Shuhul Mujoo

Discovering the Universe, Inventing the Future

California Institute of Technology

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LinkedIn

Education

- Caltech Undergraduate Sophomore (2nd year)
  - **Major: Applied Physics (GPA 4.2)**
  - Courses: **Calculus, Linear Algebra, Complex Analysis,** Introductory Physics and Chemistry Labs, Introductory Chemistry and Biology, **Semiconductor Devices, Photonics; Caltech Physics League**, Cognitive Neuroscience, Economics
  - Advanced Placement: Placed out of all Introductory Physics (**Introductory Mechanics, E&M, and SR**) and Multivariable Calculus
- Evergreen Valley High School
  - **GPA 4; SAT Score 1570/1600** (800/800 Math, 770/800 English)
  - Courses: Calculus AB & BC, Discrete Mathematics, Multivariable Calculus, Statistics, Physics Mechanics, E&M, SR and Thermo, Computer Science; Macroeconomics, Chemistry; Research Methodology, Philosophy, Photoshop

Employment

- **Quantum Engineering Intern at Rigetti Computing** (Jun - Aug 2024)
  - Completed Project: "Circuit Quantization, Julia to Python Porting" working with Joel Howard, Senior Quantum Engineer at Rigetti
  - Coded circuit simulation software to calculate **Hamiltonian specs (qubit frequencies, etc.)**
  - Ported Julia code to Python, while optimizing and thoroughly testing and documenting (test driven development)
  - **Created tensor operation, eigenvalue and eigenvector code** with methods for serialization
  - Learned superconducting physics basics - cooper pairs, Δ, T_c, quasiparticles
  - Superconducting quantum computing basics - **Josephson Junctions, Transmons, Cooper pair boxes, E_J/E_C ratio, readout resonators, chip fabrication**
  - The physical implementation of a qubit and the entire design workflow (design → electrodynamical simulation → circuit simulation → qubit parameters → iterate)
- **Research Intern at Leiden University** (Aug - Sep 2024)
  - Worked on **Superconducting Nanobridge Single Photon Detectors (SNSPD's)**
  - Mentored by PhD student Jacopo Chiesa under Professor Michiel de Dood
  - Learned superconducting physics (**BCS Theory, Coherence Length, critical field, DC Josephson and Meissner Effects, London penetration depth, Type I and Type II Superconductors, Ginzburg-Landau theory**)
  - Completed Project on "3-omega Method for Measuring Thermal Conductivity of Supercooled Substrates"
  - Deposited thin (10 micron) gold wire onto Silicon oxide substrate by first spin coating two layers of PMMA, conducting **E-Beam lithography**, depositing via evaporation deposition and developing, then wire bonding to test in cryostat
  - Worked with **Operational Amplifiers** to create subtractor circuit to measure voltage difference, removed noise using **Lock-in amplifier**, simulated circuit in **LTSpice, used LABView, pyVISA, and pyMeasure for automation**
- **Research Intern at Search For Extraterrestrial Intelligence Institute** (Feb - Jun 2023)
  - Completed project and final presentation on “Gas Temperature Prediction For Accretion Disks”, worked with Dr. Uma Gorti, head researcher at SETI on the formation of planetary disks

    - Coded using **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, motor controllers, 3D printed, and soldered components
    - Machined aluminum parts using a **CNC, bandsaw and a drill press**
    - Mentored group members through **CAD, C++, and Arduino** coding
- **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
- Soccer (Football) Referee at Cal North Soccer (2018 - 2022)
    - Worked on the weekends as an Assistant or Center Referee across the Bay Area
    - Refereed teams U8 to U12, ensured fair play, crowd control, and record keeping

Publications

- HGI-SLAM: Loop Closure With Human and Geometric Importance Features
    - Published paper on loop closure to arXiv & submitted to ICRA 2023
    - **Created novel method that combines geometric and salient features** 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
    - Submitted to High School Journal of Student Research (JSR)
    - Created a **Quantum K-Nearest Neighbors (Q-KNN)** implementation to classify objects for self-driving cars
    - Improved performance compared to the classical approach and designed a **wireless networking framework based on quantum teleportation**

Awards

- **USA Physics Olympiad (USAPhO) Silver Medalist**, 2022
- **American Invitational Mathematics Examination (AIME) Qualifier**, 2022
- **National Merit Scholarship Winner**, 2022
- **FIRST Tech Challenge (FTC) 1st In California and World Finalist**, 2022
- Award of Excellence, California Space Consortium (CaSGC), NASA
- Le Grand Concours Silver Medalist (National French Contest)
- AP Scholar with Distinction
- Speech & Debate Best Speaker Award
- Coaches Award Water Polo
- Honorable Mention, Berkeley Math Tournament
- Honorable Mention, Synopsys Silicon Valley Science and Technology Championship

Activities

- **Division III Men's Water Polo**
    - Play as an attacker (right or 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, modeled designs in Fusion 360 (CAD software)
    - Lead Programmer: Implemented Convolutional Neural Network for vision using Tensorflow Lite. Created splines and performed an inverse kinematic analysis. Tuned PID motor controllers, and created a predictive simulation of the robot.
    - Team received multiple Inspire Awards and was 1st in California, and become a world finalist
- **MIT Beaver Works Summer Institute (BWSI)**, Quantum Computing (QC)
    - 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 High School Program, Taught by Stanford & MIT alumni
    - Published blog, deploying Keras models (TensorFlow Lite)
    - Completed 2 projects on object detection (YOLO Deep Learning Architecture) & audio processing (FFT and filtering). Promoted AI in my school & community, organized outreach events.
- Competitive Soccer, San Jose Youth soccer league, Bronze Level, 2019
    - Played as Center defender in competitive matches, Most Valuable Defender

Skills

- Programming Languages: **Java, Python, Fortran, C++, Q#, Qiskit**, HTML/CSS/JS,
- Frameworks: TensorFlow AI/ML, **Fusion 360, Android Studio**, GitHub, Keras
- Languages: **English, Kashmiri, Hindi,** French

Community

- Robotics Instructor at Afterschool Programs & Community Libraries (2017 - 2022)
    - Conducted multiple camps and sessions for EV3 and First Lego League Robotics in local elementary and middle school kids, while fundraising for Terrabats
    - Hosted two qualifiers, mentored 100+ rookies, and founded two teams
- Mentoring and Tutoring at Middle and High Schools
    - Science Olympiad and Math Olympiad mentor for middle schools
    - Robotics instructor at after school programs and community Libraries
    - Tech Challenge and Odyssey of the Mind mentor for community teams
    - Robotics Booth at Bay Area Science Festival, conducted robotics camps
    - SchoolHouse World Tutor: Physics and Math tutoring with positive feedback

Traits

- **Curious, Persevering, Dedicated, Motivated, Selfless, Honest, Helpful, Learner, Thoughtful**