Hersh Sanghvi

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Education

Ph.D (in progress, est.grad 2025): University of Pennsylvania, PhD, Department of Computer and Information Science
Undergraduate: University of California, Berkeley (grad. May 2019), BS in Electrical Engineering and Computer Science, Honors in Neurobiology (GPA: 3.76)

Research Experience

Graduate Student Researcher at University of Pennsylvania (Fall 2019 – Present):

- Advised by CJ Taylor in GRASP lab.
- Overall research themes center on learning to adapt planning and control strategies using information gathered during robot operation (e.g. vision, joint encoders, etc.)
- Current and past projects include developing transfer learning approaches for fast controller adaptation to new robots and environments, supervised learning for footstep planning for legged robots, and using model-free reinforcement learning for legged robot navigation

Controls Research at UC Berkeley (Fall 2017 - Spring 2019):

- I worked in the Biomimetic Millisystems Lab to implement control schemes on novel jumping robot, Salto. This consisted of hardware improvements such as adding a hall effect sensor to better measure motor rotation and control firmware to aid in jumping on uncertain surfaces.
- Simulating and implementing inertial quaternion based sliding mode observer for onboard attitude estimation during flight phase

Computational Neuroscience Research at UC San Francisco (Spring 2016 – Summer 2017)

- Worked on accelerating simulation of neuronal circuits using a GPU to solve Markov models for NeuroGPU project
- Presented a poster & submitted an abstract at Society for Neuroscience conference in November 2016

Publications and Technical Writing

- **H. Sanghvi** and C.J. Taylor. “Fast Footstep Planning on Uneven Terrain Using Deep Sequential Models”, in *International Conference on Robotics and Automation*, May 2022. Arxiv Link
- **H. Sanghvi**. “Recent Approaches to Perceptive Locomotion”. June 2022. ArXiv Link
- R. Ben-Shalom, A. Ladd, N. S. Athreya, C. Cross, K.G Kim, **H. Sanghvi**, A. Korngreen, K. E. Bouchard, K. J. Bender. “NeuroGPU: Accelerating multi-compartment, biophysically detailed neuron simulations on GPU”. *Journal of Neuroscience Methods*, Volume 366, 2022, https://doi.org/10.1016/j.jneumeth.2021.109400.
- W. Gosrich, J. Parker, **H. Sanghvi,** T. Srivastava, S. Wolfman. “Neutralizing the Algorithm: Approaches for Reducing the Spread of Disinformation Online”, in *SciTech Forefront,* July 2022. Online Link
- V. Gupta, J. Hypolite, S. Mell, **H. Sanghvi**, “Securing Election Infrastructure with Hand-Marked Paper Ballots”. *Journal of Science Policy & Governance.* September 30, 2020. https://doi.org/10.38126/JSPG170106

Industry Experience

Robotics Software Intern at Neuralink (Summer 2018, Summer 2019):

- Developed an automated testbench for surgical robot by developing visual analysis algorithms of onboard video data
- Developed algorithm based on computer vision for guidance of surgical robot
- Designed signal processing frontend for processing and filtering data from sensors for robot test fixture

ASIC Bringup Intern at NVidia (Summer 2017):

- Analysis and characterization of high speed interconnect performance, latency, throughput (PCIe, NVLink) in various low power, error, and high-power states, and behavior with different systems. Worked with clocking, logic analyzer usage, link TL, DL, PL, and link training and initialization protocols

Relevant Coursework

University of Pennsylvania

Learning for Dynamics and Control, Data-Driven Robotic Perception and Control, Vision and Language, Introduction to Optimization, Analysis of Algorithms, Machine Learning

UC Berkeley

Computational Photography, Model Predictive Control, 3D Reconstruction and Recognition, Nonlinear System Theory, Digital Signal Processing, Stochastic Processes, Linear System Theory, ASIC Digital Design, Feedback Controls, Efficient Algorithms, Adv. Linear Algebra, Signals and Systems, Microelectronic Devices and Circuits, Molecular Neurobiology, Neurobiological Diseases

Projects & Extracurricular Activities

Online Least Squares for Convex MPC of Biped Robots (Class Project, Fall 2021)

- We developed a planning algorithm with an affine approximation of the single rigid body dynamics model, and improved the accuracy of this model by online learning of residuals to the approximation. We analyzed how perception error could affect controller performance by perturbing the switching time of the hybrid robot dynamics, and how online dynamics learning might aid in recovering from this error.

Learning UAV Flight Aggression under Map Uncertainty (Class Project, Fall 2020)

- Our key question was whether a visual flight policy trained with reinforcement learning would learn to modulate its velocity based on the estimated variance of mapping module. We integrated a mapping package, Octomap, into our controls stack, and used the uncertainty output generated by Octomap projected into the image frame to generate an uncertainty channel to add as input to our policy. We found that, for an obstacle avoidance task, the uncertainty channel encouraged slightly more conservative policies in the presence of noise.

Using Seq2Seq Models to Assemble Reasoning Modules for VQA (Class Project, Fall 2020)

- We evaluated a variety of Seq2Seq models on the task of estimating a reasoning sequence composed of simple modules necessary to answer questions, which can help prevent overfitting found in complex VQA models. We found that even simple Seq2Seq models can predict the reasoning sequence and important keywords with reasonable accuracy on the GQA test set.

CalSol (UC Berkeley Solar Car Team) (2015 – 2019):

- Leader of the electrical sub-team (2016-2017).
- PCB design, firmware, basic experience with power electronics, writing models to optimize our race strategy, systems architecture design, and debugging
- Developed a real time Unscented Kalman Filter for the tracking of our battery SoC and internal resistance, which aided us in a 2nd place finish at the 2018 Formula Sun Grand Prix.

Teaching

Teaching Assistant for CIS 581 @ UPenn: Computer Vision & Computational Photography (Fall 2020)

- Held office hours to guide students through programming assignments, developed discussion sections to reinforce lecture concepts, answered student questions online, and helped to write exam questions