Arnav Kumar

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Skills

Programming: Python, C++, Rust, Go, JavaScript, TypeScript, Haskell, Java, Bash, LaTeX
Tools: Pytorch, Pandas, Matplotlib, NumPy, Scikit-learn, OpenCV, Unix, WebGL, Three.js, Godot, Protobuf

Education

Candidate for BSc. Computer Science (4th year) @ University of Waterloo   *Waterloo, ON.* | 2022 - Present
- 4.0 GPA, all advanced level courses, and term distinction. Received four merit based scholarships totaling $46,000.

Experience

Graphics & 3D Geometry Software Engineer @ Arcol.io   *San Francisco, USA* | Sep 2025 - Dec 2025
- Designed and implemented a Rust algorithm to reconstruct terrain meshes from raw contour data for areas over 5km^2.
- Performed prototyping, iteration, and proof-of-concepts to choose and implement the most suitable approach.
- Rendered generated terrain and contour lines, sent over the Wasm ABI to TypeScript, with Three.js and WebGL.

Software Engineer @ Trend Micro   *Kanata, ON.* | Jan 2025 - Apr 2025
- Engineered utility functions for Alicloud's webservices, optimizing cloud workflows and securing data management.
- Developed serverless functions to send scan metrics and results to the backend, helping identify details about customer errors and significantly cutting customer costs.

Combinatorics Researcher @ University of Waterloo   *Waterloo, ON.* | May 2024 - Aug 2024
- Authored a paper (The dimension of sparse random graph orders) in pre-print in arXiv (https://arxiv.org/abs/2504.19029).
- Worked on novel research exploring random graph orders and poset dimension utilizing configuration models, approximation techniques, convergence in probability, devising constructions, and computationally searching for counterexamples.

Blockchain Software Engineer @ Dandelion Networks   *Remote* | 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 Jenkins pipeline which automatically build, test, vet, and format pushed code to catch regressions.

Machine Learning Research Intern @ University of Alberta   *Remote* | Jul 2021 - Aug 2021
- Trained and employed Natural Language Processing (NLP) models to help determine the cause of a change in depressive language in Tweets as part of a psychology study.
- Created an evaluation framework to analyze mouse position data and automated it in Bash to reduce time spent by 20×.

Projects

4D Raymarching Pathtracer | *C++*
- Implemented SDF raymarching in 4D space with CPU pathtracing to contruct GIF renders of the scene.
- Designed and wrote a powerful material system with microfacet BRDFs, glass, volumetric fog, and the ability to assign a geometry more than one material.

Software Rasterizer and Raytracer | *C++*
- Recreated the whole rasterization process on the CPU, including perspective correct interpolation for textures.
- Optimized for fast ray-triangle intersection. Supported multiple materials, and spherical environment mapping.

InterPlanetary File Explorer (IPFE) | *Go, Python, Scikit-learn, Estuary, Co:here, Three.js*
- Created vector embeddings for files with their headers using 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 $\sigma \approx 200$mL.

Achievements

- 335th (top 10%), with score 26, **William Lowell Putnam Mathematical Competition** 2022
- 10th in Canada, **Asian Pacific Mathematics Olympiad (APMO)** 2022
- 18th in Canada, 2 time qualifier, **Canadian Mathematical Olympiad (CMO)** .... 2021 - 2022