Pratik Mukherjee

Assistant Professor in OME Department at Florida Atlantic University (FAU)

Date of Birth: Jun. 18, 1991

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Interests

- Robust and Stable Control Theory
- Lateral Vehicle Dynamics
- Non-linear Model Predictive Control
- Indirect Optimization (PMP)
- Semidefinite Programming
- Multi-Robot Distributed Control
- Kalman Filtering Based Estimation

Skills

Programming:

- ROS, Gazebo, AirSim ●●●●●
- Python , C# C++ ●●●●○
- Physics Simulators ●●●●○

Tools:

- IPOPT, SeDuMi ●●●●○
- CasADi, YALMIP ●●●●○
- PyTorch ●●●●●

Laboratory Tools:

- Jetson TX2 ●●●●●
- RealSense Cameras ●●●●●
- Farm Robots ●●●●●

Work Experience

Aug,03, 2024 – Present — **Assistant Professor** — **777 Glades Road, Boca Raton,Florida, USA**
I head the SCUBA (Scaling Collaborative Unmanned roBots for Autonomy) lab in the Ocean and Mechanical Engineering department as an Assistant Professor. My area of research is into multi-robot topology control.

Jul,01, 2021 – May,19, 2024 — **Postdoctoral Associate** — **319 15th Ave SE, Minneapolis,55455, USA**
Funding: United States Department of Agriculture (USDA)
University of Minnesota Twin Cities- My primary responsibility as a postdoctoral associate, in the Robotic Sensor Networks Lab, is leading research problems from conception to implementation in control theory for agricultural robotic applications.

Aug,21, 2016 – May,15,2021 — **Graduate Research Assistant** — **1185 Perry St, Blacksburg, VA 24060**
Funding: National Science Foundation Award Number: 1657235
Virginia Polytechnic Institute and State University- I worked on robust algorithms where we can identify the multi-robot system of Unmanned Aerial Systems (swarm) to be stable in scenarios when communication and sensing may be faulty or limited.

Sep,1 2014 – July,29, 2016 — **Graduate Research Assistant** — **319 15th Ave SE, Minneapolis,55455, USA**
Funding: Federal Highway Administration
University of Minnesota Twin Cities- Connected vehicle environment provides the groundwork of future road transportation. Researches in this area are gaining a lot of attention to improve not only traffic mobility and safety, but also vehicles' fuel consumption and emissions. In light of this, I worked with a team that developed a Hardware-in-the-Loop-System (HiLS) testbed to evaluate the performance of connected vehicle applications using the VISSIM traffic simulator.

Education

Postgraduate Studies

Aug,21, 2016 - May,15,2021 — **Ph.D. in Electrical Engineering** — **Virginia Tech, Va, USA**
Thesis Title: Distributed, Stable Topology Control of Multi-Robot Systems with Asymmetric Interactions.
Supervisor: Prof. Ryan K.Williams.
Grade: CGPA: 3.61
Adaptive Control | Non-Linear Systems | Convex Optimization | Graph Theory | Combinatorial Optimization

Sep,1 2014 - July,29, 2016 — **M.Sc. in Mechanical Engineering** — **UMN Twin-Cities, Mn,USA**
Thesis Title: Software Development for integration of Hardware in the Loop System with Traffic Simulator for evaluating Connected Vehicle Applications.
Supervisor: Prof. Zongxuan Sun
Grade: CGPA: 3.69
Robust Control | Optimal Filtering | Hybrid Vehicle Powertrain | Hydrostatic Dynamometer | Model Predictive Control

Undergraduate Study

Sep,1 2012 - May,17, 2014 — **B.Sc. in Mechanical Engineering** — **UMN Twin-Cities, Mn,USA**
Project Title: Machine Design of Inverted Piston.
Supervisor: Prof. James Van de Ven
Grade: CGPA: 3.71

June, 1, 2010 – June,1,2012 — **Mechanical Engineering** — **Manipal Institute of Technology, Manipal, India (No Degree, Transfer to University of Minnesota Twin-Cities, Mn,USA)**
Grade: CGPA: 3.5

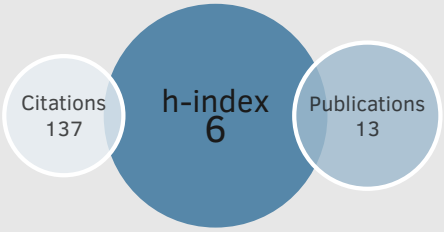
High School

June,1,2006 – June,1,2010 — **A-Levels with AICE** — **Sarala Birla Academy, Bengaluru, India**

Research Bio

During my years of Postdoctoral research, I have focused on vehicle trajectory optimization for multi-robot teams of vehicles using PMP based NMPC methods for disease detection on farm crops. I have developed robust, adaptive and stable controllers for lateral vehicle dynamics of Ackermann steered ground robots and I have hands-on experience with commercial farm robots such as Cowbot (Toro company) and Thorvald (Saga Robotics).

Metrics



Profiles

Languages

Bengali (Mother Tongue)

Hindi (Mother Tongue)

English (2nd Language)

Objective

I intend to work towards a world which is automation friendly. I bring with me a diverse set of engineering skills developed over years in academia in Mechanical, Electrical and Computer Science Engineering.

Teaching Experience

Undergraduate Courses

Virginia Tech	**ECE 3704: Continuous and Discrete Systems** Z-domain analysis, transfer functions, stability and frequency response.	Fall'16,Spring'17
University of Minnesota	**ME 4031W: Basic Measurements Lab** Calibration, Uncertainty Analysis.	Fall'14-Summer'16
	ME 4231: Motion Control Lab Frequency response testing,Closed loop velocity and position control.	Fall'15

Mentorship

2021–2022	Mentored **Ritik Mishra** for his undergraduate research to develop controllers for unmanned aerial vehicles to autonomously land/takeoff. He is currently with Parallel Systems.
2021	Mentored **Pranav Vijay** for his undergraduate research to develop a visual odometry based ground robot navigation system. He is currently an undergraduate student at UCSD.
2019–2020	Mentored a **senior design** team in the Electrical Engineering department to develop a Ground Control System for a Multi-Robot System.
2017–2018	Mentored **Yuqiao Liang** for his undergraduate research to calibrate Pozyx UWB localization system.
2017–2018	Mentored **Thomas Anyetei-Anum** for his undergraduate research to set up Pozyx UWB localization system.
2017–2018	Mentored **Stephanie Hoang** for her undergraduate research to develop April Tags detection.

Honours and Awards

Aug 2019	Multi-Robot Systems Symposium Travel Award	
Dec 2017	Conference on Decision and Control (CDC) Travel Award	
May 2014	Dean's List	UMN Twin-Cities, USA
May 2013	Dean's List	UMN Twin-Cities, USA

Other Experiences

- Undergraduate Research Project under Professor James Van de Van at University of Minnesota to develop an inverted liquid piston.
- Participated in Society Of Automotive Engineers Aero Design Competition WEST ATLANTA, GEORGIA , U.S.A.

Review Duties

Journals	Robotics and Automation Letter (RA-L), IEEE Transactions on Control of Network Systems (TCNS), IEEE Transactions on Robotics (T-RO).
Conferences	IROS, ICRA.

References

Ref. 1	**Prof. Volkan Isler** isler[at]umn[dot]edu, 612-625-1067	CS UMN Twin-Cities, USA
Ref. 2	**Prof. Ryan K.Williams** rywilli1[at]vt[dot]edu, 540-231-2224	ECE Virginia Tech, USA
Ref. 3	**Prof. Andrea Gasparri** gasparri[at]dia[dot]uniroma3[dot]it, +39 06 5733 3206	CS Roma Tre University, Italy

Publications

Journals

- **Pratik Mukherjee**, Burak Mert Gonultas, Volkan Isler, Neural $\mathcal{L}_1$ Adaptive Control of Vehicle Lateral Dynamics, **IEEE Transactions on Robotics (T-RO)**, Under Review.
- **Pratik Mukherjee**, Volkan Isler, PMP-based NMPC Trajectory Optimization of Aerial Vehicles for Active Information Acquisition using Learned Downwash Dynamics , **IEEE Robotics and Automation Letters (RA-L)**, Under Preparation.
- **Pratik Mukherjee**,Matteo Santilli, Andrea Gasparri, Ryan K.Williams, Distributed Adaptive and Resilient Control of Multi-Robot Systems with Limited Field of View Interactions using Q-Learning, **IEEE Robotics and Automation Letters (RA-L) with ICRA 2022**, February 2022.
- Matteo Santilli, **Pratik Mukherjee**, Andrea Gasparri, Ryan K.Williams, Multi-Robot Field of View Control with Adaptive Decentralization, **IEEE Transactions on Robotics(T-RO)**, February 2022.
- Mohd Azrin Mohd Zulkefli, **Pratik Mukherjee**,Z Sun, J Zheng, HX Liu, P Huang, Hardware-in-the-Loop Testbed for Evaluating Connected Vehicle Applications, **Transportation Research Part C**, March 10 2017.
- Mohd Azrin Mohd Zulkefli, **Pratik Mukherjee**,Y Shao, Z Sun, Evaluating Connected Vehicles and Their Applications, **Magazine Article ASME**, December 2016.

Conferences

- Burak Mert Gonultas, **Pratik Mukherjee** Volkan Isler, System Identification and Control of Front-Steered Ackermann Vehicles Through Differentiable Physics, **IROS 2023**.
- **Pratik Mukherjee**, Matteo Santilli, Andrea Gasparri, Ryan K.Williams, Optimal Topology Selection for Stable Coordination of Asymmetrically Interacting Multi-Robot Systems, **ICRA 2020**.
- **Pratik Mukherjee**, Matteo Santilli, Andrea Gasparri, Ryan K.Williams, Experimental Validation of Stable Coordination for Multi-Robot Systems with Limited Fields of View using a Portable Multi-Robot Testbed, **International Symposium on Multi-Robot and Multi-Agent Systems (MRS) 2019.**
- Matteo Santilli ,**Pratik Mukherjee**, Ryan K.Williams, Andrea Gasparri ,Distributed Connectivity Maintenance in Multi-Agent Systems with Field of View Interactions, **American Control Conference (ACC) 2019.**
- **Pratik Mukherjee**, Andrea Gasparri, Ryan K.Williams, Stable Motion and Distributed Topology Control for Multi-Agent Systems with Directed Interactions, **IEEE 56th Annual Conference on Decision and Control (CDC) 2017.**

Workshops/Talks

- Invited talk at NASA Jet Propulsion Lab on the topic **Coordinated Robots- Significance Of Interaction In Mobile Robots**, October 2023.
- **Pratik Mukherjee**, Matteo Santilli, Andrea Gasparri, Ryan K.Williams, Experimental Validation of Stable Coordination for Multi-Robot Systems with Limited Fields of View using a Portable Multi-Robot Testbed, **IROS 2019 - Aerial Swarms Workshop** .

Media Presence

- PBS Interview: PRAIRIE SPORTSMAN- Weed Terminator Clip: Season 15 Episode 12, https://video.pioneer.org/video/weed-terminator-p0gu14/
- AGWEEK Article: Beach, Jeff. "Mow 'em, Cowbot! University of Minnesota working on autonomous mower for pastures" AG-WEEK, June 27, 2022,https://www.agweek.com/news/mow-em-cowbot-university-of-minnesota-working-on-autonomous-mower-for-pastures.
- Virginia Tech Article: "Musical Drones" Institute for Creativity, Arts, and Technology, 2021, https://icat.vt.edu/projects/2021-2022/major/musical-drones.html
- WDBJ7 Interview: Boles, Ashley. "VT researchers look at autonomous drones for search and rescue missions" WDBJ, July 19, 2019,https://www.wdbj7.com/content/news/VT-researchers-look-at-autonomous-drones-for-search-and-rescue-missions–512963501.html.
- VT BIOMEDICAL ENGINEERING AND MECHANICS: "Researchers aim to enhance lost person search and rescue efforts using drones, artificial intelligence", April 19, 2019,Article Link.