Vishal Sudhakar

I am a physicist interested in learning and developing techniques in high-energy astrophysics and cosmology.

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Education

Bachelor of Science: Physics and Astrophysics
August 2020 – May 2023
Georgia Institute of Technology – Atlanta, GA

- GPA: 4.0/4.0
- Dean's List: Fall 2020, Spring 2021, Fall 2021, Spring 2022, Fall 2022, Spring 2023
- Faculty Honor: Fall 2020, Spring 2021, Fall 2021, Spring 2022, Fall 2022, Spring 2023

Associate of Science: Physics
August 2019 - May 2020
Dalton State College – Dalton, GA

- GPA: 4.0/4.0
- Dean's List: Fall 2019, Spring 2020

Udemy Course - Python for Machine Learning & Data Science Masterclass
Udemy Course - Artificial Intelligence A-Z™ 2023

Work Experiences

Research and Development Intern | May 2022 – Current
FlexTecs LTD

- Building upon the previous Invoice Outlier Detection system improving the efficiency using a supervised model
- Constructed an **Invoice Outlier Detection** system using **KMeans** algorithm (scikit-learn) which finds invoice numbers and invoice amount that do not match the pattern of particular vendors.
- Developed a new **Siamese Neural Network** architecture using **Tensorflow** and the **Bert-Encoder** to build a Vendor Duplicate system.
    - Model uses the vendor's name, address, phone number and email address to find duplicate vendors within the records.
- Worked with datasets with over 2 million data entries.
- Performed initial data reconstructions using statistics to prepare the data for the ML models.

Teaching Experiences

Teaching Assistant – Optics | August 2022 – December 2022
Georgia Institute of Technology

- Held office hours for students to ask questions about homework and class in general.
- Graded homework.

Teaching Assistant – Electrodynamics | January 2022 – May 2022
Georgia Institute of Technology

- Held office hours for students to ask questions about homework and class in general.
- Graded homework.

Scholarships / Research Grants

Letson Scholarship (Summer 2022) for research work on Rigidity Percolation on a Generic Lattice ($7200)

Publications

W. Stephenson, **V. Sudhakar**, J. McInerney, M. Czajkowski, and D. Z. Rocklin, Rigidity percolation in a random tensegrity via analytic graph theory, Proceedings of the National Academy of Sciences 120, e2302536120 (2023), https://www.pnas.org/doi/pdf/10.1073/pnas.2302536120.

Research Experiences

"Soft Excess" in X-ray Spectra of Active Galactic Nuclei (AGNs) | August 2022 – Current
Advisor: Prof. David Ballantyne | Georgia Institute of Technology

- Performing numerical calculations using **Python** to extend the range of the reXcor model grids.
- Using **XSPEC software** to fit and study a new developed theory of accretion disks for 32 XMM-Newton observational **X-ray data of Type-I AGNs**.
- Using **Python** and subsequent packages such as **Pandas** and **NumPy** to analyze the best fit parameters of the model to learn about the distribution of energy within the disks.
- **A second-author paper will be submitted in January 2024 to the Monthly Notices of the Royal Astronomical Society (MNRAS).**

General Tensegrity Percolation | May 2022 – Current
Advisor: Prof. Zeb Rocklin | Georgia Institute of Technology

- Extending the **rigidity percolation theory** of a square lattice structure to a general depleted triangular lattice structure with a mixture of rods, cables, and struts.
- Validating the developed theory to the general case by **analytical** and **numerical** techniques.
- Programming an optimization problem of a linear and non-linear equation in Python and Mathematica to acquire simulation data.
- Utilizing statistical methods like **nonlinear regression**, **linear fit**, etc. to further understand the significance of the data.
- **Currently writing a first-author paper to be submitted in March 2024 to Physical Review Letters (PRL).**

Tensegrity Percolation | May 2021 – May 2022
Advisor: Prof. Zeb Rocklin | Georgia Institute of Technology

- Studied the **rigidity percolation** of a square lattice structure with a mixture of rods and cables and struts.
- Applied **graph theory** to **mathematically model** the physical system.
- Utilized **avalanche statistics** to study the change in the system as cables are randomly added.
- Programmed simulations using **Python** and **Mathematica** to compare the simulation data to the developed theory.
- Employed statistical methods like **linear least square** to further understand the cogency of the data.
- **Co-first author publication is published in the PNAS journal** (https://doi.org/10.1073/pnas.230253612).

Programming Languages

Python	: proficient
Mathematica	: proficient
Java	: intermediate
C	: novice

Software Packages

XSPEC	: proficient
keras	: proficient
scikit-learn	: proficient