Durga Keerthi Mandarapu

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Summary

My current research involves developing abstractions of Ray Tracing hardware to reduce and accelerate a non-ray tracing problem. I study the applications that use trees as indexing structures and map them to the tree operations performed by the Ray Tracing cores. My broad interests are parallel systems, high-performance computing, databases, and compilers

Education

Ph.D. in Computer Science *W.Lafayette, U.S.A.*

Advisor: Prof. Milind Kulkarni,Purdue University **(GPA:3.95/4.00)** *Aug. 2019 - May. 2025**

Bachelors(Honors) in Computer Science and Engineering with Minor in Economics *Hyderabad, India*

Indian Institute of Technology, Hyderabad **(GPA:8.78/10.00)** *Jul. 2015 - Apr. 2019*

Publications**

Durga Mandarapu, Nicholas James, and Milind Kulkarni. **Mochi: Fast & Exact Collision Detection.** Under submission to Eurographics 2024.

Durga Mandarapu, Vani Nagarajan, and Milind Kulkarni. **Generalized Neighbor Search using Commodity Hardware Acceleration.** In PPoPP 2024 review.

Vani Nagarajan, **Durga Mandarapu**, and Milind Kulkarni. 2023. **RT-kNNS Unbound: Using RT Cores to Accelerate Unrestricted Neighbor Search.** In Proceedings of the 37th International Conference on Supercomputing (ICS '23). Association for Computing Machinery, New York, NY, USA, 289–300. [link]

Arsekar, R., **Mandarapu, D.K.**, Rao, M.V.P. (2017). **EpiStrat: A Tool for Comparing Strategies for Tackling Urban Epidemic Outbreaks.** In: Chen, H., Zeng, D., Karahanna, E., Bardhan, I. (eds) Smart Health. ICSH 2017. Lecture Notes in Computer Science(), vol 10347. Springer, Cham. [link]

Internships

Distributed Random Walks *Austin, U.S.A.*

Software Engineering Intern, Katana Graph *Summer 2022*

- Worked on developing a scalable uniform random walks application to overlap communication and computation costs on distributed graphs using the Katana interface.

Betweenness Centrality for Streaming Graphs *Vancouver, Canada*

MITACS Internship under the guidance of Prof. Keval Vora, Simon Fraser University *Summer 2019*

- Developed a parallel incremental algorithm that processes non-monotonous dynamic edge updates to compute a betweenness centrality measure of all the vertices in a streaming graph.

Credit Networks for better Payment Systems *W.Lafayette, U.S.A.*

PURE Internship under the guidance of Prof. Aniket Kate, Purdue University *Summer 2018*

- Developed a credit network using smart contracts in Ethereum that allow payments across different currencies without introducing a new crypto-currency and at a lowered account-creation, direct-payment, and currency transaction costs.

Strategy Selection in Epidemic Management using Agent-Based Modeling *Hyderabad, India*

Guide: Prof. M. V. Panduranga Rao, IIT Hyderabad *Fall 2016 - Spring 2017*

- Developed a tool that performs a scalable simulation of an epidemic that uses agent-based modeling of individuals to understand and predict how the disease could spread in an urban slum community.

Selected Research Projects

Collision Detection with Ray Tracing Cores (Under Submission) *W. Lafayette, U.S.A.*

Advisor: Prof. Milind Kulkarni, Purdue University. *Summer 2023**

- Devised object-object intersection test on RT interface by tracing the edges of the object's bounding volume.
- Devised 2D ray-triangle intersection test on RT interface that performs only 3D ray-triangle intersection by introducing proxy triangles.

Neighbor Search on Ray Tracing Cores (In review) *W. Lafayette, U.S.A.*

Advisor: Prof. Milind Kulkarni, Purdue University. *Fall 2022**

- Implemented non-L^2 distances on ray tracing cores that order objects on L^2 distance, by formulating two generic distance computations.
- Working on extending the search to data points from higher dimensions(1e3), although ray tracing cores only expose 3D indexing structures.

Concurrency Control with RDMA *W. Lafayette, U.S.A.*

Guide: Prof. Walid Aref, Prof. Jianguo Wang, Purdue University. *Fall 2020*

- Implemented 2-Phase-Locking (wait-die, no-wait), Optimistic Currency Control (Forward-OCC, Backward-OCC), and Multi-Version Concurrency Control (multi-version timestamp ordering) protocols using RDMA to process transactions on a 5-node cluster.

Algorithms for overlaying topologies in Data Center Networking *W. Lafayette, Indiana*

Research Assistant, Guide: Prof. Douglas Comer, Purdue University. *Summer 2020*

- Developed a heuristic that greedily selects a neighbor to map logical overlay topologies to physical underlay topologies. Runs in polynomial time which is otherwise an NP-problem.

Support for Shuffle, Broadcast and Reduce in Serverless Computing *W. Lafayette, Indiana*

Guide: Prof. Pedro Fonseca, Purdue University. *Fall 2019*

- Developed a user library that handles the direct communication between the lambda functions in Serverless Computing architecture for workloads that involve communication patterns like broadcast, shuffle, and reduce.

Parallel Sparse Matrix-Matrix Multiplication *Hyderabad, India*

Guide: Prof. Sathya Peri, IIT Hyderabad. *Fall 2018 - Spring 2019*

- Developed a lock-free and wait-free algorithm that uses relaxed barrier constraints to mitigate the synchronization delays between threads for making applications like sparse matrix-matrix multiplication more scalable.

Component Specific Passes on LLVM *Hyderabad, India*

Guide: Ramakrishna Upadrasta, IIT Hyderabad. *Spring 2019*

- Divided a program into basic components, and the clang compiler optimization passes into sub-sequences of transform and analysis passes to show that the performance achieved by applying all the passes can also be achieved by just a sub-sequence of them in a shorter time.

Optimistic Algorithms for Distributed Transactional Memory *Hyderabad, India*

Guide: Prof. Sathya Peri, IIT Hyderabad. *Fall 2018*

- Developed a library that uses a distributed basic timestamp ordering algorithm that can be plugged in to read and write shared objects in a transactional memory. Optimized the number of messages exchanged to remove redundant notifications.

Positions of Responsibility

Graduate Research Assistant, *Prof. Milind Kulkarni, Purdue University* *Fall '21 - Fall '23**

Graduate Teaching Assistant, *Data Structures, Purdue University* *Fall '19 - Summer '21*

Undergraduate Teaching Assistant, *IIT Hyderabad*

Operating Systems (Fall 2018, Spring 2019), Database Systems (Spring 2019), Data Structures (Fall 2017), Introduction to Programming (Fall 2017)

Lit-soc (Literary Society) Coordinator, National Service Scheme , *IIT Hyderabad chapter* *Fall 2017 - Spring 2018*

- Organized weekly sessions for students on Computers, English, Mathematics, and Science at local government schools.
- Developed a database of presentations on the topics from the high school textbooks, with the help of the IITH student community

Grants & Awards

2023 **PLDI,** ACM SIGPLAN Conference on Programming Language Design and Implementation, Travel Grant

2019 **SOCC,** ACM Symposium on Cloud Computing, Travel Grant

2019 **MITACS,** scholarship to intern in Canada

2018 **JENESYS,** Indian cultural ambassador to Japan, funded by Embassy of Japan

* marked refer to continuing in present timeline.
** published, in review and unpublished conference papers.