

Nikhil Jain

Senior Architect, Nvidia

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Education

- 2016 **Ph.D., Computer Science**, *University of Illinois at Urbana-Champaign*.
Optimization of Communication Intensive Applications on HPC Networks. Advisor: Laxmikant V. Kale
- 2009 **M.Tech., Computer Science and Engineering**, *Indian Institute of Technology*, Kanpur, India.
- 2009 **B.Tech., Computer Science and Engineering**, *Indian Institute of Technology*, Kanpur, India.

Research and Work Experience

- 2018-present **Nvidia**, *Senior Architect*.
 - Develop performance prediction models and tools for HPC applications.
 - Research and propose new architecture features for next generation GPUs.
- 2016-2018 **Lawrence Livermore National Laboratory**, *Computer Scientist (from 03/18), Fernbach Post-doctoral Fellow (till 03/18)*.
 - Researched and characterized communication throughput of HPC networks.
 - Developed data analytics driven methods for performance optimization.
- 2011-2016 **Dept of Computer Science, University of Illinois at Urbana-Champaign**, *Research Assistant*.
 - Created *TraceR* and contributed to *CODES* for scalable simulation of parallel codes on HPC networks.
 - Developed new features for *Charm++*, a widely used parallel programming model.
 - Contributed to development and performance improvements in *OpenAtom* and *NAMD*.
- Summer 2014 **Lawrence Livermore National Laboratory**, *Research Intern*.
Analyzed prediction models to identify factors that affect performance on HPC networks.
- Summer 2012 **Lawrence Livermore National Laboratory**, *Research Intern*.
Proposed and demonstrated use of machine learning based models for predicting communication performance of HPC applications.
- Spring 2011 **Dept of Computer Science, University of Illinois at Urbana-Champaign**, *Visiting Scholar*.
Re-designed runtime-level memory management module for speed and efficiency in *Charm++*.
- 2009-2011 **IBM Research, India**, *Blue Scholar*.
Developed 3× faster topology-aware algorithms for collective communication on Blue Gene systems.

Awards & Honors

- 2018 Best Student Paper Finalist, SC '18, Dallas, TX
- 2017 NERSC Award for Innovative Use of HPC
- 2017 Finalist, 10th IEEE International Scalable Computing Challenge
- 2017 Outstanding Mentor Award, Lawrence Livermore National Laboratory
- 2017 Best Poster Award (2nd Place), Computation Postdoc Poster Symposium, LLNL
- 2016 Fernbach Postdoctoral Fellowship
- 2014 IBM PhD Fellowship
- 2013 Silver Award, ACM Student Research Poster Competition, Supercomputing
- 2012 Best Poster, LLNL Annual Student Poster Session
- 2011 Co-winner of HPC Challenge Class 2 (performance), Charm++ Team, Supercomputing
- 2011 Andrew and Shana Laursen Fellowship, Department of Computer Science, UIUC

Skills

General C, C++, Fortran, Python, numpy, git, svn, CVS, autotools, CMake.

Parallel Computing	Parallel application development in MPI, OpenMP, and Charm++. Parallel runtime system development. Performance tool development in C/C++. MPI and Charm++ profiling tools. Analysis and tuning of parallel applications on large clusters (IBM Blue Gene, Cray, Linux). Experience with large science codes at UIllinois.
Data Analytics	Application of machine learning for application tuning, root cause analysis, and performance analysis of parallel codes.
Networks and Communication	HPC Network simulation tools. Communication and network modelling and analysis. Collective operations on large scale systems. Performance monitoring of networks.

Software Projects

traceR	Trace-driven PDES-based network simulation of parallel applications.
Damselfly	Analytical modeling of steady-state traffic flow on dragonfly networks.
bgqncI	An easy interface for network counters collection on BlueGene/Q systems.
LeanMD	A mini-application for exploring optimizations for molecular dynamics.
topoAPI	Fully-automated profiling, analysis, and mapping on HPC systems.
Charm-ROSS	Charm++ based implementation of the parallel discrete event simulator ROSS.
Open-source software I contribute to	
CODES	Packet-level HPC network simulation.
Charm++	Object-based message driven parallel programming paradigm.
OpenAtom	Scalable Ab-Initio Molecular Dynamics with diverse features.
EpiSimdemics	Hybrid contagion modeling using Charm++.
ROSS	Scalable parallel discrete simulation with optimistic execution.
NAMD	Highly scalable parallel molecular dynamics.

Representative Publications

- [1] Jayaraman Thiagarajan, **Nikhil Jain**, Rushil Anirudh, Alfredo Giménez, Rahul Sridhar, Aniruddha Marathe, Tao Wang, Murali Emani, Abhinav Bhatele, and Todd Gamblin. Bootstrapping parameter space exploration for fast tuning. In *Proceedings of the International Conference on Supercomputing*, ICS '18, June 2018.
- [2] **Nikhil Jain**, Abhinav Bhatele, Louis Howell, David Bohme, Ian Karlin, Edgar Leon, Misbah Mubarak, Noah Wolfe, Todd Gamblin, and Matthew Leininger. [Predicting the performance impact of different fat-tree configurations](#). In *ACM/IEEE International Conference for High Performance Computing, Networking, Storage and Analysis*, SC '17, Nov 2017.
- [3] **Nikhil Jain**, Abhinav Bhatele, Xiang Ni, Todd Gamblin, and Laxmikant V. Kale. [Partitioning low-diameter networks to eliminate inter-job interference](#). In *IEEE International Parallel & Distributed Processing Symposium*, IPDPS '17, May 2017.
- [4] **Nikhil Jain**, Abhinav Bhatele, Samuel T. White, Todd Gamblin, and Laxmikant V. Kale. [Evaluating HPC networks via simulation of parallel workloads](#). In *ACM/IEEE International Conference for High Performance Computing, Networking, Storage and Analysis*, SC '16, November 2016.
- [5] **Nikhil Jain**, Eric Bohm, Eric Mikida, Subhasish Mandal, Minjung Kim, Prateek Jindal, Qi Li, Sohrab Ismail-Beigi, Glenn Martyna, and Laxmikant Kale. [Openatom: Scalable ab-initio molecular dynamics with diverse capabilities](#). In *International Supercomputing Conference*, ISC HPC '16, June 2016.
- [6] **Nikhil Jain**, Abhinav Bhatele, Jae-Seung Yeom, Mark F. Adams, Francesco Miniati, Chao Mei, and Laxmikant V. Kale. [Charm++ & MPI: Combining the best of both worlds](#). In *IEEE International Parallel & Distributed Processing Symposium*, IPDPS '15, May 2015.
- [7] Bilge Acun, Abhishek Gupta, **Nikhil Jain**, Akhil Langer, Harshitha Menon, Eric Mikida, Xiang Ni, Michael Robson, Yanhua Sun, Ehsan Toton, Lukasz Wesolowski, and Laxmikant Kale. [Parallel Programming with Migratable Objects: Charm++ in Practice](#). In *ACM/IEEE International Conference for High Performance Computing, Networking, Storage and Analysis*, SC '14, Nov 2014.
- [8] **Nikhil Jain**, Abhinav Bhatele, Michael P. Robson, Todd Gamblin, and Laxmikant V. Kale. [Predicting application performance using supervised learning on communication features](#). In *ACM/IEEE International Conference for High Performance Computing, Networking, Storage and Analysis*, SC '13, November 2013.