

# Anand Jayarajan

✉ [anandj@cs.ubc.ca](mailto:anandj@cs.ubc.ca)  
🌐 <https://anandj.in>

## Education

- Sep 2017 - present **University of British Columbia, Canada.**  
Master of Science in Computer Science  
Average Grade: 96.2% (so far)
- Jul 2008 - **National Institute of Technology Calicut, India.**
- May 2012 Bachelor of Technology in Computer Science and Engineering  
CGPA: 8.18/10

## Research Experience

- Dec 2017 - present **Distributed DNN Training Optimization.**  
Graduate thesis project under *Prof. Alexandra Fedorova*
- Investigating on various optimization techniques for distributed deep neural network (DNN) training.
  - Proposed *Priority-based Parameter Propagation* mechanism for efficient data parallel training.
  - Currently exploring dynamic scheduling for model parallel training.
- Oct 2018 - present **Debugging Machine Learning Models.**  
Research project under *Prof. Margo Seltzer* and *Prof. Alexandra Fedorova*
- Ongoing project on building debugging tools for machine learning.
  - Currently exploring on methods for formally verifying machine learning model implementations.
- May 2018 - **Hardware Sensitivity Analysis for Deep Learning Models.**
- Aug 2018 Summer internship project under *Prof. Garth A. Gibson*
- Conducted experiments to analyze performance, cost effectiveness and hardware utilization of 9 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.
- Sep 2016 - **Energy Efficient Optical Networks in Multi-Core Processors.**
- June 2017 Research project under *Prof. Smruti Ranjan Sarangi*
- Instruction prefetching optimizations for multi-core machines and virtual machines.
  - Implemented support for emulating AMD-v based hardware-assisted virtualization in QEmu.
  - Developed QEmuTrace: a tool for collecting instruction trace and other performance related data from QEmu emulation.
  - Extended Tejas, a cycle accurate x86 simulator, to support AMD-v instruction set. <http://www.cse.iitd.ac.in/tejas>.
- July 2011 - **Graph Expanders and Its Applications.**
- March 2012 B.Tech Major Project under *Prof. K. Muralikrishnan*
- Formally proved the equality of complexity classes symmetric-logspace (SL) and logspace (L) using the properties of  $s - t$  connectivity in expander graphs.

## Publications

- SysML'19 **Priority-based Parameter Propagation for Distributed DNN Training.**  
**Anand Jayarajan**, Jinliang Wei, Garth A. Gibson, Alexandra Fedorova, Gennady Pekhimenko.  
In *Proceedings of the SysML 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 **Hardware Sensitivity Analysis for Deep Learning Models**, (*Poster*).

AGM'18 **Anand Jayarajan**, Alexandra Fedorova.

*Computing Hardware for Emerging Intelligent Sensory Applications Annual General Meeting 2018*

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## Work Experience

Sep 2018 - **University of British Columbia, Vancouver, Canada.**

present Research Assistant

May 2018 - **Vector Institute, Toronto, Canada.**

Aug 2018 Intern

Sep 2017 - **University of British Columbia, Vancouver, Canada.**

Apr 2018 Teaching Assistant

Sep 2016 - **Indian Institute of Technology, Delhi, India.**

June 2017 Research Assistant

Feb 2016 - **Fliptkart 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

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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## Honours and Awards

2017, 2018 **International Tuition Award, UBC.**

Fellowship for selected international students

2015 **Tech Star Award, Vizury Interactive Solutions Pvt Ltd.**

Best engineer of the year

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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>