Deng **Pan**

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Education

University of Toronto — *Toronto, ON*

Ph.D. in Computer Science and Mathematics — *July 2017 - Present*

- Advised by Prof. Anthony Chan Carusone
- Mila: Deep Learning Research, Co-Advised by Prof. Yoshua Bengio
- Research Areas: Probabilistic Learning, Optimization Theory, and Computer Architecture
- GPA: 4.00/4.00

University of Toronto — *Toronto, ON*

B.A.Sc. in Engineering Science with Honours Distinction — *Sept. 2013 - April 2017*

- Strong Emphasis on Mathematics, Computer Science, and Natural Sciences

Hong Kong University of Science and Technology — *Hong Kong*

Non-Degree Exchange Student — *Summer 2016*

- Research project on Computational Model for FinFET-based Memories

National University of Singapore — *Singapore*

Non-Degree Exchange Student — *Summer 2015*

- Research project on Soft Robotics with Engineering Science Programme

Research Interests

My research focuses on the intersection between theoretical computer science and optimization theory. I am highly enthusiastic in integrating different methods from mathematics and statistical sciences to develop highly accurate and fast algorithms and inference accelerators for machine learning problems in mobile and intelligent sensory applications.

Honors & Awards

2018 **Edward S. Rogers Sr. Graduate Scholarship**, University of Toronto
2018 **University of Toronto Fellowship**, School of Graduate Studies, University of Toronto
2017 **Nikola Tesla Scholarship**, Columbia University, NY, USA
2017 **Dean's Honor List**, Awarded for Consecutive Years Since 2013, University of Toronto
2016 **Summer Research Exchange Program (SREP) Award**, University of Toronto
2015 **Engineering Science Research Opportunities Program (ESROP) Grant**, University of Toronto
2013 **President's Entrance Scholarship**, University of Toronto

Work & Research Experience

University of Toronto — *Toronto, ON*

Graduate Research Assistant — *July 2017 - Present*

- Designing deep compression and optimization algorithms for neural network supercomputers in computer vision
- Deploying a tree structure multi-tile architecture to accelerate inferencing as an alternative to GPUs and FPGAs
- Development of a software model of machine-learning accelerator to exploit parallelism in flow of weights and activations
- Joint-research with Vector Institute and COHESA Research Network for intelligent sensory applications

University of Toronto — *Toronto, ON*

Teaching Assistant — *Jan. 2017 - Present*

- Undergraduate Engineering Research Day (UnERD), August 2018
- ECE302, Probability and Applications, Winter 2017

Mila - Quebec Artificial Intelligence Institute — *Montréal, QC*

Deep Learning Researcher — *Jan. - April 2019*

- Designing efficient algorithms for tailored inference architectures using software-hardware co-design paradigm
- Improving peak performance and energy efficiency in deep learning computing in tandem to preserving model precision
- Reducing computational complexity of matrix multiplication in neural networks through low rank tensor decomposition
- Applying iterative pruning techniques to miniaturize memory footprint of fully connected and convolutional layers

Hong Kong University of Science & Technology *Hong Kong*

Electrical Engineering Intern *June - Aug. 2016*

- Invented a novel computational model for predicting SRAM voltage margin variation aided with Monte-Carlo simulation
- Optimized and modeled SRAM circuits using 7nm FinFET technologies for dynamic voltage scalable applications
- Implemented emerging FinFET-based IC systems and semiconductor devices, focusing on memory circuits

National University of Singapore *Singapore*

Soft Robotics Research Intern *May - July 2015*

- Researched on soft polymers for robotic artificial muscles and motion-based energy harvesting
- Experimented with uniaxial prestretch dependence of dielectric permittivity in polyacrylate elastomers
- Improved the Cole-Cole permittivity model for VHB-class dissipative elastomer using dielectric spectrometry results

Hospital for Sick Children (SickKids) *Toronto, ON*

Data Analysis Assistant *May - July 2014*

- Measured gene expression area of in-situ hybridization to determine mRA level in heart and placenta samples
- Analyzed figures using ImageJ and Adobe Photoshop to determine cell counts
- Documented statistical differences between mutant and wildtype figures in detailed research report

Publications

Conference

- A Tri-Port Chest Thoracoscopic Cardiac Surgery Technique in MVR. Zengshan Ma, **Deng Pan**. International Society for Minimally Invasive Cardiothoracic Surgery (ISMICS), Vancouver, June 2018.

Workshop

- Optimization of SRAM Circuits for Dynamic Voltage Scalable Applications in 7nm FinFET Technology. **Deng Pan**, Shairfe M. Salahuddin, Volkan Kursun. SENG Workshop on Semiconductor Challenges and Innovation Opportunities, HKUST, Aug 2016.

Thesis

- **Deng Pan**. An Algorithmic Approach to Detection and Mitigation of Jitter in Multi-Gigahertz Clock and Data Recovery Circuits. B.A.Sc. Thesis, University of Toronto, 2017.

Select Projects

Optimization in Mobile Cloud and Edge Computing

ECE1505, University of Toronto, Jan - April 2018

- Numerical simulation to a resource allocation problem in MCC/MEC systems
- Devised a non-convex QCQP formulation and solved using SDR techniques
- Applied a game-theoretic approach by attaining a Nash Equilibrium solution of the joint energy-delay objective

Neural Networks for Visual Recognition with Machine Learning Techniques

ECE521, University of Toronto, March - April 2018

- Investigated the classification performance of neural networks on MNIST dataset of 28x28 images with 10 classes
- Implemented fully-connected and convolutional layers with dropout and L2-regularization to combat overfitting
- Performed random search algorithms for hyperparameter tuning and weight visualization in TensorFlow and Python

Extracurriculars

2017 **Data Science Club**, Health Division: Explored connections to psychology and biotechnology

2015 **Blue Sky Solar Racing**, Software Team: Implemented aerodynamics simulation of solar car model