

Faizan Muhammad

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EXPERIENCE

Google

July 2020 – Present

Software Engineer

Mountain View, CA

- Part of the Engineering Residency program that aims to develop the next generation of technology leaders
- Focusing on production-grade, high-impact Machine Learning applications in Google services

CTRL Labs (acquired by Facebook)

May 2019 – August 2019

Software Engineering Intern

New York City, NY

- Interfaced a hexapod robot with a neural interface for neuromuscular teleoperation [1]
- Demoed this experience for the taping of an NPR show episode regarding CTRL Labs [B]
- Devised features for physically contextualized interactions with real-world objects
- Patented these features after prototyping and demonstrating their feasibility

Autonomous Intelligent Robotics Lab (AIR Lab)

Jan 2018 – May 2020

Research Assistant

Tufts University, MA

- Pioneered the Novelty Detection capabilities for the Tufts' DARPA SAIL-ON AI agent [2]
- Achieved top results in SAIL-ON evaluations and currently leading a team to publish the system architecture
- Developed and published an Augmented Reality interface for Human-Robot Interaction [3][A]
- AR interface won \$100K funding from Verizon 5G EdTech Challenge and is still an active project in the lab

Center for Engineering Education and Outreach (CEEEO)

Dec 2016 – Aug 2017

Research Assistant

Tufts University, MA

- Created a RESTful API for lab-based IoT devices such as a web-controlled lab sign
- Developed computer vision software to digitize classwork and enhance student engagement and collaboration
- Demonstrated the software by creating a robot programming framework that used paper drawings as code [4]

International Mathematical Olympiad 2016

Sep 2015 – Jul 2016

Participant

HKUST, Hong Kong

- Selected and trained in Algebra, Number Theory, Combinatorics and Geometry for the Pakistani team
- Learned advanced mathematical problem solving skills and represented the country on an international platform

EDUCATION

Tufts University

Sep 2016 – May 2020

Bachelor of Science in Computer Science

Medford, MA

GPA: 3.95 **Honors:** Summa Cum Laude, Lieutenant Commander Robert James Manning Prize

Core Courses: Data Structures, Algorithms, Computation Theory, Programming Languages, Machine Architecture

Elective Courses: Reinforcement Learning, Intro. to Machine Learning, Probabilistic Robotics [5], Autonomous Intelligent Robotics, Computer Vision, Human Robot Interaction, Intro. to Computational Models in Cognitive Science, Ethics for AI

Other Relevant Courses: Digital Circuits [6], Discrete Mathematics, Linear Algebra, Calculus (1, 2 and 3), Logic (Philosophy), Probability and Statistics, Cultures in Computing (Anthropology), Neurobiology

Activities: President @ Tufts Robotics Club [7][8], Co-Organizer @ URSS [9], Founder @ IDIAS [10], Actor/Director @ Hype Mime Troupe [11], Foilist @ Tufts Fencing Club

TECHNICAL SKILLS

Languages: C++, Python, Java, Golang, C#, C, Matlab, VHDL

Frameworks and Tools: ROS, Unity, Git, Docker, IntelliJ, Visual Studio

Libraries: OpenCV, Tensorflow, Scikit, Pandas, NumPy, Matplotlib

Crafting: Laser Cutting, 3D Printing, Circuitry

- [1] **Robot Teleoperation through Neuromuscular Control** | *Golang, Docker, Proprietary Tech.* CTRL Labs
 - Humans are capable of very fine control over wrist and hands that can be exploited for next-gen control interfaces
 - Mapped EMG-based readings of muscle activations to a hexapod's appendages for crawling and kicking behaviour
 - Demoed this experience for the taping of an NPR show episode regarding CTRL Labs [B]
- [2] **Novelty Oriented AI Agent for DARPA SAIL-ON** | *Symbolic Reasoning & Planning, RL, Java* AIR Lab
 - SAIL-ON was created by DARPA to encourage the development of AI that can recognize and adapt to change
 - Pioneered the Novelty Detection capabilities to recognize environmental changes and express them symbolically
 - Our Novelty Detection approach achieved top performance in unseen external evaluations
 - Currently leading a sub-team of graduate and undergraduate students to publish the system architecture
- [3] **Visualizing a Robot's Perspective in Augmented Reality** | *ROS, Unity, C++, C#, Python* AIR Lab
 - Need for a fast, high-bandwidth and accessible medium to convey robot states for Human Robot Interaction
 - Proposed the project for Tufts Summer Scholars and received fellowship and funding to pursue it [C][D]
 - Supports visualizations of robot perception, belief and planning in AR through HoloLens and mobile devices
 - Published system architecture [A] and won \$100K in further funding from Verizon 5G EdTech Challenge
- [4] **Programming Robots through Paper Worksheets** | *OpenCV, C++, LabVIEW* CEEO
 - Devised a worksheet template format to specify subsections and used Computer Vision to extract them
 - Demonstrated system capabilities by programming LEGO Mindstorms robots through symbolic paper drawings
- [5] **Sound Based Robot Localization** | *Matlab, Machine Learning* Probabilistic Robotics Class
 - Indoor navigation for robots in changing physical spaces is difficult due to reduced mapping abilities
 - Some acoustic properties of a room are dependent on room structure and can be used to uniquely identify them
 - Used a Sine Sweep to generate Room Impulse Response (RIR), extract features and train a 90% accurate SVM
- [6] **Clappy Bird** | *VHDL, FPGA, Lattice Radiant* Digital Circuits Class
 - Recreated the popular game Flappy Bird in an FPGA using clapping sounds as the means to control the game
 - Developed digital circuits in VHDL and Lattice Radiant to implement the game logic and VGA rendering
 - Game logic and VGA rendering was done completely through clocks, flip-flops, latches and multiplexers
- [7] **Trinity Firefighting Robot Contest** | *ROS, C++, Arduino, Raspberry Pi, Sensors* Tufts Robotics Club
 - Yearly international contest held in Trinity College that simulates a fire-emergency in a miniature environment
 - Led the development of the club's first ROS-enabled robot capable of SLAM and point-to-point navigation
 - Won the Olympiad in Senior Individual Category in 2018 and 2019
- [8] **Robotics Club @ Tufts** | *President* 2018 - 2019
 - Improved diversity, accessibility and member retention through reimagination of club roles and support system
 - Encouraged modular and iterative design and development to allow for material reuse and improved performance
 - Led development of projects such as fire-fighting robots [7] and participated in robotics competitions [E]
- [9] **Undergraduate Research and Scholarship Symposium @ Tufts** | *Co-Organizer* 2019 & 2020
 - Held annually to showcase the work of hundreds of student researchers through presentations, panels and posters
 - Managed logistics for marketing, submissions, presentations, documentation and event management
 - Reinvented the conventional symposium into a virtual experience due to the COVID pandemic
- [10] **Interdisciplinary Data Intensive Applications Society @ Tufts** | *Founder* 2019 - 2020
 - Provides a platform for collaboration across diverse domains including robotics, environment, sociology and sports
 - Optimized for learning, skill-sharing and community-building by prioritizing the cohort experience for newcomers
 - Organizes hackathons focused on common tools (Colab, Jupyter, Py Libs) and applications (NLP, GIS, Ethics)
- [11] **Hype! Mime Troupe @ Tufts** | *Actor, Writer, Director* 2016 - 2020
 - Produced skits for university-wide shows every semester telling human stories in a transcendental format [F]
 - Collaborated with other performance groups for fundraising and outreach shows

- [A] **Creating a Shared Reality with Robots** HRI 2019
Muhammad, Faizan, et al. "Creating a shared reality with robots." 2019 14th ACM/IEEE International Conference on Human-Robot Interaction (HRI). IEEE, 2019.
Paper Link: <https://ieeexplore.ieee.org/abstract/document/8673191>
Demo Link: <https://youtu.be/WjxJnggaNr8>
- [B] **Digital Telekinesis For the Future You?** Future You @ NPR
Introduces the technology behind CTRL Labs and their neural interface, CTRL Kit. Includes the demo of my hexapod project [1]
Video Link: <https://youtu.be/cdZLg4IORc0>
- [C] **Research and/as Activism Forum** Tisch College
Invited to talk to the new cohort of Tufts Summer Scholars and other undergraduate researchers about the intersection of research and activism in AI
Article Link: <https://tischcollege.tufts.edu/news/tufts-students-discuss-research-and-as-activism>
- [D] **Hands-on Research for Undergraduates** Tufts Now
Features the Augmented Reality project [3] and my experience with Tufts Summer Scholars
Article Link: <https://now.tufts.edu/articles/hands-research-undergraduates>
- [E] **Playlist of my Mime Skits** Hype! Youtube Channel
Features some of the mime skits I have been involved with as an actor, director or writer
Playlist Link: https://www.youtube.com/playlist?list=PL74VX_wnv15E9dwS8Zwey6lO_8Y6gSIa6s