

# Alexander Speigle

speigad@umich.edu • (248)-482-9381 • adsfibonacci.github.io

## SUMMARY

Biomedical Engineering Master's student with a dual background in Biomedical Engineering and Mathematics, specializing in computational and systems biology. Experienced in combinatorial optimization, deep learning, and neural networks for drug discovery. Skilled in statistical experimental design and convex optimization, with a strong track record of developing efficient computational models and processing large biological datasets.

## EDUCATION

### University of Michigan Ann Arbor, MI

*Master of Science in Biomedical Engineering (Concentration: Biotechnology and Systems Biology)* May 2026 - GPA 4.00

*Bachelor of Science in Engineering in Biomedical Engineering*

May 2025 - GPA 3.35

*Bachelor of Science in Mathematics (Concentration: Mathematical Biology)*

*Minors: Biochemistry, Computer Science*

Courses: Machine Learning, Control Theory, Differential Equations, Immunoengineering, Bioinstrumentation

## WORK EXPERIENCE

### Course Grader - Applied Math For Biomedical Engineers

Sep 2023 - Present

- Reviewed and provided feedback on submissions to enhance understanding of coding and math concepts.
- Identified common errors and collaborated with instructional staff to refine course materials and address gaps.

### Bioinformatics Intern - Metacoder AI

Oct 2024 - Aug 2025

- Developed natural language processing algorithms to classify 800,000 disease descriptions into organ-specific categories
- Implemented graph traversal algorithms to partition 50,000 data points into accurately labeled training data, reducing compilation time by 40%.
- Generated molecular structure from graph neural networks for candidate drugs from large organ toxicity datasets.
- Processed assay data of biomarkers to identify potential drug candidates with 96% accuracy.
- Streamlined training data collection, formatting, and labeling pipelines to improve neural network performance resulting in training time reductions from 12 to 4 hours.

### Lead Student Information Technology Consultant

May 2024 - May 2025

- Coordinated staffing and scheduling for an 8-person team, ensuring efficient monitoring of computer lab usage and wait times during peak hours for scheduling optimization tasks.
- Migrated departmental website materials to an updated WordPress platform during Windows CrowdStrike outages.
- Proctored math exams and quizzes, providing guidance on study strategies to enrolled students.

## RESEARCH EXPERIENCE

### Graduate Researcher - Jensen Lab

Aug 2025 - Present

- Employed high dimensional statistics and regression methods to predict significant gene interactions of *S. mutans*.
- Designed competing neural network architectures such as transformers, convolutional neural networks, and LSTM's to maximize accuracy with minimal data in high dimensional spaces, with a success rate of around 90%.
- Developed mathematical models to improve combinatorial optimization methods to design optimal datasets to maximize reinforcement learning predictions, building on predictions from prior models.
- Implemented integer programming algorithms for arbitrary task scheduling optimization problems and robotics design.

### Undergraduate Lab Research - Chandrasekaran Lab

July 2023 - Oct 2024

- Converted literature data into linear program inputs and analyzed probabilistic outputs using MATLAB and R.
- Validated predicted transcription factors against flux balance predictions from the Cobra toolbox.
- Developed neural networks to reconstruct transcription networks following downregulation from microarray.
- Presented methodological updates and results at weekly lab meetings to facilitate collaboration and feedback.

## PROJECTS

### Math Circle

Sep 2025 - Present

- Authored and presented mini-courses on various topics for mathematically inclined middle and high school students.
- Tutored students in topics such as logic games, group and number theory, and probability with visual and kinesthetic aids tailored to skill and interests.

## SafeBite Capstone Project

Aug 2024 - Dec 2024

- Designed a portable allergy testing kit for mobile clinics serving low-income communities.
- Analyzed existing devices in literature and market to identify design improvements within a market niche.
- Prepared detailed reports documenting design ideation, development process, and biochemical test validation.
- Produced a video presentation showcasing the kit's benefits to the target population for the NIH challenge through DEBUT (Design by Biomedical Undergraduate Teams).

## Directed Study - Abstract Algebra

May 2024 - Aug 2024

- Studied material from Dummit and Foote textbook on the analogous material with weekly mentorship from a graduate student in specializing in commutative algebra and algebraic geometry.
- Analyzed algorithm efficiency in arbitrary domains such as polynomial division and complex numbers.
- Developed graphical models demonstrating the effect of deviations from optimality on algorithm run time.

## Directed Study - Partial Differential Equations

Sep 2023 - Dec 2023

- Studied material following the analogous PhD course with weekly graduate mentorship.
- Focused on fluid mechanics within biological tissues and systems and complemented current coursework.
- Modeled drug diffusion of a BMP coated hip implant through the femur using the heat equation in COMSOL.
- Presented the heat equations structure of the radial symmetries in an end of semester project to math peers.

## SKILLS

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*Languages:* Python, C++, MATLAB, R, Bash, Typescript

*Other:* COMSOL, Copasi, SolidWorks, Sheets, Mathematica

## ACTIVITIES

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*Math Department Walking Club:* Evening Walk Host

*Society of Undergraduate Math Students:* Activities Coordinator