SAYAN GHOSH

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EDUCATION

- **2015 - 2019**
  PhD, Computer Science,
  Washington State University, School of EECS, Pullman, WA.
  Adviser: Dr. Assefaw Gebremedhin
  Thesis title: *Supporting Efficient Graph Analytics and Scientific Computation using Asynchronous Distributed-Memory Programming Models*
  PhD program commitee members: Drs. Assefaw Gebremedhin (WSU), Carl Hauser (WSU), Ananth Kalyanaraman (WSU), Pavan Balaji (ANL) and Mahantesh Halappanavar (PNNL).
- **2012 - 2014**
  PhD studies, Computer Science,
  University of Houston
  Adviser: Dr. Barbara Chapman
- **2010 - 2012**
  Master of Science (Thesis), Computer Science,
  University of Houston, Houston, TX.
  Graduated: August 2012
  Thesis title: *Energy Efficiency of Parallel Scientific Kernels*
  Adviser: Dr. Barbara Chapman
- **2002 - 2006**
  Bachelor of Technology, Information Technology
  Asansol Engineering College, Asansol, India.
  Graduated: July 2006

EXPERIENCES

Pacific Northwest National Laboratory, Richland, WA Aug 2019-Present
Computer Scientist
· *Focus*: One-sided communication models, Graph analytics, Performance Analysis.

Washington State University, Pullman, WA Jan 2015-May 2019
Graduate Research Assistant *Advisor: Dr. Assefaw Gebremedhin*
· *Focus*: Graph analytics, One-sided communication models, Combinatorial algorithms.

University of Houston, Houston, TX Jan 2011-Dec 2014
Graduate Research Assistant *Advisor: Dr. Barbara Chapman*
· *Focus*: Power/energy analysis of scientific kernels, Application parallelization using compiler directives, One-sided communication models.

University of Texas Health Science Center, Houston, TX Jan-Dec 2010
Graduate Research Assistant *Advisor: Dr. Stefan Birmanns*
· *Focus*: Application parallelization using compiler directives.

Thomson Reuters, Bangalore, India Jul 2008-Dec 2009
Software Engineer
· *Focus*: Database programming and development.

Keane, Inc., Bangalore, India Jul 2006-Jul 2008
Software Engineer
· *Focus*: Database management, ETL.

PEER-REVIEWED PUBLICATIONS

- **Journals**
  - **Sayan Ghosh**, Terrence Liao, Henri Calandra and Barbara Chapman. *Performance of CPU/GPU compiler directives on ISO/TTI kernels.* Computing Journal, Springer Vienna (2013).
  - **Sayan Ghosh**, Nathan Tallent and Mahantesh Halappanavar. *Characterizing Performance of Graph Neighborhood Communication Patterns.* IEEE Transactions on Parallel & Distributed Systems (2021).
  - Seher Acer, Ariful Azad, Erik Boman, Aydin Buluç, Karen Devine, S M Ferdous, Nitin Gawande, **Sayan Ghosh**, Mahantesh Halappanavar, Ananth Kalyanaraman, Arif Khan, Marco Minutoli, Alex Pothen, Sivasankaran Rajamanickam, Oguz Selvitopi, Nathan Tallent, and Antonino Tumeo. *EXAGRAPH: Graph and Combinatorial Methods for Enabling Exascale Applications.* ECP Special Journal Issue, SAGE International Journal of High Performance Computing Applications (2021).
  - Francis Alexander, James Ang, Jenna Bilbrey, Jan Balewski, Tiernan Casey, Ryan Chard, Jong Choi, Sutanay Choudhury, Bert Debusschere, Anthony DeGennaro, Nikoli Dryden, J. Austin Ellis, Ian Foster, Cristina Garcia Cardona, **Sayan Ghosh**, Peter Harrington, Yunzhi Huang, Shantenu Jha, Travis Johnston, Ai Kagawa, Ramakrishnan Kannan, Neeraj Kumar, Zhengchun Liu, Naoya Maruyama, Satoshi Matsuoka, Erin McCarthy, Jamaludin Mohd-Yusof, Peter Nugent,Yosuke Oyama, Thomas Proffen, David Pugmire, Sivasankaran Rajamanickam, Vinay Ramakrishniah, Malachi Schram, Sudip Seal, Ganesh Sivaraman, Christine Sweeney, Li Tan, Rajeev Thakur, Brian Van Essen, Logan Ward, Paul Welch, Michael Wolf, Sotiris S. Xantheas, Kevin Yager, Shinjae Yoo, and Byung-Jun Yoon. *Codesign Center for Exascale Machine Learning Technologies (ExaLearn).* ECP Special Journal Issue, SAGE International Journal of High Performance Computing Applications (2021).
  - Nitin Gawande, **Sayan Ghosh**, Mahantesh Halappanavar, Antonino Tumeo, and Ananth Kalyanaraman. *Towards Scaling Community Detection on Distributed-Memory Heterogeneous Systems.* Parallel Computing (2022).
- **Conferences**
  - Han-Yi Chou and **Sayan Ghosh**. *Batched Graph Community Detection on GPUs.* In 31st International Conference on Parallel Architectures and Compilation Techniques (PACT).
  - Hyungro Lee, Milan Jain and **Sayan Ghosh**. *Sparse Deep Neural Network Inference Using Different Programming Models.* 26th IEEE High Performance Extreme Computing Virtual Conference (HPEC 2022). (*Graph Challenge Honorable Mention*).
  - **Sayan Ghosh**. *Improved Distributed-Memory Triangle Counting by Exploiting the Graph Structure.* 26th IEEE High Performance Extreme Computing Virtual Conference (HPEC 2022). (*Graph Challenge Innovation Award*).
  - Milan Jain, **Sayan Ghosh** and Sai Nandanoori. *Workload Characterization of a Time-Series Prediction System for Spatio-Temporal Data.* 19th ACM International Conference on Computing Frontiers (CF'22).
  - **Sayan Ghosh**, Nathan Tallent, Marco Minutoli, Mahantesh Halappanavar, Ramesh Peri and Ananth Kalyanaraman. *Single-node Partitioned-Memory for Huge Graph Analytics: Cost and Performance Trade-offs.* International Conference for High Performance Computing, Networking, Storage, and Analysis (SC 2021).
  - **Sayan Ghosh**, Yanfei Guo, Pavan Balaji, Assefaw Gebremedhin. *RMACXX: An Efficient High-Level C++ Interface over MPI-3 RMA.* 21st IEEE/ACM International Symposium on Cluster, Cloud and Internet Computing (CCGrid 2021).
  - **Sayan Ghosh**, Mahantesh Halappanavar. *TriC: Distributed-memory Triangle Counting by Exploiting the Graph Structure.* 24th IEEE High Performance Extreme Computing Conference (HPEC 2020). (*Graph Challenge Champion Award*)
  - **Sayan Ghosh**, Mahantesh Halappanavar, Antonino Tumeo, Ananth Kalyanaraman. *Scaling and Quality of Modularity Optimization Methods for Graph Clustering.* 23rd IEEE High Performance Extreme Computing Conference (HPEC 2019). (*Graph Challenge Innovation Award*)
  - **Sayan Ghosh**, Mahantesh Halappanavar, Ananth Kalyanaraman, Arif Khan, Assefaw Gebremedhin. *Exploring MPI Communication Models for Graph Applications Using Graph Matching as a Case Study.* 33rd IEEE International Parallel and Distributed Processing Symposium (IPDPS 2019).

- **Sayan Ghosh**, Mahantesh Halappanavar, Antonino Tumeo, Ananth Kalyanaraman, Assefaw Gebremedhin. *Scalable Distributed Memory Community Detection Using Vite*. 22nd IEEE High Performance Extreme Computing Conference (HPEC 2018). (*Graph Challenge Student Innovation Award*)
- **Sayan Ghosh**, Mahantesh Halappanavar, Antonino Tumeo, Ananth Kalyanaraman, Hao Lu, Daniel Chavarrià-Miranda, Arif Khan, Assefaw Gebremedhin. *Distributed Louvain Algorithm for Graph Community Detection*. 32nd IEEE International Parallel and Distributed Processing Symposium (IPDPS 2018).
- **Sayan Ghosh**, Assefaw Gebremedhin. *Parallelization of Bin Packing on Multicore Systems*. 23rd International Conference on High Performance Computing, Data, and Analytics (HiPC 2016).
- **Sayan Ghosh**, Jeff Hammond, Antonio J. Peña, Pavan Balaji, Assefaw Gebremedhin, Barbara Chapman. *One-Sided Interface for Matrix Operations using MPI-3 RMA: A Case Study with Elemental*. 45th International Conference on Parallel Processing (ICPP 2016).
- Naveen Namashivayam, **Sayan Ghosh**, Dounia Khaldi, Deepak Eachempati, Barbara Chapman. *Native Mode-Based Optimizations of Remote Memory Accesses in OpenSHMEM for Intel Xeon Phi*. 8th International Conference on Partitioned Global Address Space Programming Models (PGAS 2014). (*Best Paper*)

- **Workshops**
  - **Sayan Ghosh**, Caspar Alsobrooks, Martin Rüfenacht, Anthony Skjellum, Purushotham V. Bangalore, and Andrew Lumsdaine. *Towards Modern C++ Language Support for MPI*. Workshop on Exascale MPI (ExaMPI 2021).
  - **Sayan Ghosh**, Mahantesh Halappanavar, Antonino Tumeo, Ananth Kalyanaraman, Assefaw Gebremedhin. *miniVite: A Graph Analytics Benchmarking Tool for Massively Parallel Systems*. Performance Modeling, Benchmarking and Simulation of High Performance Computer Systems (PMBS 2019).
  - Priyanka Ghosh, Jeff Hammond, **Sayan Ghosh**, Barbara Chapman. *Performance Analysis of the NWChem TCE for Different Communication Patterns*. Performance Modeling, Benchmarking and Simulation of High Performance Computer Systems (PMBS 2013).
  - Jeff Hammond, **Sayan Ghosh**, Barbara Chapman. *Implementing OpenSHMEM using MPI-3 one-sided communication*. 1st OpenSHMEM Workshop: Experiences, Implementations and Tools (2013).
  - **Sayan Ghosh**, Sunita Chandrasekaran, Barbara Chapman. *Statistical modeling of power/energy of scientific kernels on a multi-GPU system*. Power Measurement and Profiling Workshop (PMP), in conjunction with International Green Computing Conference (IGCC 2013).
  - **Sayan Ghosh**, Terrence Liao, Henri Calandra, Barbara Chapman. *Experiences with OpenMP, PGI, HMPP and OpenACC directives on ISO/TTI kernels*. 5th International Workshop on Multi/Manycore Computing Systems (MuCoCoS 2012).
  - **Sayan Ghosh**, Sunita Chandrasekaran, Barbara Chapman. *Energy Analysis of Parallel Scientific Kernels on Multiple GPUs*. Symposium of Application Accelerators in High Performance Computing (SAAHPC 2012).
- **Posters**
  - Nikodemos Koutsoheras, **Sayan Ghosh**, Nathan Tallent, Joshua Suetterlein, Abhinav Bhatele. *The Impact of Process Topology on RMA Programming Models: A Study on NERSC Perlmutter*. General poster, International Conference for High Performance Computing, Networking, Storage, and Analysis (SC 2023).
  - Md Nahid Newaz, **Sayan Ghosh**, Joshua Suetterlein, Nathan Tallent, Hua Ming. *Simulating Application Agnostic Process Assignment for Graph Workloads on Dragonfly and Fat Tree Topologies*. General poster, International Conference for High Performance Computing, Networking, Storage, and Analysis (SC 2023).
  - Keita Iwabuchi, **Sayan Ghosh**, Roger Pearce, Mahantesh Halappanavar, Maya Gokhale. *miniVite + Metall: A Case Study of Accelerating Graph Analytics Using Persistent Memory Allocator*. General poster, International Conference for High Performance Computing, Networking, Storage, and Analysis (SC 2020).
  - **Sayan Ghosh**, Sunita Chandrasekaran, Barbara Chapman. *Statistical Power and Energy Modeling of multi-GPU kernels*. General poster, International Conference for High Performance Computing, Networking, Storage, and Analysis (SC 2012).

– **Sayan Ghosh**, Barbara Chapman. *Programming Strategies for GPUs and their Power Consumption.* General poster, International Conference on Parallel Architectures and Compilation Techniques (PACT 2012).

INTERNSHIPS

Pacific Northwest National Laboratory, Richland, WA May-Aug 2018
Supervisor: Drs. Mahantesh Halappanavar and Arif Khan

Focus: Distributed-memory graph analytic algorithms, such as community detection and matching.

Pacific Northwest National Laboratory, Richland, WA May-Aug 2017
Supervisor: Dr. Mahantesh Halappanavar

Focus: Distributed-memory network community detection.

Argonne National Laboratory, Chicago, IL May-Aug 2016
Supervisors: Drs. Pavan Balaji and Yanfei Guo

Focus: C++ bindings to MPI-3 RMA.

Argonne National Laboratory, Chicago, IL May-Aug 2014
Supervisors: Drs. Pavan Balaji, Antonio J. Peña, and Jeff Hammond

Focus: Asynchronous interface for updating distributed matrices in Elemental, a distributed-memory dense linear algebra library.

Argonne National Laboratory, Chicago, IL May-Aug 2013
Supervisor: Dr. Jeff Hammond

Focus: Design and prototype of a one-sided communication runtime on top of MPI-3, that led to development of an OpenSHMEM implementation over MPI-3 RMA.

Total R&T, Houston, TX May-Aug 2012
Supervisors: Drs. Terrence Liao and Henri Calandra

Focus: Evaluation of directive based programming models like OpenMP, PGI, HMPP and OpenACC on Finite Difference kernels used in Oil and Gas exploration, on GPU and multicore CPUs.

Pacific Northwest National Laboratory, Richland, WA Jun-Sept 2011
Supervisors: Drs. Darren Kerbyson, Kevin Barker and Abhinav Vishnu

Focus: Power/energy profiling of scientific kernels on a multi-GPU platform.

ACHIEVEMENTS/AWARDS

- MIT/IEEE/Amazon Graph challenge awards: 2018, 2019 and 2022 Innovation awards; 2022 Honorable Mention and 2020 Champion award.
- DOE ASCR user representative, NERSC User Group Executive Committee (NUGEX), May 2020-2023.
- Participant, 2020 DOE ECP SOLLVE OpenMP hackathon. Brookhaven National Laboratory, Upton, NY.
- PNNL PCSD Outstanding Performance Award (OPA), FY 2019.
- SIAM Student Travel Award, SIAM Conference on Computational Science and Engineering (CSE19), Spokane, WA
- Participant, 2018 Argonne Training Program on Extreme-Scale Computing (ATPESC), St. Charles, IL
- NSF/IEEE TCPP Travel grant, 32rd International Parallel and Distributed Processing Symposium (IPDPS 2018), Vancouver, BC, Canada
- NSF/IEEE TCPP Travel grant, 23rd International Conference on High Performance Computing, Data, and Analytics (HiPC 2016), Hyderabad, India

INVITED TALKS/PRESENTATIONS

- Mahantesh Halappanavar, Marco Minutoli, and Sayan Ghosh. *Graph analytics in the exascale era.* Proceedings of the 18th ACM International Conference on Computing Frontiers, 2021.
- *ECP 2020 Annual Meeting, Tutorial* ExaGraph: Graph and Combinatorial Methods for Enabling Exascale Applications.
- *ECP Performance Portability Panel Series, 2020: Panel 3, Pre-panel Discussion on Exagraph Co-Design center.*
- *UPC++ implementation of Half-approximate Graph Matching.* 2020 Annual UPC++ Users Group Meeting and BoF. Lawrence Berkeley National Laboratory, Berkeley, CA.
- *miniVite: A Proxy Application for Graph Community Detection.* Tutorial on ExaGraph: Graph and Combinatorial Methods for Enabling Exascale Applications. 2019 DOE ECP Annual Meeting, Houston, TX.
- *Scalable Graph Community Detection using the Louvain Method.* Distributed-Memory Graph Analytics: Programming Models, Algorithms and Applications Minisymposium. SIAM Conference on Computational Science and Engineering (CSE19)
- *Distributed-memory Graph Algorithms: Case studies with Community Detection and Weighted Matching.* Chesapeake Large-Scale Analytics Conference (CLSAC 2018).
- *Towards a More Asynchronous GraphBLAS.* SIAM workshop on Combinatorial Scientific Computing (CSC 2016).
- *Performance of ISO/TTI kernels on CPU/GPU using OpenMP, PGI, HMPP and OpenACC directives.* Rice Oil and Gas HPC Workshop (OGHPC 2013).
- *Power and Energy Prediction of Multi-GPU kernels Using Non-linear Regression.* Nvidia GPU Technology Conference (GTC 2013).
- Classroom session on OpenACC at Nvidia Global Technology Conference (GTC 2013)

SERVICE

- IEEE Symposium on High Performance Interconnects (HOTI). 2022 and 2023 Vice Technical Program Committee Chair.
- IEEE Symposium on High Performance Interconnects (HOTI). 2021 Special Issue Chair for IEEE Micro.
- IEEE International Parallel & Distributed Processing Symposium (IPDPS'22 and IPDPS'23) Technical Program: Parallel and Distributed Algorithms for Computational Science and Multidisciplinary tracks.
- ACM/IEEE International Conference for High Performance Computing, Networking, Storage, and Analysis (SC'21, SC'22 and SC'23) Technical Program: Machine Learning and HPC track, Research Posters and Birds of a Feather (BOFs) tracks.
- Journal/Conference paper reviewer: JPDC, TPDS, TPDS (special issue on AI/ML), JCST, PARCO, TOPC, IEEE Access, ICS (2020) and HiPC (2018 and 2019)
- Mystery Application (`miniVite`) judge, Virtual Student Cluster Competition, Supercomputing 2020, Atlanta, GA
- Student Volunteer: Supercomputing (SC 2016), Salt Lake City, Utah
- Booth setup personnel, Gulf Coast Advanced Supercomputing (GCAS) booth, Supercomputing 2014, New Orleans, Louisiana
- Booth duty at Gulf Coast Advanced Supercomputing (GCAS) booth, Supercomputing 2013, Denver, Colorado
- Student Volunteer, Architectural Support for Programming Languages and Operating Systems (ASPLOS 2013) conference, Houston, TX
- Booth duty at OpenMP booth and Gulf Coast Advanced Supercomputing (GCAS) booth, Supercomputing 2012, Salt Lake City, UT
- Represented University of Houston in OpenMP booth at Multicore Developers Conference, San Jose, CA (2011 and 2012)

TEACHING ASSISTANTSHIPS

- Spring 2016, Washington State University, EECS, Distributed Computing, CPTS 464/564 (*Course Instructor:* Dr. David Bakken)
- Fall 2015, Washington State University, EECS, Computer Communication Networks, CPTS 455 (*Course Instructor:* Dr. Carl Hauser)
- Spring 2015, Washington State University, EECS, Distributed Computing, CPTS 464/564 (*Course Instructor:* Dr. Dave Bakken)
- Fall 2010, University of Texas Health Science Center, Introductory Course on Data Structures (*Course Instructor:* Dr. Stefan Birmanns). Unofficial appointment, prepared course materials and helped students.

MEMBERSHIPS

- ACM Special Interest Group in High Performance Computing (SIGHPC)
- Institute of Electrical and Electronics Engineers (IEEE), IEEE Computer Society
- Society for Industrial and Applied Mathematics (SIAM)