

Arnav Kumar

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Experience

Blockchain Software Engineer @ Dandelion Networks May 2023 - Aug 2023

- Developed and implemented an enhanced lattice syncing and node discovery algorithm in Go, querying peers with Protocol Buffers to identify and address missing blocks in the local lattice with secure and concurrent updates.
- Created and deployed a locally hosted debugging website in Go to be run by each node of the blockchain network.
- Designed multiple mock servers, clients, and services to create multiple tests for the syncing and discovery algorithms with Go's Ginkgo and Gomega testing frameworks.
- Integrated Jenkins with the project through a Jenkinsfile to automatically build, test, vet, and format pushed code.

Data Science Intern @ Tektorch.ai Apr 2022 - Aug 2022

- Extracted features such as job title, location, classification, and pay from a job listing website using Python, BeautifulSoup 4, NumPy, and Pandas to create a dataset for analysis.
- Developed an end-to-end data visualization pipeline to ingest data and display trends using Matplotlib, and NumPy.

Machine Learning Research Intern @ University of Alberta Jul 2021 - Aug 2021

- Trained and employed natural language processing models to help determine the cause of a change in depressive language in Tweets as part of a psychology study.
- Created an evaluation framework with graphs and videos to analyse subject mouse position data during exams.
- Developed automation pipeline in Bash to reduce time spent by 20× on the application of the evaluation framework.

Projects

InterPlanetary File Explorer (IPFE) | *Go, Python, Scikit-learn, Estuary, Co:here, Three.js*

- Created vector embeddings for files with their headers using Co:here's NLP embeddings to facilitate classification of files.
- Performed principal component analysis of the vector embeddings to reduce the dimensionality from 4096 to 3 to be plotted and displayed interactively in 3D space using Three.js.

Prognosing Idiopathic Pulmonary Fibrosis (IPF) | *Python, Tensorflow2, Pandas, Scikit-learn*

- Implemented an auto-encoder, linear regression, dense neural network, and bayesian model in order to accurately predict future lung capacity and give a confidence value using initial lung capacity data, age, sex, smoking status, and more.
- Obtained a Laplace Log Likelihood score of -6.9 (much better than the baseline score -8.1) with $\sigma \approx 200\text{mL}$.

Custom Language Interpreter | *Haskell*

- Created an expression evaluator for a self-made stack-based language.
- Implemented zipper traversal to determine which part of the stack has already been processed in a followable, stepwise manner.

CLI Chess | *Haskell*

- Created a local multiplayer clone of the game of chess in Haskell that can be played in the CLI with the Haskell REPL.
- Developed safe and scalable functions to determine the state of the board and identify check and checkmate.
- Employed lists as applicative functors and monads to write concise, readable code for determining all valid next moves.

Achievements

- 335th (top 10%), with score 26, **William Lowell Putnam Mathematical Competition** 2022
- Estuary Sponsor Prize Winner, **UofTHacks X** 2023
- 10th in Canada, **Asian Pacific Mathematics Olympiad** 2022
- 11th in Canada, **Canadian Association of Physicists High School Exam** 2022
- 18th in Canada, 2 time qualifier, **Canadian Mathematical Olympiad** 2021 - 2022
- Invited to write, **United States of America Mathematical Olympiad** 2022
- Bronze medalist for machine learning project on prognosing IPF, **Canada Wide Science Fair** 2021

Education

Candidate for BSc. Computer Science @ University of Waterloo 2022 - Present

- Received the Ronald G. Dunkley National Scholarship (\$18,000), the President's Entrance Scholarship (\$2,500), and the Cenovus Energy STEM Scholarship (\$14,000).
- Core average of 98% (4.0 GPA) with all advanced level courses and received term distinction.

Skills

Languages: Go, Python, C++, JavaScript, Haskell, Racket, Java, Bash, L^AT_EX, HTML, CSS, Markdown, RegEx

Frameworks: Linux, Unix, Protobuf, Gomega, Ginkgo, Pandas, Matplotlib, NumPy, BeautifulSoup, Tensorflow, Scikit-learn, OpenCV