MICHAEL SCOTT FULTON

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EDUCATION

Ph.D – Computer Science August 2017 - 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 August 2017 - December 2019
Advisor: Junaed Sattar
College of Science and Engineering, University of Minnesota-Twin Cities

B.S. – Computer Science August 2013 - 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 upon pre-existing 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.
- 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 - Present
– UMN Graduate School Excellence Research Grant September 2019 - Present
– 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-Present
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.

INDUSTRY EXPERIENCE

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 Fall 2016
Introduction To Computer Science *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 Fall 2015-Fall 2016
Clarkson Open Source Institute *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

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