

# Anand Jayarajan

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## Education

- Sep 2019 - **University of Toronto, Canada.**  
present PhD in Computer Science
- 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  
CGPA: 8.18/10

## Research Experience

- January 2020 **High Performance Stream Processing.**  
- Present Research project under Prof. Gennady Pekhimenko
- Building high performance and hardware efficient data processing engines for the increasingly ubiquitous streaming data.
  - Implemented a hardware efficient stream processing engine *LifeStream* for physiological data processing.
- 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.
- Dec 2017 - **Priority-based Parameter Propagation for Distributed DNN Training.**  
Sep 2019 Graduate thesis project under Prof. Alexandra Fedorova and Prof. Gennady Pekhimenko
- Optimizing distributed deep neural network (DNN) training.
  - Proposed *Priority-based Parameter Propagation* mechanism for efficient data parallel training.
  - Implementation publicly available as part of the Apache MXNet mainstream branch.
- 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 - **Training Benchmark for DNNs (TBD).**  
June 2018 Research project under Prof. Gennady Pekhimenko
- A benchmark suite for deep neural network (DNN) training workloads. <http://tbd-suite.ai/>
  - Prepared speech recognition benchmark DeepSpeech2 and contributed a network profiling tool for MXNet framework.

## Publications

- ASPLOS '21 **LifeStream: A High-performance Stream Processing Engine for Periodic Streams.**  
**Anand Jayarajan**, Kimberly Hau, Andrew Goodwin, Gennady Pekhimenko.  
About to appear at 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*.
- Techreport **Hardware Sensitivity Analysis for Deep Learning Models.**  
**Anand Jayarajan**, Gennady Pekhimenko, Garth A. Gibson.
- COHESA AGM'18 **Hardware Sensitivity Analysis for Deep Learning Models, (Poster).**  
**Anand Jayarajan**, Alexandra Fedorova.  
*Computing Hardware for Emerging Intelligent Sensory Applications Annual General Meeting 2018*

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## Skills and Interests

- Languages C, C++, Java, C, Python, Bash, CUDA, OpenCL.
- Research Interests Operating Systems, Big Data Processing, Parallel Computing, Machine Learning.

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## Work Experience

- May 2018 - **Vector Institute, Toronto, Canada.**  
Aug 2018 Intern
- Sep 2016 - **Indian Institute of Technology, Delhi, India.**  
June 2017 Research Assistant
- Feb 2016 - **Flipkart Internet Pvt Ltd, Bangalore, India.**  
Sep 2016 Senior Software Development Engineer
- Dec 2014 - **Vizury Interactive Solutions Pvt Ltd, Bangalore, India.**  
Jan 2016 Software Engineer
- Jun 2012 - **Oracle India Pvt Ltd, Bangalore, India.**  
Sep 2014 Member of Technical Staff

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## Teaching Experience

- Fall 2020 CSCB58 - Computer Organization
- Spring 2019 CPSC 415 - Advanced Operating Systems
- Spring 2018 CPSC 317 - Internet Computing
- Fall 2017 CPSC 221 - Basic Algorithms and Data Structures

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## Other Projects

- Spring 2018 **Iroko: RL based solution for data center congestion control.**  
Communication Protocols course project  
A centralized reinforcement learning (RL) based congestion control system for tightly controlled data center networks. Built a data center emulator on Mininet and explored effectiveness of various RL algorithms like REINFORCE and DDPG.  
<https://github.com/fruffy/iroko>
- Fall 2017 **F(O)MG: Few-shOt Music Generation.**  
Multimodal Learning with Vision, Language and Sound course project.  
Model to generate genre-specific music from a few training samples using meta-learning approach. FOMG demonstrated faster training and better generation quality compared to the baseline auto-regression model.  
<https://fomg.surge.sh/>
- Fall 2017 **SASOX: A single address space operating system for x86.**  
Operating Systems course project.  
A Unix like single address space operating system for x86 architecture based on xv6. Evaluating against baseline xv6 implementation, SASOX produced superior improvement in performance for multi-threaded programs.  
<https://github.com/anandj91/xv6-sasos>