Buddhi Ashan Mallika Kankanamalage

Doctoral Candidate, Department of Computer Science, University of Texas at San Antonio, TX 78249

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I am a Computer Science Ph.D. candidate at the University of Texas, San Antonio, specializing in geometric intersection and approximate nearest neighbor similarity search within expansive geospatial datasets. Proficient in parallel and distributed computing, high-performance computing, GPU programming, and spatiotemporal data processing, my research aims to optimize polygonal operations' performance and scalability across diverse computing platforms. I design efficient data structures and algorithms for multi-core and many-core systems, contributing valuable insights at the interface of computer science and geospatial data, and seeking to leverage my expertise in research-driven innovation to tackle complex challenges in computer science.

Education

- **Ph.D. in Computer Science**   Aug. 2019 - Jul. 2024 (Expected)
  University of Texas at San Antonio
  Dissertation: Geometric intersection and approximate nearest neighbor similarity search over large geospatial polygonal datasets
  Advisor: Dr. Sushil K. Prasad (UTSA), **Co-advisor:** Dr. Satish Puri (MST)

- **M.S. in Computing and Information Science**   Aug. 2017 - May 2019
  Sam Houston State University (GPA 4.0/4.0)
  Project: Performance evaluation of transfer learning for pornographic detection

- **B.Sc. (Special) in Computer Science**   Nov. 2011 - Feb. 2016
  University of Kelaniya, Sri Lanka (First class honours. GPA 3.77/4.0)
  Dissertation: Recognition of vehicle license plates using MATLAB.

Experience

- **Graduate Research / Teaching Assistant**   Aug. 2019 - Onwards
  Department of Computer Science, University of Texas at San Antonio
- **Graduate Assistant**   Aug. 2017 - May 2019
  Department of Computer Science, Sam Houston State University
- **Temporary Lecturer**   Mar. 2017 - Aug. 2017
  Department of Software Engineering, University of Kelaniya, Sri Lanka
- **Temporary Demonstrator**   Feb. 2016 - Feb. 2017
  Department of Statistics and Computer Science, University of Kelaniya, Sri Lanka

Research Interests

Parallel and distributed computing | High performance computing |GPU programming |Spatiotemporal data processing

Awards and Honors

- Best paper finalist: CCGrid 2023.
- NSF student travel grant: Annual MVAPICH user group (MUG) 2022 conference.
- Member of the Team Northern Lights-UTSA selected for final 3 teams at the Innovation Bowl competition organized by Radiance Technologies, 2023.

Publications

- Ashan, M. K. Buddhi, Satish Puri, and Sushil K. Prasad. "Extending segment tree for polygon clipping and parallelizing using OpenMP and OpenACC compiler directives." *53rd International Conference on Parallel Processing (ICPP).* 2024 (**Accepted**).

- Ashan, M. K. Buddhi, Satish Puri, and Sushil K. Prasad. "Efficient PRAM and Practical GPU Algorithms for Large Polygon Clipping with Degenerate Cases." *2023 IEEE/ACM 23rd International Symposium on Cluster, Cloud and Internet Computing (CCGrid)*. IEEE, 2023 (**Acceptance rate 21%. Best paper finalist**).
- Ashan, M. K. Buddhi, Hyuk Cho, and Qingzhong Liu. "Performance evaluation of transfer learning for pornographic detection. "*Advances in Natural Computation, Fuzzy Systems and Knowledge Discovery: Volume 2*. Springer International Publishing, 2020.
- Ashan, M. K. Buddhi, and N. G. J. Dias. "Recognition of Vehicle License Plates using MATLAB." *European International Journal of Science and Technology* 5.6, 2016.

Under Review

- Ashan, M. K. Buddhi, Satish Puri, and Sushil K. Prasad. "Quad tree-based polygon encoding for shape-based similarity over large datasets of exponential area variations." *32nd ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems (SIGSPATIAL).* ACM, 2024

Poster Presentations

- IPDPS 2024 PhD forum: accepted. IPDPS 2022 PhD forum.
- Annual MVAPICH user group (MUG) 2022 conference.
- 30 to R1 research poster showcase organized by the UTSA graduate school, 2023.

Research Projects

- Efficient PRAM and practical GPU algorithms for large polygon clipping with degenerate cases (*CCGRID '23*).
  - ✓ Presented a **CREW PRAM** polygon clipping algorithm that handles degenerate cases properly.
  - ✓ Developed **CUDA C++** implementation of the theoretical algorithm optimizing it employing filtering techniques.
  - ✓ Presented a performance analysis using real-world and synthetic datasets.
- Extending segment tree for polygon clipping and parallelizing using OpenMP and OpenACC compiler directives (*ICPP '24 Accepted*).
  - ✓ The first work to extend a segment tree data structure for polygon clipping leveraging Chaselle's rules.
  - ✓ Parallelized segment tree construction including augmented data structures and line segment intersection finding using **OpenMP** directives.
  - ✓ Presented a performance analysis including parallel kernel offloading using **OpenACC**.
- Quad tree-based polygon encoding for shape-based similarity over large datasets of exponential area variations (NSF # 2344585) (*Under review*).
  - ✓ Contributed to writing the NSF proposal (NSF # 2344585).
  - ✓ Developed uniform grid-based and quad tree-based **polygon encoding** techniques to encode a polygon into a feature vector.
  - ✓ Presented a workflow leveraging Jaccard distance to find similar shapes from a large reference dataset employing an HNSW graph for fast searching (**Python**)**.**
- Applications and data visualization researcher: ScooterLab (NSF # 2234516).
  - ✓ Developed a Map tool employing an **ArcGIS base map** visualizing scooter trip trajectories and their sensor data (**JavaScript**).
  - ✓ Designed and contributed to developing a **PHP** backend application to manage researchers and experiments using **Laravel** framework.

Teaching Experience

- Graduate teaching assistant (UTSA)
  - ✓ **CS4593 CS-CURE** (Spring 2024).
    Gave a talk on the NSF project "Approximate Nearest Neighbor Similarity Search for Large Polygonal and Trajectory Datasets".
  - ✓ **CS 3844 Computer Organization** (Spring 2022).
    Conducted recitation classes to help the students understand theoretical concepts and solve problems using a discussion-based environment.
  - ✓ **CS4823/CS6643 Parallel programming/processing** (Fall 2021).
    Conducted parallel programming classes using hands-on sample code snippets helping the students to learn and understand the concepts and covered a book chapter.
- Graduate assistant (SHSU)
  - ✓ **COSC 1436: Introduction to programming and algorithms** (Fall 2018, Spring 2019).
    Helped the students understand basic programming concepts and improve their problem-solving and debugging skills.

- Temporary Lecturer/Demonstrator (UoK - Sri Lanka)
  - ✓ **Data structures and Algorithms course and Web technologies**.
    Conducted tutorial classes helping the students understand basic concepts and their final projects. Prepared and graded student assignments.

Skills

- Algorithms and data structures: Strong background in developing data structures for parallel algorithms.
- Big data parallel and distributed programming: CUDA, OpenMP, OpenACC, MPI, SLURM, Hadoop.
- Machine learning: Entry-level experience developing DNN models for image classification using transfer learning techniques.
- Software development: Git and Docker.
- Programming languages: C, C++, Python, Java.
- Web-based system development: HTML, PHP, CSS, MySQL, Laravel.

Other Contributions

- Student volunteer at the international conference for high performance computing, networking, storage, and analysis (SC 2023).
- Webmaster for workshop series on Education for High Performance: EduHiPC-23 in conjunction with HiPC 2023, EduHPC-23 in conjunction with SC 2023, EduPar-24 in conjunction with IPDPS 2024, EduHPC-24 in conjunction with SC 2024.

References

- Dr. Sushi K. Prasad (Advisor)
  University of Texas at San Antonio
  Email: sushil.prasad@utsa.edu
- Dr. Satish Puri (Co-advisor)
  Missouri University of Science and Technology
  Email: satish.puri@mst.edu