

ANDREW BOUTROS

PhD Student in the department of Electrical and Computer Engineering at the University of Toronto

E-mail: andrew.m.boutros@gmail.com - **Web page:** aboutros.info

EDUCATION

PhD. in Electrical and Computer Engineering *Sep 2019 - Present*
University of Toronto, Canada

Advisor: Prof. Vaughn Betz

MASc. in Electrical and Computer Engineering *Sep 2016 - Aug 2018*
University of Toronto, Canada

Thesis Title: Enhancing FPGA Architecture for Efficient Deep Learning Inference

Advisor: Prof. Vaughn Betz

GPA: 4.00/4.00

BSc. in Electronics Engineering *Sep 2011 - Jul 2016*
German University in Cairo, Egypt

Thesis Topic: Pedestrian Detection Based on the HOG Algorithm on a Xilinx Zynq FPGA

Advisor: Prof. Diana Göhringer - Ruhr University Bochum, Germany

GPA: 3.98/4.00 (or 0.72/0.7 in German grading system)

RESEARCH EXPERIENCE

Memory and Accelerator Architecture Lab (MAAL), Intel Labs *Aug 2018 - June 2019*
Research Scientist *Oregon, USA*

- Defining the next-generation Intel FPGA architecture.
- Researching efficient acceleration of persistent deep learning models (CNNs, RNNs, LSTMs, GRUs).

University of Toronto *Sep 2016 - Aug 2018*
Graduate Research Assistant *Toronto, Canada*

- Building a benchmark suite of FPGA-based CNN accelerators including: Intel-DLA, ASU and ChainNN.
- Designing more efficient FPGA DSP blocks for reduced-precision deep learning applications.
- Enhancing FPGA logic blocks for increased on-chip multiply-accumulate density.

Advanced Microelectronic Systems Lab, German University in Cairo *Mar 2016 - Aug 2016*
Undergraduate Research Intern *Cairo, Egypt*

- Researching new chaos-based image encryption algorithms and implementing a real-time FPGA-based hardware accelerator for encrypting 512×512 video frames at 256 fps.

Opto-Nano-Electronics Lab, Cairo University *Jul 2016 - Aug 2016*
Undergraduate Research Intern *Cairo, Egypt*

- Implementing VPR architecture description files for a proposed new FPGA architecture and developing a testing bitstream for the fabricated FPGA chip.

Ruhr University Bochum *Mar 2015 - Jul 2015*
Undergraduate Visiting Research Student *Bochum, Germany*

- Implementing a real-time FPGA-based pedestrian detection solution based on the Histogram of Oriented Gradients (HOG) algorithm and AdaBoost classifiers on a Xilinx Zynq device.

PUBLICATIONS

E. Nurvitadhi, **A. Boutros**, P. Budhkar, A. Jafari, D. Kwon, D. Sheffield and others, “Scalable Low-Latency Persistent Neural Machine Translation on CPU Server with Multiple FPGAs”, Int. Conference on Field-Programmable Technology (FPT), 2019 [**Pre-Print**]

M. Hall, **A. Boutros**, E. Nurvitadhi, V. Betz, “Programmable Hardware for Efficient Deep Learning Inference”, Evolution Of Deep Learning Symposium, 2019 [**Poster Presentation**]

E. Nurvitadhi, D. Kwon, A. Jafari, **A. Boutros**, J. Sim, D. Marr and others, “Why Compete When You Can Work Together: FPGA-ASIC Integration for Persistent RNNs”, Int. Symposium on Field-Programmable Custom Computing Machines (FCCM), 2019 [**Acceptance Rate: 26%**]

A. Boutros, M. Eldafrawy, S. Yazdanshenas and V. Betz, “Math Doesn’t Have to be Hard: Logic Block Architectures to Enhance Low-Precision Multiply-Accumulate on FPGAs”, Int. Symposium on Field-Programmable Gate Arrays (ISFPGA), 2019 [**Acceptance Rate: 19%**]

E. Nurvitadhi, D. Kwon, A. Jafari, **A. Boutros**, J. Sim, D. Marr and others, “Evaluating and Enhancing Intel Stratix 10 FPGAs for Persistent Real-Time Artificial Intelligence”, Int. Symposium on Field-Programmable Gate Arrays (ISFPGA), 2019 [**Poster Presentation - Acceptance Rate: 19%**]

A. Boutros, S. Yazdanshenas and V. Betz, “You Cannot Improve What You Do not Measure: FPGA vs. ASIC Efficiency Gaps for Convolutional Neural Network Inference”, Transactions on Reconfigurable Technology and Systems (TRETs), 2018

A. Boutros, S. Yazdanshenas and V. Betz, “Embracing Diversity: Enhanced DSP Blocks for Low-Precision Deep Learning on FPGAs”, Int. Conference of Field-Programmable Logic and Applications (FPL), 2018 [**Acceptance Rate: 17% - Best Paper Award**]

A. Boutros, B. Grady, M. Abbas and P. Chow, “Build Fast, Trade Fast: FPGA-based High-Frequency Trading using High-Level Synthesis”, Int. Conference of Reconfigurable Computing and FPGAs (ReConFig), 2017

A. Boutros, S. Hesham, B. Georgey and M. Abd El Ghany, “Hardware Acceleration of Novel Chaos-Based Image Encryption for IoT Applications”, Int. Conference of Microelectronics (ICM), 2017

J. Rettkowski, **A. Boutros** and D. Göhringer, “A HW/SW Co-Design of the HOG Algorithm on Xilinx Zynq SoC”, Journal of Parallel and Distributed Computing (JPDC), 2017

J. Rettkowski, **A. Boutros** and D. Göhringer, “Real-time Pedestrian Detection on a Xilinx Zynq using the HOG Algorithm”, Int. Conference of Reconfigurable Computing & FPGAs (ReConFig), 2015 [**Best Paper Award**]

SCHOLARSHIPS & AWARDS

- **Stamatis Vassiliadis Best Paper Award** at the 2018 International conference on Field-Programmable Logic and Applications (FPL).
- **Right Track CAD Graduate Scholarship** valued at \$4,350 (2018).
- **Vector Institute Student Affiliation** with an honorarium of \$4,000 (2018).
- University of Toronto **Edward Rogers Sr. Grad Scholarship** valued at \$15,000 for 2 years (2016, 2017).
- **Ranked 2nd** among more than 250 students in the Information Engineering and Technology class of 2016 at the German University in Cairo.
- **Best Paper Award** at the 2015 International Conference on ReConFigurable Computing and FPGAs.
- German University in Cairo **Top-Ranked Student Award** valued at €1,800 for 3 times (2011, 2013, 2015).
- German University in Cairo **Academic Excellence Award** valued at €1,500 for 2 times (2011, 2013).
- German University in Cairo **High-School Excellence Scholarship** valued at €2,700 for 5 years (2011-2015).

RELEVANT COURSES

Grad Courses: Programming Massively Parallel Multiprocessors (A+), VLSI for DSP Architectures (A+), Reconfigurable Computing and FPGA Architecture (A+), CAD for Digital Circuit Synthesis and Layout (A+)

Undergrad Courses: System-on-a-Chip (A+), Advanced Microelectronics Lab (A+), Programmable Logic Circuits (A+), Very Large Scale Integration (A+), Integrated Circuits Design (A+)

Online Courses: Machine Learning (Stanford University), Deep Learning Specialization (deeplearning.ai)

TEACHING EXPERIENCE

ECE1756: Reconfigurable Computing and FPGA Architecture - University of Toronto Fall 2019

- Grading weekly reading questionnaires and FPGA design assignments, and conducting DSP lab sessions for a class of 27 graduate students.

ECE244: Programming Fundamentals - University of Toronto*Fall 2019*

- Conducting weekly lab sessions covering the fundamentals of C++ programming and data structures for second-year ECE students.

ECE1508: Introduction to Statistical Learning - University of Toronto*Fall 2017*

- Grading weekly problem sets, programming assignments, midterm and final exams covering the mathematical foundations of different machine learning topics for a class of 47 graduate students.

ECE241: Digital Systems - University of Toronto*Fall 2017*

- Conducting a weekly lab session and mentoring 6 teams of second-year ECE students to implement a course-project of a complete digital system of their choice on the DE1-SoC boards.

ECE297: Communication and Design - University of Toronto*Winter 2017 - Winter 2018*

- Conducting two weekly lab sessions and mentoring 10 teams of second-year ECE students to implement a course-project of a Google-Map-like navigation software using C++ and EasyGL graphics library.
- Grading and giving detailed feedback for students' coding style, milestone demos and final presentation.

ELCT707: Microcomputer Applications - German University in Cairo*Winter 2015*

- Conducting several introductory sessions about VHDL design for third-year Electronics engineering students.
- Mentoring students during the course project of implementing a 5-stage MIPS processor in VHDL.

SKILLS

Programming Languages	C++, Python, Matlab
Design Tools	Intel Quartus Prime, Xilinx ISE & Vivado, Cadence Virtuoso
Simulation Tools	ModelSim, VCS, Cocotb
HDL	Verilog, VHDL, SystemVerilog
ML Frameworks	Caffe, TensorFlow
FPGA Academic Tools	VPR, ABC, ODIN
Languages	Arabic (Native), English (Fluent), German & French (Basic)

EXTRA-CURRICULAR ACTIVITIES

Vice President of ESA UofT*2017 - 2018*

- Supporting Egyptian students during their transition and study at the University of Toronto.
- Organizing several social, cultural, academic, sport and charity events throughout the academic year.

Fund Raising Campaigns Team Leader*2010 - 2016*

- Leading a team of 10-20 people to organize fund-raising campaigns for: cancer treatment in Egypt (2010), children with sick hearts (2012), homeless children in Upper Egypt (2014), fighting poverty in Egypt (2016).

Summer School Teacher*2010 - 2013*

- Teaching a group of 10-15 children aged 10-12 years old the basics of electronics and electric circuits using simple kits to implement practical and fun applications for kids.

REFERENCES

Prof. Vaughn Betz	vaughn@eecg.toronto.edu
Dr. Eriko Nurvitadhi	eriko.nurvitadhi@intel.com
Prof. Jason Anderson	janders@ece.utoronto.ca
Prof. Paul Chow	pc@eecg.toronto.edu
Prof. Diana Göhringer	diana.goehringer@tu-dresden.de