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Undergraduate Research Assistant Positions on
Two Projects @ Reconfigurable Computing Laboratory

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Project1: Exploring the applications of neuromorphic computing

Project Background: In 2017 we started a project funded by Raytheon tailored for undergraduate students to conduct research in the field of neuromorphic computing, and prepare each student for a research and development oriented career. We are interested in exploring the neuromorphic computing architectures with a focus on the TrueNorth chip. Seven undergraduate students have participated in this project. Accomplishments to date:

- We emulated the TrueNorth architecture with 150 cores on the Xilinx Virtex-7 series Field Programmable Gate Array (FPGA) and verified its functionality.
- We extended our implementation to streaming enabled TrueNorth emulation based on Zynq UltaScale MPSoC platform.
- We verified one-to-one spiking behavior with FPGA emulation for 10,000 MNIST testing images. We validated our emulation platform in collaboration with researchers form the Air Force Research Laboratory with a one-to-one match to IBM's Compass TrueNorth programming and simulation environment) outputs.

Current State and Expectations: Recently we implemented the Vector Matrix Multiplication (VMM) on the TrueNorth and conducted functional verification against the Compass based implementation of the VMM. Current VMM implementation requires non-scalable workarounds due to the fixed nature of the TrueNorth chip. Additionally, there are a number of design decisions, which are not inherent to the hardware: the number of weights a neuron can have, the number of neurons in a core, and the number of cores a neuron can communicate with. During the 2019- 2020 cycle, the team will investigate architectural modifications to the TrueNorth on the scalability of mapping VMM to TrueNorth. The undergraduate students will work collectively, participate in weekly meetings with graduate students, be involved in writing technical papers as a lead author or co-author.

Contact Dr. Akoglu (akoglu@ece.arizona.edu) with the subject line "neuromorphic research position" and include your resume that highlights your relevant course projects and programming experience.

Preferred Background: Programming with FPGAs and Python/C

Project 2: Heterogeneous Computing

We are in the process of building a robot that tests mobile devices. In this setup, a camera takes a snapshot of a phone screen and sends the image to the optical character recognition (OCR) processor to find the location of buttons and icons. Our aim is to reduce the time scale of the OCR process through parallelization efforts. This work requires investigating existing open source OCR implementations, evaluating their accuracy and suitability for parallelization, implementing the chosen method and quantifying the speedup benefit as a standalone OCR processor. The interface of the OCR processor with the camera is not within the scope of this work.

Contact Dr. Akoglu (akoglu@ece.arizona.edu) with the subject line "heterogeneous computing position" and include your resume that highlights your relevant course projects and programming experience.

Preferred Background: Programming with GPU or FPGA, and Matlab/Python/C