DISHA KAMALE

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CONTACT INFORMATION

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RESEARCH INTERESTS

My research vision is to advance the theoretical foundations and practical implementation of intelligent robotic systems for complex, safety-critical applications, with the ultimate goal of augmenting human capabilities. I am specifically interested in informed decision-making and planning methodologies to realize this goal. My doctoral research has been at the intersection of formal methods, motion planning, optimization, controls and graph theory. My current research interests include but are not limited to:

- Perception-aware planning and decision-making
- Planning under imperfect perception
- Preference-based planning for complex missions with formal guarantees
- Planning for multi-robot teams

EDUCATION

Lehigh University *Bethlehem PA, USA*

Ph.D., Mechanical Engineering and Mechanics (GPA: 4.0) *2020-present*

Advisor: *Dr. Cristian-Ioan Vasile*

Thesis: *Perception-aware planning with relaxed satisfaction of complex mission specifications and user preferences*

Visvesvaraya National Institute of Technology(NIT), Nagpur *Nagpur, India*

B.Tech. Mechanical Engineering (GPA:4.0 - converted using WES) *2015-2019*

Capstone: *Static gait of quadruped robot: advantages of using an inertial appendage*

RESEARCH EXPERIENCE

- **Graduate Research Assistant** *Advisor: Dr. Cristian-Ioan Vasile* *2020-present*

Explainable Robotics Lab (ERL) and AIRLAB, Lehigh Univerisity

Key Highlights: *Robotics* | *Formal Methods*| *Planning with user preferences* | *Perception-aware Planning* | *Planning in Discrete Space* | *Optimization* | *Graph Search Algorithms* | *Automata Theory*

◦ Safe planning and decision-making for single and multi-robot teams for complex temporal logic goals. Developed automata and optimization-based techniques to achieve meaningful satisfaction of potentially infeasible tasks using human preferences.

◦ Devised an effective theoretical representation of partial symbolic perception with incremental improvement. Developed control synthesis algorithms for tackling perception-aware reactive and constrained active exploration problems.

- **Research Intern** *Mentor: Manish Saroya, Dr. David Isele, Dr. Sangjae Bae* *Summer 2024*

Honda Research Institute US HRI, San Jose, CA

Key Highlights : *Neurosymbolic path planning*

◦ Proposed and developed a learning-based framework for autonomous driving with formal guarantees

• **Research Intern** *Advisor: Dr. Amir Ghalamzan Esfahani* (now at University of Surrey) *2019-2020*
Intelligent Manipulation Lab IML and LCAS, University of Lincoln, Lincoln, UK.

Key Highlights: *Arm Motion and Grasp Planning* | *Human-Robot Shared Manipulation* | *Human-subject Tests*

◦ Developed a shared control architecture to provide informative haptic cues to users in human-in-the-loop telemanipulation tasks.

• **Summer Research Intern** *Advisor: Dr. Calogero Maria Oddo* *Summer 2018*
Neuro-Robotic and Touch Lab, The Biorobotics Institute, Sant'Anna School of Advanced Studies, Pisa, Italy.

Key Highlights: *Hand-pose Estimation* | *Tendon-driven Control of Articulated Robotic Hand*

◦ Developed a learning-based 3D hand-pose estimation and control framework for telecommunication as part of a larger project PARLOMA

• **Voluntary Student Researcher** *Advisor: Dr. Shital Chiddarwar* *2016-2019*
IvLabs, NIT Nagpur.

Key Highlights: *Biped Robots* | *Static Gait Generation* | *Quadruped Robots*

◦ Developed an inertial-appendage controlled underactuated Quadruped robot. Implemented static gait generation on Biped and Quadruped robots designed and fabricated in-house.

◦ Proposed and developed a blind-assistive device to enable safe navigation using multiple sensing modalities and audio feedback.

PUBLICATIONS

• **Journal Articles**

[J1] **Disha Kamale**, Cristian-Ioan Vasile. **Optimal Planning with Relaxation of Temporal Logic specifications** (*In preparation*)

[J2] Gustavo A. Cardona, **Disha Kamale**, Cristian-Ioan Vasile. **STL and wSTL control synthesis: A disjunction-centric mixed-integer linear programming approach.** *IFAC, Nonlinear Analysis: Hybrid Systems, NAHS 2025*

[J3] **Disha Kamale**, Xi Yu, Cristian-Ioan Vasile. **A*-based Temporal Logic Path Planning with User Preferences on Relaxed Task Satisfaction.** *(In preparation)*

• **Refereed Conference Articles**

[C1] Kaier Liang, Gustavo Cardona, **Disha Kamale**, Cristian-Ioan Vasile. Learning Optimal Signal Temporal Logic Decision Trees for Classification: A Max-Flow MILP Formulation. *IEEE Conference on Decision and Control (CDC) 2024*

[C2] **Disha Kamale**, Cristian-Ioan Vasile. **Optimal Control Synthesis with Relaxed Global Temporal Logic Specifications for Homogeneous Multi-robot Teams.** *IEEE International Conference on Robotics and Automation (ICRA) 2024*

[C3] **Disha Kamale**, Sofie Haesaert, Cristian-Ioan Vasile. **Energy-Constrained Active Exploration Under Incremental-Resolution Symbolic Perception.** *IEEE Conference on Decision and Control (CDC) 2023*

[C4] **Disha Kamale**, Sofie Haesaert, Cristian-Ioan Vasile. **Cautious Planning with Symbolic Perception: Implementing Verified Reactive Driving Maneuvers.** *IEEE International Conference on Robotics and Automation (ICRA) 2023*

[C5] Gustavo A. Cardona, **Disha Kamale**, Cristian-Ioan Vasile. **Mixed Integer Linear Programming Approach for Control Synthesis with Weighted Signal Temporal Logic.** *ACM International Conference on Hybrid Systems: Computation and Control (HSCC) 2023*

[C6] Guangyi Liu, **Disha Kamale**, Cristian-Ioan Vasile, Nader Motee. Symbolic Perception Risk in Autonomous Driving (*American Control Conference (ACC) 2023*)

[C7] **Disha Kamale**, Eleni Karyofilli, Cristian-Ioan Vasile. **Automata-based Optimal Planning with Relaxed Specifications.** *IEEE International Conference on Intelligent Robots and Systems (IROS) 2021*

[C8] Soran Parsa*, **Disha Kamale***, Sariah Mghames*, Kiyanoush Nazari, Tommaso Pardi, Aravinda R. Srinivasan, Gerhard Neumann and Amir Ghalamzan*. **Haptic-guided shared control grasping for collision-free manipulation.** *International Conference on Automation Science and Engineering (CASE) 2020*

- **Preprint**

Muhammad Arshad Khan*, Max Kenney*, Jack Painter*, **Disha Kamale***, Riza Batista-Navarro, Amir Ghalamzan*. **Natural Language Robot Programming: NLP integrated with autonomous robotic grasping**

- **Workshop Paper**

Disha Kamale*, Sariah Mghames*, Tommaso Pardi, Aravinda Srinivasan, Gerhard Neumann, Amir Masoud Ghalamzan Esfahani : **Abstract - Haptic-guiding to Avoid Collision during Teleoperation** - *Open-Ended Learning for Object Perception and Grasping, IROS 2019*

HONORS AND AWARDS

- **NSF CPS Rising Star** 2025.
- Recipient of **Rossin Professional Development Program Fellowship** for academic year 2023-24.
- Recipient of **RCEAS Fellowship**, Rossin College of Engineering and Applied Sciences, Spring 2023.
- **Dean's fellow**, Department of Mechanical Engineering and Mechanics in the Rossin Doctoral Fellows program for the academic year 2020-21.
- **Finalist for the best conference paper award** at the International Conference on Automation Science and Engineering (CASE) 2020.
- IEEE RAS Student Travel Support Award for ICRA 2024 in Yokohama, Japan.
- DTG-GO Doctoral Travel Grant for Global Opportunities, Lehigh University
- IEEE RAS Student Travel Support Award for ICRA 2023 in London, UK.
- IEEE CSS Student Travel Award and Workshop Support for CDC 2023, Singapore
- Graduate Student Senate (GSS) Travel Grant, Lehigh University for HSCC 2023, San Antonio, USA.
- **Inclusion fellow** Robotics: Science and Systems (RSS) conference, 2021
- **Quarter finalist at DST and TIIIC** Texas Instruments India Innovation Challenge Design Contest, 2016 for the project of Blind Navigator.

◦ In **top 1 percentile students in HSC Examination, 2015 among 12,37,241 students**. Eligible for Scholarship for Higher Education under Innovation in Science Pursuit for Inspired Research (INSPIRE)

INVITED TALKS AND DEMONSTRATIONS

Safe Autonomous Systems Lab (xLab), University of Pennsylvania *March 2025*
Robotics and Autonomous Systems Group, George Mason University *March 2025*
Berkley EECS Lab Group Meeting, University of California, Berkley *August 2024*
ILIAD Lab Group Meeting, Stanford University *July 2024*
Control Systems Group Meeting, Eindhoven University of Technology TU/e *May 2023*
Demonstration of LOMAP and TWTL at the workshop on Transforming Specifications into Robot Programs: A Survey of Formal Methods Tools for Non-Experts, *IROS 2021*

NEWS AND DISSEMINATION

◦ Lehigh MEM Celebrates Womens' History Month - my brief journey and vision about women in Mechanical Engineering
◦ The World Through a Robot's Lens: Enabling Complex Decision-Making With The Help of Reactive Games - a contributed article as part of the Graduate Student Research Series
◦ Advancing Autonomous Vehicles in Urban Spaces - news article
◦ A Testbed For Self-driving Vehicles in Urban Environments - news article
◦ Advancing Autonomy - resolve magazine AIRLAB feature
◦ Student panelist at Graduate Student Forum- Institute for Data, Intelligent Systems & Computation

SERVICE

Diversity, Equity and Inclusion

◦ DEI seminar in MEM Department, Lehigh University *Oct 2024*

I co-moderated a dialogue on DEI in academia.

◦ Charting Horizons and Opportunities in Careers in Engineering and Sciences CHOICES *2022*

I mentored middle-school girls for a week-long program introducing various opportunities in science and engineering.

Organized a session on introducing planning and decision-making for a robotic *capture-the-flag* game.

◦ Mentor for the Mentor Collective, Lehigh *2022*
I served as a mentor for 2 first-year international graduate students to help them navigate the new academic environment.

Workshop Organizing

Co-organized a workshop on "How to Ensure Correct Robot Behaviors? Software Challenges in Formal Methods for Robotics" at the *International Conference on Robotics and Automation* ***ICRA 2024***

Review Activities

International Journal of Robotics Research (IJRR) 2024
IEEE Robotics and Automation Letters (RA-L) 2021, 2022, 2023, 2024, 2025
International Conference on Robotics and Automation (ICRA) 2021, 2022, 2024, 2025

International Conference on Intelligent Robots and Systems (IROS) 2022, 2024
Conference on Decision and Control (CDC) 2023, 2024
American Control Conference (ACC) 2023, 2024
Ubiquitous Robotics (UR) 2022
International Conference on Advanced Robotics (ICAR) 2021
IEEE International Conference on Automation Science and Engineering (CASE) 2020

TEACHING QUALIFICATIONS

- P C Rossin Doctoral Fellows Intensive Teaching Workshop
- Teaching Skills Development - a semester-long course as a part of the Rossin Professional Development Program

TEACHING EXPERIENCE

Teaching Assistant *Lehigh University*

- Numerical Methods in Mechanical Engineering ME 017

Responsibility: Teaching *Fall 21*

Responsibility: Grading, office hours *Spring 22,23,24,25, and Fall 22, 23, 24*

Voluntary Teaching Assistant *University of Lincoln*

- Advanced Robotics *Spring 20*

Responsibility: Designing homework problems and test codes on Motion Primitives

MENTORING

- Lehigh University
  - Multiple teams of undergraduate students for Mountaintop Summer Experience Program *Research*
  - Maria Maragkelli *Research*
  - Eleni Karyofylli *Research*
- University of Lincoln
  - Jack Painter *Capstone Project*
  - Max Kenny *Capstone Project*
- NIT, Nagpur
  - Mentored a project on ATGV: Stair Climbing Robot at IvLabs during Summer mentorship project program, VNIT, India. *Technical*
  - Mentored 20 students for academic years 2017-18 and 2018-19 under the Student Mentorship Programme (SMP), VNIT, India. *Academic and career mentoring*
  - An active member of IvLabs; Conducted multiple IEEE workshops at NIT Nagpur.

TECHNICAL STRENGTHS

Programming languages	Python, C/C++, MATLAB
Robotics Middleware	ROS, ROS2
Mathematical Skills	Numerical Methods, Stochastic Calculus, Optimization
Optimization Framework	Gurobi
Learning Frameworks	PyTorch
Environments	Linux, Windows
Simulation platforms	Simulink, CARLA, CoppeliaSim, Gazebo
Workflow and tools	Github, Gitlab, Jupyter Notebook, Matplotlib

REFERENCES

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