

# JOHANNA HANSEN

johanna.hansen@mail.mcgill.ca  $\diamond$  <http://johannah.github.io>

## EDUCATION

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### McGill University, Montreal, QC

2016 – 2023

Ph.D. in Computer Science (expected), Mobile Robotics Lab  
Thesis work on Planning with Prediction in Scientific Sampling Robots  
under the supervision of Dr. Gregory Dudek and Dr. Joelle Pineau

### University of Texas at San Antonio, San Antonio, TX

2012 – 2015

Graduate coursework (30 hours) in Electrical Engineering, Digital Signal Processing

### Texas State University, San Marcos, TX

2007 – 2011

B.S. in Electrical Engineering, Networking and Communication  
B.S. in Resource and Environmental Geography

## TECHNICAL SKILLS

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**Expertise:** Machine Learning, Reinforcement Learning, Robotic Path Planning, Sensors, Scientific Data Science, Signal Processing, Communication and Networking, Environmental Geography

**Software:** Scientific Python (numpy, pytorch, scikit-learn, pandas), ROS, C/C++, Matlab

**Hardware:** Sensors, Embedded Systems, Localization Systems, Marine Instrumentation

**Data:** Images, Geospatial, Time Series, Scientific Sensors, Robot Navigation

## EXPERIENCE

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### NASA Jet Propulsion Lab (JPL)

Summer 2019

*Research Intern and Remote Affiliate, Mobility and Robotics Section*

*Pasadena, CA*

- Worked on machine vision aspects of the Mars Sample Return Project. Implemented state-of-the-art geometric and direct object localization methods for finding sample tubes on the Martian terrain with care given to estimation uncertainty and computational performance.
- Research on a model which learns to contextually switch between different localization methods to facilitate efficient autonomous rover sample tube collection in a reliable manner.

### McGill University

Jan 2016–current

*Graduate Researcher, Mobile Robotics Lab*

*Montreal, QC*

- Research on model-based planning and reinforcement learning with generative models for mobile agents.
- Spearheaded collaboration with ecologists to develop automatic classification and spatial modeling of zooplankton in Canadian lakes. Led research and design of strategic marine sampling with custom low-cost floating sensors and autonomous surface vehicles.

### Woods Hole Oceanographic Institution (WHOI)

Jan 2014 – Sept 2015

*Autonomous Underwater Vehicle Engineer, National Deep Submergence Facility*

*Woods Hole, MA*

- Software/Data/Electrical Engineer for deep-diving autonomous underwater vehicles (AUVs) working in research and ship-board operational environments. Primary at-sea data scientist for geophysical, acoustic, and image processing.
- Assisted in all aspects of at-sea operations including AUV deployments, hardware repair and maintenance, autonomous navigation, software development, networking and communications for robots and staff, acoustic and visual mapping of the seafloor, and scientific data analysis. Developed automated spatio-temporal processing pipeline for high-resolution multibeam, sidescan sonar, and optical maps.

### Southwest Research Institute (SwRI)

Jan 2012 – Dec 2013

*Engineer, Automation and Data Systems Division*

*San Antonio, TX*

- Primary end-to-end software engineer building a mapping sensor consisting of acoustic transducers, DSP, camera, and embedded computer with remote control and interpretation. Developed sampling, filtering, visualization scheme and beamforming calibration routine for live acoustic data.

- Designed and configured SONET, optical fiber, Ethernet, and microwave systems for critical communication infrastructure including power generation/distribution, dam and irrigation control, and emergency response coordination.

## ACADEMIC PAPERS

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**Working Draft** *Denavit–Hartenberg Parameterization for Structured Behavior Learning in Robot Manipulators*, 2020.

**Working Draft** *Rover Localization for Tube Pickup: Dataset, Methods and Validation for Mars Sample Return Planning*, 2020.

**Hansen, J.**, Manjanna, S., Quattrini, L. A., Rekleitis, I., Dudek, G., *Autonomous Marine Sampling Enhanced by Strategically Deployed Drifters in Marine Flow Fields*, MTS/IEEE OCEANS, 2018, (*Top 20 Student Submission*).

**Hansen, J.**, Dudek, G., *Coverage Optimization with Non-Actuated, Floating Mobile Sensors using Iterative Trajectory Planning in Marine Flow Fields*, IEEE International Conference on Intelligent Robots (IROS), 2018.

**Hansen, J.\***, Kastner, K.\*, Courville, A., Dudek, G., *Planning in Dynamic Environments with Conditional Autoregressive Models*, International Conference on Machine Learning (ICML), workshop on Prediction and Generative Modeling in Reinforcement Learning, 2018.

Henderson P., Chang, W.D., Shkurti, F., **Hansen, J.**, Meger, D., Dudek G., *Benchmark Environments for Multitask Learning in Continuous Domains*, International Conference on Machine Learning (ICML), workshop on Lifelong Learning, 2018, <https://arxiv.org/abs/1708.04352>.

Manjanna, S., **Hansen, J.**, Quattrini, L. A., Rekleitis, I., Dudek, G., *Collaborative Sampling Using Heterogeneous Marine Robots Driven by Visual Cues*, Canadian Conference on Computer and Robot Vision (CRV), 2017.

Quattrini L. A., Rekleitis, I., Manjanna, S., Kakodkar, N., **Hansen, J.**, Dudek, G., Bobadilla, L., Anderson, J., and Smith, R., *Data Correlation and Comparison from Multiple Sensors over a Coral Reef with a Team of Heterogeneous Aquatic Robots*, International Symposium on Experimental Robotics (ISER), 2016.

**Hansen, J.**, Fourie, D., Kinsey, J., Pontbriand, C., Ware, J., Farr, N., Kaiser, C., and Tivey, M., *Autonomous Acoustic-Aided Optical Localization for Data Transfer*, MTS/IEEE OCEANS, 2015.

Pontbriand, C., Farr, N., Fourie, D., **Hansen, J.**, Kinsey, J., Pelletier, J., and Ware, J., *Wireless Data Harvesting Using the AUV Sentry and WHOI Optical Modem*, MTS/IEEE OCEANS, 2015.

**Hansen, J.**, Wilden, G., Abbott, B., and Green, R., *The Ultrasonic Culvert Inspection System (UCIS): A Low-Cost Device for Conduit Inspection*, 2014 Transportation Research Board 93rd Annual Meeting.

## PROFESSIONAL ACTIVITIES

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### Invited Presentations

- 2019: Tutorial on Model-Based Reinforcement Learning at AI4Good Summer School
- 2019: GRIL Presentation on Robotic Sampling in Aquatic Environments
- 2018: PyLadies Montreal Meetup: Velo Vamos! ML on open bike data
- 2015: CapePy Python Meetup Tutorial: Introduction to Machine Learning with Scikit-learn
- 2015: BRATS Talk: Standardizing Machine Learning Tasks with Scikit-learn

## **Field Trials, Workshops, and Professional Development**

- 2017-2020 National Canadian Field Robotics Symposium and Field Trials
- 2017-2019: Barbados Marine Field Trials
- 2017: MILA Deep Learning and Reinforcement Learning Summer School
- 2017: McGill Innovation's AI for Social Good Summer Lab, Project on Improving Cycling Transportation in Low-Income Neighborhoods
- 2016: IEEE Marine Robotics Summer School
- 2016: National Canadian Field Robotics Symposium and Field Trials
- 2012-13: SwRI Professional Courses in Proposal Writing, Promoting Research and Development, Technical Writing, & Project Management
- NAUI Master Scuba Diver, Diving for Science Certified

## **Leadership and Volunteer Work**

- Reviewer at numerous conferences and workshops including CORL, RSS, ICRA, IROS, and NeurIPS
- 2020: Co-organizer and Mentorship Chair of the NeurIPS workshop on Differentiable Vision, Graphics, and Physics
- 2020: Co-organizer and Sensors/Sampling Chair of the NeurIPS workshop on AI for Earth Science
- 2020: Co-organizer and Sensing/Theory Chair of the ICLR workshop on AI for Earth Science
- 2019: Co-organizer of the IROS workshop on Informed Scientific Sampling
- 2018: NIPS WiML Volunteer
- 2017: ICML Volunteer
- 2015: Scikit-learn developer sprint in Paris
- 2015: Neural Information Processing Systems (NIPS), Volunteer
- 2015: Founder and Technical Organizer of WHOI-Software Technical Group
- 2015: CapePy Python Meetup Leader and Member
- 2014: Big-data, Robotics, Autonomy, Technology and Sensing (BRATS) Member
- 2013: South-Central CleanTech Open Incubator Judge, San Antonio and Austin TX

## **Selected Awards**

- 2019: NCRN Travel Grant
- 2017: WiML NIPS Travel Grant
- 2016: McGill GREAT Travel Award
- 2012: UTSA M.S. COE Valero Research Fellowship (declined)
- 2013: SwRI Internal Research and Development Funding, Primary Investigator
- 2007: Terry Foundation Scholarship (Complete Undergraduate Funding)
- 2007: Dick Walrath Foundation Scholarship
- 2007: American Quarter Horse Association Scholarship

## **Teaching and Mentorship**

- 2020: Mentor for undergraduate Mechanical Engineering capstone project developing a sensor recovery system for an autonomous surface vehicle
- 2020: Mentor for summer undergraduate work on Robot Manipulator Simulation
- 2020: AI4Good Summer Lab Mentor and Advisor for Recycling Sorting Project
- 2019: Mentor for undergraduate Mechanical Engineering capstone project developing a sensor deployment system for an autonomous surface vehicle
- 2019: AI4Good Summer Lab Mentor and Advisor for Pain Relief Project (winning team)
- 2018: AI4Good Summer Lab Mentor and Advisor for AI4Good Project
- 2011: Teaching Assistant: EE Signals and Systems
- 2011: Teaching Assistant: EE Electronics

- 2010: Lab Assistant: EE Microprocessors
- 2010: Teaching Assistant: EE Engineering Management

## OCEANOGRAPHIC RESEARCH CRUISES

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**Studies of Evolution and Ecology of Petroleum Systems, Gulf of Mexico** Jun 2015  
*R/V Atlantis, Chief Scientist: Dr. David Valentine*

- Primary software/data processing engineer for Sentry AUV working with multibeam, sidescan, and sub-bottom pipeline data.

**Mapping, Exploration, and Sampling at Havre Volcano, Southwestern Pacific** Mar 2015  
*R/V Revelle, Chief Scientist: Dr. Adam Soule*

- Primary software/data processing engineer for Sentry AUV in collaboration with Jason ROV. Developed sidescan and sub-bottom pipeline for processing sonar signal using MB-System.

**Monitoring Recovery of Pacific Seamounts, Hawaiian Islands** Oct 2014  
*R/V Sikuliaq, Chief Scientists: Dr. Amy Baco-Taylor and Dr. Brendon Roark*

- Primary software/data engineer processing subsea navigation and images. Developed classifier for seafloor images for easier processing.

**Juan de Fuca Ridge, Northeastern Pacific** Jul 2014  
*R/V Atlantis, Chief Scientists: Dr. James Kinsey and Dr. Maurice Tivey*

- Lead software engineer for AUV optical communication system integration. Developed acoustic/optical search algorithm for finding an optical modem on the seafloor. Also provided navigation/data processing and visualization for science.

**Iron Eaters of the Loihi Seamount, Hawaiian Islands** Jun 2014  
*R/V Falkor, Chief Scientist: Dr. Brian Glazer*

- Primary software/data engineer working with subsea navigation, scientific sensors, and images. Developed thematic map of iron location in images for easy inspection and planning.

**Deep Water Supercoral in Low pH Environments, Gulf of Mexico** Apr 2014  
*R/V Atlantis, Chief Scientist: Dr. Erik Cordes*

- Primary software/data engineer working with subsea navigation, scientific sensors, and images.

**Mineral Exploration, Southeastern Pacific** Jan 2014  
*R/V Ka'imikai-O-Kanaloa, Chief Scientist: Dr. Carl Kaiser*

- Learned AUV deployment, mission planning, data processing, and networking. Developed new initiative for robust data management.