

Rahel Joshi

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EDUCATION

California Institute of Technology (Caltech)

Graduation: June 2026

Bachelor of Science in Computer Science

GPA 4.2/4.3

Taken Courses: Linear Algebra, Intro Computer Programming, Data Structures, Object-Oriented Software Design, Theory of Computation, Intro to Tensorflow

2024-2025 Planned Courses: Computer Systems & Architecture, Machine Learning Systems, Functional Programming, Algorithms, Relational Databases, Machine Learning & Data Mining, Advanced Operating Systems, Programming Languages & Interpreters, Discrete Math, Applied Linear Algebra

EXPERIENCE

Research Fellow

June 2024 – August 2024

Caltech/NASA/JPL - High Energy Astrophysics Group

Pasadena, CA

- Developed machine learning model with Pytorch to emulate x-ray spectroscopy of black holes and neutron stars as a more accurate alternative to linear interpolation of simulated x-ray spectra tables, with $\sim 98\%$ accuracy
- Achieved $\sim 85\%$ increase in accuracy and reduction in noise over prior emulator models
- Reduced $\sim 98\%$ of memory and storage consumption by replacing x-ray spectra tables with DNN models
- Visualized the model's error across the entire 5D parameter space, identifying outlier regions of higher error
- Sped up training process by 20x by utilizing parallelism and adaptive learning
- Planning for academic paper and submission to astrophysics conferences
- Working on open-sourcing model and integrating with HEAsoft/Xspec for the astrophysics community to utilize

Research Scholar

June 2022 – August 2022

Texas Tech University - Cyber Physical Systems Lab

Lubbock, TX

- Selected as 1 of 12 Anson L. Clark Scholars from 700+ applicants
- Developed an ECG Sonification System in Python to convert ECG signals into audio, to enhance the detection and diagnosis of heart irregularities such as arrhythmia.
- Utilized variable thresholds to identify PQRST wave features of the ECG with $\sim 97\%$ accuracy
- Implemented ECG signal denoising through Fourier Transform, Wavelet Transform, and moving average filters, eliminating $\sim 80\%$ of noise
- Mapped ECG amplitude and standard deviation to audio wave frequency, volume, and morphology
- Collected ECGs with electrodes, heart rate monitor, & Arduino, and applied sonification in real-time

Research Intern

May 2021 - July 2021

UT San Antonio - Multiple Autonomous Robot Systems Lab

San Antonio, TX

- Researched various Swarm Foraging algorithms and their performance
- Presented demos of different foraging algorithms in ARGoS and ARGoS-Khepera IV physics simulators
- Wrote comprehensive guides for installing the physics simulators

PROJECTS

Physics Engine | C, Gitlab, Emscripten, SDL2

- Created a custom physics engine from scratch, for simulations and game development
- Implemented forces (gravity, springs, etc), collision handling, efficient memory handling, and input management
- Encapsulated code into components such as forces, assets, bodies, scenes, collisions, etc
- Created simulation and game demos like N-Body Simulation, Frogger, Pacman, Space Invaders, and more
- Added unit testing for each feature to ensure code works as expected

Chess Bot | Python

- Implemented a chess bot using the Minimax algorithm
- Utilized alpha-beta pruning and Zobrist Hashing for optimization

TECHNICAL SKILLS

Languages: Java, Python, C, C++, HTML, CSS, JavaScript, SQL

Developer Tools: Git, GitHub, Jupyter Notebook

Libraries/Frameworks: Pandas, NumPy, Matplotlib, TensorFlow, PyTorch, OpenCV, Scikit, BeautifulSoup, Selenium, Next.js, React