MICHAEL SCOTT FULTON

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EDUCATION

Ph.D – Computer Science March 2023
Advisor: Junaed Sattar
Research Focus: Human-robot interaction, perception, underwater robotics.
Thesis: Robust, Natural, and Multi-Modal Underwater Human-Robot Interaction **[Link here]**
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

SKILLSET

Prog. Languages	Python3, C++, R, Javascript, C, Java, C#, Go
Prog. Concepts	OOP, real-time programming, concurrency, data analysis
Prog. Areas	Robotics, HRI, deep learning, statistics, GUI design, web development
Experienced w/	ROS 1/2, Gazebo, OpenCV, TensorFlow, PyTorch, ArcGIS, Node.js, jQuery
Dev Tools	Git, Github, Jira, VSCode, continuous integration software

EMPLOYMENT

Roboticist at Independent Robotics March 2023 - Present
Building novel applications for underwater robots. *Remote – Minneapolis, MN*

- Languages/frameworks used: ROS 2, Python3, Javascript.
- Building new software to improve novice and expert users' effectiveness and user experience.
- Worked with state machines for autonomous behavior creation.
- Proposing, researching, and preparing applications for substantial government contracts and grants.
- Researching new applications: sensor selection, prototype creation, software development, planning.

Graduate Research Assistant at University of Minnesota August 2017 - March 2023
Six years of research on AUV interaction, perception, and autonomy. *Minneapolis, MN*

- Languages/frameworks used: ROS 1, Python, C++, Tensorflow, OpenCV, R,
- Invented and advanced methods of robot-to-human communication underwater.
- Developed a broad suite of human-robot interaction software for AUVs.
- Developed various perception algorithms for AUVs, including deep learning-powered perception.
- Created complex autonomous behaviors for AUVs including human approach, context-aware communication mediation, trash detection, and representation of internal system state to users.
- Performed extensive user testing and statistical analysis of autonomy and interaction.
- See graduate research summary for more details on projects.

Software Engineering Intern at C Speed LLC. May 2016 - August 2016
Developing internal productivity tools. *Liverpool, NY*

- Languages/frameworks used: C#, ASP.NET, Java, JavaFX
- 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

RESEARCH EXPERIENCE

Graduate Research Summary August 2017-March 2023
Interactive Robotics and Vision Lab — Junaed Sattar *University of Minnesota—Twin Cities*

- Published papers in top-tier conferences (5 ICRA, 4 IROS, 1 RSS) and journals (RAL, THRI), communicating the results of research on human-robot interaction, perception, and underwater robotics
- Pioneered the study of multi-modal AUV-to-human communication and studied the comparative performance of different communication methods in different interaction contexts
- Developed a system that enables AUVs to autonomously modify their choice of communication methods based on the context of an interaction, including user proximity
- 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 diver using biologically inspire motion, similar to robot "body language"
- Created a new device and method for communicating information and gaze direction from an AUV to a diver using biologically inspired light displays
- Created a new device and two methods (one verbal, one musical) for communicating information from an AUV to a diver using sound
- 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 and planned numerous lab experimental trials in pool, lake, and ocean environments

Undergraduate Research Assistant January 2015 - March 2016
RAIL Lab — Junaed Sattar *Clarkson University*

- Designed and researched 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

- **Michael Fulton**. Aditya Prabhu, Junaed Sattar. *HREyes: Design, Development, and Evaluation of a Novel Method for AUVs to Communicate Information and Gaze Direction*, to appear at IEEE International Conference on Robotics and Automation (ICRA) 2023.
- 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

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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