Varshini Subhash

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Education

Harvard University Cambridge, Massachusetts
Master of Engineering in Computational Science and Engineering *Sept 2021 – Present*
Expected Graduation Date – May 2023

Manipal Institute of Technology Manipal, India
Bachelor of Technology in Mechanical Engineering, CGPA: 9.09/10.0 *Aug 2014 – July 2018*

Research Publications

· **Varshini Subhash**, Karran Pandey, Vijay Natarajan, "GPU Parallel Computation of Morse-Smale Complexes", *Short Paper Proceedings*, IEEE VIS Conference 2020. [IEEE Xplore]
Varshini Subhash, Karran Pandey, Vijay Natarajan, "A GPU Parallel Algorithm for Computing Morse-Smale Complexes", *(Provisionally accepted to IEEE Transactions on Visualization and Computer Graphics)*

· Abhijath Ande, **Varshini Subhash**, Vijay Natarajan, "Scalable Computation of Extremum Graphs", *(Submitted to IEEE Pacific Visualization Symposium 2022)*

Relevant Coursework and Skills

· **Courses**: Introduction to Data Science (AC 209a), Advanced Scientific Computing: Numerical Methods (AM 205), Systems Development for Computational Science (AC 207), Ethics for Engineers - AI Track (MIT 6.9041).

· **Skills**: C++, Python, Data Structures and Algorithms, Parallel Computing, Machine Learning, CUDA, OpenMP.

Research Experience

Indian Institute of Science Bangalore, India
Research Assistant *June 2019 - August 2021*
Advisor: Professor Vijay Natarajan

GPU Parallel Computation of Morse-Smale Complexes | *Project Page* | *Code*

· Designed the **first** fully GPU parallel algorithm for Morse-Smale complex computation on 3D scalar fields; improved upon state-of-the-art by up to **8.6x**. Devised novel graph traversal algorithms for saddle reachability and path counting, with speedups up to **577.7x** and **5.4x** each.

· Accepted for **publication** and **presentation** at the IEEE VIS 2020 Conference. Presented at Women in High Performance Computing Lightning Talks 2021, ACM ARCS Symposium 2021 & Bangalore VIS Workshop 2020.

Scalable Computation of Extremum Graphs

· Helped devise a parallel algorithm for the fast computation of extremum graphs on n-dimensional scalar fields, with efficient simplification and scalable performance.

Indian Institute of Science Bangalore, India
Research Assistant & Research Intern *Jan 2018 - February 2019*
Advisor: Professor Ramsharan Rangarajan

Parallel Performance in Mesh Optimization | *Project Page*

· Improved the performance and scalability of a parallel mesh optimization algorithm DVR – reduced mesh optimization time by **47.4%**, enabled **100%** scalability with a **40**× speedup for mesh sizes as large as **14 million**.

Adaptive Mesh Refinement Using Quadtrees | *Project Page* | *Code*

· Implemented the paper 'Provably Good Mesh Generation' by Bern et al. – developed open-source software for adaptive mesh refinement using quadtrees. Improved obstacle problem accuracy by an **order of magnitude**.

Indian Institute of Technology Mumbai, India
Research Intern *May 2017 - June 2017*
Advisor: Professor Arindrajit Chowdhury

Spray Ignition Setup for Combustion of Hypergolic Propellants | *Project Page*

· Developed a spray ignition setup for hypergolic propellant combustion in rocket propulsion – modeled and structurally analysed the combustion chamber using SolidWorks & ANSYS. Designed and validated a theoretical injector system.

Work Experience

- **Deloitte** — Bangalore, India
  Business Analyst | Led Windchill cloud deployment, performance tuning and part classification. *Aug 2018 - June 2019*
- **Fiat Chrysler Automobiles** — Pune, India
  Summer Intern | Worked on the optimization of FCA's proprietary assembly line technology. *June 2016 - July 2016*
- **PTC** — Pune, India
  Summer Intern | Conducted functional & regressive sprint testing of Windchill MPMLink. *June 2015 - July 2015*

Awards & Honors

- Selected as **one among 30 finalists** for the Adobe Women-In-Technology Scholarship Award 2022. *2021*
- Accepted to a 3-month program as a **Google CS Research Mentorship Program Scholar** where students are matched with Google mentors and peers to support pursuit of computer science research pathways. *2021*
- Recognized as a **top performer** among **100**+ analysts during Deloitte's Annual Talent Review. *2019*
- Ranked in the top **3%** among **270** students during junior year of Bachelor's. *2016–17*
- Qualified for the quarter-finals of the All-India Tata Power Energy Q-Quiz. *2009*

Projects

- **Homelessness in the United States**
  Predicted homelessness trends in the US by comparing boosting, random forests, linear and polynomial regression models.
- **Algorithmic Bias in Recidivism Risk-Assessment for Criminal Justice**
  Predicted risk of recidivism in criminal justice using logistic regression and determined classification thresholds for fairness.
- **Higgs boson Particle Collisions**
  Predicted Higgs boson particle collision in Monte-Carlo simulations using trees, bagging, random forests and boosting.
- **College Acceptance into Elite Universities**
  Built classification models like kNN and regularized logistic regression for predicting admission into elite universities.
- **End Gender-Based Violence** | *Project Page* | *BTB Feature* | *Podcast*
  Detected a sharp rise in domestic violence in the US due to COVID-19 using interactive visualizations.
- **Fourier Transforms** | *Code* | *Project Page*
  Computed and visualized Fourier Transforms (3Blue1Brown) for input signals and extracted constituent pure signals.

Teaching Experience

- **Teaching Fellow**, CS50 - Introduction to Computer Science (Fall 2021), by David Malan.

Invited Talks

- Women in High Performance Computing (WHPC) Lightning Talk at the Supercomputing Conference 2021.
- STEM Career Spotlight Speaker at Summit K2 High School, via SENDforC - UC Berkeley, 2021.
- 'GPU Parallel Computation of Morse-Smale Complexes', ACM ARCS Symposium 2021. [Slides] [Poster]
- Panelist, STEM For Her Fundraiser, Superposition Chapter - San Ramon, California, 2020. [YouTube]
- 'GPU Parallel Computation of Morse-Smale Complexes', IEEE VIS 2020 Conference. [Talk] [Preview]
- 'GPU Parallel Computation of Morse-Smale Complexes', Bangalore VIS Workshop 2020.

Social Impact

- **Vizathon 2021** | *Organizer* | [Webpage] | Visualization hackathon with ∼400 registrations. *May 2021*
- **Humans of AI Podcast** | *Volunteer* | [Webpage] *Jan 2021 - Sept 2021*
- **She Belongs Podcast** | *Co-Founder & Co-Host* | [YouTube] [Spotify] [Medium] *Sept 2020 - Present*
  Discusses gender inequity and why women belong at the table. Over 2.4k views on YouTube.
- **Coronavirus Visualization Team, Harvard University** | [Webpage] *May 2020 - Aug 2021*
  Project Planning Co-Director | *Project Co-Lead* | *Community Manager*
- **Testbook** | *Educator* | Designed 500+ mock test questions for underprivileged students. *Mar - Sept 2018*