Kevin Doherty

CONTACT INFORMATION

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RESEARCH INTERESTS

My research interests lie at the intersection of autonomous robot navigation and machine learning, with specific interests in semantic SLAM and nonparametric inference.

EDUCATION

Massachusetts Institute of Technology, Cambridge, Massachusetts

S.M./Ph.D. MIT/Woods Hole Oceanographic Institution Joint Program, June 2017 - Present

- Dept: Aeronautics & Astronautics, Applied Ocean Science and Engineering
- Research Advisor: John Leonard, Academic Advisor: Nicholas Roy
- GPA: 5.0 / 5.0

Massachusetts Institute of Technology, Cambridge, Massachusetts

S.M. Aeronautics & Astronautics, June 2017 - September 2019

- S.M. Thesis Topic: "Robust Non-Gaussian Semantic SLAM"
- Research Advisor: John Leonard, Academic Advisor: Nicholas Roy
- GPA: 5.0 / 5.0

Stevens Institute of Technology, Hoboken, New Jersey

B.E. with Thesis, Electrical Engineering, September, 2013 - May, 2017.

- Thesis Topic: "Learning-aided 3D Occupancy Mapping for Mobile Robots"
- Advisor: Brendan Englot, Reader: Philippos Mordohai
- GPA: 3.97 / 4.0. Minor: Computer Science. GRE: 169 Q / 167 V / 5.5 W

RESEARCH EXPERIENCE

MIT Computer Science and Artificial Intelligence Lab, Cambridge, MA
Graduate Research Assistant **June, 2017 - Present**

Researcher in the Marine Robotics Group advised by John Leonard. My current work involves developing methods to quantify and mitigate uncertainty in robot perception, with application to semantic navigation.

Robust Field Autonomy Lab, Stevens Institute of Technology, Hoboken, NJ
Undergraduate Research Assistant **May, 2015 - May, 2017**

Studied autonomous robotics with specific interest in the problems of mapping and exploration. Investigated techniques to aid fast exploration of unknown environments. Developed approximate mapping approaches based on fusion of independent classifiers. Developed mapping approach using Bayesian kernel inference for real-time mapping using sparse range data.

MIT Lincoln Laboratory, Lexington, MA
Summer Research Intern **June, 2016 - August, 2016**

Developed algorithms for semantic map filtering and object localization with application to search using lightweight UAVs and UUVs. Integrated algorithms into a SLAM system with the goal of enhancing situational awareness for a user via a heads-up display.

INDUSTRY EXPERIENCE

Cizr Tennis www.cizr.com, Austin, TX
Part-time Software Engineering Intern **December, 2014 - June, 2016**

Back- and front-end development for a tennis video annotation and editing platform. Built several features currently in production for uploading matches, saving match events, and generating and sharing highlight reels.

Resolute Innovation www.resoluteinnovation.com, New York City, NY
Part-time Software Engineering Intern **December, 2014 - June, 2016**
Prototyped web crawlers and parsers for the backend of a university tech-transfer search engine. Built support for user accounts and saved documents. Studied techniques for machine learning-assisted expert data curation.

Teaching Experience

MIT 16.485 Visual Navigation for Autonomous Vehicles, Fall 2019
Teaching Assistant **August, 2019 - Present**
This course is concerned with the theory and practice of navigation using visual and inertial sensors for a variety of autonomous systems. We aim to familiarize students with the mathematical foundations of visual navigation and state-of-the-art algorithms, which students implement and test using the Intel Aero drone platform. Primary responsibilities include developing assignment materials and weekly lab sessions.

MIT 6.S198 Deep Learning Practicum, Spring 2018
Course Staff **October, 2017 - December 2017**
Developed course content using deeplearn.js relating to generative adversarial networks and other deep generative models.

Refereed Publications

K. Doherty, T. Shan, J. Wang, and B. Englot, "Learning-aided 3D Occupancy Mapping with Bayesian Generalized Kernel Inference", *IEEE Transactions on Robotics (T-RO)*, Accepted.

K. Doherty, D. Fourie, and J. Leonard, "Multimodal Semantic SLAM with Probabilistic Data Association", *IEEE International Conference on Robotics and Automation (ICRA)*, May 2019. Accepted.

T. Shan, K. Doherty, J. Wang, and B. Englot, "Bayesian Generalized Kernel Inference for Terrain Traversability Mapping", *2nd Annual Conference on Robot Learning (CoRL)*, October 2018.

K. Doherty, G. Flaspohler, N. Roy, and Y. Girdhar, "Approximate Distributed Spatiotemporal Topic Models for Multi-Robot Terrain Characterization", *IEEE International Conference on Intelligent Robots and Systems (IROS)*, October 2018. **Best Paper Award Finalist (6 finalists of 1,254 accepted submissions)**.

K. Doherty, J. Wang, and B. Englot, "Bayesian Generalized Kernel Inference for Occupancy Map Prediction", *IEEE International Conference on Robotics and Automation (ICRA)*, May 2017.

K. Doherty, J. Wang, and B. Englot, "Probabilistic Map Fusion for Fast, Incremental Occupancy Mapping with 3D Hilbert Maps", *IEEE International Conference on Robotics and Automation (ICRA)*, 8 pp., May 16-21, 2016.

S. Bai, J. Wang, K. Doherty, and B. Englot. "Inference-Enabled Information-Theoretic Exploration of Continuous Action Spaces", *The International Symposium on Robotics Research (ISRR)*, September 12-15, 2015.

Other Publications

K. Doherty, D. Fourie, J. Leonard, "Robust Semantic Navigation with Probabilistic Data Association", *MIT College of Computing Launch*, Poster. February 28, 2019.

K. Doherty, Y. Girdhar, "Unsupervised Spatial-Semantic Maps for Human-Robot Collaboration in Communication-Constrained Environments", *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Poster. September 24-28, 2017.

K. Doherty, J. Wang, and B. Englot, "Bayesian Learning with Generalized Kernels for Occupancy Map Prediction", *IEEE MIT Undergraduate Research Technology Conference*, Poster. November

4-6, 2016.

Open Source Releases

Learning-aided 3D Mapping Library (LA3DM)
Library providing implementation of recent learning-based mapping approaches developed at the Robust Field Autonomy Lab at Stevens Institute of Technology with Jinkun Wang.
`https://github.com/RobustFieldAutonomyLab/la3dm`

Outreach Activities

Open Ocean Initiative, MIT (2019)
Presentation and demonstration of "Marine Robot Navigation and Communication" (with Brendan O'Neill) for ≈ 100 international middle school students visiting MIT.

Professional Activities

- (2019) Reviewer for International Journal of Robotics Research (IJRR)
- (2017-2019) Reviewer for *IEEE Robotics and Automation Letters (RA-L)*, *IEEE International Conference on Intelligent Robots and Systems (IROS)*, *IEEE International Conference on Robotics and Automation (ICRA)*.
- (2017) Student volunteer for *Robotics: Science and Systems (RSS)*.

Honors and Awards

- NSF Graduate Research Fellowship Award. $102,000 plus tuition. 2018 - Present.
- MIT Graduate Student Council Travel Grant. $382. 2018.
- Link Ocean Engineering Fellowship Honorable Mention. 2018.
- Batchelor Award, in recognition of the highest graduating GPA in electrical engineering at Stevens Institute of Technology. 2017.
- IEEE Robotics and Automation Society ICRA Travel Grant. $700. $2017.
- ICFNJ Research Symposium Grant, in support of undergraduate research on underwater robotics. $1000. 2015.
- Anne P. Neupauer Scholarship, a four year, full-tuition merit scholarship granted by Stevens Institute of Technology. 2013-2017.

Computer Skills

Languages:
- Current experience: C++, Python, Julia, LaTeX
- Previous experience: Scala, Java, Coffeescript/Javascript, HTML, CSS, MATLAB

Tools: ROS, Gazebo, PCL, OpenCV, TensorFlow, Git, Jenkins CI

Other Activities

IEEE Robotics and Automation Society (RAS), Tau Beta Pi (TBP) Honor Society, Eta Kappa Nu (HKN) Honor Society, CSAIL Buddy (2018-2019), PADI SCUBA Diver

Relevant Coursework

Visual Navigation, Nonlinear Optimization, Inference and Information, Cognitive Robotics, Principles of Autonomy and Decision Making, Advances in Computer Vision, Machine Learning