

# Vikas Dhiman

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## RESEARCH INTERESTS

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

## APPOINTMENTS

### Assistant Professor

Electrical and Computer Engineering, University of Maine

Bangor, ME  
Aug 2021-Present

*Primary Focus:* Safe control of robots under uncertainty, learning navigation costs from imitation.

### Postdoctoral Researcher

Jacobs School of Engineering, University of California San Diego

San Diego, CA  
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, and visual-inertial odometry and game-theoretic patrolling with heterogeneous agents.

### Research Assistant

EECS, University of Michigan

Ann Arbor, MI  
Aug 2014 - Dec 2018

*Advisor:* Prof. Jason J. Corso

*Primary Focus:* Localization, mapping, and navigation in mobile robots using probabilistic graphical models and reinforcement learning.

### Research Intern

NEC Lab America, INC.

Cupertino, CA  
May 2014 - Aug 2014

*Mentor:* Prof. Manmohan Chandraker

*Project:* Occlusion-aware models for localization

### Research Assistant

Dept. of CSE, State University of New York at Buffalo

Buffalo, NY  
Jan 2012 - May 2014

*Advisor:* Prof. Jason J. Corso

*Primary Focus:* Multi-robot localization, mapping, and navigation in mobile robots for search and rescue.

### Senior IT Engineer

D.E. Shaw Software India Private Ltd.

Hyderabad, India  
2008 - 2012

*Responsibilities:* Automation of data collection, scraping, parsing, and visualization jobs.

## EDUCATION

### University of Michigan

Ph.D. in Electrical and Computer Engineering

Ann Arbor, MI  
2014 - 2018

*Advisor:* Jason J. Corso

*Dissertation title:* Towards Better Navigation: Optimizing Algorithms for Mapping, Localization and Planning

### State University of New York at Buffalo

M.S. in Computer Science and Engineering

Buffalo, NY  
2012 - 2014

### Indian Institute of Technology Roorkee, India

B.S. in Electrical Engineering

Roorkee, India  
2004 - 2008

## PUBLICATIONS <sup>1</sup>

<sup>1</sup>h5-Index (h5) provided by Google Scholar. CVPR, AAAI, IROS and ICRA are premier conferences in computer vision and Robotics. For each, typical number of submissions is around 2000 and the overall acceptance rate is around 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.

16. T. Wang, **Dhiman, V.**, and N. Atanasov. Inverse reinforcement learning for autonomous navigation via differentiable semantic mapping and planning. *Autonomous Robots*, 47(5), 2023.
15. K. Long, **Dhiman, V.**, M. Leok, J. Cortés, and N. Atanasov. Safe control synthesis with uncertain dynamics and constraints. *IEEE Robotics and Automation Letters*, pages 1–8, 2022. (h5: 71)
14. M. Shan, **V. Dhiman**, Q. Feng, J. Li, and N. Atanasov. OrcVIO: Object residual constrained Visual-Inertial Odometry. *IEEE Transactions on Robotics (Under Review)*, 2022 (Re-submitted).
13. A. Langley, **Dhiman, V.**, 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.
12. **V. Dhiman\***, M. J. Khojasteh\*, M. Franceschetti, and N. Atanasov. Control barriers in Bayesian learning of system dynamics. *IEEE Transactions on Automatic Control*, 2021.
11. C. Nieto-Granda, S. Wang, **Dhiman, V.**, 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)<sup>2</sup>
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

### **Object residual constrained Visual-Inertial Odometry (OrcVIO)**

[github.com/shanmo/OrcVIO-Stereo-Mapping](https://github.com/shanmo/OrcVIO-Stereo-Mapping)

### **Control Barriers in Bayesian Learning of System Dynamics**

[github.com/wecacuee/Bayesian\\_CBF](https://github.com/wecacuee/Bayesian_CBF)

### **A critical investigation of Deep-Reinforcement Learning for Navigation**

[github.com/umrobotslang/does-drl-learn-to-navigate](https://github.com/umrobotslang/does-drl-learn-to-navigate)

### **Learning compositional sparse bimodal models**

[bitbucket.org/surenkum/bimodal\\_sparse](https://bitbucket.org/surenkum/bimodal_sparse)

**Modern MAP inference methods for occupancy grid mapping on higher order factor graphs.**

[github.com/wecacuee/modern-occupancy-grid](https://github.com/wecacuee/modern-occupancy-grid)

**Voxel Planes: Rapid visualization and meshification of point cloud ensembles**

[bitbucket.org/wecacuee/voxelplanes](https://bitbucket.org/wecacuee/voxelplanes)

**Mutual Localization: Two camera relative 6-dof pose estimation from reciprocal fiducial observation.**

[github.com/wecacuee/mutual\\_localization](https://github.com/wecacuee/mutual_localization)

## MENTORING

Mentoring an undergraduate student Matthew Harzewski for his capstone and CUGR fellowship project on “Turtlebot exploration, mapping and navigation.”

## TEACHING

**ECE 417: Introduction to (Mobile) Robotics** Spring 2022  
This course intends to introduction to basic Robotic algorithms, in perception, planning and control.

**ECE 275: Sequential Logic systems** Fall 2021, (Ongoing) 2022  
Provided an introduction to Sequential Logic Systems. The topics included how to design logical systems (both combinational and sequential) by hand and by using computer aided tools. By the end of the course, the students were able to design a Pong game using Verilog on a FPGA development board.

**Lecture on Filtering and SLAM (Course: Introduction to Robotics)** Oct 2019  
[bit.ly/2W2rrfZ](https://bit.ly/2W2rrfZ)

A lecture on Simultaneous Localization and Mapping with slides adapted from Prof Henrik Christensen. I developed a simple jupyter notebook example of EKF implementation as a part of exposure to SLAM concepts.

**Lecture on Probabilistic graphical models (Course: Computer Vision)** Nov 2017  
[vikasdhiman.info/eecs442/20171109.html](https://vikasdhiman.info/eecs442/20171109.html)

A lecture on the basics of probabilistic graphical models in class on introduction to computer vision. The students had limited background in machine learning and probability.

**Lecture on OpenGM2 at (Course: Probabilistic Graphical Models)** Jan 2015  
[github.com/wecacuee/opengmdemo](https://github.com/wecacuee/opengmdemo)

A lecture on the usage of the library OpenGM2 with an in class demo of OpenGM2 library applied to a simple problem. This gave the students a quick start on their course projects.

**Outreach on Computer Vision and Pinhole Cameras (Camp: Xplore Engineering)** Jun 2015, 2016  
[vikasdhiman.info/xplore-workshop/pinhole.pdf](https://vikasdhiman.info/xplore-workshop/pinhole.pdf)

Organized a workshop for middle school students to create interest in sciences and the field of computer vision and explain modern cameras through pinhole cameras.

## SERVICE

1. Served as Associated Editor for IROS 2021, 2022 (Ongoing).
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 excellent speakers
3. Served as reviewer for
  - IEEE Control Systems Letters Submission 2020
  - IEEE American Control Conference 2020-22
  - IEEE Robotics and Automation Letters 2019, 2022
  - IEEE International Conference on Robotics and Automation 2014, 2016 - 18, 2020-22
  - IEEE/RSJ International Conference on Intelligent Robots and Systems 2013, 2016, 2020, 2022
  - IEEE Conference on Computer Vision and Pattern Recognition 2014, 2016
  - Indian Conference on Computer Vision, Graphics and Image Processing 2014, 2016
  - Association for the Advancement of Artificial Intelligence 2015

- International Journal of Computer Vision
- International Journal of Robotics Research

2014  
2016