Mahebub Aalam Khatri

Education

Northwestern University   **Expected June 2023**

B.A. Physics, Astronomy concentration
B.A. Computer Science
Overall GPA (up to December 2022): 3.766

Research Experience

Dahl Group, Scintillating Bubble Chamber (SBC) Collaboration   June 2020 - Present

Undergraduate Researcher
Advisor: Eric Dahl

- Created a camera calibration program using OpenCV in python. Wrote documentation describing its operation and step by step instructions on its use including potential errors and their solutions.
- Developed and tested a robust event builder which handled the logic and operation of the camera array. It automated the simultaneous capture of a bubble across all cameras while validating that all parts of the system were operational. It included an image buffering system to increase frame rates and speed of acquisition. Also included an intuitive user interface to view system status, change settings, and view captured events.
- Built a mock bubble chamber to test the imaging quality of different lighting setups. This required the collection and analysis of several combinations of wavelengths of illumination and reflector materials. Determined that initial assumptions about chamber lighting requirements were false.
- Improved bubble detection and tracking using a hough-transform based approach instead of simple image subtraction. This decreased false detections, improved reliability of detection for edge cases, and provided better positional accuracy.

Relevant coursework

Astrophysics

Observational Astrophysics, Stellar Astrophysics, Extragalactic Astrophysics and Cosmology

Computer Science

Computational Optics, Programming Massively Parallel Processors with CUDA, Intermediate Computer Graphics, Machine Learning, Compiler Construction

Selected Projects

- Wrote a compiler for a C-like language using C++ that iteratively converted code down to assembly through multiple intermediate representations and implemented several algorithms to make the generated assembly code run faster.
- Created a navigable animated 3D scene in WebGL using JavaScript which allowed the user to explore different lighting methods and material properties using different shaders.
- Used Numpy, Pandas, Astropy, and Astroquery to determine the period-luminosity relationship of Cepheid Variables and in turn calculate the distance to the Large Magellanic Cloud using data from GAIA and OGLE.

Honors and Awards

NU WCAS Dean's List Recipient   **2019 - 2022**

NU Summer Undergraduate Research Grant (SURG)   **Summer 2021**

    Received for "Dark Field Bubble Imaging for the SBC"

Skills

Programming Languages

    Python, C, C++, Javascript, HTML, CSS, WebGL/OpenGL, GLSL, LaTeX

Libraries and Frameworks

    Numpy, Pandas, OpenCV (python), D3.js, jQuery