# Darshan Dinesh Kumar

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## EDUCATION

**New York University (Courant Institute of Mathematical Sciences)** **Sept 2024 – Present**
Master of Science in Computer Science, **CGPA: 4.00/4.00** *New York, USA*

**PES University** **July 2018 – May 2022**
B.Tech in Computer Science and Engineering, **CGPA: 9.54/10**, Class Top 5% *Bangalore, India*
Specialization: Systems and Core Computing

**RV PU College** **May 2016 – Apr 2018**
II PU State Boards: 95.33%, KCET State Rank: 276 *Bangalore, India*

**Carmel School** **June 2006 – Apr 2016**
10th Grade ICSE Boards: 96.83% *Bangalore, India*

## COURSEWORK

- Engineering Mathematics - I & II
- Discrete Mathematics & Logic
- Linear Algebra
- Introduction to Computing using Python
- Problem Solving with C
- Programming with C++
- Advanced Java
- Data Structures
- Design & Analysis of Algorithms
- Advanced Algorithms
- Generic Programming
- Design Patterns
- Fine Techniques - I & II
- Performance Engineering
- Digital Design & Computer Organization
- Microprocessor & Computer Architecture
- Theory of Computation
- Computer Networks
- Operating Systems
- Programming Languages
- Compiler Design
- Multicore Processors: Architecture & Programming
- Programming Parallel Algorithms
- Machine Intelligence
- Database Management Systems
- Big Data
- Cloud Computing
- Object Oriented Analysis & Design with Software Engineering

## SKILLS

**Programming Languages**: C, C++, Python, Java, Shell Script
**Tools and Platforms**: Git/GitHub, Linux, Docker, Kubernetes, Jenkins, AWS, Android Studio, Unreal Engine, LaTeX
**Other Technical Skills**: Generic Programming, Parallel Programming, Vectorization & SIMD, Compiler Optimisations using LLVM and custom LLVM Passes, Android App Development, Computer Graphics, CI/CD Pipelines, DevOps Practices, Microservices Architecture, RESTful API Development, Agile and Scrum Methodologies
**Industry tools**: Jira, Confluence
**Soft Skills**: Research acumen, Team Management, Project Management

## EXPERIENCE

**Samsung R&D Institute India - Bangalore** **July 2022 – Aug 2024**
*Platform & Software Research, 6G Lab | C, C++, SIMD, Vectorization, Compiler Passes, LLVM* *Bangalore, India*
***Engineer*** (July 2022 – March 2024)
***Senior Engineer*** (March 2024 – August 2024)

- Worked in the *Platform & Software Research* team at *6G Lab*, building the platforms & software for future technologies
- Implemented an end-to-end test bed that achieved 100 Gbps in the data plane as a proof-of-concept for 6G
- Explored SIMD and Vectorization for different architectures like Intel, ARM & AMD, realizing gains of up to 20%
- Researched compilers, LLVM, and designed custom LLVM passes for various optimizations, achieving 10% improvements
- Involved in the creation of IPs, Provisional Specifications, Patents, Research Papers, and Technical Blogs
- Mentored a Spring Intern and 2 Summer Interns

**Samsung R&D Institute India - Bangalore** **Jan 2022 – July 2022**
***Research Intern****, Vision Research Team | Python, Unreal Engine, Computer Vision & Graphics* *Bangalore, India*

- Built a Photorealistic Data Engine for the purpose of Depth Estimation

**PES University** **Jan 2022 – May 2022**
***Teaching Assistant*** | *C, C++, Data Structures, Algorithms* *Bangalore, India*

- Teaching Assistant for the course - *Design and Analysis of Algorithms* for over 1000 students
- Under the guidance of Prof. NS Kumar and Prof. Channa Bankapur
- Created course content, assignments, projects, and a comprehensive evaluation system

**Samsung R&D Institute India - Bangalore** **May 2021 – July 2021**
***Research Intern***, *IoT Platform & Connectivity Team* | *Android Studio, IoT, Smart Things* *Bangalore, India*

- Improved the User Experience via the Smart Things IoT Ecosystem
- Built an alternate and effective solution to solve a particular use case for the Smart Things Application

**Center for Data Science and Applied Machine Learning, PES University** **June 2019 – July 2019**
***Research Intern*** | *Python, C++, Unreal Engine, Computer Vision* *Bangalore, India*

- Implemented the Spacetime Trajectory Estimation Project [Link]
- Simulated the events after a video in a Physics Engine such as Unreal

## PROJECTS

**Automated Parallelization of Source Code using Program Comprehension** | *C++, Clava, LARA, Pthreads, OpenMP*

- A research project aimed at exploring methods to improve the performance of sequential source code by automatically converting it to its functionally accurate parallel equivalent to ensure efficient utilization of the underlying hardware
- Implemented Intra-Function Parallelism and Inter-Function Parallelism
- Intra-Function parallelism was implemented using program comprehension to identify the algorithm of a particular code section and replace it with the optimized parallel version based on the defined mapping in the backend database
- Inter-Function parallelism was implemented using a novel thread scheduling algorithm that enabled the parallel execution of the different functions in the original sequential program
- Achieved a substantial performance gain of up to 500 times for large data
- [Project Details] [Video Demo] [Report] [Presentation] [Code]

**Memory Allocator for OpenMP Programs** | *C++, OpenMP, Python* | [Project Details] [Report] [Presentation] [Code]

- A research project aimed at implementing a scalable & concurrent memory allocator for parallel applications (OpenMP)
- Implemented a memory allocator with per-thread heaps and memory ownership that can scale efficiently while almost eliminating false sharing and minimizing fragmentation
- Developed benchmarks for Speed, Scalability, False Sharing Avoidance and Fragmentation metrics
- Exhibited substantial performance improvements as compared to the Hoard and Malloc Allocators
- Exhibited super-linear speedup for the Scalability benchmark while Malloc & Hoard showed negligible speedup
- Demonstrated the best performance (Execution Time) for both the Active and Passive False Sharing benchmarks
- Demonstrated the best performance (Fragmentation Ratio) by a factor of 10000 for the Fragmentation benchmark

**Generic Programming in C** | *C, Design Patterns* | [Project Details] [Video Demo] [Report] [Readme] [Code]

- A project aimed at implementing Generic Programming features as a design pattern in C, using pre-processor directives
- Implemented generic containers - list, stack, queue, vector, and hashmap supporting all the different data types
- Implemented Iterators for each of these containers to decouple the containers and algorithms
- Implemented Generic Algorithms like find, find_if, count, count_if, min, max, accumulate that make use of the iterators

**Implementation of Treaps** | *C++, Generic Programming* | [Project Details] [Video Demo] [Report] [Readme] [Code]

- A project aimed at implementing Treap as a generic data structure along with its different functionalities
- A Treap stores pairs (say [X,Y]) in a binary tree such that it is a binary search tree by X and a binary heap by Y
- Built the entire treap and its individual nodes as generic, canonical classes supporting all the different data types
- Supported operations such as insert & delete a node, split, merge, union, intersection, difference & traversal of treaps
- Implemented a bidirectional iterator as a nested class within the treap class
- Implemented multiple member algorithms such as find and replace

**Mini-Compiler for Python** | *Lex, Yacc, C++, Python, Compiler Design* | [Project Details] [Video Demo] [Report] [Code]

- A project aimed at implementing a mini compiler for the Python programming language
- Supported the different phases of a typical compiler, namely lexical analysis, syntax analysis, semantic analysis, intermediate code generation, and intermediate code optimization
- Supported the if, if-else, if-elif-else and for constructs, arithmetic, relational and logical operators, keywords, identifiers, and various other features, including error detection and error handling mechanisms

**YACS - Yet Another Centralized Scheduler** | *Python, Sockets, Threading, Logging* | [Project Details] [Report] [Code]

- A project aimed at implementing a centralized scheduling framework for the Master-Worker paradigm

- The Master node receives job requests, which are scheduled on multiple slots across available worker machines
- The Master process consists of separate threads to listen to requests, to schedule map and reduce tasks, and to listen to job completion information from workers
- The Worker process listens to job allocation information and simulates execution
- Implemented three different scheduling algorithms, namely Least loaded, Round Robin, and Randomised

**Spacetime Trajectory Estimation** | *Python, C++, Unreal Engine, CV, Graphics* | [Project Details] [Video Demo]

- A project aimed at simulating the events occurring after the end of a given video
- Implemented the following different stages in sequence:
  1. Detecting the relative depth of objects from a single camera using relative monocular depth perception
  2. Identifying the objects in the video using the YOLO Object Detection model
  3. Tracking the selected objects using a Multi-Object Tracker and OpenCV
  4. Using the assimilated information to accurately estimate the three-dimensional kinematic parameters of the objects
  5. Simulating the events after the video in Unreal Engine by spawning the selected objects with calculated parameters
- Can enhance the decision-making abilities of self-driving vehicles & generate diverse data to train learning models

## TECHNICAL IP/PATENTS

**Method and System for AI Compute Networking in Virtual RAN** **2023-2024**
*Filing of Provisional Specification and Complete Specification Completed* *Patent Application No.: 202341032551*

**Method and System for efficient TB preparation in real time** **2023-2024**
*Filing of Provisional Specification and Complete Specification Completed* *Patent Application No.: 202341037879*

**Method and System for efficient memory management during HARQ** **2023-2024**
*Filing of Provisional Specification and Complete Specification Completed* *Patent Application No.: 202341037877*

## BLOGS

**Optimization** **Link**
*A technical blog on performance optimization*

**Vector Processing** **Link**
*A technical blog on Vector Processing and SIMD*

## AWARDS AND RECOGNITIONS

**CNR Rao Merit Scholarship - PES University** **All semesters**
*Received merit scholarships for being among the top 5% in Undergraduate academics* *(2018-2022)*

**Spot Award - Samsung Research** **June 2023**
*Recognized and Awarded for outstanding contribution to Research at Samsung*

**Super Tech Excellence Award - Samsung Research** **Jan 2024**
*Recognized and Awarded for outstanding contribution to Advanced Development and Research at Samsung*

**Google Hash Code Coding Competition - Top 100** **Feb 2020**
*India Rank: 87, Global Rank: 933*

**Google Hash Code Coding Competition - Top 150** **Feb 2021**
*India Rank: 128, Global Rank: 847*

**Microsoft's Hashcode Hackathon - Third Place** **Sept 2019**
*Won third place in Hashcode, a hackathon by Microsoft Innovation Lab for Blockchain-based Transaction System*

**Bhopal Smart City Hackathon - Finalist** **Dec 2019**
*Top 25 for Voice based Grievance System at Bhopal Smart City Hackathon*

**Rakuten Hackathon - Finalist** **Oct 2019**
*Top 50 for Blockchain based Transaction System at Rakuten Hackathon*

**Guinness World Record Holder** **Sept 2015**
*Awarded for being a part of the largest electronic keyboard ensemble*

**Special Grant Award - Government of India** **Aug 2017**
*Awarded for Outstanding achievements in drawing and painting with over 100 State-level prizes, 25 National-level prizes and 3 International-level prizes*