

# Jay Patrikar

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## EDUCATION

**Carnegie Mellon University | School Of Computer Science (Robotics Institute)**

*Doctor of Philosophy in Robotics*

Advisor: **Dr. Sebastian Scherer**

Pittsburgh, PA

Fall 2020 – Summer 2024<sup>1</sup>

**Carnegie Mellon University | School Of Computer Science (Robotics Institute)**

*Master of Science in Robotics*

Advisor: **Dr. Sebastian Scherer**

GPA: 4.04 / 4.00

Pittsburgh, PA

Fall 2018 – Summer 2020

**Indian Institute of Technology Kanpur | Department Of Aerospace Engineering**

*Masters and Bachelors of Technology (Intergrated)*

Advisor: **Dr. Mangal Kothari**

CPI (PG) : 10.0/10.0, CPI (UG): 8.6/10.0

**Minors** : Controls Systems (EE) and English Literature (Humanities)

Kanpur, India

Fall 2013 – Summer 2018

**Selected Courses:** Theoretical and Empirical Foundations of Modern Machine Learning, Planning and Decision-making in Robotics, Deep Reinforcement Learning, Computer Vision, Introduction to Machine Learning (PhD)

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## RESEARCH EXPERIENCE

**Autonomous Systems Research Group, Microsoft Research**

Director: **Dr. Ashish Kapoor**

Redmond, WA

Summer 2022

- Developed techniques that enable uncertainty quantification for large pre-trained models using learned temporal variational representations.

**Airlab, Carnegie Mellon University**

Director: **Dr. Sebastian Scherer**

Pittsburgh, PA

2018 – Now

- Worked on various projects at the intersection of artificial intelligence and robotics to improve the robustness and reliability of real world robot autonomy.

**Intelligent Guidance & Control Laboratory, Indian Institute of Technology Kanpur**

Director: **Dr. Mangal Kothari**

Kanpur, India

2016 – 2018

- Developed and flight tested a novel guidance law for 3D path following of fixed-wing Unmanned Aerial Vehicles using input-based nested saturation techniques to improve the stability characteristics.

**Unmanned Aerial Vehicles Laboratory, Indian Institute of Technology Kanpur**

Director: **Dr. A.K.Ghosh**

Kanpur, India

2015 – 2017

- Designed and tested autopilot systems for fixed wing and rotary UAVs with applications in surveillance and target-tracking.

**National Aerothermochemistry and Hypersonics Laboratory, Texas A&M University**

Director: **Dr. R Bowersox**

College Station, TX

Summer 2016

- Studied Boundary Layer Transition on Elliptic cone geometries in Hypersonic flow using thermal flow visualization.

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## SKILLS & LICENSES

- **Licenses** : Private Pilot Certificate Part 61, Remote Pilot Certificate FAA Part 107
- **Coding** : Python, C++, SQL
- **Tools and Libs** : Pytorch, OMPL, ROS, PX4, PostGRES, PostGIS, Redis, TensorFlow
- **Languages** : English, Hindi, Marathi (Native), French (A1 Level Certification)

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## AWARDS & RECOGNITION

- **2 A+ grades** for exceptional performance in courses at Carnegie Mellon University
- **2 Academic Excellence Awards** (for distinctive academic performance in years 2016-17 and 2017-18) at Indian Institute of Technology Kanpur
- Awarded the **Summer Undergraduate Research Grant for Excellence (SURGE)** for Summer 2015
- **4 A+ grades** for exceptional performance in courses at Indian Institute of Technology Kanpur

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<sup>1</sup> Planned

## TEACHING EXPERIENCE

- **TA, 16-833: Robot Localization and Mapping**, Robotics Institute, Carnegie Mellon University Spring 2021
  - **TA, 16-384: Robot Kinematics and Dynamics**, Robotics Institute, Carnegie Mellon University Fall 2020
  - **TA, AE361A: Aeromodel Design & Fabrication**, Department of Aerospace Engineering, IIT Kanpur Spring 2018
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## SELECTED PROJECTS

**Close-Proximity Safe and Seamless Operation of Manned and Unmanned Aircraft in Shared Airspace** Pittsburgh, PA  
*U.S. Army AI Task Force* PI: Dr. Sebastian Scherer, Co-PI: Dr. Jean Oh 2021

- Developed end-to-end multi-modal (vision, language and context) system to achieve safe manned-unmanned vehicle teaming to improve the system performance and have each (robot/human) teammate learn from each other in various aircraft operations.
- Areas: Multi-modal AI, Trajectory Prediction, Decision Making and Planning

**Improving Last-mile Autonomous Delivery in Urban Areas** Pittsburgh, PA  
*U.S. Department of Energy* PI: Dr. Constantine Samaras 2019

- Carried out a flight data collection campaign to collect energy consumption data for a drone-based system to train a first-principle physics-based energy model.
- Areas: First principles modeling, Autonomous path planning, Energy Sciences

**Development of a Preflight Path Planning Tool for General Aviation Pilots** Pittsburgh, PA  
*Near Earth Autonomy Inc.*, PI: Dr. Sebastian Scherer 2019

- Developed a multi-objective risk-aware graph-based pre-flight planner for VFR (Visual-Flight Rules) cross-country flights
- Areas: Cloud Computing, GIS, Database Management, Graph-based planning, risk modelling

**Development of UAV Dynamics Model and Study of Control Effectiveness** Hyderabad, India  
*DRDO Centre for High Energy Systems and Sciences (CHESS)* PI: Dr. Mangal Kothari 2018

- Designed a full system dynamics simulator for fixed-wing UAVs and performed ablation studies to characterise control surface effectiveness.
- Areas: 6-DOF Simulations, Control Ablation Studies

**Development of a High Altitude Surveillance Platform** Bangalore, India  
*TATA Advanced Systems Pvt Ltd* PI: Dr. A.K. Ghosh 2016

- Carried out system identification of a high-altitude fixed wing platform for surveillance operations at > 4500m MSL.
  - Areas: High Altitude Flight Mechanics, Design Optimization, Parameter Estimation, UAV Operations Management
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## LEADERSHIP AND MENTORING

- **President** The Flying Club, Carnegie Mellon University 2021 – 2022
  - **Student Representative** Robotics Institute, Graduate Student Assembly, Carnegie Mellon University 2020 – Now
  - **President** Society of Aerospace Engineers, IIT Kanpur 2016 – 2017
  - **Student Representative** Departmental Undergraduate Committee, IIT Kanpur 2015 – 2016
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## PUBLICATIONS

### Thesis

- [1] **Wind-Field Estimation and Curvature Continuous Path Planning for Low Altitude Urban Aerial Mobility**  
Master's Thesis, Tech. Report, CMU-RI-TR-20-30 2020
- [2] **A 3D Guidance Law for Path Following**  
Master's Thesis, Tech. Report 2018

### Papers

- [3] **Follow The Rules: Online Signal Temporal Logic Tree Search for Guided Imitation Learning in Stochastic Domains**  
*J Patrikar\**, *Jasmine Aloor\**, *Parv Kapoor*, *Jean Oh*, *S Scherer* 2023  
International Conference on Robotics and Automation (ICRA) [Submitted]
- [4] **Vision-based Aircraft Detection and Tracking For Detect-and-Avoid**  
*Sourish Ghosh*, *J Patrikar*, *B Moon*, *Milad Hamdi*, *S Scherer* 2023  
International Conference on Robotics and Automation (ICRA) [Submitted]

- [5] **Quantification of Viable Drone Flight Hours Due to Weather Conditions**  
*A Sharma, J Patrikar, B Moon, C Samaras, S Scherer*  
 Journal of Transport Findings [Submitted] 2022
- [6] **Challenges in Close-Proximity Safe and Seamless Operation of Manned and Unmanned Aircraft in Shared Airspace**  
*J Patrikar\*, et al.*  
 International Conference on Robotics and Automation (ICRA) 2022
- [7] **Predicting Like A Pilot: Dataset and Method to Predict Socially-Aware Aircraft Trajectories**  
*J Patrikar, B Moon, Jean Oh, S Scherer*  
 International Conference on Robotics and Automation (ICRA) 2022
- [8] **CVaR-based Flight Energy Risk Assessment for Multirotor UAVs using a Deep Energy Model**  
*J Patrikar\*, B Moon\*, A Choudhry\*, C Samaras, S Scherer*  
 International Conference on Robotics and Automation (ICRA) 2021
- [9] **Adaptive Tube Library for Safe Online Planning Under Unknown Tracking Performance**  
*C Ho, J Patrikar, R Bonatti, S Scherer*  
 Workshop, Robotics: Science and Systems 2021
- [10] **In-flight positional and energy use dataset of package delivery quadcopter UAVs**  
*T Rodrigues, J Patrikar, A Choudhry, J Feldgoise, V Arcot, A Gahlaut, S Lau, B Moon, B Wagner, S Matthews, S Scherer, C Samaras*  
 Nature Scientific Data 2020
- [11] **Wind and the City: Utilizing UAV-Based In-Situ Measurements for Estimating Urban Wind Fields**  
*J Patrikar, B Moon, S Scherer*  
 International Conference on Intelligent Robots and Systems (IROS) 2020
- [12] **Real-time Motion Planning of Curvature Continuous Trajectories for Urban UAV Operations in Wind**  
*J Patrikar, V Dugar, V Arcot, S Scherer*  
 International Conference on Unmanned Aircraft Systems (ICUAS) 2020
- [13] **Nested Saturation Based Guidance Law for Unmanned Aerial Vehicles**  
*J Patrikar, VR Makkapati, A Pattanaik, H Parwana, M Kothari*  
 Journal of Dynamic Systems, Measurement, and Control, ASME 2019
- [14] **Sequential Auto-Landing of Multiple UAVs using Control Constrained Path Following**  
*J Patrikar, VR Makkapati, M Kothari*  
 AIAA Guidance, Navigation, and Control Conference 2019
- [15] **Convolutional Neural Network Based Sensors for Mobile Robot Relocalization**  
*J Patrikar\*, H Sinha\*, EG Dhekane\*, G Pandey, M Kothari*  
 23rd International Conference on Methods & Models in Automation & Robotics 2018
- [16] **A novel fully quaternion based nonlinear attitude and position controller**  
*H Parwana, J Patrikar, M Kothari*  
 AIAA Guidance, Navigation, and Control Conference 2018
- [17] **A Low-Cost Tilt-Augmented Quadrotor Helicopter : Modeling and Control**  
*M Bhargavapuri, J Patrikar, SR Sahoo, M Kothari*  
 International Conference on Unmanned Aircraft Systems (ICUAS) 2018
- [18] **MARAAL: A Low Altitude Long Endurance Solar Powered UAV For Surveillance and Mapping Applications**  
*VS Dwivedi, J Patrikar, A Addamane, AK Ghosh*  
 23rd International Conference on Methods & Models in Automation & Robotics 2018

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## PATENTS

- [1] **Using CVaR-based metrics for energy risk assessments of UAV flights**<sup>2</sup>  
*Jay Patrikar, Brady Moon, Arnav Choudhry, Sebastian Scherer and Constantinos Samaras*  
 2022
- [2] **Multi-camera visual detect & avoid system and detection algorithms.**  
*Sebastian Scherer, Sourish Ghosh, Jay Patrikar and Brady Moon*  
 CMU Intellectual Property Disclosure no. 2021-113 2021
- [3] **Wind-Aware Planning for Last Mile Delivery**  
*Sebastian Scherer, Jay Patrikar, Vishal Dugar, Vaibhav Arcot and Constantinos Samaras*  
 CMU Intellectual Property Disclosure no. 2020-071 2020

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<sup>2</sup>Submitted