Shuhul Mujoo

Discovering the Universe, Inventing the Future

California Institute of Technology

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LinkedIn

Education

- **Caltech Undergraduate Sophomore (2nd year) majoring in Applied Physics (GPA 4.2)**
  - Courses: Quantum Mechanics, Statistical Mechanics, Waves, Differential Equations, Multivariable Calculus, Linear Algebra, Complex Analysis; Introductory Mechanics, E&M, Special Relativity, Semiconductor Devices, Photonics, Caltech Physics League

Employment

- **Research Intern at Leiden University** (Aug - Sep 2024)
  - Worked on Superconducting Nanobridge Single Photon Detectors (SNSPD's); Completed project on 3-omega Method for Measuring Thermal Conductivity of Supercooled Substrates
  - Learned superconducting physics: BCS Theory, Coherence Length, London penetration depth, DC Josephson and Meissner Effects, Type I & II Superconductors, Ginzburg-Landau theory
  - Deposited 10 μm gold wire on SiO_2 substrate, spin coated 2 layers of PMMA, E-Beam lithography, then evaporation deposition and developing, finally wire bonding to test in cryostat
  - Created op amp subtractor circuit, removed noise with Lock-in amplifier, simulated circuit in LTSpice, used LABView, pyVISA, and pyMeasure for automation
- **Quantum Engineering Intern at Rigetti Computing** (Jun - Aug 2024)
  - Coded circuit simulation software to calculate Hamiltonian specs and qubit frequencies; ported Julia code to Python (test driven development), created tensor operation and eigensolver code
  - Learned superconducting quantum computing: Josephson Junctions, Transmons, Cooper pair boxes, Quasiparticles, T_c, EJ/EC ratio, readout resonators, chip fabrication
- **Research Intern at Search For Extraterrestrial Intelligence Institute** (Feb - Jun 2023)
  - Completed project and final presentation on Gas Temperature Prediction For Accretion Disks
  - Coded in Fortran and Python, cleaned data and fixed exponent overflows, created/trained neural network with dozens of iterations, 94% accuracy, analyzed weights of network, collected runtime results; extensive use of packages: numpy, scikit learn, tensorflow, matplotlib, joblib
- **Research Intern at NASA California Space Consortium** (Jun - Aug 2022)
  - Designed and constructed an Arduino powered prototype fire detection robot with distance & smoke sensors; 3D printed, and soldered; machined aluminum parts with CNC, bandsaw, drill press; mentored others through Computer Aided Design (Fusion 360), and Arduino/C++
- **Robotics Intern at Dusty Robotics** (Jul - Aug 2021)
  - Assembled printer robots from start to finish; drove robots around sites to print construction markings on floor; wrote unit test cases and debugged navigation issues; documented a tutorial for new hires and indexed parts inventory; designed battery mount for next gen of robots

Publications

- **HGI-SLAM: Loop Closure With Human and Geometric Importance Features**
  - Published paper on Simultaneous Localization and Mapping Loop Closure to arXiv & submitted to IEEE International Conference on Robotics and Automation 2023
  - Created novel method with better precision\recall than state of the art; implemented and tested the algorithms in the paper as an independent researcher using a custom robot
- **Quantum Computing for Self-Driving Cars and Pedestrian Detection**
  - Created a Quantum K-Nearest Neighbors (Q-KNN) implementation to classify objects and pedestrians for self-driving cars to improve safety
  - Improved performance compared to the classical approach and designed a wireless networking framework based on quantum teleportation

Awards

- **USA Physics Olympiad Silver Medalist**, American Invitational Mathematics Examination Qualifier, National Merit Scholarship Winner, FTC Robotics Competition World Finalist, National French Contest Silver Medalist, Coaches Award Water Polo

Activities

- **Division III Men's Water Polo** (2023 - present)
    - Play as an attacker (right/left wing) on the Caltech Men's Water Polo team
- **Founder and President of Quantum Computing Club (QCC)** (2022 - 2023)
    - Instructor of EVHS QCC, created lesson plans, lectures, and mentored 6 officers; created feedback forms and a website, organized meetings and finance; outreached to UC Davis Quantum Club, increased membership to 25
- **Founder and Captain of FTC Robotics Team Terrabats 14525** (2017 - 2023)
    - Designed robot using CNC machined and 3D printed parts, created CAD designs; lead programmer, implemented convolutional neural network using Tensorflow Lite; created splines and performed inverse kinematic analysis; created feedforward PID motor controllers
    - Team achieved 1st in California, and became a world finalist
- **MIT Beaver Works Summer Institute (BWSI) Quantum Computing** (2020 - 2021)
    - Learned and implemented QC Algorithms: Shor's, Deutsch-Jozsa, Grover's, and quantum teleportation, mastered QC languages: Q# and Qiskit; completed final team project, quantum KNN algorithm, made of internal subroutines such as quantum phase estimation
- **Student Ambassador Inspirit AI Program Taught by Stanford & MIT alumni** (2019 - 2021)
    - Published blog; 2 projects on object detection (YOLO Deep Learning Architecture) & audio processing (FFT and filtering); promoted AI in my school and community

Skills

- **Java, Python, C++**, C, Fortran, Julia, Q#, Qiskit, Arduino, JavaScript
- **Fusion 360, Android Studio, LTSpice**, GitHub, Linux, Layout Editor, Adobe Photoshop, LABView
- **Electron Beam Lithography, Lock-in Amplifier**, Operational Amplifier,, 3D Printing, CNC, Drill Press
- **English, Kashmiri**, French, Hindi

Community

- **Robotics Instructor at Afterschool Programs and Community Libraries** (2017 - 2023)
    - Conducted multiple camps and sessions for EV3 and First Lego League Robotics at local elementary and middle schools; mentored 100+ new students, and founded two teams
- **Mentoring and Tutoring Middle and High School Students** (2019 - 2023)
    - Science olympiad and math olympiad mentor for middle schools; the Tech Challenge and Odyssey of the Mind mentor for community teams; robotics camps and workshops
    - SchoolHouse World Tutor: physics and math tutoring with positive feedback given

Traits

- **Curious, Hardworking, Passionate,** Persevering, Motivated, Selfless, Honest, Helpful, Thoughtful