Elliptilinear representations for estimation of the 3D rim of an object from its 2D occluding contour

Professor: James Elder
Lab Website: https://www.elderlab.yorku.ca/
Position Type: Lassonde Undergraduate Research Award (LURA); NSERC Undergraduate Student Research Award (USRA);
Open Positions: 1

Project Description: The local shape of the occluding contour of an object is known to constrain the local shape of the object surface, however, these constraints are qualitative. While strict quantitative constraints relating the occluding contour to solid shape are unlikely, we posit here that typical regularities of common objects and rules of projection induce dependencies that can be used to derive statistical estimates of quantitative solid shape from the occluding contour. To explore this conjecture, we partition the problem into two parts: 1) Estimation of the 3D rim from the 2D occluding contour, and 2) Estimation of the visible surface shape from the estimated 3D rim. We train and evaluate statistical models on two distinct 3D object datasets and evaluate their ability to capture statistical regularities that enable 3D estimation of the object shape.

Line and ellipses are invariant under projection, making them convenient contour representations for the estimation of the 3D rim from the occluding contour. In this project we will therefore focus specifically on “elliptilinear” representations of the occluding contour and rim, i.e., piecewise elliptical curves, with linear intervals occurring with non-vanishing probability.

Duties and Responsibilities: The student will inherit 3D object datasets and software designed to recover optimal elliptilinear representations of occluding contours. The student will validate the software and then analyze how these occluding contour representations relate to elliptilinear approximations of the rim. Based on this analysis, the student will develop an algorithm to estimate the 3D shape of the rim from the 2D shape of the occluding contour. The student will have regular meetings with postdoctoral fellow Yiming as well as tri-weekly meetings with principal investigator Prof. James Elder.

Work Setting: Project work is carried out remotely

Desired Technical Skills: MATLAB; Aptitude in mathematics and statistics

Desired Course(s): N/A

Other Desired Qualifications: N/A

Contact Info: Prof. James Elder (jelder@yorku.ca); Anna Kajor (akajor@yorku.ca)
Evaluating systems for long-term tracking of hockey players

Professor: James Elder
Lab Website: https://www.elderlab.yorku.ca/
Position Type: Lassonde Undergraduate Research Award (LURA); NSERC Undergraduate Student Research Award (USRA);
Open Positions: 1
Project Description: Supervisor: Maria Koshkina
Tracking players in sports videos is extremely useful for both coaching and game statistics. Tracking involves detection of a bounding box around each player in each frame and associating these boxes across frames. The problem is challenging due to occlusions and wide variations in pose. Motion blur and changing illumination complicate the task further.
Most of the current research in the area has focused on short-term tracking (30 to 60 seconds). However, real-world applications such as tracking hockey players call for tracking for longer time intervals. In this project, the student will explore various approaches to long-term tracking of hockey players.
Duties and Responsibilities: The student will be responsible for investigation, implementation, and quantitative evaluation of state-of-the-art approaches for long-term object tracking and their application to hockey player tracking. The student will have daily meetings with PhD student Maria Koshkina to discuss progress, as well as tri-weekly meetings with principal investigator Prof. James Elder.
Work Setting: Project work is carried out remotely
Desired Technical Skills: Understanding of deep learning methodology; Python programming experience
Desired Course(s): N/A
Other Desired Qualifications: N/A
Contact Info: Prof. James Elder (jelder@yorku.ca; Anna Kajor akajor@yorku.ca)
Video-Based Traffic Analytics at Intersections

Professor: James Elder

Lab Website: https://www.elderlab.yorku.ca/

Position Type: Lassonde Undergraduate Research Award (LURA); NSERC Undergraduate Student Research Award (USRA);

Open Positions: 1

Project Description: Supervisor: Sajjad Savoji

The goal of the project is to research and develop computer vision algorithms, software, and specialized hardware for the analysis of mixed traffic at intersections. Multiple cameras will be employed. Road users will be detected and classified as motor vehicles, pedestrians, and bicycles. Motor vehicles will be further classified as vehicles with two wheels (motorcycles) and vehicles with 4 or more wheels (cars, trucks, buses). Road users will be geo-located within a 3D model of the intersection, tracked, and classified according to trajectory.

The research will include the design and development of systems for traffic counting and traffic anomaly detection. A system for 3D visualization of recorded or streaming traffic data (digital intersection) will also be designed and developed.

Duties and Responsibilities: Assist in ground-truthing and evaluation of algorithms for detection, classification, tracking, and trajectory classification of motor vehicles at intersections. Tabulate and analyze results, identifying failure modes. The student will have daily meetings with Master’s student Sajjad Savoji to discuss progress, as well as tri-weekly meetings with principal investigator Prof. James Elder.

Work Setting: Project work is carried out remotely

Desired Technical Skills: Software - Python, MATLAB; Concepts – Familiarity with computer vision and 3D geometry skills preferred.

Desired Course(s): N/A

Other Desired Qualifications: N/A

Contact Info: Prof. James Elder (jelder@yorku.ca; Anna Kajor akajor@yorku.ca)
LiDAR-free 3D ground-truthing of motor vehicles
Professor: James Elder
Lab Website: https://www.elderlab.yorku.ca/
Position Type: Lassonde Undergraduate Research Award (LURA); NSERC Undergraduate Student Research Award (USRA);
Open Positions: 1
Project Description: Supervisor: Thao Tran
This is a novel symmetry-based framework for single-view 3D ground-truthing of motor vehicles. LiDAR-based 3D ground-truthing is expensive, requires joint calibration of LiDARs and cameras, and may be inaccurate in the far field where LiDAR returns are sparse. We are developing a tool to annotate and ground truth 3D location, pose and shape of motor vehicles from a 2D image based on 3D symmetry cues and a generalized cylinder model of motor vehicles. The project will involve developing a GUI environment with 2D and 3D widgets that accepts user input through mouse interactions on a 2D image. The annotation and ground truth will be used to train a deep learning network for 3D object detection and estimation of motor vehicles.

Duties and Responsibilities: Develop and maintain a software tool using Python, PyQt, OpenGL (pyopengl), and OpenCV. The student will work with OpenGL 3D and 2D environments and interface with back-end functions. The student will have daily meetings with Master’s student Thao Tran to discuss progress, as well as tri-weekly meetings with principal investigator Prof. James Elder.

Work Setting: Project work is carried out remotely
Desired Technical Skills: Software - Python, OpenGL; Concepts – Familiarity with computer vision and 3D geometry skills preferred.
Desired Course(s): N/A
Other Desired Qualifications: N/A
Contact Info: Prof. James Elder (jelder@yorku.ca; Anna Kajor akajor@yorku.ca)
Attentive Sensing for Vulnerable Road Users
Professor: James Elder
Lab Website: https://www.elderlab.yorku.ca/
Position Type: Lassonde Undergraduate Research Award (LURA); NSERC Undergraduate Student Research Award (USRA);
Open Positions: 1

Project Description: Supervisors: Kartikeya Bhargava, Nizwa Javed
A current issue for video-based traffic analytics is to understand vulnerable road user behaviour as they step off the curb. In addition, it may be important to get detailed information about these road users to assess vulnerability. For example, is this person walking with a cane? Are they pushing a stroller? Are they distracted by a cell phone? Answering these questions requires high-resolution video data, and we have developed and deployed a specialized attentive sensor at an intersection in the GTA that can provide the resolution needed.
We will assess to what degree this system improves the accuracy of detection and tracking of these road users. We will also explore the use of this higher-resolution data stream to automatically estimate the vulnerability of each road user. To this end, we will first mine the literature on factors that contribute to vulnerability. This could include mode of transportation (bicycle, wheelchair, motorcycle), age, motor disability, visual disability, distraction (e.g., with a cellphone), inebriation, encumbrance (e.g., with a stroller) etc. From the literature we hope to extract a quantitative model that predicts risk based upon these factors. This will then lead to a set of target factors for which manual ground-truth datasets are constructed. Classifiers will then be trained to estimate these factors, which can then be used to predict vulnerability for each road user. A second task will be to predict the time required to cross the intersection based on these factors.

Duties and Responsibilities: The student will work closely with the supervisors to collect and label video data, and to train and evaluate classifiers and road-crossing time estimators. The student will have daily meetings with Software Engineer Kartikeya Bhargava and PhD student Nizwa Javed to discuss progress, as well as tri-weekly meetings with principal investigator Prof. James Elder.

Work Setting: Project work is carried out on campus, but can be shifted to remote work if necessary

Desired Technical Skills: Machine learning, software
Desired Course(s): N/A
Other Desired Qualifications: N/A

Contact Info: Prof. James Elder (jelder@yorku.ca; Anna Kajor akajor@yorku.ca)
Attentive Sensing for Mobile Robotics

Professor: James Elder
Lab Website: https://www.elderlab.yorku.ca/
Position Type: Lassonde Undergraduate Research Award (LURA); NSERC Undergraduate Student Research Award (USRA);
Open Positions: 1
Project Description: Supervisors: Kartikeya Bhargava, Nizwa Javed
It is often useful for mobile robots to have panoramic (360 deg) vision, but this limits resolution needed to make finer-scale judgements (e.g., face, gender, expression recognition). In this project, we explore the use of attentive sensing to address this problem. On our mobile robot test platform, four Intel RealSense cameras provide a panoramic field-of-view, allowing events of interest to be detected and localized. A fifth camera with a long lens, coupled with an oblique mirror mounted on a rotational motor will serve as the attentive sensor. By spinning the mirror, the attentive sensor can be rapidly deployed in any direction, providing high resolution sensing to support detailed analysis.

Duties and Responsibilities: The student will work closely with the supervisors to design, build and validate this attentive sensing system. The student will then work with the team to evaluate the sensor on several fine-scale benchmark tasks. The student will have daily meetings with Software Engineer Kartikeya Bhargava and PhD student Nizwa Javed to discuss progress, as well as tri-weekly meetings with principal investigator Prof. James Elder.

Work Setting: Project work is carried out on campus, but can be shifted to remote work if necessary

Desired Technical Skills: SolidWorks, Camera systems, Raspberry Pi, NVIDIA Jetson, motor control
Desired Course(s): N/A
Other Desired Qualifications: N/A
Contact Info: Prof. James Elder (jelder@yorku.ca; Anna Kajor akajor@yorku.ca)
Cleanbot

Professor: James Elder
Lab Website: https://www.elderlab.yorku.ca/

Position Type: Lassonde Undergraduate Research Award (LURA); NSERC Undergraduate Student Research Award (USRA);

Open Positions: 1

Project Description: Supervisors: Kartikeya Bhargava, Nizwa Javed
Ultraviolet-C (UV-C) light is known to be effective for surface disinfection against pathogens such as COVID-19. Unfortunately, existing delivery methods are incomplete, leaving high-risk 'shadow' regions (e.g., the undersides of surfaces and doorknobs) unsterilized. This project addresses this problem with an agile, fully autonomous, AI-driven Cleanbot solution based on recent advances in UV-C LED technology. While parked and charging, the Cleanbot will use onboard cameras, computer vision and machine learning algorithms to visually monitor a room for human activity, building a map of high-risk areas. When activated, the Cleanbot will autonomously tour the room, optimally orienting multiple articulating UV-C panels to irradiate and disinfect identified high-risk surfaces, including those not reachable by existing systems.

Duties and Responsibilities: The student will work closely with the supervisors to design, build and validate sensing and control algorithms to guide the Cleanbot LED panels to sweep over surfaces, ensuring adequate radiation for sterilization. These algorithms will first be tested in simulation (Gazebo) and then verified using the Cleanbot prototype in the lab. The student will have daily meetings with Software Engineer Kartikeya Bhargava and PhD student Nizwa Javed to discuss progress, as well as tri-weekly meetings with principal investigator Prof. James Elder.

Work Setting: Project work is carried out on campus, but can be shifted to remote work if necessary

Desired Technical Skills: ROS, control algorithms, software skills, 3D geometry

Desired Course(s): N/A

Other Desired Qualifications: N/A

Contact Info: Prof. James Elder (jelder@yorku.ca; Anna Kajor akajor@yorku.ca)
**Image Processing for Software Engineering**

**Professor:** Maleknaz Nayebi  
**Lab Website:** [http://www.maleknazn.com/](http://www.maleknazn.com/)  
**Position Type:** NSERC Undergraduate Student Research Award (USRA); Lassonde Undergraduate Research Award (LURA);  
**Open Positions:** 2

**Project Description:** Developers are increasingly sharing images in social coding environments alongside the growth in visual interactions within social networks. The analysis of the ratio between the textual and visual content of Mozilla’s change requests and in Q/As of StackOverflow programming revealed a steady increase in sharing images over the past five years. Developers' shared images are meaningful and are providing complementary information compared to their associated text. Often, the shared images are essential in understanding the change requests, questions, or the responses submitted. Relying on these observations, we delve into the potential of automatic completion of textual software artifacts with visual content. Gathering and automatically mining these images is part of the project to be conducted in a team with other researchers.

**Duties and Responsibilities:**  
- gathering data  
- pre-processing and mining the metadata  
- pre-processing and mining images  
- auto captioning  
- operating databases

**Work Setting:** Project work is carried out on campus, but can be shifted to remote work if necessary

**Desired Technical Skills:** python programming, image processing

**Desired Course(s):** EECS 3311

**Other Desired Qualifications:** team player, communication skills

**Contact Info:** Prof. Maleknaz Nayebi ([mnayebi@yorku.ca](mailto:mnayebi@yorku.ca))
Audio-Video Scene Recognition

Professor: Rick Wildes
Lab Website: https://vision.eecs.yorku.ca/main/
Position Type: Lassonde Undergraduate Research Award (LURA); NSERC Undergraduate Student Research Award (USRA);
Open Positions: 1

Project Description: Scene recognition in videos refers to the task of leveraging a temporal sequence of images to identify scenes (e.g., flowing river, vehicular traffic, crowds of people). This ability is important for artificial intelligence, as it helps a system understand its environment and thereby guide subsequent operations. Temporal and spatial features (e.g., texture and motion) are the most important properties to extract from videos lacking audio for scene classification. While state-of-the-art algorithms yield promising results on this task, their performance greatly degrades when visual clues are not well captured (e.g. hampered by occlusion from obstacles). Thus, another source of information should be helpful. The audio signal is perhaps the most reliable accompanying information source, but is little considered in current computational video understanding. This project will explore this novel approach to scene recognition, i.e., combining audio and video for enhanced overall performance.

Duties and Responsibilities: The research assistant will gather audio-video test data from the web, curate it and test classification algorithms developed in our lab.

Work Setting: Project work is carried out on campus, but can be shifted to remote work if necessary

Desired Technical Skills: equivalent of 3rd year major computer science skills
Desired Course(s): Disciplines: computer science, computer engineering or electrical engineering; desired course work: signal processing, computer vision

Other Desired Qualifications: Ability to work in a small team.

Contact Info: Prof. Rick Wildes (wildes@cse.yorku.ca)
Software Development for a Wearable Brain EEG Monitoring Device

Professor: Hossein Kassiri
Lab Website: https://electronics.eecs.yorku.ca/
Position Type: NSERC Undergraduate Student Research Award (USRA);
Open Positions: 2

Project Description: Electroencephalography (EEG) is known as the best non-invasive method for high-resolution real-time monitoring of brain neural activities. The standard way of conducting EEG recording, however, requires a trained technician to conduct the experiment which involves patient preparation, electrodes placement, equipment setup, data collection, and interpretation. Motivated by this, several wireless wearable EEG recording headsets have been developed over the past few years, aiming to provide a fast, low-cost, and medically-relevant alternative to the existing technology, thus achieving long-term ambulatory EEG recording. Successful development of such technology has a significant positive impact on many diagnostics, treatment, rehabilitation, and communication applications.

In the integrated Circuits and Systems Lab, we have developed a wearable wireless device that is designed to be used as a low-cost long-term brain monitoring solution capable of integrating a high number of recording channels. The device hosts a proprietary algorithm for the early detection of epilepsy seizures.

The main objective of this project is to design, develop, and test windows-based software (or an android app) that interacts with this wearable technology. The software/app is required to collect, store, and display the data received from the wearable device.

Duties and Responsibilities: The successful candidate will work closely with a PhD student to develop and test the first prototype of the above-mentioned wearable EEG recording device. The main responsibility of the student will be the development and testing of the computer software.

Work Setting: Project work is carried out on campus, but can be shifted to remote work if necessary

Desired Technical Skills: - Basic understanding of signals and systems, experience in development of software that can interact with the Bluetooth port of a computer or cellphone

Desired Course(s): N/A
Other Desired Qualifications: N/A
Contact info: Prof. Hossein Kassiri (hossein@eecs.yorku.ca)
Electroencephalography (EEG) is known as the best non-invasive method for high-resolution real-time monitoring of brain neural activities. The standard way of conducting EEG recording, however, requires a trained technician to conduct the experiment which involves patient preparation, electrodes placement, equipment setup, data collection, and interpretation. Motivated by this, several wireless wearable EEG recording headsets have been developed over the past few years, aiming to provide a fast, low-cost, and medically-relevant alternative to the existing technology, thus achieving long-term ambulatory EEG recording. Successful development of such technology has a significant positive impact on many diagnostics, treatment, rehabilitation, and communication applications.

In the integrated Circuits and Systems Lab, we have developed a wearable wireless device that is designed to be used as a low-cost long-term brain monitoring solution capable of integrating a high number of recording channels. The device hosts a proprietary algorithm for the early detection of epilepsy seizures.

The main objective of this project is to design, develop, and optimize a 3D-printed structure that is used as the frame of the wearable EEG headset. The structure will be designed to host both the EEG recording dry electrodes and electronics and should allow for adjustable positioning of electrodes for different skull shapes.

**Duties and Responsibilities:** The successful candidate will work closely with a PhD student to develop and test the first prototype of the above-mentioned wearable EEG recording device. The main responsibility of the student will be the design and development of the EEG headset's frame through 3D printing.

**Work Setting:** Project work must be carried out on campus (as permitted by COVID-19 regulations)

**Desired Technical Skills:** Previous experience in 3D printing, interest in health technologies

**Desired Course(s):** All Engineering students who meet the technical requirements are welcome to apply.

**Other Desired Qualifications:** N/A

**Contact Info:** Prof. Hossein Kassiri (hossein@eecs.yorku.ca)
Federated learning in edge computing
Professor: Ping Wang
Lab Website: https://www.eecs.yorku.ca/~pingw/
Position Type: NSERC Undergraduate Student Research Award (USRA);
Open Positions: 1
Project Description: In the traditional machine learning (ML) approach, data collected by local nodes is uploaded to the data center and processed centrally, where formidable computational resources can be exploited. However, this approach is no longer suitable for edge computing networks. Firstly, users' data is privacy-sensitive than ever. Secondly, transferring data generated by a large number of nodes for processing burdens the network and becomes the bottleneck of overall performance. Thirdly, the centric fashion involves long propagation delay and incurs unacceptable latency, which is unbearable for many applications with instantaneous decision making. Therefore, a natural question arises with the concerns mentioned above: how to train an ML model from decentralized data at a resource-constrained edge node? Federated Learning (FL) is a technique that fulfills this purpose. FL is an ML setting where many nodes collaboratively train a model under the orchestration of a central server (e.g. service provider) while keeping training data decentralized. However, FL also faces challenges. One major challenge is system heterogeneity. FL involves the heterogeneous participants whose local dataset, computational ability, channel condition, power level and willingness to participate may vary. Given the system heterogeneity, an optimal strategy for resource allocation needs to be developed to maximize the efficiency of FL. Another challenge is communication cost during global model training. Compared with traditional distributed machine learning, where several computational centers are involved, the FL framework is usually related to a large number of edge nodes, incurring an extremely high communication cost. Therefore, the effort to reduce communication costs (e.g., model compression) is needed to improve efficiency. This project will focus on developing cutting-edge FL techniques to address these challenges.

Duties and Responsibilities: The student will gain sufficient knowledge of federated learning and gain hands-on experience in implementing federated learning algorithms. The student will do some research in the relevant field, under the guidance of the supervisor and senior graduate students.

Work Setting: Project work is carried out on campus, but can be shifted to remote work if necessary

Desired Technical Skills: Good at coding. Have basic knowledge of machine learning.

Desired Course(s): students from computer science are preferred.

Other Desired Qualifications: Good GPA; Self-motivated.

Contact Info: Prof. Ping Wang (pingw@yorku.ca)
Gallium-Nitride Based Multi-MHz Bidirectional Power Interface for Integrated Energy Storage in a DC Microgrid

Professor: John Lam
Lab Website: https://pelser.lab.yorku.ca/

Position Type: Lassonde Undergraduate Research Award (LURA); NSERC Undergraduate Student Research Award (USRA); Dr. James Wu Scholarship;

Open Positions: 1

Project Description: The Information and Communication Technology (ICT) data centers electricity consumption in Canada has already reached more than 90 peta-joules in 2020. In addition, the COVID-19 pandemic has led to an explosive increase in digital communications and as a result, the data center energy consumption is rising at an alarming rate. PV-powered datacenters with high voltage battery storage that utilizes a DC microgrid architecture is an attractive solution. A new PV energy optimizer structure with integrated energy storage is currently under development. Unlike the conventional centralized storage power architecture, the proposed design consists of an integrated energy storage power interface that stores extra extracted power or deliver required power directly. To significantly reduce the physical size of the proposed system, latest surface-mount gallium-nitride (GaN) switching devices with ultra-small footprints will be employed in the devised circuit. In this project, the student will be responsible for investigating and designing a GaN-based high frequency AC/DC energy storage bidirectional power interface circuit for use as the energy storage power interface in a DC microgrid. A power controller that supports the devised bidirectional power circuit will also be investigated.

Duties and Responsibilities: - investigate state-of-the-art GaN based power topologies, develop GaN AC/DC bidirectional converter
- perform power electronic circuits simulation in Powersim
- analysis in MATLAB
- devise controller in Powersim/DSP

Work Setting: Project work is carried out on campus, but can be shifted to remote work if necessary

Desired Technical Skills: Strong math and circuit analysis background, good presentation skills

Desired Course(s): electronics, electric circuits, power electronics, analog electronics

Other Desired Qualifications: Hardware development experience

Contact Info: Prof. John Lam (johnlam@eecs.yorku.ca)
Assurance of systematic mapping studies in software engineering

Professor: Alvine BOAYE BELLE
Lab Website: https://lassonde.yorku.ca/users/alvinebelle
Position Type: Lassonde Undergraduate Research Award (LURA); NSERC Undergraduate Student Research Award (USRA);
Open Positions: 2

Project Description: Systematic mapping studies are used to classify existing literature on a given research area in order to structure that area. They have become increasingly popular since reading them notably allows becoming more familiar with a research area. Steps to carry out a systematic mapping study typically consists in searching the literature that is relevant for a research area, selecting that literature using a set of criteria, and analyzing and reporting the data retrieved from the selected literature. However, to the best of our knowledge, no approach has been proposed to assure that a mapping study is systematic i.e. that it sufficiently covers all the features embodied by the guidelines proposed to carry out systematic mapping studies.

The main objective of this project is therefore to develop and assess assurance cases that demonstrate that a mapping study carried out in the software engineering field is systematic.

Duties and Responsibilities: 1. Survey existing measures used to assess systematic mapping studies carried out in software engineering and assess the limitations of these measures
2. Survey the different guidelines and/or steps that have been proposed to create systematic mapping studies.
1) Survey the different categories of evidence that can be used to assure that a mapping study is systematic
2) Rely on the surveyed evidence and guidelines to create and implement an assurance case arguing that a mapping study is systematic
3) Propose a new confidence measure that assesses the so-created assurance case to quantify the degree of systematicity of a mapping study carried out in the software engineering field.

Work Setting: Project work is carried out on campus, but can be shifted to remote work if necessary

Desired Technical Skills: Equivalent of 3rd year major computer science skills, math skills

Desired Course(s): Disciplines: computer science

Other Desired Qualifications: Analytical mind, team player, excellent writing skills

Contact Info: Prof. Alvine BOAYE BELLE (alvine.belle@lassonde.yorku.ca)
In-memory Vector-Matrix Multiplication Hardware Programming for Machine Learning Applications

Professor: Amirali Amirsoleimani
Lab Website: https://lassonde.yorku.ca/users/amirsol

Position Type: NSERC Undergraduate Student Research Award (USRA);
Open Positions: 2

Project Description: In the Lab for Computing Research and Innovation (LCRAIN), we are aiming to design efficient and versatile systems for the next generation of machine learning hardware. Our goal is to propose scalable, flexible, and innovative strategies for the implementation of the synaptic weight and the associated Multiply and Accumulate (MAC) operation, which are the most demanding resources for efficient Machine Learning (ML) hardware. We capitalize on emerging multi-technology platforms such as high-performance CMOS and high-density memory devices to introduce efficient solutions to existing techniques. In this specific project, we are aiming for a candidate to specifically on programming the FPGA for custom-designed PCB and chip to run vector-matrix multiplication on memory arrays. We are investigating novel writing and reading schemes on memory crossbars to implement more efficient operations for in-memory computing platforms.

Duties and Responsibilities: Here is the summary of the USRA student tasks:
1. Student will study different CMOS-RRAM architecture operation modes (READ, WRITE, ...)
2. Student will develop models for different modes of operation on Python and the platform model.
3. Student will start implementing the datapath for the custom-designed PCB and chip on FPGA and testing different READ and Write techniques.
4. The final step of the implementation is testing and developing appropriate test benches for the system.
5. The findings on novel READ and WRITE schemes will be documented for the publication.

Work Setting: Project work is carried out on campus, but can be shifted to remote work if necessary.

Desired Technical Skills: • Good Machine Learning Skills, acceptable hardware knowledge • Proficiency in Python, SPICE and HDL language like Verilog

Desired Course(s): The student should already be knowledgeable on the course e.g. Digital logic design, Electrical circuits, Electronics1&2, Machine learning, Computer Organization.

Other Desired Qualifications: The student should be passionate about working on a challenging project with hybrid technologies, and also should be interested on AI hardware. Prior research experience on AI hardware will be an asset.

Contact Info: Prof. Amirali Amirsoleimani (amirsol@yorku.ca)
HUMAN-COMPUTER INTERACTION IN VIRTUAL REALITY

Professor: Robert Allison
Lab Website: https://percept.eecs.yorku.ca/
Position Type: NSERC Undergraduate Student Research Award (USRA); Lassonde Undergraduate Research Award (LURA);
Open Positions: 2

Project Description: Students will help design, develop and conduct experiments related to human-computer interaction in virtual environments and digital media. In our lab we have a wide range of apparatus to study human perception in computer-mediated worlds including a new and unique fully immersive virtual environment display. The student would develop interactive 3D virtual worlds and conduct experiments to study self-motion perception, visual perception and human computer interaction in these virtual worlds. In particular, working with a senior graduate student or postdoctoral fellow, the successful applicant would model 3D environments, render them in a virtual reality or other digital media display, develop/implement interaction methods to control and interact with the simulation, and/or develop and run experimental scenarios to investigate these issues with human participants.

Duties and Responsibilities: Depending on skills and preparation the student would be responsible for:
• Literature reviews and research
• Design of virtual environments
• Computer programming
• Testing
• Recruiting participants
• Conducting user studies
• Modeling and Data analysis
• Preparation of reports, graphics and presentations

Work Setting: Project work must be carried out on campus (as permitted by COVID-19 regulations)

Desired Technical Skills: Good programming skills, previous work with computer graphics or virtual reality would be helpful, as would basic mechanical skills. Students with background in Psychology and interest in Experimental Psychology are also welcome to apply. Artistic background or skill would be an asset but is not required.

Desired Course(s): Digital Media, Electrical Engineering, Computer Engineering, Computer Science, Psychology, or Vision Science

Other Desired Qualifications: Students should be self-directed and work well in a team
environment.

Contact Info: Prof. Robert Allison (allison@eecs.yorku.ca)