

Education

- Sep 2019 - **University of Toronto, Canada.**
present PhD in Computer Science
GPA: 4.00/4.00
- Sep 2017 - **University of British Columbia, Canada.**
Sep 2019 Master of Science in Computer Science
Average Grade: 96.2%
- Jul 2008 - **National Institute of Technology Calicut, India.**
May 2012 Bachelor of Technology in Computer Science and Engineering
GPA: 8.18/10

Research Experience

- December 2020 - **Temporal Query Processing Engines for Next-Generation Streaming Analytics.**
PhD thesis projects under Prof. Gennady Pekhimenko
- Present
- LifeStream: A stream processing engine specially optimized to process signal processing operations and performs up to $8\times$ faster than Trill. Currently used at SickKids hospital for physiological data analysis.
 - TiLT: A domain specific language (DSL) and an LLVM-based JIT compiler for generating hardware-efficient code for temporal queries. TiLT achieves up to $100\times$ higher throughput and sub millisecond latency compared to state-of-the-art stream processing engines.
- Sep 2019 - **DNN Training Performance Analysis: A Divide and Conquer Approach.**
Present Research project under Prof. Gennady Pekhimenko
- A fast and affordable methodology for prototyping and analysing the performance of hardware designs/optimizations for DNN training. Currently building a tool based off Tensorflow XLA for emulating arbitrary precision floating point arithmetic in DNN training computations.
- Dec 2017 - **Priority-based Parameter Propagation for Distributed DNN Training.**
Sep 2019 Masters thesis project under Prof. Alexandra Fedorova and Prof. Gennady Pekhimenko
- A communication scheduling mechanism called *P3* for efficient data parallel DNN training. *P3* improves DNN training performance up to $1.66\times$ and is currently part of Apache MXNet ML framework.
- May 2018 - **Hardware Sensitivity Analysis for Deep Learning Models.**
Aug 2018 Summer internship project under Prof. Garth A. Gibson and Prof. Gennady Pekhimenko
- Conducted experiments to analyze performance, cost effectiveness and hardware utilization of modern GPUs using TBD benchmark suite.
- Dec 2017 - **TBD Suite: Training Benchmark for DNNs.**
June 2018 Research project under Prof. Gennady Pekhimenko
- A benchmark suite for deep neural network (DNN) training workloads. Prepared speech recognition benchmark DeepSpeech2 and contributed a network profiling tool for MXNet framework.

Publications

- ASPLOS '23 **TiLT: A Time-Centric Approach for Stream Query Optimization and Parallelization.**
Anand Jayarajan, Yudi Sun, Wei Zhao, Gennady Pekhimenko.
About to appear in *28th International Conference on Architectural Support for Programming Languages and Operating Systems 2023*.
- CHIL '22 **How to validate Machine Learning Models Prior to Deployment: Silent trial protocol for evaluation of real-time models at ICU.**
Sana Tonekaboni, Gabriela Morgenshtern, Azadeh Assadi, Aslesha Pokhrel, Xi Huang, **Anand Jayarajan**, Robert Greer, Gennady Pekhimenko, Melissa McCradden, Fanny Chevalier, Mjaye Mazwi, Anna Goldenberg.
In *Proceedings of the Conference on Health, Inference, and Learning 2022*.

- MICRO '21 **FPRaker: A Processing Element For Accelerating Neural Network Training.**
Omar Mohamed Awad, Mostafa Mahmoud, Isak Edo, Ali Hadi Zadeh, Ciaran Bannon, **Anand Jayarajan**, Gennady Pekhimenko, Andreas Moshovos.
In *Proceedings of the 54th IEEE/ACM International Symposium on Microarchitecture* 2021.
- ASPLOS '21 **LifeStream: A High-performance Stream Processing Engine for Periodic Streams.**
Anand Jayarajan, Kimberly Hau, Andrew Goodwin, Gennady Pekhimenko.
In *Proceedings of the 26th International Conference on Architectural Support for Programming Languages and Operating Systems* 2021.
- SOSP **DNN Training Performance Analysis: A Divide and Conquer Approach.**
SRC'19 **Anand Jayarajan**, Gennady Pekhimenko.
In SOSP Student Research Competition 2019.
- MLSys'19 **Priority-based Parameter Propagation for Distributed DNN Training.**
Anand Jayarajan, Jinliang Wei, Garth A. Gibson, Alexandra Fedorova, Gennady Pekhimenko.
In *Proceedings of the 2nd Conference on Machine Learning and Systems* 2019.
- IISWC'18 **Benchmarking and Analyzing Deep Neural Network Training.**
Hongyu Zhu, Mohamed Akrouf, Bojian Zheng, Andrew Pelegris, **Anand Jayarajan**, Amar Phanishayee, Bianca Schroeder, Gennady Pekhimenko.
In *Proceedings of the IEEE International Symposium on Workload Characterization* 2018.

Academic Services

- 2022 External Review Committee *MLSys 2023*
2022 Reviewer of *ACM Transactions on Computer Systems*
2022, 2021 Reviewer of *IEEE Transactions on Computers*
2021 Artifact Evaluation Committee *ASPLOS 2021*
2019 Artifact Evaluation Committee *MLSys 2019*

Skills and Interests

- Languages C, C++, LLVM IR, Java, C#, Python, Bash, CUDA, Tensorflow XLA.
Research Big Data Analytics, Stream Processing, Compilers, Machine Learning, Operating Systems
Interests

Work Experience

- May 2018 - **Vector Institute, Toronto, Canada.**
Aug 2018 Intern
Analyzed the performance and cost-effectiveness of Nvidia and AMD GPUs using TBD benchmark suite. My analysis were used to make decisions about hardware procurement at Vector institute.
- Sep 2016 - **Indian Institute of Technology, Delhi, India.**
June 2017 Research Assistant
Worked on building a software-based emulator for hardware virtualization technology called AMD SVM.
- Feb 2016 - **Flipkart Internet Pvt Ltd, Bangalore, India.**
Sep 2016 Senior Software Development Engineer
Worked in the pricing team at the largest E-commerce company in India. I built and maintained the infrastructure that makes real-time decisions on the pricing of different products in the Flipkart website.
- Dec 2014 - **Vizury Interactive Solutions Pvt Ltd, Bangalore, India.**
Jan 2016 Software Engineer
Worked in the platform team of the online advertisement startup. I maintained the Real-Time Bidding (RTB) infrastructure that handles millions of advertising requests per second.
- Jun 2012 - **Oracle India Pvt Ltd, Bangalore, India.**
Sep 2014 Member of Technical Staff
Worked in the globalization team at Oracle. I built tools that automatically translates Oracle products to different languages.

Teaching Experience

Fall 2022 CSC 2224 - Parallel Computer Architecture and Programming
Winter 2021 CSC 263 - Data Structures and Analysis
Fall 2020 CSC B58 - Computer Organization
Spring 2019 CPSC 415 - Advanced Operating Systems
Spring 2018 CPSC 317 - Internet Computing
Fall 2017 CPSC 221 - Basic Algorithms and Data Structures