

MEHRNAZ SABET

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Research Focus

My research aims to enable machines to learn how to coordinate with humans and other machines as a team towards shared goals. I believe learning effective cooperative behaviors can ultimately enable reliable autonomous systems. I build on emerging techniques in Multi-Agent Machine Learning and apply them to new training environments that are informed by real-world application scenarios involving drones.

Education

Ph.D. Information Science — Computer Science minor

Cornell University, College of Computing and Information Science

Jan 2021 – Present

Concentrations: Artificial Intelligence, Robotics, Human Computer Interaction

Committee: Susan Fussell ^{chair}, Sanjiban Choudhury, Malte Jung, Qian Yang

MSc. Information Science

Cornell University, College of Computing and Information Science

May 2023

Awarded upon completion of PhD Candidacy Exam (A-Exam)

BSc. Computer Engineering

University of Tehran, Department of Electrical and Computer Eng.

Sep 2014 – Jul 2020

Thesis: Integrating quadcopter drones to ad-hoc operations during disaster response

Achievements and Awards

Partnerships for AI-enabled Traffic Management for Advanced Air Mobility

2024

Led industry engagement for my NASA-funded project and secured more than 8 key partnerships with leading stakeholders and industry players for the project's execution. Raised an additional \$15,000 in funds

NASA University Student Research Challenge – Grant: \$80k

2024

Awarded to student research projects with novel approaches to solving some of the biggest technical challenges facing aviation as identified by NASA's Aeronautics Research Mission Directorate

Global Advanced Air Mobility Academic Paper Competition Finalist

2024

NSF Innovation Corps National Award – Grant: \$50k

2023

Awarded to top researchers in science and engineering fields with promising lab inventions

Cornell Engineering Commercialization Fellowship

2023

Awarded to three PhD candidates with research-based impactful technology innovations

NSF Spirit of I-Corps Award

2023

Awarded for demonstrating excellence in leadership and execution during the national program

ACM Best Paper Award

2022

Best ECE Undergraduate Thesis Project for Fundamental Design and Innovation

2020

Awarded by University of Tehran

Best Computer Eng. Undergraduate Thesis Project 2020
Awarded by University of Tehran

(4 x) Best Undergraduate Thesis Project by Industry 2020
Awarded by 4 different commercial companies

Selected Publications and Patents

- **Sabet, M.**, 2024. Intelligent Testbeds for Aerial Autonomy Assurance in Cooperative Airspace via Large Language Models, *under review in Global AAM Academic Paper Competition for submission in the Drone Systems and Applications journal*
- **Sabet, M.**, Palanisamy, P., & Mishra, S. (2023). Scalable modular synthetic data generation for advancing aerial autonomy. *Robotics and Autonomous Systems*, 166, 104464.
- **Sabet, M.**, Orand, M., & W. McDonald, D. (2021). Designing Telepresence Drones to Support Synchronous, Mid-air Remote Collaboration: An Exploratory Study. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*.
- **Sabet, M.** 2024. Neural engine for training distributed neural networks in simulated environments. Submitted to The United States Patent and Trademark Office.
- **Sabet, M.** 2024. System and methods for generating synthetic validation data for adaptive autonomous machines. Submitted to The United States Patent and Trademark Office.
- **Sabet, M.** 2024. Multi-agent human-in-the-loop simulation system for human-autonomy teaming training and evaluation. Submitted to The United States Patent and Trademark Office.

Research Experience

Cornell University — Lead Researcher on Human-Drone Systems Jan 2021 – Present

- Currently working on implementing a new multi-agent imitation learning algorithm for learning cooperative policies from humans in partially observable multi-agent simulation environments
- Implemented a suite of multi-agent human-in-the-loop cooperative simulation training environments informed by real-world search missions collected from more than 60 search and rescue drone operations
- Created an optimized training pipeline for on-policy MARL baseline finetuning in high-fidelity simulation environments
- Conducted studies on a new system for human-machine teaming data collection using a multi-person human-drone platform [paper submission underway]

NASA University Student Research Challenge — PI/Team Lead Feb 2024 – Present

Title: Learning cooperative policies for adaptive human-drone teaming in shared airspace

website: projectorion.info

- Building on my PhD research work to develop and test new cooperative policies for airspace coordination (leading to AI-enabled Traffic Management software for Advanced Air Mobility)
- Implementing end-to-end data engine for training and testing multi-agent learning baselines in new simulation configurations that represent challenges faced in urban air mobility scenarios
- Leading a multi-disciplinary team of 7 undergraduate and master students across CS, IS, and ECE

Nvidia-NASA Hackathon Aug 2024 - Sep 2024

- Selected as part of an exclusive cohort of teams with large-scale NASA-funded projects to participate in a 1-month hackathon and work with Nvidia mentors to accelerate training compute for my project

- Pretrained and optimized two state-of-the-art navigation transformer models on DGX cloud. By leveraging accelerated computing, we achieved a 55% improvement in training performance and a 40% increase in memory efficiency
- Developed a more compact navigation model to accelerate deployment in scenarios where balancing performance and generalizability is crucial
- Created reusable pipelines for mixed precision, kernel fusion and distributed training for our ongoing work in the project to increase compute utilization
- Results were shared as part of Open Accelerated Computing (OAC) Summit'24 under dedicated session: Accelerating AI for Autonomous Navigation: Optimizing Navigation Transformers for Large-Scale Use Cases

Microsoft — Autonomous Systems Group Intern

June 2022 – August 2022

- Designed, developed and studied a new procedural generative aerial synthetic training data augmentation framework that increases end data variants by 75% and contributes to increased generalizability of trained models
- Designed and implemented an adaptive Domain Randomization approach for type-agnostic realistic scene augmentation to address sim-to-real
- Proposed a new iterative data collection optimization approach for efficiently generating synthetic aerial datasets to meet a performance target
- Ran experiments on representation learning methods for localization towards improving vision-based drone navigation using multi-modal synthetic data

Projects

Advanced simulation system for validating autonomous robots

Feb 2021 – May 2023

- Implemented an advanced modular simulation system to validate the autonomy behaviors in autonomous robots. This system provides scalable testbeds for robot autonomy through a modular data-driven environment
- Implemented a novel approach in multi-modal data collection, through a performant rendering mechanism that enables the simulator to generate large-scale test data to validate autonomy behaviors for single or multi-robot scenarios thus mitigating risk of deployment and accelerating test and validation
- This system has won 2 major awards including an NSF grant and is actively being used for research

Integrating quadcopter drones to ad-hoc operations during disaster response

B.Sc. Thesis – Department of Electrical and Computer Engineering

Jan 2018 – Feb 2020

- Studied first responders' collaboration during natural disasters and designed a platform prototype using quadcopter drones, advanced cloud computing, machine learning and data visualization techniques to support and facilitate drone operations in distributed teams for effective response.
- This project won 6 awards from industry and academia in total.

Professional activities

Project Director, Shaping Autonomy

2023 – 2024

- Conducted more than 100 interviews with industry experts for inspiring applied cross-institutional projects that address critical gaps and empower research and engineering community
- Initiative backed by NSF and supported by three major partnerships with leading industry associations

Technical Committee Member, Human-Machine Teaming, AIAA

2024 – Present

Friend of the Technical Committee, Intelligent Systems, AIAA

2024 – Present

Multi-Vehicle Control (m:N) Working Group member, NASA 2022 – Present
Data for Safety Cases sub-group lead, Queueing algorithms sub-group co-lead

Associate member, Association for Uncrewed Vehicle Systems International (AUVSI) 2022 – Present

Speaker, Open Accelerated Computing (OAC) Summit'24, Accelerating AI for Autonomous Navigation: Optimizing Navigation Transformers for Large-Scale Use Cases

Speaker, AUVSI '24, Shaping Autonomy: Enabling New Generation of Collaborations Towards Desired Outcomes

Speaker, Women & Drones Coffee Connection, Advancing the field through new collaborations, Oct 2023

Session Chair, AIAA SciTech '25, Human-Machine Teaming: Human Performance and Cyber-Physical Systems

Session Chair, AUVSI '23, Designing Autonomy: Data Foundations

Workshop Facilitator, AIAA SciTech '25, Idea Challenge Workshop: Defining Opportunities on the Bleeding Edge. The workshop focuses on technologies and opportunities that are more than 10 years away from being feasible, innately “DARPA hard”.

Reviewer, IEEE Transactions on Circuits and Systems II: Express Briefs, ACM Human Factors in Computing Systems (CHI), International Journal of Drones, ACM CSCW

Coverage

NASA Selects University Teams to Explore Innovative Aeronautical Research, By Jim Banke, nasa.gov, Feb 21, 2024

Ph.D. student Mehrnaz Sabet advances autonomous drone systems with industry partners, Cornell Graduate Student Spotlight, Oct 26, 2023

Commercialization Fellows assess innovations' potential, By Bridget Hagen, Cornell Chronicle, May 8, 2023

From ideas to impact, By Wpengine, Oct 4, 2023