Faizan Muhammad

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Experience

Google July 2020 – Present
Software Engineer *Mountain View, CA*

- Currently part of the Tensorflow team, focusing on tf.function and other ML program authoring APIs
- Successfully led multi-quarter, multi-SWE effort to re-architect tf.function implementation for next-gen use cases
- Previously worked on mission-driven applied ML use cases:
  - Training an RL heuristic for dynamic parallelization of computation
  - Developing an Active Learning pipeline for Anomaly Detection over fraudulent shopping offers

Department of Computer Science, Tufts University Dec 2016 – May 2020
Research Assistant *Medford, MA*

- DARPA SAIL Open-world Novelty [4]
  - Pioneered the Novelty Handling capabilities of the Tufts AI agent for the challenge
  - Achieved top results in independent evaluations and led a team to publish the system architecture [1]
- ROS Augmented Reality Interface [5]
  - Developed an Augmented Reality interface enabling the visualization of robot state, intent and uncertainty
  - Presented it in HRI conference 2019 [2] and won $100K funding from the Verizon 5G EdTech Challenge

CTRL Labs (acquired by Meta) May 2019 – August 2019
Software Engineering Intern *New York City, NY*

- Neuromuscular Teleoperation
  - Mapped forearm EMG readings to a hexapod robot enabling navigation and leg-kicking
  - Demoed this neural-controlled soccer robot for the taping of an NPR show episode regarding the startup [15]
- Physically Contextualized Interactions
  - Added SLAM capabilities to the neural wristband using a mini 3D camera
  - Prototyped interaction mechanisms combining localization and neural data and patented them [3]

International Mathematical Olympiad Sep 2015 – Jul 2016
Participant *HKUST, Hong Kong*

- Selected and trained in Algebra, Number Theory, Combinatorics and Geometry for the 2016 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

Highlight Courses: Reinforcement Learning, Intro. to Machine Learning, Probabilistic Robotics [7], Autonomous Intelligent Robotics, Computer Vision, Human Robot Interaction, Intro. to Computational Models in Cognitive Science, Ethics for AI, Digital Circuits [8], Cultures in Computing (Anthropology)

Technical Skills

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

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

Crafting: Laser Cutting, 3D Printing, Circuitry

Publications

[1] A Novelty-Centric Agent Architecture for Changing Worlds AAMAS 2021

Outlines and evaluates the agent architecture developed for the DARPA SAIL-ON challenge [4]

Paper Link: https://scholar.google.com/scholar?cluster=15664072414346569807
Presentation Link: http://slideslive.com/389548878

[2] Creating a Shared Reality with Robots HRI 2019

Presents the system architecture for the Augmented Reality Robot Interface [5]

Paper Link: https://scholar.google.com/scholar?cluster=5356441431963683611
Demo Link: https://youtu.be/WjxJnggaNr8

[3] Systems and methods for contextualized interactions with an environment USPTO

Details the SLAM+EMG based interaction mechanisms devised for CTRL Labs (acquired by Facebook)

Document Link: https://patents.google.com/patent/US20210158630A1

Projects

[4] Novelty Oriented AI Agent for DARPA SAIL-ON | *Java, C, Python* Tufts CS

- SAIL-ON challenge was created by DARPA to encourage development of AI that can adapt to change
- Tufts team aims to build a cognitive architecture integrating symbolic approaches (Planning, Logical Reasoning etc.) and neural approaches (Reinforcement Learning, Deep Learning etc.) to participate in this challenge
- Pioneered development of this architecture, focusing on developing an extensible framework
- Agent achieved top performance in independent external evaluations against other approaches
- Led a group of graduate and undergraduate students to publish the system architecture [1]

[5] Visualizing a Robot's Perspective in Augmented Reality | *ROS, Unity, C++, C#, Python* Tufts CS

- 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
- Supports visualizations of robot perception, belief and planning in AR through HoloLens and mobile devices
- Published the system architecture [2] and won $100K in further funding from Verizon 5G EdTech Challenge
- Received Outstanding Undergraduate Researcher Award Honorable Mention by Computing Research Association
- Talks given at:
  - HRI Conference Late-Breaking Report Track, Daegu, South Korea (2018)
  - Tufts Summer Scholars Presentation Session (2018)
  - Tufts Engineering Advisory Board (2019)
  - Tufts Campaign Committee (2019)

[6] 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

[7] 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

[8] 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

[9] 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

Activities

[10] Robotics Club @ Tufts | *President* 2018 - 2019

- Led development of projects such as fire-fighting robots [9] and the Tufts teams in robotics competitions
- 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

[11] 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

[12] 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)

[13] Hype! Mime Troupe @ Tufts | *Actor, Writer, Director* 2016 - 2020

- Produced skits for university-wide shows every semester telling human stories in a minimalistic format [18]
- Collaborated with other performance groups for fundraising and outreach shows

Media

[14] Research and Activism Forum Tisch College

Invited as a panelist 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-events/news/tufts-students-discuss-research-andas-activism

[15] Digital Telekinesis For the Future You? Future You @ NPR

Introduces the technology behind CTRL Labs and their neural interface, CTRL Kit and includes the demo of my neuromuscular teleoperation project there

Video Link: https://youtu.be/cdZLg4IORc0

[16] Hands-on Research for Undergraduates Tufts Now

Features the Augmented Reality project [5] and my experience with Tufts Summer Scholars

Article Link: https://now.tufts.edu/articles/hands-research-undergraduates

[17] Mime Skits Playlist Hype! Youtube Channel

Features some of the mime skits I have been involved with as an actor, director or writer [13]

Playlist Link: https://www.youtube.com/playlist?list=PL74VX_wnv15E9dwS8Zwey6lO_8Y6gSIa6s