Vikas Dhiman

716 220 8719 vikas.dhiman@maine.edu vikasdhiman.info

Research Interests

3D Computer Vision, Robotics, Safe Control, Localization, Mapping

Appointments

Assistant Professor Bangor, ME
Electrical and Computer Engineering, University of Maine Aug 2021-Present
Primary Focus: Safe control of robots under uncertainty, learning navigation costs from imitation.

Postdoctoral Researcher San Diego, CA
Jacobs School of Engineering, University of California San Diego March-July 2019
Advisors: Prof. Henrik Christensen and Prof. Nikolay Atanasov
Primary Focus: Safe control of robots under uncertainty, learning navigation costs from imitation, tightly coupled semantic localization, visual-intertial odometry and game-theoretic patrolling with heterogeneous agents.

Senior IT Engineer Hyderabad, India
D.E. Shaw Software India Private Ltd. 2008-2012
Responsibilities: Automation of data collection, scraping, parsing, and visualization jobs.

Education

University of Michigan Ann Arbor, MI
Ph.D. in Electrical Engineering: Systems 2014-2019
Advisor: Jason J. Corso
Dissertation: Towards Better Navigation: Optimizing Algorithms for Mapping, Localization and Planning

State University of New York at Buffalo Buffalo, NY
M.S. in Computer Science and Engineering 2012-2014

Indian Institute of Technology Roorkee, India Roorkee, India
B.S. in Electrical Engineering 2004-2008

Publications [1]

25. M. Ataei, M. J. Khojasteh, and **V. Dhiman**. DAREK - Distance Aware Error for Kolmogorov Networks. In *International Conference on Acoustics, Speech and Signal Processing*. IEEE, 2025. (*h5: 129*)
24. S. Gharatappeh, S. Neshatfar, S. Y. Sekeh, and **V. Dhiman**. FogGuard: guarding YOLO against fog using perceptual loss. In *Computing Conference*, 2025. (*h5: 16*)
23. J. Eiyike, E. Gyaase, and **V. Dhiman**. Fast object compositional neural radiance field. In *Proceedings of IEEE International Conference on Intelligent Realty*, 2024.
22. S. U. Ahamad, M. Ataei, V. Devabhaktuni, and **V. Dhiman**. Omobot: a low-cost mobile robot for autonomous search and fall detection. In *2024 IEEE International Conference on Advanced Intelligent Mechatronics (AIM)*, 2024. (*h5: 17*)
21. A. Durgam, S. Paheding, **V. Dhiman**, and V. Devabhaktuni. Cross-view geo-localization: A survey. *IEEE Access*, 12:192028–192050, 2024. (*h5: 266*)
20. A. Rai, N. Bhujel, **V. Dhiman**, D. Hummels, U. Tamrakar, R. H. Byrne, and R. Tonkoski. A physics-informed neural network modeling approach for energy storage-based fast frequency support in microgrids. In *2024 IEEE Electrical Energy Storage Application and Technologies Conference (EESAT)*, pages 1–5, 2024.

[1] h5-Index (h5) provided by Google Scholar. CVPR, AAAI, IROS and ICRA are premier conferences in computer vision and Robotics. For each, the typical number of submissions is around 2000 and the overall acceptance rate is roughly 25%. CVPR is the highest rated publication venue for computer vision, and eighth-highest across all engineering and computer science, according to Google Scholar metrics.

19. P. Ghimire, S. Poudel, N. Bhujel, **V. Dhiman**, D. Hummels, and R. Tonkoski. Data-driven modeling of commercial off-the-shelf photovoltaic inverters using neuromancer. In *2024 International Symposium on Power Electronics, Electrical Drives, Automation and Motion (SPEEDAM)*, pages 135–140. IEEE, 2024.

18. C. Ewanik, K. Barai, Y.-J. Zhang, U. R. Hodeghatta, and **V. Dhiman**. Airborne spectral detection of leaf chlorophyll concentration in wild blueberries. In *2024 16th International Conference on Precision Agriculture*, 2024.

17. T. Tran, K. Barai, Y.-J. Zhang, **V. Dhiman**, and U. R. Hodeghatta. Predicting water potentials of wild blueberries during drought treatment using hyperspectral sensor and machine learning. In *2024 16th International Conference on Precision Agriculture 21-24 July 2024*, 2024.

16. T. Wang, **V. Dhiman**, and N. Atanasov. Inverse reinforcement learning for autonomous navigation via differentiable semantic mapping and planning. *Autonomous Robots*, 47(5), 2023. (*h5: 48*)

15. **V. Dhiman***, M. J. Khojasteh*, M. Franceschetti, and N. Atanasov. Control barriers in bayesian learning of system dynamics. *IEEE Transactions on Automatic Control*, 68(1):214–229, 2023. (*h5: 111*)

14. K. Long, **V. Dhiman**, M. Leok, J. Cort'es, and N. Atanasov. Safe control synthesis with uncertain dynamics and constraints. *IEEE Robotics and Automation Letters*, pages 1–8, 2022. (*h5: 71*)

13. M. Shan, **V. Dhiman**, Q. Feng, J. Li, and N. Atanasov. OrcVIO: Object residual constrained Visual-Inertial Odometry. *CoRR*, abs/2007.15107, 2020.

12. A. Langley, **V. Dhiman**, and H. Christensen. Heterogeneous multi-robot adversarial patrolling using polymatrix games. In *International Symposium on Automation, Mechanical and Design Engineering*, pages 13–27. Springer, 2021.

11. C. Nieto-Granda, S. Wang, **V. Dhiman**, J. Rogers, and H. Christensen. Distributed heterogeneous multi-robot source seeking using information based sampling with visual recognition. In *International Symposium on Experimental Robotics*, pages 462–471. Springer, 2020.

10. M. J. Khojasteh*, **V. Dhiman***, M. Franceschetti, and N. Atanasov. Probabilistic safety constraints for learned high relative degree system dynamics. In *Proceedings of the 2nd Conference on Learning for Dynamics and Control*, volume 120 of *Proceedings of Machine Learning Research*, pages 781–792, The Cloud, 10–11 Jun 2020. PMLR.

9. T. Wang, **V. Dhiman**, and N. Atanasov. Learning navigation costs from demonstration with semantic observations. In *Learning for Dynamics and Control*. PMLR, 2020.

8. T. Wang, **V. Dhiman**, and N. Atanasov. Learning navigation costs from demonstration in partially observable environments. In *IEEE International Conference on Robotics and Automation (ICRA)*, pages 4434–4440, 2020. (*h5: 71*)

7. J. Bi, **V. Dhiman**, T. Xiao, and C. Xu. Learning from interventions using hierarchical policies for safe learning. In *AAAI Conference on Artificial Intelligence*, volume 34, pages 10352–10360, 2020. (*h5: 56*)

6. S. Kumar, **V. Dhiman**, P. A. Koch, and J. J. Corso. Learning compositional sparse bimodal models. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 40(5):1032–1044, 2018. (*h5: 114*)

5. **V. Dhiman**, Q. Tran, J. Corso, and M. Chandraker. A continuous occlusion model for road scene understanding. In *IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, pages 4331–4339, June 2016. (*h5: 158*)[2]

4. **V. Dhiman**, A. Kundu, F. Dellaert, and J. J. Corso. Modern MAP inference methods for accurate and faster occupancy grid mapping on higher order factor graphs. In *IEEE International Conference on Robotics and Automation (ICRA)*, 2014. (*h5: 71*)

3. S. Kumar, **V. Dhiman**, and J. J. Corso. Learning compositional sparse models of bimodal percepts. In Carla E. Brodley and Peter Stone, editors, *Proceedings of AAAI Conference on Artificial Intelligence*, pages 366–372. AAAI Press, 2014. (*h5: 56*)

2. J. Ryde, **V. Dhiman**, and R. Platt. Voxel planes: Rapid visualization and meshification of point cloud ensembles. In *IEEE/RSJ International Conference on Intelligent Robots and Systems*, 2013. (*h5: 50*)

1. **V. Dhiman**, J. Ryde, and J. J. Corso. Mutual localization: Two camera relative 6-dof pose estimation from reciprocal fiducial observation. In *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2013. (*h5: 50*)

Software

2024: FogGuard: guarding YOLO against fog using perceptual loss.
`github.com/Sekeh-Lab/FogGuard`

2023 Control Barriers in Bayesian Learning of System Dynamics
`github.com/wecacuee/Bayesian_CBF`

2020: Object residual constrained Visual-Inertial Odometry (OrcVIO)
`github.com/shanmo/OrcVIO-Stereo-Mapping`

2019: A critical investigation of Deep-Reinforcement Learning for Navigation
`github.com/umrobotslang/does-drl-learn-to-navigate`

2018: Learning compositional sparse bimodal models
`bitbucket.org/surenkum/bimodal_sparse`

2014: Modern MAP inference methods for occupancy grid mapping on higher order factor graphs.
`github.com/wecacuee/modern-occupancy-grid`

2013: Voxel Planes: Rapid visualization and meshification of point cloud ensembles
`bitbucket.org/wecacuee/voxelplanes`

2013: Mutual Localization: Two camera relative 6-dof pose estimation from reciprocal fiducial observation.
`github.com/wecacuee/mutual_localization`

Grants Awarded[3]

Total Funding: $6,687,869; Share Credit: $833,350
Dollar amounts listed as $Total ($ Share; Percent Credit)

11. ***PI:** *State Of Health Monitoring in Electric Power Grids and New Visualization Frameworks.* — $91,028 ($36,411; 40%)
    Source: Sandia Labs, US DOE — 09/2024-09/2025
    Collaborators: Reinaldo Tonkoski (Co-PI), Don Hummels (Co-PI).
    Objective: To use energy storage systems to perform system identification and state of health monitoring in electric power grids.

10. ***Co-PI:** *Collaborative Research: RII Track-2 FEC: STORM: Data-Driven Approaches for Secure Electric Grids in Communities Disproportionately Impacted by Climate Change.* — $1,802,109 ($270,316; 15%)
    Source: NSF — 09/2023-09/2027
    Collaborators: Don Hummels (PI) Sharon Klein (Co-PI), Reinaldo Tonkoski (Former-PI), Prabuddha Chakraborty Bradfield Lyon, Sean Birkel, Vijaya Kumar Devabhaktuni, Mohamad Musavi, Paul Villeneuve.
    Objective: The proposed research, education, and workforce development activities will advance the nation's smart grid technologies to support communities disproportionately impacted by climate change.

9. ***PI:** *UMaine High Altitude Ballooning and School Launches in Maine 2023-2024* — $40,000 ($40,000; 100%)
    Source: MSGC, NASA — 09/2023-05/2025
    Collaborators: Richard Eason (Co-PI).
    Objective: Development and operation of undergraduate and K-12 associated scientific ballooning program.

8. **Co-PI:** *Decentralized and Resource Efficient Satellite Swarm* — $50,000 ($15,000; 30%)
    Source: MSGC, NASA — 01/2023-12/2023
    Collaborators: Prabuddha Chakraborty (PI), Salimeh Yasaei Sekeh (Co-PI).
    Objective: Through this project we plan to push innovations in the areas of (i) consensus-based decentralized control systems, (ii) domain & application adaptive data compression, and (iii) efficient neural network representations for mitigating the mentioned challenges.

7. **Co-PI:** *Robust Lifelong Learning to Improve the Health of Aquatic Ecosystems* — $40,000 ($20,000; 50%)
    Source: MSGC, NASA — 01/2022-12/2023

[3] Funding is sorted by start date (recent first). Active funding is prefixed with an asterisk (*).

Collaborators: Salimeh Yasaei Sekeh (PI).
Objectives: To address the problem of algal bloom by early detection using satellite and citizen data.

6. ***PI:** *UMaine High Altitude Ballooning and School Launches in Maine 2022-2023* $40,000 ($40,000; 100%)
Source: MSGC, NASA 09/2022-08/2023
Collaborators: Richard Eason (Co-PI).
Objective: Development and operation of undergraduate and K-12 associated scientific ballooning program.

5. **PI:** *Autonomous UAVs for crop monitoring in the state of Maine* $66,667 ($13,333; 50%)
Source: MSGC, NASA 09/2022-05/2025
Collaborators: Yongjiang Zhang (Co-PI), Umesh Hodeghatta (Co-PI).
Objective: We propose to advance the techniques of data collection and analysis for monitoring plant physiology in wild blueberries.

4. ***Co-PI:** *Aerospace Science and Technology in Secondary Schools (ASTSS)* $80K ($12,000; 15%)
Source: MSGC, NASA 09/2022-05/2025
Collaborators: Wilhelm Friess (PI), Seth Campbell (Co-PI), Parinaz Rahimzadeh-Bajgiran (Co-PI), Shawn Laatsch (Co-PI), Yongjiang Zhang (Co-PI).
Objectives: Aims to increase secondary school student interest and knowledge in aerospace STEM fields to strengthen the aerospace workforce in response to regional and national needs.

3. ***Co-PI:** *RII Track-2: Explainable and Adaptable Artificial Intelligence for Advanced Manufacturing* $3,000,000 ($300,000; 10%)
Source: NSF 09/2022-07/2026
Collaborators: Yifeng Zhu (PI), Brett Ellis (Co-PI), Chaofan Chen (Co-PI), Liping Yu (Co-PI), Vikas Dhiman (Co-PI), John Belding (Co-PI), Bruce Segee (Co-PI), Todd Gabe (Co-PI), Andrew Crawley (Co-PI), Rebecca Colannino (Co-PI).
Objectives: This project will create the Northeast Integrated Intelligent Manufacturing Lab (NIIM), integrating research across three EPSCoR jurisdictions Maine, New Hampshire, and Vermont to accelerate fundamental discoveries in advanced manufacturing (AdvMfg).

2. **PI:** *NASA Robotic Mining Challenge: Lunabotics 2023* $12,911 ($6,455; 50%)
Source: MSGC, NASA 04/2022-12/2023
Collaborators: Lisa Weeks (Co-PI).
Objectives: To enable participation of UMaine students in the NASA Robotic Mining Challenge.

1. **PI:** *NASA Robotic Mining Challenge: Lunabotics 2022* $5,100 ($2,550; 50%)
Source: MSGC, NASA 02/2022-06/2022
Collaborators: Lisa Weeks (Co-PI).
Objectives: To enable participation of UMaine students in the NASA Robotic Mining Challenge.

Mentoring and Teaching

I lead a research group with three PhD students, two Masters students, and several undergraduate students.

ECE 417/598: Introduction to Mobile Robotics Spr 22, Fall 23-24
Introduces basic Robotic algorithms in perception, planning, and control.

ECE 490/590: Neural Networks Spr 23-24, Fall 24
Introduces fundamentals of single-layer, two-layer, and convolution neural networks. Walks through implementing auto-differentiation from scratch using numpy library.

ECE 275: Sequential Logic systems Fall 2021-23
Provides an introduction to Sequential Logic Systems. Topics included how to design logical systems (both combinational and sequential) by hand- and computer-aided tools.

Service

1. Served as Associated Editor for IROS 2021, 2022.
2. Organized a workshop on “Safe Robot Control with Learned Motion and Environment Models” in the IEEE International Conference on Robotics and Automation 2021 conference with a participation of over 50 attendees and 8 speakers

3. Served as reviewer for

• IEEE Transactions on Robotics	2024
• IEEE International Conference on Robotics and Automation	2014, 2016-18, 2020-24
• IEEE Robotics and Automation Letters	2019, 2022-24
• ACM/IEEE International Conference on Human-Robot Interaction	2023
• IEEE American Control Conference	2020-22
• IEEE/RSJ International Conference on Intelligent Robots and Systems	2013, 2016, 2020-22
• IEEE Control Systems Letters	2020
• IEEE Conference on Computer Vision and Pattern Recognition	2014, 2016, 2022-23
• Indian Conference on Computer Vision, Graphics and Image Processing	2014, 2016
• International Journal of Robotics Research	2016
• Association for the Advancement of Artificial Intelligence	2015
• International Journal of Computer Vision	2014