

Vaagishwaran Sivakumar

✉ sivak049@cs.utexas.edu

☎ 0952 245 9337

in [vaagishwaran-sivakumar](#)

🔗 [sivak049](#)

Education

- | | | |
|------------|---|----------------------|
| PhD | University of Texas, Austin , Computer Science | Aug 2025 - Current |
| | <ul style="list-style-type: none">• Coursework: Visual Recognition, Cryptography, Supervised Teaching in CS. | |
| BS | University of Minnesota, Twin-Cities , Computer Science | Sept 2021 – May 2025 |
| | <ul style="list-style-type: none">• GPA: 3.955/4.0• Graduated with Magna Cum Laude Latin Honors• Graduated with High-distinction• Coursework: Computer Vision, Robotics, Deep Learning, Machine learning, Intro to Artificial Intelligence, Algorithms and Data Structures, Operating Systems, Software Engineering, Program design and development, Object Oriented Programming, Machine Architecture and Organization | |
| BS | University of Minnesota, Twin-Cities , Mathematics | Sept 2021 – May 2025 |
| | <ul style="list-style-type: none">• GPA: 3.955/4.0• Graduated with High-Distinction• Coursework: Fourier Analysis, Mathematical modeling, Probability theory, Stochastic Processes, Modern Algebra, Series-Sequences and Real Analysis, Linear Algebra and Differential Equations, Multivariable Calculus, Math of ML & Data Analysis | |

Honors/Awards

- Achieved Dean's List honors for all semesters in University of Minnesota
- Recipient of the Ella Thorp Undergraduate Mathematics Scholarship. (2024-25)
- Recipient of the Global Excellence Scholarship.
- UROP research grant

Research Experience

- | | |
|--|--|
| Research Assistantship , Health Intelligence Lab  , U. of Minnesota | Minneapolis, MN
April 2024 – May 2025 |
| <ul style="list-style-type: none">• Working on domain-guided AI for Medicine under Professor Yogatheesan Varatharajah, primarily focusing on generative models for EEG data. I outline my individual contributions to the projects I've worked on:<ul style="list-style-type: none">– Data Synthesis<ul style="list-style-type: none">* <i>Motivation:</i> To apply data synthesis towards data augmentation.* Synthesized single-channel EEG data using Generative Adversarial Networks (GANs) to emulate realistic EEG signals.* Extended synthesis to multi-channel EEG data by conditioning the GAN model on electrode channels. Later improved spatial fidelity by conditioning on the 3D spatial coordinates of each electrode, resulting in more accurate multi-channel synthetic data.* Evaluated various data synthesis models—Conditional GANs, Variational Autoencoders (VAEs), Transformers, and Diffusion Models—on their ability to reproduce statistical and frequency features of EEG data, helping to determine the most effective approach.– Data Imputation | |

- * *Motivation: Data Imputation has applications in EEG data standardization across different datasets.*
- * Developed imputation model for masked EEG signals, reconstructing 25% zeroed-out windows in single-channel EEG data. Used a Wasserstein GAN with Gradient Penalty (WGAN-GP) and domain-specific loss functions to prioritize frequency domain accuracy. Improved reconstruction performance by conditioning GANs on the specific EEG channels, achieving channel-specific imputations with higher fidelity.
- * Developed a pipeline for multi-channel EEG imputation by using the HvEEG-Net model by using it as a foundation model with the masked-data reconstruction problem as the Self-supervised learning objective. Despite the limitations observed in the reconstruction performance, the potential of the learned representations for EEG-pertinent classification tasks was demonstrated. (This was my Honors Thesis)
- **Wearable Data** (project team of two people)
 - * (Current) Analyzing data from the [FRENZ](#) band, exploring preprocessing and application potential in tasks like sleep stage classification, mental health assessment, and abnormality detection.

Research Collaboration with PhD Student, Dept. of Computer Science, U. of Minnesota

Minneapolis, MN
Sept 2024 - Present

- This project focuses on designing a synthetic benchmark dataset to evaluate models that predict annotators' ratings on text based on annotation history, motivated by the [Perspectivist Data Manifesto](#).

My key contributions include:

- **Literature Review:** Surveyed relevant Natural Language Processing (NLP) papers to identify and contextualize approaches for personalized rating prediction in text.
- **Task Hypothesis Development:** Proposed key pattern recognition tasks, such as identifying annotator-specific biases, context-based preferences, and clustering tendencies within annotator populations, all critical for enhancing model personalization and prediction accuracy.
- **Pattern Identification:** Created Python scripts to query and analyze existing datasets, extracting and quantifying occurrences of hypothesized patterns to inform dataset design.
- **Benchmark Dataset Design:** Collaboratively designed a synthetic dataset generation strategy using frequently identified patterns as the foundation.
- **Model Integration:** Implemented and integrated a state-of-the-art baseline model to serve as a reference point for testing and evaluating the benchmark task.

Research Assistantship, Dept. of Mathematics, U. of Minnesota

Minneapolis, MN
May 2022 – May 2023 &
Sept 2024 - Present

- Advisor: Jeff Calder
- **Research Goal:** Advance numerical methods for simulating weighted mean curvature motion, optimizing both accuracy and efficiency in curve evolution under partial differential equations (PDEs).
- **Visualization and Simulation Development:** Implemented a codebase to visualize the progression of curves governed by the weighted mean curvature motion PDE. Applied a generalizable scheme capable of handling regular mean curvature flow, enabling clear observation of the curve evolution.
- **Numerical Scheme Enhancement:** Enhanced the baseline scheme to improve simulation speed and practical accuracy. Although this adjustment removed the scheme's monotonicity assurance, we established a novel convergence proof to ensure simulated solutions closely approached true solutions with increasing res-

olution.

- **Experimental Analysis and Benchmarking:** Conducted a series of targeted experiments to assess and compare the enhanced scheme against the original baseline:
 - Assessed error dynamics over simulation time.
 - Explored error reduction trends as spatial resolution increased.
 - Demonstrated exponential convergence by plotting cumulative error against spatial resolution on a log scale, yielding a linear trend.
 - Applied the approach to multiple known curves under various boundary conditions (Dirichlet, Neumann, periodic).
- **Validation and Robustness Checks:** Verified the numerical scheme's reliability by cross-validating boundary condition implementations on the heat equation, a well-understood PDE, to confirm accuracy and ensure consistency in results.
- **Key Findings and Insights:** The enhanced scheme showed strong performance across all scenarios except periodic boundary conditions, which required further analysis. This discrepancy, alongside successful experiments, informed our recommendations for future scheme improvements.
- Funded by UROP (Undergraduate Research Opportunity Program) grant
- Public repository: <https://github.com/sivak049/MeanCurvatureMotion> 

Summer Research Internship, Minnesota NLP Group, U. of Minnesota

Minneapolis, MN
May 2022 – Aug 2022

- Reimplemented an AI-based machine translation system targeting low-resource languages.
- Analyzed the correlation between the system's BLEU score and language resource availability, revealing performance variations based on linguistic similarities to English.
- Showed that translation accuracy was higher for languages with alphabets closer to English, providing insights into system limitations.
- Presented system functionality, experimental methodology, and key findings in a lab presentation.

Projects

Drone Delivery Simulation Web App

[video presentation](#) 

- Course project for Program Design and Development.
- Implemented business logic for an app over the semester, integrating given front end and backend components.
- This involved the creation and managing the interactions of the various entities in simulation (eg. drones, clients, package, map textures and terrains etc.)
- Capstone Project: Extended the business logic of the developed app to include a simulation of the drones' battery life, a framework of recharge stations, and more complex logic to facilitate the logistics while constrained by battery; we extended the frontend and backend frameworks to support this.
- Tools Used: C++, html, JavaScript

Autonomous Navigation and Collision Avoidance for Drones

[Code repo link](#) 

- Trained policy for a neural network model that provides drone controls given on-board sensor data (depth images from stereo camera).
- Implemented an imitation-learning approach where student policy trains to imitate the controls of an expert-policy (sampling-based motion planning) which has access to privileged data in simulation.
- Achieved completely collision-free trajectories 42% of the time for highly complex

terrain.

- video: [link](#)
- Tools Used: C, C++, Python

SLOWARC

[Code repo link](#)

- Built a system to classify Softball pitches into Ball or Strike and achieved 100% accuracy on client provided test data.
- Given input from one camera and one sensor, our system ascertained the pitch trajectory, and the shape of the strike zone, and gave its verdict classifying the pitch.
- Our project used the SCRUM methodology for software development, with a team of five.
- Tools Used: C++

Implementation and Comparison of Robot Configuration-Space Planning and Search Algorithms

[Simulation Video](#)

- Collaborated in a team of four to implement and compare three algorithms each for mapping and search in a robot's configuration space.
- Implemented the rapidly-exploring random tree (RRT) mapping algorithm and A* search algorithm.
- Developed methods to visualize the simulation of all the 9 combinations (3 mapping * 3 search) in the same frame.
- Presented a poster on the implementation and analysis of results in the Robotics, Perception, and Manipulation Lab (RPM lab @ U. of M.) meeting.

Teaching Experience

Teaching Assistant, Dept. of Computer Science, UT Austin

Texas, Austin
Aug 2025 – Current

- Led weekly discussion sections for a cohort of 21 students to reinforce core concepts, review lecture material, and work through representative problem solutions.
- Assessed homework and exams for 21 students using standardized rubrics; coordinated with the instructor and TAs to ensure consistent, rigorous grading while fairly evaluating valid alternative solutions.
- Held regular office hours, responding to numerous student questions with clear explanations and actionable next steps while managing equitable time allocation.
- Collaborated with the instructor and fellow TAs to gather feedback, identify gaps, and refine course policies and assessment practices.

Math Paper Grader, Dept. of Mathematics, U. of Minnesota

Minneapolis, MN
Sept 2023 – Dec 2023

- Graded student papers and gave students feedback in an upper division Math course.
- Contributed towards the creation of a rubric for course problem sets to enable standardized correction in subsequent semesters.

Teaching Assistant, Honors College, U. of Minnesota

Minneapolis, MN
Sept 2023 – Dec 2023

- Co-conducted a section of the NEXUS One program alongside the facilitator.
- Took lead on the 'Research at the U' meeting, shared my research experience and prompted student discussion.

Skills

Languages: Python, C++, C, Java, SQL, OCaml, JavaScript, html

Technologies: Linux/Unix, Pytorch, Computer Vision, Git, Agile, Bash, CUDA, Data Structures & Algorithms, Docker, JIRA, JUnit, Jupyter, NumPy, Keras, Deep Learning, Neural Networks, Robotics, Express.js, PostgreSQL, Pandas, Node.js, Tensorflow, Natural Language Processing

Links

Linkedin: <https://linkedin.com/in/vaagishwaran-sivakumar>

Github: <https://github.com/sivak049>

Health Intelligence Lab: <https://sites.google.com/view/yoga-personal/lab?authuser=0>

FRENZ band: https://frenzband.com/?srltid=AfmBOopUkkt0gZg8tL_NDeV5G9NhKh9JXb17CccW2IzL2Kr5ySILscL0

Perspective Data Manifesto: <http://pdai.info>

Drone Delivery Simulation Web App video presentation: <https://www.youtube.com/watch?v=y3wZ3pq8M1U>

Autonomous Navigation and Collision Avoidance for Drones code repo:

<https://github.com/MasonJohnHawver42/Carthage.git>

Autonomous Navigation and Collision Avoidance for Drones video:

https://drive.google.com/file/d/1GZ0NekQChSPg_gIz4HOfZTUg1K24PZR4/view?resourcekey

SLOWARC code repo: <https://github.com/sivak049/SLOWARC>

Implementation and Comparison of Robot Configuration-Space Planning and Search Algorithms video:

<https://drive.google.com/file/d/1QDTfzPFPvUJQZZh4-AZC6LDoWAVaU6Z5/view?usp=sharing>