Neelay Junnarkar

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Education

University of California, Berkeley   Fall 2021 - Expected Spring 2026
Ph.D. Student in Electrical Engineering and Computer Sciences

University of California, Berkeley   Fall 2017 - Spring 2021
B.S. in Electrical Engineering and Computer Sciences
Graduated with Highest Honors
GPA: 4.0 / 4.0

Relevant Coursework:
- Reinforcement Learning, Machine Learning, Artificial Intelligence.
- Nonlinear System Theory, Linear System Theory, Robotics.

Research Interests

Safe learning in control; control theory; reinforcement learning.

Application of machine learning to control, with an emphasis on safety guarantees, particularly under model uncertainty.

Professional Experience

Power System Control and Optimization Intern at Siemens   Spring 2023

Development of an algorithm to safely handle power-line failures (contingencies) in a computationally tractable manner by grouping contingencies by similarity from a controls perspective, and designing one controller per group of contingencies. Paper published in IEEE Transactions on Power Systems.

Embedded Software Simulation Intern at Waymo   Summer 2020

Design and implementation of a C++ library for loading and simulating interconnected models of hybrid dynamical systems using the Functional Mock-up Interface standard.

Autoflight Intern for 777X Program at Boeing   Summer 2019

Creating monitors of autonomous takeoff. Modeling in Simulink, simulation of models, and analysis of data with MATLAB.

Intelligent Robotics Group Intern at NASA Ames   Summer 2018

Research and implementation of algorithms for relative localization of nodes in a wireless sensor network using ultra-wide band radios for pair-wise distance measurement. Additional hardware and firmware prototyping of nodes.

Works Under Review

- **Neelay Junnarkar**, Murat Arcak, and Peter Seiler. *Synthesizing Neural Network Controllers with Closed-Loop Dissipativity Guarantees*. 2024. arXiv: `2404.07373` [`eess.SY`] Submitted to IFAC Automatica.

Publications

- **Neelay Junnarkar**, Can Kızılkale, Nevena Golubovic, Murat Arcak, and Aydın Buluç. "Sempervirens: A Fast Reconstruction Algorithm for Noisy and Incomplete Binary Matrix Representations of Trees". In: *INFORMS Journal on Computing* (). DOI: `10.1287/ijoc.2023.0373`

- **Neelay Junnarkar**, Murat Arcak, and Peter Seiler. *Stability Margins of Neural Network Controllers*. 2024. arXiv: `2409.09184` [`eess.SY`]
  Accepted to 2025 American Control Conference.

- Emily Jensen, **Neelay Junnarkar**, Murat Arcak, Xiaofan Wu, and Suat Gumussoy. "Certifying Stability and Performance of Uncertain Differential-Algebraic Systems: A Dissipativity Framework". In: *IEEE Transactions on Control of Network Systems* (2024). DOI: `10.1109/TCNS.2024.3510585`

- Yasin Sonmez, **Neelay Junnarkar**, and Murat Arcak. "Exploiting Symmetry in Dynamics for Model-Based Reinforcement Learning With Asymmetric Rewards". In: *IEEE Control Systems Letters* 8 (2024). DOI: `10.1109/LCSYS.2024.3409560`

- **Neelay Junnarkar**, Emily Jensen, Xiaofan Wu, Suat Gumussoy, and Murat Arcak. "Grouping of N-1 Contingencies for Controller Synthesis: A Study for Power Line Failures". In: *IEEE Transactions on Power Systems* (2024). DOI: `10.1109/TPWRS.2024.3393866`

- **Neelay Junnarkar**, He Yin, Fangda Gu, Murat Arcak, and Peter Seiler. "Synthesis of Stabilizing Recurrent Equilibrium Network Controllers". In: *2022 IEEE 61st Conference on Decision and Control (CDC)*. 2022. DOI: `10.1109/CDC51059.2022.9992684`

- **Neelay Junnarkar**, Emmanuel Sin, Peter Seiler, Douglas Philbrick, and Murat Arcak. "Fast Assignment in Asset-Guarding Engagements using Function Approximation". In: *2022 American Control Conference (ACC)*. 2022. DOI: `10.23919/ACC53348.2022.9867720`

Presentations

- "Synthesis of Stabilizing Recurrent Equilibrium Network Controllers",   December 2022
  2022 IEEE 61st Conference on Decision and Control (CDC), Cancún, Mexico.

- "Synthesis of Stabilizing Recurrent Equilibrium Network Controllers",   June 2022
  NorCal Controls Workshop, UC Santa Cruz, Santa Cruz, California.

- "Fast Assignment in Asset-Guarding Engagements",   June 2022
  2022 American Control Conference (ACC), Atlanta, Georgia.

Other Experience

Undergraduate researcher in UC Berkeley Arcak lab (Advisor: Murat Arcak)
Fall 2019 - Summer 2021

- Synthesizing safe exploratory controllers to optimally gather data to improve a learned Gaussian Process model of a dynamical system using control barrier functions and sum-of-squares programming.

- Toolbox for Interval Reachability Analysis (TIRA): Implementing, testing, and optimizing methods for interval over-approximation of reachable sets for dynamical systems.

- Training and testing classifiers to select optimal parameters for multiple interceptors to intercept threat missiles under uncertainty. Used this classifier as a fast (real-time) approximation of a detailed but computationally expensive dynamics model.

Avionics Lead for Space Technologies and Rocketry (STAR) Club
Lead: Summer 2019 - Spring 2021, Member: Fall 2017 - Spring 2021

- Lead for design and implementation of club's avionics projects, and coordination of avionics with other rocket subsystem development.
- Designed an ARM microcontroller based ground station (schematic, PCB layout, and firmware) to relay telemetry and commands between a computer and the rocket via radio. Additional work on desktop-based software for live telemetry visualization.

Undergraduate researcher in UC Berkeley Swarm lab (Advisor: Kristofer Pister)
Spring 2018 - Spring 2019

- Research of computationally-inexpensive pose-estimation algorithms fusing IMU data for implementation on ARM Cortex-M4 processors.

Teaching Experience

Teaching Assistant for Linear System Theory   Fall 2022

Taught recitation section, developed homeworks, graded homeworks and exams.

Honors and Awards

- Dean's Honors List: GPA in the top 10% in the College of Engineering, UC Berkeley.

Skills and Interests

Languages: Python, C++, MATLAB, Rust, C.
Software: PyTorch, TensorFlow, UNIX & Linux.

May 13, 2025