MIHIR VINAY KULKARNI

Website | GitHub | Google Scholar | LinkedIn

EDUCATION

1. **Ph.D. in Engineering Cybernetics** *January 2022 - August 2025*
   Norwegian University of Science and Technology
   Department of Engineering Cybernetics
   Thesis title: Vision-based Navigation for Aerial Robots: From Parallelized Simulation to Resilient Flight in Cluttered Environments. [Link]
   Advisors: Prof. Dr. Kostas Alexis *(supervisor)*, Prof. Dr. Davide Scaramuzza *(co-supervisor)*
   Committee: Prof. Dr. Georgia Chalvatzaki, Prof. Dr. Dimitrios Kanoulas, Prof. Dr. Damiano Varagnolo
2. **M.S. in Computer Science and Engineering** *August 2020 - December 2021*
   University of Nevada, Reno
   Department of Computer Science and Engineering (GPA: 3.875/4.0)
3. **B.E. in Mechanical Engineering** *August 2016 - July 2020*
   Birla Institute of Technology and Science, Pilani (Goa Campus)
   Department of Mechanical Engineering (GPA: 8.66/10)

WORK EXPERIENCE

1. **Researcher** - Department of Engineering Cybernetics, NTNU *September 2025 - Present*
2. **Graduate Research Assistant** - Department of CSE, UNR *January 2021 - December 2021*

JOURNAL PUBLICATIONS

1. G. Malczyk, M. Kulkarni and K. Alexis, **"Semantically-Driven Deep Reinforcement Learning for Inspection Path Planning,"**, IEEE Robotics and Automation Letters. [DOI].

2. M. Kulkarni, W. Rehberg and K. Alexis, **"Aerial Gym Simulator: A Framework for Highly Parallelized Simulation of Aerial Robots"**, IEEE Robotics and Automation Letters. [DOI].

3. M. Tranzatto, M. Dharmadhikari, L. Bernreiter, M. Camurri, S. Khattak, F. Mascarich, P. Pfreundschuh, D. Wisth, S. Zimmermann, M. Kulkarni, V. Reijgwart, B. Casseau, T. Homberger, P. De Petris, L. Ott, W. Tubby, G. Waibel, H. Nguyen, C. Cadena, R. Buchanan, L. Wellhausen, N. Khedekar, O. Andersson, L. Zhang, T. Miki, T. Dang, M. Mattamala, M. Montenegro, K. Meyer, X. Wu, A. Briod, M. Mueller, M. Fallon, R. Siegwart, M. Hutter, K. Alexis, **"Team CERBERUS Wins the DARPA Subterranean Challenge: Technical Overview and Lessons Learned"**, Field Robotics. [DOI].

4. M. Tranzatto, T. Miki, M. Dharmadhikari, L. Bernreiter, M. Kulkarni, F. Mascarich, O. Andersson, S. Khattak, M. Hutter, R. Siegwart, K. Alexis, **"CERBERUS in the DARPA Subterranean Challenge"** Science Robotics. [DOI].

5. F. Mascarich, M. Kulkarni, P. de Petris, T. Wilson, K. Alexis, **"Autonomous Mapping and Spectroscopic Analysis of Distributed Radiation Fields using Aerial Robots"**, Autonomous Robots. [DOI].

6. M. Tranzatto, F. Mascarich, L. Bernreiter, C. Godinho, M. Camurri, S. Khattak, T. Dang, V. Reijgwart, J. Loje, D. Wisth, S. Zimmermann, H. Nguyen, M. Fehr, L. Solanka, R. Buchanan, M. Bjelonic, N. Khedekar, M. Valceschini, F. Jenelten, M. Dharmadhikari, T. Homberger, P. De Petris, L. Wellhausen, M. Kulkarni, T. Miki, S. Hirsch, M. Montenegro, C. Papachristos, F. Tresoldi, J. Carius, G. Valsecchi, J. Lee, K. Meyer, X. Wu, J. Nieto, A. Smith, M. Hutter, R. Siegwart, M. Mueller, Ma. Fallon, K. Alexis, **"CERBERUS: Autonomous Legged and Aerial Robotic Exploration in the Tunnel and Urban Circuits of the DARPA Subterranean**

Challenge", Field Robotics. [DOI].

CONFERENCE PUBLICATIONS

1. M. Kulkarni, M. Dharmadhikari, N. Khedekar, M. Nissov, M. Singh, P. Weiss andK. Alexis, 2025. **"UniPilot: Enabling GPS-Denied Autonomy Across Embodiments"**. IEEE International Conference on Advanced Robotics (ICAR) 2025. [DOI].
2. M. Harms, M. Kulkarni, N. Khedekar, M. Jacquet, K. Alexis. **"Neural Control Barrier Functions for Safe Navigation"**. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2024. [DOI].
3. M. Kulkarni and K. Alexis. **"Reinforcement Learning for Collision-free Flight Exploiting Deep Collision Encoding"**. IEEE International Conference on Robotics and Automation (ICRA) 2024. [DOI].
4. M. Dharmadhikari, P. De Petris, M. Kulkarni, N. Khedekar, H. Nguyen, A.E. Stene, E. Sjøvold, K. Solheim, Bente Gussiaas, and Kostas Alexis. **"Autonomous Exploration and General Visual Inspection of Ship Ballast Water Tanks using Aerial Robots."**, IEEE International Conference on Advanced Robotics (ICAR) 2023. ***Winner - Best Paper Award.*** [DOI].
5. M. Kulkarni and K. Alexis, **"Task-driven Compression for Collision Encoding based on Depth Images"**. International Symposium on Visual Computing (ISVC) 2023. [DOI].
6. M. Kulkarni, H. Nguyen, and K. Alexis. **"Semantically-enhanced Deep Collision Prediction for Autonomous Navigation using Aerial Robots"**. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2023. [DOI].
7. M. Dharmadhikari, P. De Petris, H. Nguyen, M. Kulkarni, N. Khedekar and K. Alexis, **"Manhole Detection and Traversal for Exploration of Ballast Water Tanks using Micro Aerial Vehicles"**, International Conference on Unmanned Aircraft Systems (ICUAS) 2023, [DOI].
8. N. Khedekar, M. Kulkarni and K. Alexis, **"MIMOSA: A Multi-Modal SLAM Framework for Resilient Autonomy against Sensor Degradation"**, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2022. [DOI].
9. P. De Petris, H. Nguyen, M. Dharmadhikari, M. Kulkarni, N. Khedekar, F. Mascarich, and K. Alexis. **"RMF-Owl: A Collision-Tolerant Flying Robot for Autonomous Subterranean Exploration."**, International Conference on Unmanned Aircraft Systems (ICUAS) 2022. [DOI].
10. M. Kulkarni, M. Dharmadhikari, M. Tranzatto, S. Zimmermann, V. Reijgwart, P. De Petris, H. Nguyen, N. Khedekar, C. Papachristos, L. Ott, R. Siegwart, M. Hutter, and K. Alexis, **"Autonomous Teamed Exploration of Subterranean Environments using Legged and Aerial Robots"**, IEEE International Conference on Robotics and Automation (ICRA) 2022. [DOI]. ***Winner - Outstanding Deployed Systems Paper Award.***
11. P. De Petris, H. Nguyen, M. Kulkarni, F. Mascarich and K. Alexis, **"Resilient Collision-tolerant Navigation in Confined Environments"**, 2021 IEEE International Conference on Robotics and Automation (ICRA), 2021. [DOI].
12. M. Kulkarni, H. Nguyen, and K. Alexis, **"The Reconfigurable Aerial Robotic Chain: Shape and Motion Planning"**. IFAC World Congress, 2020. [DOI].

WHITE PAPERS

1. M. Mittal et. al. **"Isaac Lab: A GPU Accelerated Simulation Framework For Multi-Modal Robot Learning"**. [DOI].

2. M. Dharmadhikari et. al. **"The Unified Autonomy Stack: Toward a Blueprint for Generalizable Robot Autonomy"**. [Link].

BOOK CHAPTERS

1. **Mihir Kulkarni**, Brady Moon, Sebastian Scherer, Kostas Alexis, **"Aerial Field Robotics"**, Encyclopedia of Robotics. [DOI].

TALKS AND LECTURES

1. **PX4 Developer Summit 2025** - "From Pixels To Propellers: Sim2Real Control and Vision-based Navigation". [Link]
2. **Invited Lecture: WPI RBE-595-F02-ST** - "Reinforcement learning for control and navigation of aerial robots"
3. **Aerial Robotics ROS Group Meeting** - "Aerial Gym Simulator" [Link]
4. **Tutorial: Learning-oriented Simulation for Aerial Robots, SSCI 2025** - "Aerial Gym 2.0: Isaac Gym-based Massively Parallelized Simulation for Efficient Aerial Robot Learning"

AWARDS AND ACHIEVEMENTS

1. Best Paper Award — IEEE ICAR 2023
2. Outstanding Deployed Systems Paper Award — IEEE ICRA 2022
3. Certificate of Special Recognition — United States Senate (2021)
4. Winner - Prize Round — DARPA Subterranean Challenge (2021)

OPEN SOURCE CONTRIBUTIONS

1. **Unified Autonomy Stack** - a field-tested autonomy architecture. **[GitHub]** **[Website]**
2. **Aerial Gym Simulator** - massively parallelized aerial robot simulator. **[GitHub]** **[Website]**.
3. **Semantically-enhanced Variational Autoencoder**. **[GitHub]**.
4. **GSOC 2020: Sensor Data Visualization** - Open Robotics. **[Link]**.
5. **Simulation Models** - Team CERBERUS - DARPA Subterranean Challenge Simulator. **[GitHub]**.
6. **SuperMegaBot Simulator** - Team CERBERUS Roving Robot **[GitHub]**.

PROGRAMS, INTERNSHIPS AND EXPERIENCE

1. Nordic Probabilistic AI School - ProbAI — *June 2023*
2. Google Summer of Code 2020, Open Robotics — *May 2020 - September 2020*
3. Visiting Scholar, University of Nevada, Reno — *June 2019 - January 2020*
4. Summer Research Intern, CSIR-CEERI Pilani, India — *May 2018 - July 2018*

SKILLS AND PROFICIENCIES

Programming Languages and Libraries - Python, PyTorch, NVIDIA Warp, C, C++
Mechanical Design - SOLIDWORKS, PTC Creo, Autodesk Fusion, Onshape
Simulation and Rendering - NVIDIA Isaac Gym/Sim/Lab, Gazebo, Blender
Robotics Middleware and Tools - ROS, ROS 2, Docker
Licenses - Remote UAS Pilot - A1,A2,A3 (EASA)

MEDIA COVERAGE

1. **IEEE Spectrum**: Video Friday
   (a) Reinforcement Learning for Collision-free Flight Exploiting Deep Collision Encoding. [Link]
   (b) Autonomous Teamed Exploration of Subterranean Environments using Legged and Aerial Robots. [Link]
   (c) Semantically-enhanced Deep Collision Prediction for Autonomous Navigation using Aerial Robots. [Link]
   (d) DARPA SubT Finals: Robot Operator Wisdom. [Link]
2. **The Washington Post Magazine**: "The Pentagon's $82 Million Super Bowl of Robots". [Link]
3. **Teknisk Ukeblad**: "Seier for NTNU-basert robotmiljø: Bedre enn både Nasa og MIT". [Link]
4. **Gemini.no** "Vant 17 millioner med undergrunnsroboter". [Link]
5. **GazeboSim Community**: GSOC 2020: Sensor Data Visualisation.[Link]
6. **BITS R&D**: Thesis at The University of Nevada, Reno. [Link]

REVIEWING ACTIVITIES

Journals:

1. IEEE Robotics and Automation Letters (RA-L)
2. IEEE Robotics and Automation Magazine (RAM)
3. International Journal of Robotics Research (IJRR)
4. IEEE Transactions on Robotics (T-RO)
5. IEEE Transactions on Field Robotics (T-FR)

Conferences:

1. IEEE International Conference on Robotics and Automation
2. IEEE/RSJ International Conference on Intelligent Robotics and Systems (IROS)
3. IEEE International Conference on Unmanned Aircraft Systems
4. IEEE International Conference on Advanced Robotics

POSITIONS OF RESPONSIBILITY

1. **Chief Coordinator**, Aerodynamics Club, BITS Pilani — *March 2018 - May 2019*
2. **Sub-Coordinator**, Electronics and Robotics Club, BITS Pilani — *April 2018 - May 2019*
3. **Electronics Team Lead**, Hyperloop India — *March 2018 - January 2019*

TEACHING AND RESEARCH EXPERIENCE

1. **Teaching Assistant** - Computer Programming (BITS Pilani) — *Jan 2020 - May 2020*
2. **Instructor** - Intermediate Robotics (CTE, BITS Pilani) — *Jan 2019 - May 2019*
3. **Instructor** - Introduction to Robotics (CTE, BITS Pilani) — *Aug 2018 - Dec 2018*