Anoushka Alavilli

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Education

Carnegie Mellon University   **Pittsburgh, PA**
M.S. in Electrical & Computer Engineering   *August 2022 – December 2023 (expected)*
GPA – 4.0/4.0 (cumulative)
Coursework: Optimal Control & Reinforcement Learning, Intro. to Machine Learning for Engineers, Robot Dynamics & Analysis, Applied Stochastic Processes, Computer Vision, Digital Signal Processing.

Tufts University   **Medford, MA**
B.S. in Electrical Engineering   *September 2018 – May 2022*
GPA – 3.91/4.0, graduated *summa cum laude*
Relevant Coursework: Convex Optimization, Linear Systems, Feedback Control Systems, Probabilistic Systems Analysis, Distributed Machine Learning and Control, Computational Geometry, Mathematical Aspects of Data Analysis, Data Structures.

Experience

Robotic Exploration Lab, Carnegie Mellon University   **Pittsburgh, PA**
Master's student researcher under Professor Zachary Manchester

DARPA RACER   *October 2023 – current*
- Developing an onboard model adaptation module for the DARPA RACER vehicle (an autonomous high-speed vehicle for extreme terrain) as part of a joint project between the Robotic Exploration Lab and the DARPA RACER team at NASA Jet Propulsion Laboratory.
- Using Koopman theory to learn an invariant subspace for dynamics offline and planning to create a module which performs linear regression over this basis during drive-time to re-estimate dynamics as terrain, engine, and tire conditions affect the dynamics of the vehicle.

TinyMPC   *January 2023 – current*
- Developed a fast and memory-efficient model predictive control (MPC) solver for embedded applications with trajectory tracking and real-time obstacle avoidance. Showcased functionality on a Crazyflie drone.
- Formulated and implemented the Alternating Direct Method of Multipliers (ADMM) to solve the underlying MPC problem.
- Submitted this work as a conference paper to IEEE ICRA 2024 within a student group [2].
- Currently creating a code generation interface to promote adoption.

Mars 2020 Instrument Data Systems Operations, NASA Jet Propulsion Laboratory   **Pasadena, CA**
Summer Intern   *May – July 2023*
- Designed a variation of Gaussian mixture models with probabilistic uncertainty quantification (exceeding initial assignment) to predict data pipeline outputs for Mars 2020 mission downlink operations. Model circumvents the prior dependence on image content, instead only using instrument metadata from Mars, to make output predictions.

Advanced Sensors and Techniques Group, MIT Lincoln Laboratory   **Lexington, MA**
Summer Research Program Intern   *Summer 2021, Summer 2022*
- In 2022, independently developed a convolutional neural network (CNN) to classify radar images. Performed extensive literature review due to lack of prior experience in deep learning. Helped the team transition to ML-based techniques from previously exclusively physics-based methods. Image classification

tool was delivered to government sponsor.
- In 2021, developed a radar imaging toolbox to aid radar imaging analysts in processing data, finding trends, forming radar images, and using image processing algorithms.

Convex Optimization Research Project, Tufts University   **Medford, MA**
Undergraduate student researcher under Professor Mai Vu   *April 2021 – July 2022*

- Developed a novel algorithm to increase efficiencies in a ride-hailing services model. Relevant topics include convex optimization, flow networks, distributed decisions, and ant colony optimization.
- Published in ACM GECCO 2022 and presented at conference as first author. Open access paper: [1].

Levin Lab, Tufts University   **Medford, MA**
Undergraduate student intern under Professor Mike Levin   *May 2020 – December 2020*

- Developed an autonomous image analysis tool to track wound healing. Used MATLAB Image Processing Toolbox. In another project, implemented a genetic algorithm and experimented with other optimization algorithms for a job scheduling problem.

Teaching Experience

Principles and Engineering Applications of AI, Carnegie Mellon University   **Pittsburgh, PA**
Teaching assistant under Professor Ozan Tonguz   *January 2023 – May 2023*

- Delivered a guest lecture on convolutional neural networks (CNNs).
- Taught and created lesson plans for course recitations.
- Assisted in designing homework assignments and conducted office hours.

Awards

- **Harry Poole Burden Prize in Electrical Engineering**, Tufts University, Spring 2022 (Awarded for the best design or research project done by electrical engineering undergraduate students)
- **Morris and Sid Heyman Prize Scholarship**, Tufts University, Spring 2021 (Awarded for academic achievement and future promise)

Publications

[1] **Anoushka Alavilli** and Mai Vu. 2022. PLAN: a leafcutter ant colony optimization algorithm for ride-hailing services. In Proceedings of the Genetic and Evolutionary Computation Conference (GECCO '22). Association for Computing Machinery, New York, NY, USA, 4–12. Paper link.

[2] **Alavilli, A.**, Nguyen, K., Schoedel, S., Plancher, B., & Manchester, Z. (2023). TinyMPC: Model-Predictive Control on Resource-Constrained Microcontrollers. arXiv preprint arXiv:2310.16985. Arxiv link. (Submitted to IEEE ICRA 2024.)

Talks and Presentations

- First-author presentation at ACM GECCO in Boston, MA.
- Guest lecture on convolutional neural networks for the course *Fundamentals and Engineering Applications of AI* at Carnegie Mellon University.

Skills

Programming languages: Python, Julia, MATLAB, C++

Computational tools: Git, LaTeX, CVX/CONVEX.jl, PyTorch, MeshCat

Last updated November 9, 2023.