

# MICHAEL SCOTT FULTON

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## EDUCATION

### Ph.D – Computer Science

Expected Jan 2023

*Advisor:* Junaed Sattar

*Research Focus:* Underwater robotics, human-robot interaction, perception.

*Thesis Title:* Methods for Robust, Natural, and Multi-Modal Underwater Human Robot Interaction

College of Science and Engineering, University of Minnesota-Twin Cities

### MS. – Computer Science

December 2019

*Advisor:* Junaed Sattar

College of Science and Engineering, University of Minnesota-Twin Cities

### B.S. – Computer Science

May 2017

College of Arts and Sciences, Clarkson University

Minor in Mathematics

## RESEARCH EXPERIENCE

### Research Interests

- Human-robot interaction in challenging, unstructured environments
- Object detection and robot perception in challenging environments
- Development of new mobile robots for specific tasks and domains
- Application of field robotics to biological field science

### Graduate Research Summary

August 2017-Present

*Interactive Robotics and Vision Lab — Junaed Sattar*

*University of Minnesota—Twin Cities*

- Published papers in top-tier conference venues (4 ICRA, 4 IROS, 1 RSS) and journals (RAL, THRI), communicating the results of my research on robot perception, human-robot interaction, and underwater robotics
- Developed a method that allows AUVs to approach divers using only monocular vision as input
- Improved state-of-the-art methods for underwater diver detection
- Adapted pedestrian motion prediction methods to predict the future motion of divers
- Explored methods for underwater object detection for use in marine trash detection and cleanup
- Prototyped an algorithm for localization of an AUV using bathymetric maps and observations
- Created a new method for communicating information from an AUV to a human using motion
- Created a new device and method for communicating information and gaze direction from an AUV to a human using emitted light
- Created a new device for communicating information from an AUV to a human using sound
- Pioneered the study of multi-modal AUV-to-human communication and studied the comparative performance of different communication methods in different interaction contexts
- Collaboratively designed and built a new low-cost, open-source, micro-AUV for general use
- Designed and prototyped a buoyancy-controlled AUV for long-term sensor monitoring underwater

- Created and released multiple annotated datasets including images of divers and marine trash
- Researched algorithms and methods for underwater localization, object detection, and interaction
- Maintained and improved a variety of robots, both in terms of software and hardware
- Coordinated numerous lab experimental trials in pools, lakes, and ocean

#### Undergraduate Research Assistant

January 2015 - March 2016

*RAIL Lab — Junaed Sattar*

*Clarkson University*

- Designed and explored vision algorithms for lane identification in driving videos
- Developed a system for recording video, location, and accelerations while driving
- Collected, organized, and analyzed over 200 GB of driving data

### FELLOWSHIPS AND AWARDS

- NSF Graduate Research Fellowship September 2019 - August 2022
- UMN Graduate School Excellence Research Grant September 2019 - August 2022
- Graduate Assistance in Areas of National Need Fellowship September 2018 - September 2019
- Miller/Davis Service Award for Computer Science, Clarkson University May 2017

### SCHOLARSHIP

#### Journal Articles

- **Michael Fulton**, Chelsey Edge, Junaed Sattar. *Robot Communication Via Motion: A Study on Modalities for Robot-to-Human Communication in the Field*, ACM Transactions on Human-Robot Interaction, 11, 2, Article 15 (June 2022), 40 pages. DOI:10.1145/3495245
- Md Jahidul Islam, **Michael Fulton**, Junaed Sattar. *Towards a Generic Diver-Following Algorithm: Balancing Robustness and Efficiency in Deep Visual Detection.*, Robotics and Automation Letters, in IEEE Robotics and Automation Letters, vol. 4, no. 1, pp. 113-120, Jan. 2019, DOI: 10.1109/LRA.2018.2882856.

#### Conference Publications

- Sadman Sakib Enan, **Michael Fulton**, Junaed Sattar. *Robotic Detection of a Human-Comprehensible Gestural Language for Underwater Multi-Human-Robot Collaboration*, IEEE/RSJ International Conference on Robots and Systems (IROS), Kyoto, 2022. Nominated for Best Paper on Cognitive Robotics.
- **Michael Fulton**, Muntaqim Mehtaz, Owen Queeglay, Junaed Sattar. *Underwater Robot-To-Human Communication Via Motion: Implementation and Full-Loop Human Interface Evaluation*. Robotics: Science and Systems (RSS), New York, NY, 2022.
- **Michael Fulton**, Jungseok Hong, Junaed Sattar. *Using Monocular Vision and Human Body Priors for AUVs to Autonomously Approach Divers*. IEEE International Conference on Robotics and Automation (ICRA), Philadelphia, PA, 2022.
- Tanmay Agarwal, **Michael Fulton**, Junaed Sattar. *Predicting the Future Motion of Divers for Enhanced Underwater Human-Robot Collaboration*. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Prague, 2021.
- Karin de Lagnis, **Michael Fulton**, Junaed Sattar. *Towards Robust Visual Diver Detection Onboard Autonomous Underwater Robots: Assessing the Effects of Models and Data*, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Prague, 2021.

- Chelsey Edge, Sadman Sakib Enan, **Michael Fulton**, Jungseok Hong, Jiawei Mo, Kimberly Barthelemy, Hunter Bashaw, Berik Kallevig, Corey Knutson, Kevin Orpen, Junaed Sattar, *Design and Experiments with LoCO AUV: A Low Cost Open-Source Autonomous Underwater Vehicle*, International Conference on Intelligent Robots and Systems (IROS), Las Vegas, NV, 2020. (Authors listed semi-alphabetically)
- Jungseok Hong, **Michael Fulton**, Junaed Sattar. *A Generative Approach Towards Improved Robotic Detection of Marine Litter*. IEEE International Conference on Robotics and Automation (ICRA), Paris, 2020.
- **Michael Fulton**, Chelsey Edge, Junaed Sattar. *Robot Communication Via Motion: Closing the Underwater Human-Robot Interaction Loop*. IEEE International Conference on Robotics and Automation (ICRA), Montreal, 2019.
- **Michael Fulton**, Jungseok Hong, Md Jahidul Islam, Junaed Sattar. *Robotic Detection of Marine Litter Using Deep Visual Detection Models*. IEEE International Conference on Robotics and Automation (ICRA), Montreal, 2019.
- Md Jahidul Islam, **Michael Fulton**, Junaed Sattar. *Towards a Generic Diver-Following Algorithm: Balancing Robustness and Efficiency in Deep Visual Detection*. IEEE International Conference on Robotics and Automation (ICRA), Montreal, 2019.

## Presentations

- **Michael Fulton**, *Robot Communication Via Motion: A Study on Modalities for Robot-to-Human Communication in the Field*, Robotics: Science and Systems (RSS), New York, NY, 2022.
- **Michael Fulton**, *Using Monocular Vision and Human Body Priors for AUVs to Autonomously Approach Divers*. IEEE International Conference on Robotics and Automation (ICRA), Philadelphia, PA, 2022.
- **Michael Fulton**, *Predicting the Future Motion of Divers for Enhanced Underwater man-Robot Collaboration*, IEEE/RSJ International Conference on Intelligent Robots and Systems, Virtual, 2021. (Presentation recorded as a video due to COVID-19).
- **Michael Fulton**. *LoCO-AUV*, IEEE/RSJ International Conference on Intelligent Robots and Systems, Virtual, 2020. (Presentation recorded as a video due to COVID-19).
- **Michael Fulton**. *Robot Communication Via Motion: Closing the Underwater Human-Robot Interaction Loop*. University of Minnesota — Twin Cities, Visual Computing and Artificial Intelligence Seminar [VCAI]

## Interactive Presentation Sessions

- **Michael Fulton**, Muntaqim Mehtaz, Owen Queeglay, Junaed Sattar. *Underwater Robot-To-Human Communication Via Motion: Implementation and Full-Loop Human Interface Evaluation*. Robotics: Science and Systems (RSS), New York, NY, 2022.
- **Michael Fulton**, Jungseok Hong, Junaed Sattar. *Using Monocular Vision and Human Body Priors for AUVs to Autonomously Approach Divers*. IEEE International Conference on Robotics and Automation (ICRA), Philadelphia, PA, 2022.
- **Michael Fulton**, Chelsey Edge, Junaed Sattar. *Robot Communication Via Motion: Closing the Underwater Human-Robot Interaction Loop*. International Conference on Robotics and Automation, Montreal, 2019.
- **Michael Fulton**, Jungseok Hong, Md Jahidul Islam, Junaed Sattar. *Robotic Detection of Marine Litter Using Deep Visual Detection Models*. International Conference on Robotics and Automation, Montreal, 2019.

- Md Jahidul Islam, **Michael Fulton**, Junaed Sattar. *Towards a Generic Diver-Following Algorithm: Balancing Robustness and Efficiency in Deep Visual Detection*. International Conference on Robotics and Automation, Montreal, 2019.

## Workshop Presentations

- Chelsey Edge, Sadman Sakib Enan, **Michael Fulton**, Jungseok Hong, Junaed Sattar. *Power-On-and-Go Capabilities for a Low-Cost Modular Autonomous Underwater Vehicle*, Robotics: Science and Systems – Power-On-and-Go Workshop, Virtual, 2020.

## Dataset Releases

- Karin de Langis, **Michael Fulton**, Junaed Sattar. *Video Diver Dataset (VDD-C) 100,000 annotated images of divers underwater.*, <https://conservancy.umn.edu/handle/11299/219383>, 2021.
- Jungseok Hong, **Michael Fulton**, Junaed Sattar. *TrashCan 1.0 An Instance-Segmentation Labeled Dataset of Trash Observations*, <https://conservancy.umn.edu/handle/11299/214865>, 2020.
- **Michael Fulton**, Jungseok Hong, Junaed Sattar. *Trash-ICRA19: A Bounding Box Labeled Dataset of Underwater Trash*, <https://conservancy.umn.edu/handle/11299/214366>, 2020.

## SERVICE

**Minnesota Robotics Institute Outreach (MnRI Gadgets)** Spring 2020-Fall 2020  
*Content Creator* University of Minnesota

- Created a new outreach program for children stuck at home during COVID-19
- Designed, built, and programmed multiple Arduino gadgets for children
- Taught Arduino programming and device design through tutorials on said gadgets
- Recorded video tutorials available at <https://cse.umn.edu/mnri/mnri-video-hub>

**Computer Science Graduate Student Association** Fall 2019-Summer 2020  
*Student Officer* University of Minnesota

- Planned and managed social events for the computer science graduate student association
- Planned and participated in welcome events for new and prospective graduate students

**Graduate Research and Discussion Seminar** Spring 2019-Summer 2020  
*Coordinator* University of Minnesota

- Managed a bi-weekly seminar for graduate students to present their work
- Coordinated speakers, announced seminars, solicited support from local business, and purchased food for bi-weekly seminars

**MNDrive Scholars Tech Camps** Summer 2018  
*Counselor for middle school STEM camp* University of Minnesota

- Taught STEM concepts, including circuits, simple Arduino programming, and soldering to children from local middle schools
- Developed and improved curriculum for future summer tech camps

**Clarkson Open Source Institute** August 2015 - May 2017  
*Lab Director and Member* Clarkson University

- Director from October 2015 to April 2017, responsible for day-to-day lab operations, meetings, events
- Mediated discussions and performed conflict resolution when necessary

- Founded COSI Project For Robotics, Beowulf Cluster interest group
- Taught basic robotics programming to fifteen students over the years

### **IMPETUS Summer Roller Coaster Camp**

Summer 2014, Summer 2015

*Counselor for middle school STEM camp for underprivileged children*

*Clarkson University*

- Taught STEM concepts, simple mathematics and physics to middle and junior high school children
- Acted as a general counselor to under-privileged students, teaching encouraging them in the pursuit of higher education and careers in STEM

## **EMPLOYMENT**

### **Software Engineering Intern at C Speed LLC.**

May 2016 - August 2016

*Programming with C#, ASP.NET, Java, JavaFX*

*Liverpool, NY*

- Developed a software system for managing over 1 TB of operating system image backups
- Took part in the development of an internal time-logging web application
- Researched programming interfaces for an RF test device, both their usability and construction

## **TEACHING EXPERIENCE**

### **Teaching Interests**

- Robotics (Programming, Perception, and Navigation)
- Human Robot Interaction and Interfaces
- Computer Vision, Machine Learning, and Artificial Intelligence
- Programming (Basics, Data Structures, Operating Systems, Algorithms, etc.)

### **Teaching Assistant, CSCI 5551**

Fall 2020

*Introduction To Intelligent Robotic Systems*

*University of Minnesota—Twin Cities*

- Taught lectures (pre-recorded and live) on core ROS concepts
- Designed, wrote, and created automated grading for a homework on navigation with ROS
- Conducted weekly office hours to aide students in understanding course materials
- Created innovative new course policies, structures, and materials with professor and TA's in order to cope with the online format forced by COVID-19
- Collaborated with professor and TA's on course material and grading policies
- Managed LMS software (Canvas) for the entire course

### **Teaching Assistant, CSCI 4061**

Spring 2018

*Introduction to Operating Systems*

*University of Minnesota—Twin Cities*

- Taught weekly labs, teaching students operating systems programming concepts based on lectures
- Conducted office hours to help students understand the course material and solve homework problems
- Wrote a programming assignment testing students on their knowledge of socket-based network programming in C and developed grading tools for that assignment
- Graded weekly labs and four programming assignments
- Helped to respond to student emails and questions on a course-wide help email
- Collaborated with professor and TA's on course material and grading policies

### **Substitute Lecturer, CSCI 5551**

Fall 2017

*Introduction to Intelligent Robotic Systems*

*University of Minnesota—Twin Cities*

- Introduced students to programming for ROS (Robot Operating System)
- Explained core concepts of ROS including nodes, topics, services, messages, and the ROS graph.
- Covered simple ROS command-line tools and ROS build system

### **Substitute Lecturer, CS 141**

*Introduction To Computer Science*

Fall 2016

*Clarkson University*

- Introduced basic programming concepts such as variables, types, and data representation
- Reviewed concepts including loops and flow control
- Provided informal tutoring for a number of students in this course through the semester

### **Workshops and Seminars**

*Clarkson Open Source Institute*

Fall 2015-Fall 2016

*Clarkson University*

- Taught workshops covering topics such as computer vision and Android development basics
- Taught a series of workshops covering simple robotics concepts and ROS use
- Gave a number of brief, informative talks on subjects in computer science

## **REFERENCES AVAILABLE UPON REQUEST**