FAIZAN MUHAMMAD

Robotics - Computer Vision - Augmented Reality - Software Engineering

@ faizan.muhammad7@outlook.com
faizan.muhammad@tufts.edu | Massachussets, USA | faizan-m.github.io | linkedin.com/in/faizan-muham | github.com/faizan-m

EXPERIENCE

Software Engineering Intern

CTRL Labs

May 2019 – August 2019 | New York

- CTRL Labs is currently developing CTRL Kit: a non-invasive neural interface for general purpose human-machine interaction
- Mapped EMG-based neural signals to a hexapod robot to mimic user's hand state and play soccer
- Devised and prototyped experimental features for CTRL Kit to power physically contextualized interactions
- Working with the IP Lawyers to file four patents derived from the prototype and feature designs

Robotics Research Assistant

Autonomous Intelligent Robotics Lab (AIR Lab)

Jan 2018 – Ongoing | Tufts University

- Proposed, designed and implemented an Augmented Reality interface for robots using Unity and ROS (supports Hololens, Android, iOS)
- The interface allows a user to visualize the robot's state, intent and plan as an added visual layer over the real world
- Designed and conducted pilot studies involving the use of this interface as a tool for Human-Robot Interaction
- Currently planning the logistics and structure of a full study based on the feedback from the pilot study

Co-President

Tufts Robotics Club

Apr 2018 – Apr 2019 | Tufts University

- Reformed club's internal dynamics to promote diversity, accessibility and member retention
- Led the design of a custom, modular club robot that could be specialized to several competitions (Trinity Firefighting, Harvard PacBot etc.)
- Trained and mentored new members, particularly in the areas of software development
- Active members doubled during the year which later created the most diverse Executive Board in club history

Computer Vision Research Assistant

Center for Engineering Education and Outreach

Dec 2016 – Aug 2017 | Tufts University

- Devised a programming paradigm for K-12 students to code robots using paper drawings *(C++, OpenCV, LabView, Lego Mindstorms)*
- Formulated a custom RESTful API for lab-based Internet of Things devices *(C++, HTML, Arduino)*
- Developed a teacher-assistance tool for digitization of classwork to promote discussion and collaboration *(C++, OpenCV)*

EDUCATION

BS Computer Science

Tufts University - School of Engineering

Sept 2016 – May 2020

GPA: 3.94

Senior Honors Thesis (Ongoing): EMG-Based Demonstrations for Robot Learning (CTRL Labs Research Partnership)

Senior Capstone Project (Ongoing): Faster Factoring Algorithms through Quantum Annealing (IQC Sponsored)

Activities: HYPE! Mime Troupe, Fencing Club, Robotics Club

Elective Courses: Probabilistic Robotics | Autonomous Intelligent Robotics | Human Robot Interaction | Machine Learning | Computer Vision | Reinforcement Learning

HONORS

Tufts Summer Scholar 2018
Received a grant to pursue the AR Interface research project at AIR Lab

Verizon 5G EdTech Challenge 2019
AR Interface was part of the winning proposal for the $100K grant

Trinity College International Fire Fighting Robot Contest
Won the Olympiad in Senior Individual Category in 2018 and 2019

International Mathematical Olympiad 2016
Selected and participated as a member of the Pakistani Team

SKILLS

C++ | Python | C# | Golang | Matlab | C | VHDL | LabView

ROS | Unity | OpenCV | Git | Docker

English | Urdu | Punjabi | Hindi

PROJECTS

EMG Based Demonstrations for Robot Learning

Senior Honors Thesis

Manipulating unique, unknown, fragile and deformable objects is a challenge for robots

Humans have a significantly better judgement of these properties and are able to manipulate such objects with relative ease

Using Surface Skin Electromyography to recognize human teacher's grip types and forces applied to the object

Using Reinforcement Learning to find the appropriate mapping between human demonstration and required robot action

Faster Factoring Algorithms through Quantum Annealing

Senior Capstone Project

Continuing the work done by my partner at the Institute for Quantum Computing (IQC) last summer (https://arxiv.org/abs/1910.09592)

Using Elliptic Curve Method and Number Field Sieve to represent factoring problems in Conjunctive Normal Form to be solved by a Quantum Annealer

We are hoping to obtain a speedup over classical approaches as potentially suggested by the theoretical estimates

Trinity College International Fire Fighting Robot Contest

Tufts Robotics Club

2018: Led the development of software architecture based on a central Raspberry Pi Zero interfaced with an Arduino Mega

2019: Led the full-stack development containing dedicated real-time subsystems running on Arduinos and a central Raspberry Pi 3B+ running ROS

Sound Based Robot Localization

Probabilistic Robotics Class

Used acoustic signatures in the form of Room Impulse Responses to classify spaces within an indoor environment. Intended to serve as an augmentation of a robot's navigation stack to provide a possible solution to the kidnapped robot problem *(Matlab)*

Clappy Bird

Digital Circuits Class

Recreated Flappy Bird video game on an FPGA using digital circuit design to maintain game state and render it on a VGA display. The system used clapping as the input to play the game. *(VHDL)*

Remote Virtual Reality for Service Robots

Autonomous Intelligent Robotics Class

Created a VR experience that lets a user see through the perspective of a remote service robot to support remote human takeover when something goes wrong *(Unity, ROS, C#, C++)*

MEDIA&PUBLICATIONS

Late Breaking Report, HRI 2019 - South Korea
Muhammad, F., Hassan, A., Cleaver, A., and Sinapov, J. "Creating a Shared Reality with Robots", *In Proceedings of Late-Breaking Reports Track at the 14th ACM/IEEE Annual Conference on Human-Robot Interaction, Daegu, Korea, Mar. 11-14, 2019.*

Featured Video - Future You @ NPR
"Digital Telekinesis For the Future You?" featured the hexapod project at CTRL Labs
https://youtu.be/cdZLg4IORc0

Featured Article - Tufts Now
"Hands-on Research for Undergraduates" featured my Tufts Summer Scholars research
https://now.tufts.edu/articles/hands-research-undergraduates

Featured Video - Tufts University
"Visualizing a Robot's Perspective of the World" featured our lab's aims, efforts and progress in the domain
https://youtu.be/9_9RNRNd9y8

Demos, Documentation, Code and More
For more details about me visit:
https://faizan-m.github.io