Umar Rajguru

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Education

McMaster University Hamilton, ON
B.A.Sc Honours Computer Science, Minor in Math, GPA: 3.65 *Sept. 2021 – April 2025*

Experience

McMaster Battery Challenge Team November 2023 – Present
McMaster University *Hamilton, ON*

- **Competing against 12 universities** in the Battery Workforce Challenge where we **build, test, and integrate a cutting-edge EV battery pack** made from scratch into a **Stellantis** vehicle.
- **Designing algorithms** that optimize **energy efficiency**, **battery management**, and **safety protocols**, ensuring the successful integration of our custom EV battery pack into the Stellantis vehicle in the three year competition.

Projects

Project Pythia: K_p Index Prediction | *Python, TensorFlow, JavaScript, ThreeJS* Oct 2023 - Oct 2023

- **Selected to represent Hamilton as a global nominee** in the NASA Space Apps Challenge hackathon for creating a machine learning model that predicts geomagnetic storms using spectral data from the DSCOVR satellite.
- Employed **Convolutional Neural Networks** and **Recurrent Neural Networks** using **TensorFlow** and **Keras**, utilizing a 2D CNN for spatial data, a 1D CNN for sequential data, and an RNN for capturing temporal dependencies.
- Crafted an aesthetically engaging web application with a **ThreeJS-powered** globe visualization, enabling users to interact with a time-slider for intuitive exploration of forecasted K_p index variations in electromagnetic storm forecasts.
- Co-authored a paper on our combined CNN and RNN approach for K_p index prediction, illustrating our methods to construct a model with **87%** accuracy.

Double Pendulum Numerical Solver | *C++* Dec 2022 – Dec 2022

- Implemented a **numerical solver in C++** for a double pendulum system that can be used to simulate the motion of a double pendulum.
- Used Runge-Kutta 4th Order numerical integration methods to solve for pendulum angles and angular velocities.
- **Visualized the results** of the solver by using an external plotting library to plot resulting data.
- Converted resulting angle data to Cartesian coordinates to create a 2D trajectory plot of the double pendulum.

3D N-Body Simulation | *JavaScript, React, ThreeJS* Aug 2022 – Aug 2022

- Created a web-based 3D N-Body simulation using **ThreeJS** and **React**.
- Utilized Runge-Kutta 4th Order numerical integration methods to simulate the motion of numerous gravitational bodies.
- Made use of **OOP design principles** to create a modular and extensible codebase.

JadeLang Virtual Machine | *C* Jan 2021 – Jan 2021

- **Worked in a team of 2** to design a syntactically unique programming language.
- Developed a **stack-based virtual machine** for the purpose of program bytecode execution.
- Outlined a **unique instruction set architecture** for the virtual machine and implemented it in **C**.
- Collaboratively worked on and formalized a grammar for the programming language.

StratusVM | *C* Dec 2020 – Dec 2020

- Developed a **stack-based virtual machine with an assembler** for the purpose of executing instructions.
- Wrote and documented an extensible instruction set for the virtual machine.

Technical Skills

Languages: C/C++, Python, x86/x64 Assembly, Haskell, Lua, MATLAB, Java, JavaScript, HTML/CSS, SQL, LaTeX
Libraries/Frameworks: React, ThreeJS, Node, NumPy, Matplotlib, Pandas, TensorFlow, Keras, OpenGL
Developer Tools: Git, GNU/Linux, Visual Studio, GDB, SSH, NASM (x86 Assembler)