

# Arnold Kalmbach

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## References (contact info available upon request)

**MSc. Advisor** Prof. Gregory Dudek, Mobile Robotics Lab, McGill University  
**Exchg. Advisor** Dr. Yogesh Girdhar, Autonomous Robots and Perception Lab, Woods Hole Oceanographic Inst.  
**Past Employer** Ryan Garipey, CTO Clearpath Robotics Inc.

## Education

**McGill University** – MSc. Comp. Sci. (Advisor Gregory Dudek, Mobile Robotics Lab) Jan. 2016 – Pres

Significant work in machine learning and algorithmic robotics problems as well as robot deployments and field experiments.

Achieved 3.88/4.0 GPA

**McGill University** – BSc. Comp. Sci. 2009 – 2013

Emphasis on mathematical foundations of Comp. Sci.

Began involvement with robotics research, Mobile Robotics Lab (2012).

## Honors and Awards

2<sup>nd</sup> place, Student Poster Competition, MTS Oceans 2017

2017 ICRA IEEE RAS Travel Grant Recipient

Guest Student Appointment, Summer 2016, Woods Hole Oceanographic Institution

3<sup>rd</sup> place, McGill CS Undergraduate Research Symposium 2012

## Publications & Research Experience

***Learning Seasonal Phytoplankton Communities with Topic Models.*** Oceans 2017

A Kalmbach, H M Sosik, G Dudek, and Y Girdhar

An unsupervised method to learn probabilistic associations between species (communities) with a topic model, incorporating priors for sparseness and spatio-temporal smoothness.

The method finds an interpretable community model by ensuring community distributions can be predicted from simple environment data.

Documented novel seasonal structure in the daily species distribution of phytoplankton.

***Phytoplankton Hotspot Prediction with an Unsupervised Spatial Community Model.*** ICRA 2017

A Kalmbach, Y Girdhar, H M Sosik and G Dudek.

A method to predict presence of sparse spatio-temporal phenomena by their denser associates.

The method predicts the ‘hotspot locations’ of phytoplankton species by the abundance of other species which may be easier to observe.

***Learning Deep-Sea Substrate Types with Visual Topic Models.*** WACV 2016

A Kalmbach, M Hoeberechts and A Branzan Albu

Unsupervised learning of distribution-of-visual-features representations for sea-floor types from ROV dive logs.

Sea-floor classifications at were used in further bio-geophysical studies of the study sight.

***Adaptive Parameter EXploration (APEX): Adaptation of Robot Autonomy from Human Participation.*** A Xu, A Kalmbach, and G Dudek. ICRA 2014

Formulation and implementation of a robot system which models human trust levels and adapts its behavior to gain trust and increase user satisfaction.

Designed, implemented, and evaluated user-studies with a (real) terrestrial rover and a simulated aerial vehicle.

**Assymmetric Rendezvous at Sea.** M. Meghjani, F Shkurti, JC Gamboa Higuera, A Kalmbach, D Whitney, and G Dudek. CRV 2014

Investigated strategies for an active searcher to find a passive drifter at sea.

Implemented UDP-based communications between an AUV and a floating sensor box.

**Unsupervised environment recognition and modeling using sound sensing.** A Kalmbach, Y Girdhar, and G Dudek ICRA 2013

Unsupervised learning of distribution-of-audio-features representations for ambient noise from walking through urban environments.

Similarity in the learned topic space indicates intuitively similar environments, and can be used for a soft loop-closure.

**AQUA Robot Hardware Test Tools** IROS 2012

Developed a suite of hardware diagnostic tools for AQUA family amphibious robots.

Tools were used in 2012 Barbados sea-trials, leading to F. Shkurti et al. *Multi-domain monitoring of marine environments using a heterogeneous robot team.*

## Selected Work Experience

**Machine Learning Scientist** – Kinsol Research Inc. May 2017 – Pres

Rapid Development of proof of concept machine learning systems.

Developed food ‘doneness’ models for a low-cost vision system in a smart oven.

Regularly communicated findings to the client and guided dataset annotators.

**Teaching Assistant, Introduction to Robotics and Intelligent Systems** – Jan. – May 2017

McGill University, School of Computer Science, COMP 417

**Automated Video Analysis Intern** – Ocean Networks Canada Jun. – Nov. 2015

Developed algorithms for automated quality control of live deep-sea video.

Deployed supporting tools to automatically download, encode, and pre-process live video streams from a network of underwater observatories.

**Test Technician (Contract)** – Clearpath Robotics Inc. Jan. – May 2015

Developed continuous integration tools for Clearpath autonomy stack.

Tools automatically initiated Gazebo simulation of Husky robot autonomy tasks on each new commit.

Tasks exercised ROS packages for localization, path planning, and path following.

**Autonomy Software Co-Op** – Clearpath Robotics Inc. May – Aug. 2014

Developed Gazebo models, and MoveIt / MoveBase (ROS path planner) integration for a variety of customized client robots.

Used canopen protocol and pcan drivers to integrate an industrial robot arm with a Husky terrestrial rover.

## Languages & Other Skills

**Main Programming Languages** Python (numpy/pytorch/tensorflow/Edward), C++, C, matlab  
Experience with bash, HTML/CSS/javascript, Java, lua etc.

**Robotics Tools** Extensive use of ROS, Gazebo, OpenCV

**Spoken Languages** First language, English. Basic conversational level: French and Spanish.