



# Connor Robertson

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## Education

### PhD - Applied Mathematics

NEW JERSEY INSTITUTE OF TECHNOLOGY

Aug. 2018 - May 2023

Newark, New Jersey

### B.S. - Applied and Computational Mathematics

BRIGHAM YOUNG UNIVERSITY

Aug. 2010 - May 2018

Provo, Utah

## Research Experience

### Data-driven discovery of governing equations for active nematics

RESEARCH ASSISTANT - NEW JERSEY INSTITUTE OF TECHNOLOGY

Sep. 2019 -

Newark, New Jersey

Discovering the governing partial differential equation of an active nematic system directly from experimental video. Includes image processing, numerical differentiation of noisy data, sparse regression, symbolic generation of differential terms, continuum models of active nematic liquid crystal systems, and pseudospectral PDE simulations.

### Forecasting bacterial growth and interaction via recurrent neural networks

GRADUATE STUDENT RESEARCH AWARD (SCGSR) - OAK RIDGE NATIONAL LABORATORY

June 2021 - June 2022

Remote

Using images of mutant and natural bacterial strains from the researchers at Oak Ridge National Lab, modified PredRNN recurrent network architecture to model and predict population and colony growth. Quantified quality of fit via various image and biological metrics. Included image processing, recurrent neural network architecture, and accelerating agent-based modeling approaches.

### Water main break prediction for city utilities

COFOUNDER - COVENTINA LLC

Mar. 2018 - Dec. 2018

Provo, Utah

Developed machine learning toolkit used to forecast water main breaks for public works departments. Research and development consisted of data collection from various public and private sources, cleaning, imputation, regression analysis, tree-based model tuning, validation, and balance of physical models and machine learning predictions.

### Determining optimal new facility locations via network theory

RESEARCH ASSISTANT - BRIGHAM YOUNG UNIVERSITY

Mar. 2017 - May 2018

Provo, Utah

Undergraduate research team focused on applying mathematical concepts to new problems in society and industry. Projects include: Use of network theory and Markov Chains for facility location problems in operations research and utilizing statistical modeling to optimize infrastructure decisions for water access in developing countries.

### Developing computational math curriculum

PROJECT ASSISTANT - BRIGHAM YOUNG UNIVERSITY

Sep. 2016 - May 2018

Provo, Utah

Editing and writing academic programming assignments in Python and managing lab computers and servers. Assignments include curriculum on: web scraping, serialization, noSQL, parallel processing techniques, Quasi-Newton optimization, and Arnoldi method for eigenvalue and eigenvector numerical computation.

## Conferences

### TALKS

### Data-driven continuum modeling of active nematics via sparse identification of nonlinear dynamics

ANNUAL MEETING OF THE APS DIVISION OF FLUID DYNAMICS (APS DFD)

Nov. 2022

Indianapolis, Indiana

## Data-driven continuum modeling of active nematics via sparse identification of nonlinear dynamics

Mar. 2022

ANNUAL MEETING OF THE AMERICAN PHYSICAL SOCIETY (APS MARCH)

Chicago, Illinois

## Neural networks for function approximation and data-driven modeling

Oct. 2021

MACHINE LEARNING AND OPTIMIZATION SEMINAR - DEPARTMENT OF MATHEMATICAL SCIENCES NJIT

Newark, New Jersey

## Facility location using Markov chains

Mar. 2018

CPMS STUDENT RESEARCH CONFERENCE - BRIGHAM YOUNG UNIVERSITY

Provo, Utah

## Efficiency of Water Distribution in Water Poor Areas of the World

July 2017

STUDENT DAYS - SIAM ANNUAL MEETING

Pittsburgh, Pennsylvania

## POSTERS

### Data-driven discovery of PDEs for active nematic systems

Oct. 2022

NATIONAL ACADEMY OF INVENTORS - NJIT CHAPTER WORKSHOP

Newark, New Jersey

### Discovering governing equations of an active nematic system using PDE-Find

Aug. 2020

GAMM JUNIORS' SUMMER SCHOOL

Magdeburg, Germany (virtual)

### Aligning Self-Propelling Particles in Non-trivial Domains

May 2019

FRONTIERS IN APPLIED AND COMPUTATIONAL MATHEMATICS

Newark, New Jersey

## ORGANIZATION

### Machine Learning and Optimization Seminar Chair

Sep. 2022 - May 2023

DEPARTMENT OF MATHEMATICAL SCIENCES - NJIT

Newark, New Jersey

<https://cnrrobertson.github.io/other/mlseminar/mlseminar.html>

## Honors & Awards

- 2023 **DSECOP Fellow**, Data Science Education Community of Practice - APS
- 2021 **Graduate Student Research Award (SCGSR)**, US Department of Energy - ORNL (remote)
- 2021 **Ahluwalia Doctoral Fellowship**, Department of Mathematical Sciences - NJIT
- 2020 **(Honorable mention) Graduate Research Fellowship Program**, National Science Foundation

## Qualifications & Skills

- Programming**
- Mastery: Python, Julia
  - Proficiency: Matlab, Mathematica
  - Familiarity: R, C++, Javascript

- Projects**
- Markov Chain Monte Carlo, differentiation of noisy data, sparse basis pursuit and regression, recurrent neural networks for image prediction, pseudospectral PDE solvers, Markov chains for NLP, optimization (simplex method, Newton's method, varieties of gradient descent, etc.), simple facial recognition, implementation of numerical solvers for ODES, and various applications of machine learning algorithms

## Teaching

### Teaching Assistant

DEPARTMENT OF MATHEMATICAL SCIENCES - NJIT

Newark, New Jersey

- Math 110,111,238 - Precalculus and calculus
- Math 340,391 - Numerical Methods and Numerical Linear Algebra
- Math 631 - Graduate Linear Algebra

## Professional Associations

- 2017 - **Society for Industrial and Applied Mathematics (SIAM)**, Member
- 2022 - **American Physical Society**, Member

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## Publications

- 2023 **Performing Video Frame Prediction of Microbial Growth with a Recurrent Neural Network**  
Frontiers in Microbiology: Systems Microbiology, <https://doi.org/10.3389/fmicb.2022.1034586>
- 2021 **Investigating the growth of an engineered strain of Cyanobacteria with an Agent-Based Model and a Recurrent Neural Network**  
bioRxiv, <https://doi.org/10.1101/2021.10.11.463942>
- 2021 **Using Survey Data and Mathematical Modeling to Prioritize Water Interventions in Developing Countries**  
Water Resource Management, <https://doi.org/10.1007/s11269-020-02761-8>