Hrishee M. Shastri

shastrihm.github.io

Education

B.A. Computer Science & Mathematics, Reed College, Portland, OR, USA — Sep 2017 – May 2021

- GPA: 3.87
- **Thesis:** "Cutting the Chord: Interleaved and Demand-Aware Skip Graphs," 2021
  - Link: shastrihm.github.io/assets/hrisheesthesis.pdf
  - Advisors: Prof. Jim Fix & Prof. Marcus Robinson

Honors & Awards

National Science Foundation Graduate Fellowship — 2024 - 2027

- Awarded 3-year NSF CSGrad4US fellowship to commence upon matriculation in a CS PhD program.
- Each year for 3 years: $37,000 stipend and $16,000 cost-of-education allowance for tuition and fees.

Phi Beta Kappa — 2021

Reed College Commendations of Academic Excellence — 2018 - 2021

NSF Research Experiences for Undergraduates — 2020

Reed College Undergraduate Research Opportunity Grant — 2020

Publications

[1] Aniruddha Bapat, Andrew Childs, Alexey Gorshkov, Samuel King, Eddie Schoute, and **Hrishee Shastri**.[1] "Quantum routing with fast reversals." Quantum Journal (2021). Talk and extended abstract appeared in the ACM PLDI PLanQC workshop, 2021.

[2] **Hrishee Shastri** and Eitan Frachtenberg. "An analysis of the locality of binary representations in genetic and evolutionary algorithms." PeerJ Computer Science (2021).

[3] **Hrishee Shastri** and Eitan Frachtenberg, "Locality bounds for nonredundant binary-integer representations," 2020 IEEE Symposium Series on Computational Intelligence (SSCI).

Work Experience

Software Engineer, Outreach.io, Seattle, WA — March 2022 – Present

- Responsible for large-scale data analytics pipelines and the infrastructure and services needed to reliably serve that data to internal and external customers.
- Delivered a complete redesign of the insights data pipeline from a SQL-based ETL pipeline in a Snowflake data warehouse to a PySpark ETL pipeline in Databricks Lakehouse.
- Pitched, created, and maintained a developer tool used across teams for continuous integration and deployment to parse, compile, and verify queries written in our proprietary templating language.
- Designed and developed a self-service developer platform of gRPC services and OLAP databases to allow engineers across the company to seamlessly integrate analytics into their applications.

Research Engineer, JAN Scientific Inc, Seattle, WA — Jul 2021 – March 2022

- Developed deep learning models for image processing tasks in protein crystallography.
- Curated and pre-processed tens of thousands of images from client deployments of high-throughput crystallization experiments for training and testing data.
- Leveraged open-source convolutional neural network architectures to implement, train, and evaluate custom object detection and image classification models using Tensorflow and Keras in Python.
- Implemented flexible and reproducible pipelines for training experiments, including hyperparameter optimization, Tensorboard visualization, and custom evaluation metrics.
- Achieved 99% average precision for droplet detection and 95% accuracy for crystal classification, with a sub-5% false negative rate, for both ultraviolet and brightfield images.
- Integrated models for real-time inference with LabVIEW systems on Windows. Systems in production on-premise at industry and university pharmaceutical labs around the world.

Research Experience

Senior Undergraduate Thesis, Reed College, Portland, OR — Sep 2020 – May 2021

- Titled "Cutting the Chord: Interleaved and Demand-Aware Skip Graphs", this thesis formulated and explored demand-aware network optimization problems through the lens of a distributed data structure called the skip graph (Aspnes & Shah).

[1] Authors listed in alphabetical order by last name.

- Formulated the minimum expected path length problem, a network optimization problem to construct a skip graph minimizing path length for a given communication demand, and provided necessary and sufficient conditions on skip graphs for which the problem would be NP-Complete.
- Constructed the interleaved skip graph, a class of highly connected skip graphs resembling Chord. Derived its average path length and conjectured its optimality for uniform communication demand.
- Designed, analyzed, and implemented heuristics to generate skip graphs optimized for a given communication demand, with empirical evidence suggesting they outperform a random sampling baseline.

Research Intern, NSF REU Combinatorics, Algorithms, & AI for Real Problems, University of Maryland
College Park, MD Jun 2020 – March 2021

- Advised by Prof. Andrew Childs, Prof. Alexey Gorshkov, and now graduated PhD students Dr. Aniruddha Bapat and Dr. Eddie Schoute, worked with fellow REU intern Sam King to design and analyze algorithms to route qubits along graphs using a quantum parallel reversal primitive, specifically measured against classical swap-only protocols.
- Devised a quicksort-like algorithm adapted to parallel reversals on the path graph that grants a provable asymptotic constant factor improvement in the worst case routing time over the optimal swap only protocol (odd-even sort), the first known quantum advantage over classical routing schemes.
- Proved that the average case routing time of our algorithm significantly outperforms the optimal swap only algorithm by a constant factor, asymptotically.
- Expounded a more general algorithm for parallel reversal routing on general graphs, proving that it also achieves an asymptotic worst-case constant factor speedup over swap-only protocols given necessary conditions on the radius of the graph.
- Implemented simulations of our algorithms in Python to corroborate theoretical results.
- Co-authored paper for peer-reviewed conference workshop (*ACM PLDI PlanQC '21*) and journal (*Quantum*) publications.

Independent Study Research, Reed College, Portland, OR Sep 2019 – Feb 2021

- Conducted research as part of an independent study advised by Prof. Eitan Frachtenberg analyzing Evolutionary Algorithm representation locality, a measure of the degree to which a change in the representation of a solution corresponds to a change in the solution space.
- Demonstrated several theoretical and empirical results relating to the locality of bijective bitstring-to-integer representations under bit-flip mutation and single-point crossover.
- Derived tight bounds and expected value of locality metrics, proved that standard binary and binary reflected gray representations exhibit optimal locality, described algorithms for generating optimal and pessimal representations based on Hamiltonian paths on the hypercube, and proved asymptotic equivalence among all representations for global locality.
- Implemented several genetic and evolutionary algorithm experiments in Python and C++ to understand convergence behavior as a function of locality.
- Co-authored papers and presentations for peer-reviewed conference (*IEEE SSCI '20*) and journal (*PeerJ Computer Science*) publications.

TEACHING EXPERIENCE

Teaching Assistant, Reed College Computer Science Department Sep 2018 – May 2020

- Staffed evening office hours and morning lab sessions for introductory computer science classes, assisting students with basic computer science concepts, Python, Assembly, and C++ programming.
- Graded projects and exams. Communicated personalized feedback to students in 1-on-1 meetings.
- Acted as a liaison between students and course instructors, advocating for student needs and feedback on pacing and material.

Peer Tutor, Reed College Mathematics Department Sep 2019 - Dec 2019

- Staffed evening office hours for the Math center. Supported students with calculus, introductory analysis, discrete math, linear algebra, and vector calculus coursework.

SKILLS

Languages: Python, Go, C++, Typescript, Javascript, SQL, Bash, LaTeX, MIPS Assembly
Technologies: Git, Tensorflow, Keras, Pytorch, Jupyter, Numpy, Pandas, Networkx, GraphQL, MySQL, gRPC, REST, AWS, Docker, Kubernetes, Terraform, Airflow, PySpark