Vikas Dhiman

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RESEARCH INTERESTS

Safe Control, Machine Learning, Robotics, Localization, Mapping, and Navigation

WORK EXPERIENCE

Postdoctoral Researcher   San Diego, CA
Jacobs School of Engineering, University of California San Diego   March 2019 - Present
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-intertial odometry and game-theoretic patrolling with heterogeneous agents.

Research Assistant   Ann Arbor, MI
EECS, University of Michigan   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   Cupertino, CA
NEC Lab America, INC.   May 2014 - Aug 2014
Mentor: Prof. Manmohan Chandraker
Project: Occlusion-aware models for localization

Research Assistant   Buffalo, NY
Dept. of CSE, State University of New York at Buffalo   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   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 and Computer Engineering   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   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]

13. **V. Dhiman***, M. J. Khojasteh*, M. Franceschetti, and N. Atanasov. Control barriers in Bayesian learning of system dynamics. *IEEE Transactions on Automatic Control (Under Review)*, 2020 (Submitted).

12. T. Wang, **V. Dhiman**, and N. Atanasov. Inverse reinforcement learning for autonomous navigation via differentiable semantic mapping and planning. *International Journal of Robotics Research (Under Review)*, 2020 (Submitted).

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[1] 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.

11. M. Shan, **V. Dhiman**, Q. Feng, J. Li, and N. Atanasov. OrcVIO: Object residual constrained Visual-Inertial Odometry. *IEEE Transactions on Robotics (Under Review)*, 2020 (Submitted).

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

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

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

Learning compositional sparse bimodal models
bitbucket.org/surenkum/bimodal_sparse

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

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

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

TEACHING

Lecture on Filtering and SLAM (Course: Introduction to Robotics) Oct 2019
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`
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`
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`
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 AS REVIEWER

- IEEE Control Systems Letters Submission   2020
- IEEE American Control Conference   2020
- IEEE Robotics and Automation Letters   2019
- IEEE International Conference on Robotics and Automation   2014, 2016 - 18, 2020
- IEEE/RSJ International Conference on Intelligent Robots and Systems   2013, 2016, 2020
- 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   2014
- International Journal of Robotics Research   2016

REFERENCE LIST

Jason J. Corso   jjcorso@umich.edu
Director, Stevens Institute of Artificial Intelligence, Stevens Institute of Technology,Hoboken, NJ.

Henrik Christensen   hichristensen@ucsd.edu
Director, Institute of Contextual Robotics, University of California San Diego, San Diego, CA.

Nikolay Atanasov   natanasov@ucsd.edu
Assistant Professor, ECE, University of California San Diego, San Diego, CA.