FENGJUN YANG

fengjun@seas.upenn.edu ◇ Philadelphia, PA, 19104 ◇ fjyang96.github.io

EDUCATION

Ph.D. in Computer Science	Univerity of Pennsylvania	Sept. 2020 - Now
M.Sc. in Aerospace Engineering	Stanford University	Sept. 2018 - Jun. 2020
B.A. in Computer Science	Swarthmore College	Sept. 2014 - May 2018

RESEARCH EXPERIENCE

Controller-Aware Trajectory Generation for Robotic Systems *2022 - Present*
Mentor: Dr. Igor Spasojevic, Dr. Nik Matni, Collaborator: Anusha Srikanthan GRASP Lab, UPenn

- Co-developed an algorithm to bias a trajectory generator to generate easier-to-track trajectories by using a heuristics learned from past trajectories offline. Helped implement and deploy the algorithm on quadrotors and showed that our algorithm led to lower tracking errors.
- Currently working on (1) designing an RL algorithm that jointly designs the tracking controller and the trajectory generator via actor-critic learning, and (2) analyzing the performance degradation of planning with a reduced-order model on linear systems using system-level synthesis.

Data-Driven Methods for Distributed Control of Networked Systems *2020 - Present*
Mentor: Dr. Nik Matni GRASP Lab, UPenn

- Developed a **graph-neural-network**-based algorithm for co-designing distributed controllers with their communication network. Implemented the algorithm in **PyTorch** and showed that our method achieves good control performance with sparser communication than traditional methods.
- Theoretically analyzed the performance of linear graph filter (GNN without nonlinearities) controllers on graph-symmetric systems. Designed and implemented (in **cvxpy**) an algorithm that sparsifies communication networks while maintaining performance guarantees.
- Applied **ADMM** and the **behavioral control** framework to synthesize distributed MPC controllers without explicitly constructing a model of the system. Showed theoretically and empirically that our method achieves identical performance as model-based methods on linear systems.

Coordination of Multi-Agent Systems *2019–2020*
Mentor: Dr. Negar Mehr, Dr. Mac Schwager, Dr.Marco Pavone Stanford University

- Combined **model predictive control** with a learned heuristics to reduce the planning horizon of controlling robot-taxi fleets. Showed, in an in-house simulator, that the RL-learned heuristics can reduce the planning horizon by 40% while maintaining equal level of performance.
- Designed a **game-theoretic** algorithm for **role allocation** in robotic teams. Implemented and demonstrated the effectiveness of the algorithm on a collaborative transport problem.

Approximate Analysis of Large Symmetric Games *2016–2018*
Mentor: Dr.Bryce Wiedenbeck, Dr. Michael Wellman (UMich) Swarthmore College

- Applied **Gaussian process regression** to learn the pure-strategy payoff function of a large symmetric game from sparse samples. Derived a closed-form expression for evaluating expected payoffs of mixed-strategies from the GP, thereby circumventing expensive sampling-based evaluation.
- Designed a subclass of action graph games (AGG) and showed that our method outperformed state-of-the-art methods on all AGG test cases for finding Nash equilibria.

INDUSTRY EXPERIENCE

Leveraging Language Models to Build a Robot Tour Guide Summer 2023
Mentor: Dr. David Watkins, Dr. Surya Singh Boston Dynamics AI Institute

- Worked with a team of three other interns to design and implement a software stack that turned a Boston Dynamics Spot robot into a tour guide of the company space. Users can converse with the robot via a microphone and ask the robot to take them to various pre-specified locations.

- Integrated the OpenAI GPT backend to translate user's natural language input to commands for the robot to perform. Implemented various components in perception, navigation, and user input processing. Contributed to the company **ROS2** codebase.

PUBLICATION

1. Anusha Srikanthan, **Fengjun Yang**, Igor Spasojevic, Dinesh Thakur, Vijay Kumar, Nikolai Matni. "A Data-Driven Approach to Synthesizing Dynamics-Aware Trajectories for Underactuated Robotic Systems", *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2023
2. Haoze Wu*, Teruhiro Tagomori*, Alexander Robey*, **Fengjun Yang***, Nikolai Matni, George Pappas, Hamed Hassani, Corina Pasareanu, and Clark Barrett. "Toward Certified Robustness Against Real-World Distribution Shifts", *IEEE Conference on Secure and Trustworthy Machine Learning (SaTML)*, 2023
3. **Fengjun Yang**, Fernando Gama, Somayeh Sojoudi, and Nikolai Matni. "Distributed Optimal Control of Graph Symmetric Systems via Graph Filters", *IEEE Conference on Decision and Control (CDC)*, 2022
4. Carmen Amo Alonso*, **Fengjun Yang***, and Nikolai Matni. "Data-driven Distributed and Localized Model Predictive Control", *IEEE Open Journal of Control Systems, 2022*
5. **Fengjun Yang** and Nikolai Matni. "Communication Topology Co-Design in Graph Recurrent Neural Network based Distributed Control", *IEEE Conference on Decision and Control (CDC)*, 2021
6. Bryce Wiedenbeck, **Fengjun Yang**, and Michael Wellman. "A Regression Approach for Modeling Games with Many Symmetric Players", in the *Thirty-Second AAAI Conference on Artificial Intelligence (AAAI)*, 2018

TEACHING AND SERVICE

Teaching Assistant for UPenn ESE 2040 - Decision Models *Fall 2022*
Teaching Assistant for UPenn ESE 6050 - Modern Convex Optimization *Spring 2022*
Reviewer for: IEEE Transactions on Control of Network Systems (TCNS), IEEE Control Systems Letters (L-CSS), Learning for Dynamics and Control Conference (L4DC), IEEE Conference on Decision and Control (CDC), American Control Conference (ACC), IEEE International Symposium on Multi-Robot and Multi-Agent Systems (MRS).

AWARDS AND HONORS

Stanford University Graduate Engineering Fellowship ($110,000) *2018-2020*
Phi Beta Kappa, Sigma Xi at Swarthmore College *2018*

COURSEWORK

Mathematics: Convex Optimization(G[†]), Probability Theory(G), Linear Algebra(G), Statistics(U), Probabilistic Methods(U), Honors Several Variable Calculus(U), Mathematical Modeling(U)
Computer Science: Machine Learning(G), Reinforcement Learning(G), Artificial Intelligence(U), Operating Systems (G), Compilers(U), Computer Networks(U), Algorithms(U)
Robotics: Optimal Control(G), Mobile Robotics(G), Classical Control Theory(G), Model Predictive Control (G), Multi-robot control(G), Computer Vision(U), Linear Dynamical Systems(G)

[†] **G**:graduate-level, **U**:undergrad-level