# EDUCATION

## Cornell University Ithaca, NY

## Ph.D. Candidate, Computer Science, GPA: 3.94/4.0 September 2020 – present (expected: December 2025)

*Relevant Coursework*: Model-Based State Estimation, Robot Manipulation, Machine Learning Theory, Deep Probabilistic and Generative Models, Matrix Computations

## Massachusetts Institute of Technology (MIT) Cambridge, MA

## M.Eng. in Electrical Engineering and Computer Science, GPA: 4.5/5.0 June 2019

## S.B. in Electrical Engineering and Computer Science, GPA: 4.9/5.0 June 2018

*Relevant Coursework*: Statistical Learning Theory and Applications, Robotics: Science and Systems, Bayesian Modeling and Inference, Machine Learning, Inference and Information, Design and Analysis of Algorithms, Computational Cognitive Science, Discrete-Time Signal Processing, Elements of Software Construction, Computation Structures

## Thomas Jefferson High School for Science and Technology Alexandria, VA

## SAT: 2400, GPA (weighted): 4.538/4.0 September 2010 – June 2014

*Relevant Coursework*: Artificial Intelligence, Parallel Computing

# RESEARCH EXPERIENCE

**Cornell University Ithaca, NY**

*Ph.D. Student*September 2020 – present

* Principal Investigators: Prof. Sarah Dean and Prof. Tapomayukh Bhattacharjee (March 2023 – present)
* Conducting research as part of EmPRISE (Empowering People with Robots and Intelligent Shared Experiences) lab
* Research area: Developing human-in-the-loop interactive learning algorithms for robot-assisted bite acquisition
* Principal Investigator: Prof. Mark Campbell (September 2020 – October 2022)
* Conducted research as a member of the ASL (Autonomous Systems Laboratory) group
* Research area: Developing reinforcement learning (RL) algorithms for the autonomous navigation domain that are robust to variations in the surrounding environment

**Massachusetts Institute of Technology Cambridge, MA**

*Research Engineer*June 2019 – June 2020

* Conducted research as a member of the DRL (Distributed Robotics Laboratory) group at CSAIL (Computer Science and Artificial Intelligence Laboratory)
* Refined autonomous driving simulation platform based on CARLA open-source driving simulator
* Validated research algorithms in simulation for vehicle navigation, dynamic obstacle avoidance, and end-to-end learning
* Supported research in language understanding and human-robot interaction involving the Toyota Human Support Robot platform

**Massachusetts Institute of Technology Cambridge, MA**

*M.Eng. Researcher*March 2018 – June 2019

* Principal Investigator: Prof. Daniela Rus
* Conducted research as a member of the DRL (Distributed Robotics Laboratory) group at CSAIL (Computer Science and Artificial Intelligence Laboratory)
* Thesis Title: “Development of a Simulation-Based Platform for Autonomous Vehicle Algorithm Validation”
* Developed autonomous vehicle simulation platform based on CARLA open-source driving simulator
* Investigated learning algorithms for LIDAR-based rural road detection

**Massachusetts Institute of Technology Cambridge, MA**

*UROP (Undergraduate Research Opportunities Program)*November – December 2017

* Principal Investigator: Prof. Jonathan How
* Conducted research as a member of the ACL (Aerospace Controls Laboratory) group
* Contributed to the development of a tripod-based sensor platform for pedestrian localization and intention recognition
* Calibrated webcams and LIDAR (Velodyne VLP-16), and investigated power management options for tripod platform

**Massachusetts Institute of Technology Cambridge, MA**

*SuperUROP Advanced Undergraduate Research Program*September 2016 – May 2017

* Principal Investigator: Dr. Jim Glass
* Conducted research as member of the SLS (Spoken Language Systems) group at CSAIL (Computer Science and Artificial Intelligence Laboratory)
* Contributed to the development of a conversational robotic system that can acknowledge speaking subjects
* Converted offline Voice Activity Detector module into real-time streaming module
* Researched techniques for integrating visual face detection and audio source localization

## George Mason University Fairfax, VA

## *Applied* *Mathematics Intern, Aspiring Scientists Summer Internship Program* June – August 2012, June – August 2013

* Principal Investigator: Prof. Padmanabhan Seshaiyer
* Developed MATLAB simulation of 1D Euler-Bernoulli Beam PDE system (2012); Modeled deformation of 2D membrane PDE system in COMSOL (2013)
* Simulated lung tissue fluid-structure interaction in MATLAB and developed lung tissue edge detection Python program: Pneumothorax Modeling and Diagnosis (2012)

**THESES**

**R. Banerjee**, “Development of a Simulation-Based Platform for Autonomous Vehicle Algorithm Validation”. MIT, 2019.

**PUBLICATIONS**

**JOURNAL PAPERS**

T. Ort, K. Murthy, **R. Banerjee**, S.K. Gottipati, D. Bhatt, I. Gilitschenski, L. Paull, and D. Rus, “MapLite: Autonomous Intersection Navigation Without a Detailed Prior Map,” *IEEE Robotics and Automation Letters*, vol. 5, no. 2, pp. 556–563, 2020.

A. Amini, I. Gilitschenski, J. Phillips, J. Moseyko, **R. Banerjee**, S. Karaman, and D. Rus. “Learning Robust Control Policies for End-to-End Autonomous Driving From Data-Driven Simulation,” *IEEE Robotics and Automation Letters*, vol. 5, no. 2, pp. 1143–1150, 2020.

**R. Banerjee** & P. Seshaiyer. “Computational Mechanics of a Coupled Flow-Structure Interaction Problem with Applications to Bio-Inspired Micro Air Vehicles,” *International Journal of Aerospace and Lightweight Structures* *(IJALS)*, vol. 3, no. 3, pp. 399-407, 2013.

A.R. Bhandarkar, **R. Banerjee** & P. Seshaiyer, “On the Stability of Lung Parenchymal Lesions with Applications to Early Pneumothorax Diagnosis,” *Computational and Mathematical Methods in Medicine*, vol. 2013, pp. 1-12, 2013.

**WORKSHOP PAPERS**

**R. Banerjee**, S. Dean, and T. Bhattacharjee, “To ask or not to ask: Robot-assisted bite acquisition with human-in-the-loop contextual bandits,” in *First Workshop on Out-of-Distribution Generalization in Robotics at CoRL 2023*, 2023.

**R. Banerjee\*,** P. Ray\*, M. Campbell. Improving Environment Robustness of Deep Reinforcement Learning Approaches for Autonomous Racing Using Bayesian Optimization-based Curriculum Learning, *IROS Workshop on Learning Robot Super Autonomy*, 2023.

# INDUSTRY EXPERIENCE

**Autoliv (now Veoneer) Lowell, MA**

*Intern, Advanced Sensing Group*June – August 2017

* Developed mapping algorithm for LIDAR data (Velodyne HDL-64) using point cloud registration to maintain coherent point cloud history and advance lane/object tracking algorithms
* Investigated mapping/registration techniques with lower-resolution (Velodyne VLP-32) LIDAR data to improve point cloud data resolution
* Investigated ego-motion estimation techniques with VLP-64 data to support vehicle localization

**Northrop Grumman San Diego, CA**

*Intern, Systems Integration, Test & Evaluation*June – August 2016

* Supported Systems Integration, Test & Evaluation for the Triton UAV (Unmanned Aerial Vehicle) program
* Developed Python test automation script for Triton test-bench landing test
* Co-developed SQL database for automated processing of Triton System Test Requests
* Improved upon Excel database for tracking flight requirements and test points
* Researched test automation methods for future modular hot-bench

**NASA Goddard Space Flight Center**  **Greenbelt, MD**

*Intern, Mission Engineering and Systems Analysis Division*January 2015; June – August 2015; January 2016

* Contributed to the NICER (Neutron Star Interior Composition Explorer)/SEXTANT (Station Explorer for X-Ray Timing and Navigation) mission
* Updated 1PPS signal interrupt handler Linux kernel module for hardware timing and synchronization
* Co-developed simulator of bi-directional science and telemetry packet transmission with another intern

**HONORS AND AWARDS**

* Member, IEEE-HKN (Eta Kappa Nu), inducted 2018
* Fourth Place in Category: Mathematical Sciences, Intel International Science and Engineering Fair, Phoenix, 2013
* Regional Finals participant, Siemens Competition in Math, Science, and Technology, Atlanta, 2012

**TEACHING EXPERIENCE**

**Cornell University Ithaca, NY**

*Teaching Assistant, Introduction to Reinforcement Learning (CS 4789)*February – May 2023

* Revised problem set questions and managed grading of assignments

**Cornell University Ithaca, NY**

*Teaching Assistant, Foundations of Artificial Intelligence (CS 4700)*February – May 2021

* Developed problem set and exam questions
* Recognized by Prof. Haym Hirsh at Cornell CS Student Recognition Event (May 2021)

**Cornell University Ithaca, NY**

*Teaching Assistant, Introduction to Machine Learning (CS 4780)*September – December 2020

* Developed problem sets in coordination with undergraduate TAs
* Conducted office hours to assist students with concepts and problem sets

**Massachusetts Institute of Technology Cambridge, MA**

*Teaching Assistant, Introduction to Probability (6.041/6.431)*September – December 2018, February – May 2018

* Taught weekly tutorial problem-solving sessions to small student groups
* Conducted office hours to assist students with concepts and problem sets

**Massachusetts Institute of Technology Cambridge, MA**

*Lab Assistant, Introduction to Electrical Engineering and Computer Science I (6.01)*February – May 2015

* Assisted students with in-class Software Labs and engineering Design Labs

**SERVICE**

* Participated in Cornell Student-Applicant Support Program, assisting 2 prospective PhD applicants with preparing application materials (2022)
* Helped improve course materials for Cornell Foundations of Robotics class (CS 4750): Summer 2023

**PROJECTS**

## Generating Simulated Environments for 2D Path Planning Using Deep Conditional Generative Models Ithaca, NY

## *Class Project, Deep Probabilistic and Generative Models (CS 6783)* February 2021 – May 2021

* Explored the application of deep generative models to the problem of generating simulated 2D map environments
* Experimented with conditional variational autoencoder (CVAE) and PixelCNN architectures on a synthetic 2D dataset

## 3D Point Cloud Clustering Using Small-Variance Asymptotics Cambridge, MA

## *Class Project, Bayesian Modeling and Inference (6.882)* March 2018 – May 2018

* Explored Bayesian non-parametric clustering of 3D point cloud data using small-variance asymptotics approximate inference algorithms
* Implemented Kulis and Jordan (2012) small-variance asymptotics algorithm for DP-GMM and Straub et al. (2015) algorithm for DP-vMF-MM in Python

## MIT Unmanned Aerial Vehicle Team Cambridge, MA

## *Student Participant* September 2014 – September 2017

* Developed refined 2D simulator of competition arena and agent dynamics for the International Aerial Robotics Competition as simulation team lead
* Managed development of computer vision gridline and circle detection Python programs as computer vision team lead
* Co-developed Python simulator of competition arena and contributed to UAV path planning algorithms as member of artificial intelligence team

**SKILLS**

**Programming Languages**: Python, MATLAB, C++, Java, C, HTML, LaTeX

**Frameworks/Libraries:** PyTorch, ROS, Scikit-learn