrocarbon Pyrolysis:** using random graph theory, I predicted the size distribution of molecules in hydrocarbon pyrolysis. I developed a semi-analytic approach to estimate the degree distribution of the carbon skeleton and a random graph model that incorporates loops. Parameters for this model are obtained from molecular dynamics (MD) data. This method accurately predicts the size distribution of small molecules and the size of the largest molecule from MD data in seconds using a modern laptop. This research is joint work with Vincent Dufour-Decieux, Cristopher Moakler, and Professor Maria Cameron in a manuscript in progress.

Undergraduate Research Assistant, Advisor: Manuel E. Lladser — Boulder, CO
University of Colorado — *Aug. 2018 - May 2021*
- **Numerical Representation of Symbolic Data:** I developed a method to represent strings, e.g. DNA and text, numerically. This is done by introducing a novel notion of Levenshtein graph (nodes are strings, and neighboring nodes are at edit distance one). Using multilateration, a notion analogous to trilateration of points on the plane but in a graph (or metric space), I can now represent any string as a low-dimensional numerical vector. I have characterized various other features of this new graph family (geodesic distance, automorphism group, determining sets, bounds on metric dimension). This work is part of manuscripts [2,3].

Undergraduate Research Assistant, Advisor: Juan G. Restrepo — Boulder, CO
University of Colorado — *Jan 2019 - May 2021*
- **Mathematical Models of Dodgeball:** I developed a continuous rate equation model, described by a variant of the Lotka-Volterra model, and a stochastic agent-based model, of dodgeball, a popular sport in elementary school across the United States. I tested my methods analyzing real dodgeball games datasets. This work led to publication [1].

Outreach

REU: Rare Events in Stochastic Systems — College Park, MD
University of Maryland — *June 2023 – Aug. 2023*
- I provided programming and mathematical guidance for undergraduate students. Topics range from machine learning techniques for dimension reduction, data driven methods for nonlinear oscillators, and the stochastic block model with epidemiology. This REU was organized by Professor Maria Cameron.

Probably Novel: Radio Show & Podcast — Boulder, CO
University of Colorado — *Sep 2019 – Mar. 2020*
- Probably Novel is a podcast that interviews undergraduate and graduate students, and occasionally professors, to showcase their research to a general audience. It is produced by Professor Lladser and sponsored by the Applied Mathematics department at CU.
- I co-hosted 18 shows of Probably Novel with two undergraduate students: Spas Angelov and Maria Marquez. Besides finding, contacting, and scheduling guests, I also operated the radio volume and broadcast controls for each live show.
- Recordings can be found at https://www.colorado.edu/amath/probably-novel.

Publications

[1] Ruth P, Lladser ME. *Levenshtein Graphs: Resolvability, Automorphisms & Determining Sets.* Discrete Mathematics. 2023. https://www.sciencedirect.com/science/article/pii/S0012365X22005167
[2] Ruth P. *Numerical Encoding of Symbolic Data: Standard, State of the Art, and New Techniques.* Honors Thesis, 2021.
[3] Ruth P, Restrepo JG. *Dodge and survive: Modeling the predatory nature of dodgeball.* Physical Review E. 2020. https://journals.aps.org/pre/abstract/10.1103/PhysRevE.102.062302

Seminars and Conference Presentations

- ***SIAM Conference on Mathematics of Data Science*** MDS22, San Diego, CA. Sep. 2022
- ***Dodge and survive: modeling the predatory nature of dodgeball*:** Dynamics Seminar. University of Colorado, Boulder, CO. Oct. 2020.
- ***Numerical Representation of Symbolic Datasets*:** SIAM Front Range Student Conference. University of Colorado, Denver, CO. Mar. 2020.

Awards

- **NSF GRFP Fellow** Fall 2023 – Present
- Dean's Fellowship, University of Maryland Fall 2021 – Spring 2023
- Double Engineering Scholarship, University of Colorado Fall 2020 – Spring 2021
- CU Esteemed Scholars Award – Sewall, University of Colorado Fall 2017 – Spring 2021
- Ivar Pearson Award, University of Colorado Fall 2017 – Spring 2020
- Dean's List, University of Colorado Fall 2017 – Spring 2020

Teaching Experience

Graduate Teaching Assistant

- MATH 241: Calculus III Spring 2023
- MATH 135: Discrete Mathematics for Life Sciences Fall 2022
- MATH 141: Calculus II Spring 2022
- MATH 241: Calculus III Fall 2021

Undergraduate Course Assistant

- APPM 3570: Intro to Probabiliity Spring 2019
- APPM 1340: Calculus 1A Fall 2018

Technical Skills

- Programming Languages: Python, Matlab, C,
- Mathematical Tools: Mathematica, Matlab, LaTeX
- CAD: SolidWorks, Autodesk Fusion, FreeCAD