STUDENT RESEARCH SHOWCASE 2018

Thursday, August 23

Business and Information Technology Building

Hosted by:
The Office of Vice-President Research, Innovation and International

UNIVERSITY OF ONTARIO INSTITUTE OF TECHNOLOGY

TABLE OF CONTENTS

POSTER ABSTRACTS

EVENT AGENDA

8:30 to 9:30 a.m.	
UB Atrium/ UB Mezzanine	**Registration and poster set up for poster presenters**
9:30 to 10 a.m.	
UB 2080	**Opening Remarks** Douglas Holdway, Interim Vice-President Research, Innovation & International Jennifer Freeman, Director of Research Services, Office of the Vice-President Research, Innovation & International Karen Zavitz, Entrepreneurship Network Manager, Brilliant Entrepreneurship
10 to 11:30 a.m.	
UB Atrium/ UB Mezzanine	**Poster showcase and competition**
11:30 a.m. to noon	
UB 2080	**Guest Speaker Presentation** Markus Piro, PhD Canada Research Chair (Tier II), Nuclear Fuels and Materials Professor, Faculty of Energy Systems and Nuclear Science Presentation Title: "Emerging Technologies in Nuclear Fuels and Materials Research"
Noon to 12:30 p.m.	
UB 2080	**Best Poster Awards announced for each faculty followed by closing**
12:30 to 1:30 p.m.	
UB Atrium	**Lunch/ Networking for all RSVP'd guests**

EXTERNAL PARTICIPANTS

Natural Sciences and Engineering Research Council of Canada (NSERC)

NSERC aims to make Canada a country of discoverers and innovators for the benefit of all Canadians. The agency supports university students in their advanced studies, promotes and supports discovery research, and fosters innovation by encouraging Canadian companies to participate and invest in postsecondary research projects. NSERC researchers are on the vanguard of science, building on Canada's long tradition of scientific excellence. NSERC offers a number of opportunities for undergraduate and graduate students.

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Ontario Centres of Excellence (OCE)

OCE drives the commercialization of cutting-edge research across key market sectors to build the economy of tomorrow and secure Ontario's global competitiveness. In doing this, OCE fosters the training and development of the next generation of innovators and entrepreneurs and is a key partner with Ontario's industry, universities, colleges, research hospitals, investors and governments. A champion of leading-edge technologies, best practices and research, OCE invests in sectors such as advanced health, digital media and information communications, advanced manufacturing and materials, and cleantech including energy, environment and water. OCE is a key partner in delivering Ontario's Innovation Agenda as a member of the province's Ontario Network of Entrepreneurs (ONE). Funded by the Government of Ontario, the ONE is made up of regional and sector-focused organizations and helps Ontario-based entrepreneurs rapidly grow their company and create jobs.

For more information, visit www.oce-ontario.org

Come say hello to our external participants between 10 and 11:30 a.m. at their designated booths!

INTERNAL PARTICIPANTS

School of Graduate and Postdoctoral Studies (SGPS), University of Ontario Institute of Technology

The University of Ontario Institute of Technology offers over 30 master's, PhD and graduate diploma programs that aim to equip students with a competitive advantage through practical learning experience. As a member of the campus community, you will have the opportunity to contribute to the university's mission to advance the highest quality research, and engage in efforts that are truly making a difference.

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Brilliant Entrepreneurship, University of Ontario Institute of Technology

Supported by FastStart, NRC-IRAP, Firefly

The University of Ontario Institute of Technology Supports and encourages students to get involved in entrepreneurship by following their own entrepreneurial interests, participating in a startup team, or taking an entrepreneurial approach into their future workplace. We recognize that experiential learning is key.

Brilliant Entrepreneurship enables students to:

- Understand what entrepreneurship means for your future.
- Learn entrepreneurship skills from practitioners.
- Refine and build their ideas and teams for success.
- Connect with mentors, practitioners and student startup teams.
- Accelerate business formation and growth.

Want to know more?

Please contact us at karen.zavitz@uoit.ca or jeffrey.peng@uoit.ca

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COMMUNITY CONTRIBUTORS

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GUEST SPEAKER

Markus Piro, PhD

Canadian Research Chair (Tier II), Nuclear Fuels and Materials
Professor, Faculty of Energy Systems and Nuclear Science, University of Ontario Institute of Technology

Markus Piro is Assistant Professor, Faculty of Energy Systems and Nuclear Science, and Canada Research Chair (Tier II) in Nuclear Fuels and Materials at the University of Ontario Institute of Technology.

His primary research interests are in computational thermodynamics, nuclear fuel engineering, multi-scale multi-physics modelling and simulation of nuclear fuels and materials, and experimental and computational fluid dynamics.

He received a Bachelor of Science in Engineering and a Master of Science in Mechanical and Materials Engineering from Queens University, and a PhD in Nuclear Engineering at the Royal Military College of Canada in conjunction with the Computer Science and Mathematics Division of the Oak Ridge National Laboratory (ORNL).

After completing his graduate studies, he spent two years as a Postdoctoral Fellow in the Materials Science and Technology Division at ORNL.

Afterwards, he led the Fuel Modelling and Fission Product Transport Section at the Canadian Nuclear Laboratories for nearly four years. He has experience consulting for both industry and government in Canada and the U.S

Presentation Title: *"Emerging Technologies in Nuclear Fuels and Materials Research"*

2017 BEST POSTER AWARD WINNERS

Faculty	Student Name(s)	Poster Title	Supervisor
Business and Information Technology	Mathew Coe	Comparing Privacy Codes of Practice in the Connected Vehicle Industry	Rajen Akalu, PhD
Education	Allison Saunders and Alex Gadanidis	Classrooms of the Future: The Potential of Artificial Intelligence in Kindergarten to Grade 12 Education	Janette Hughes, PhD
Energy Systems and Nuclear Science	Jason Chang and Ralph Laite	Computational Fluid Dynamic Investigations in Support of Nuclear Reactor Safety	Markus Piro, PhD
Engineering and Applied Science	Rahul Vaghasia	Experimental Study of Effect of Anolyte Concentration and Electrical Potential on Electrolyzer Performance in Thermochemical Hydrogen Production Using the Cu-Cl Cycle	Marc Rosen, PhD
Health Sciences	Bridve Sivakumar	Personal and System Barriers to End-of-Life Care Discussions in the Acute Care Setting: Identifying Them and Providing Solutions	Manon Lemonde, PhD
Science	Leanna Calla	Beyond 48 Hours	Sean Bohun, PhD
Social Science and Humanities	Irina Levit	Karl Brandt: Application of Serial Murder and Mass Murder Models to a Genocidal Actor	Hannah Scott, PhD

POSTER ABSTRACTS

FACULTY OF BUSINESS AND INFORMATION TECHNOLOGY

POSTER 1

Research Team: Campbell Hamilton

Supervisor: Dr. Andrew Hogue

Title: Automated Data Analysis

The GAMERLab at UOIT contains an observation lab that produces a large amount of synchronized video and sensor data. This lab is used to conduct observational studies to analyze player behaviours for a variety of human-computer interaction studies (e.g. while they are playing games). Analyzing observational data is difficult. The goal of this project is to make the analysis of the data easier and less time consuming as researchers have to analyze the video data by hand traditionally. After looking at existing methods of data analysis, we developed an observational tool to aid the analysis process and apply algorithms to classify data "events". The tool allows the user to select what data they wish to analyze, synchronize the video with multiple sensors in the room (or attached to participants) and also how they wanted it to be analyzed and then display it. This tool is intended to reduce the time and effort spent on sifting through a large amount of data and allows researchers to focus on specific areas that are important for statistical analysis.

FACULTY OF BUSINESS AND INFORMATION TECHNOLOGY

POSTER 2

Research Team: Daniel MacCormick

Supervisor: Dr. Loutfouz Zaman

Title: The Use of Subjunctive Nodes in Visual Programming for Game Development

We present a system which uses subjunctive nodes within a visual programming system for game development. The system allows the end-user to represent and switch between many different ideas within the same graph. Furthermore, the system allows for small scale changes in expression through node alternatives and larger scale changes in algorithm through graph scenarios. The system was implemented as an extension to Unreal Engine's Blueprint system. The source code of Unreal Engine was modified to incorporate these alternatives and scenarios as a layer on top of the existing Blueprint system. The end-user can control these variations through the use of 'tabs', which function similarly to tabs within a web browser. In the base system, users can only represent one idea at a time, creating issues when they want to try something similar without removing their current implementation. Our system addresses that by allowing the user to switch back and forth quickly and easily. Programmers and artists alike can benefit from our system as it can improve their workflow.

POSTER 3

Research Team: Joss Moo-Young

Supervisor: Dr. Bill Kapralos

Title: Development of USEIT- A New Epidural Simulator

Positioning an epidural catheter is one of the most demanding physical skills for an anesthetist to learn. It is a complex task of 3D visualization, tactile sensitivity, and fine motor skills. With increasing demand for safe and ethical methods of practicing medical procedures, the body of virtual haptic simulators attempts to enhance training for epidurals. Further research into emulating the complex interactions with haptics can enable the creation of an epidural simulator that can be adopted for widespread use, improving new anesthesiologists' expertise, increasing patient safety, and mitigating costs. Here, we present Unity Simulator for Epidural Insertion Training (USEIT), a haptic-enabled system which aims to facilitate further study in epidural training. It incorporates a new model for emulating soft tissue forces and offers fluid resistance through a valve system. It is built in the Unity engine, which allows it to be easily extended, and enables it to easily integrate with future projects.

FACULTY OF BUSINESS AND INFORMATION TECHNOLOGY

POSTER 4

Research Team: Samantha Stahlke, Atiya Nova

Supervisor: Dr. Pejman Mirza-Babaei

Title: Investigating Use of AI in Game User Experience Evaluation

Games user research (GUR) is a subfield of human-computer interaction (HCI) dedicated to understanding user experience (UX) in video games. A common GUR methodology is playtesting, where researchers collect and analyze data from players interacting with a digital game. Playtesting is used in both academic and commercial contexts as a method for investigating UX and player behaviour. However, the orchestration of playtesting sessions with human participants can be very resource-intensive, especially for independent developers. Furthermore, it is challenging to recruit an appropriately diverse population of participants reflecting a game's target market. To address this challenge, we propose the development of a framework using AI agents as proxies for human players. As a background to our technical design, we conduct a review of the literature surrounding AI-driven tools in the GUR state-of-the-art. Based on this understanding of researcher needs, we present a system design overview of the framework, as well as preliminary work on a prototype proof-of-concept. Ultimately, we hope to develop a tool, which will help to increase the efficiency and accessibility of playtesting for academic and commercial users alike.

POSTER 5

Research Team: Jacky Yang, Michael Chan

Supervisor: Dr. Alvaro Joffre Uribe-Quevedo

Title: Prototyping Immersive Interactions with Artificial Avatars in Virtual Reality

Following the moderate commercial success of virtual reality-based technologies, there are currently numerous applications in entertainment, education, training, and healthcare amongst others. However, progress has been slow in improving the experience of interacting with a virtual avatar. Traditional methods of interaction use buttons and menus which are fit for 2D screens and triggered by keyboard, mouse, and game controllers. Such input devices do not take advantage of the medium of virtual reality. We sought to prototype a framework that allows including speech, gesture, and virtual reality headset orientation modes of interaction to enhance user immersion when working with a non-player character in virtual reality. This prototype serves as a testing ground for our interaction framework to study its performance and effectiveness. A case study was implemented as part of ongoing research on developing a virtual eye fundus examination that requires a physician to interact with a virtual patient through speech, gestures, and gaze.

FACULTY OF BUSINESS AND INFORMATION TECHNOLOGY

POSTER 6

Research Team: Kevin Yardy, Abdulaziz Almehmadi

Supervisor: Dr. Khalil El-Khatib

Title: Detecting Abnormal Driving with Machine Learning

The purpose of the research project was to collect car data from an OBD Sensor and determine if there was abnormal driving patterns. We carried out the research by conducting many road tests with normal and abnormal driving patterns. Also, we conducted a study which involved the ACE Wind Tunnel. The issue of importance is detecting abnormal driving patterns, and the solution that can be identified is developing a prevention system, which can be used if the machine believes abnormal driving is occurring. There are three major parties which we have identified that will benefit from the research completed, the daily driver of the car, and car manufacturers looking to discover new ways to keep customers safe on the road, and the insurance companies to determine rates of each driver.

POSTER 7

Research Team: Jackson Rushing

Supervisor: Dr. Andrew Hogue

Title: Photogrammetry for Low Budget Game Development

3D modelling is an aspect of game development that is extremely time-consuming, most notably when photo-realistic assets are required. Photogrammetry is a technique that can be used instead of traditional 3D modelling which involves using software to generate a 3D model from a collection of images. By utilizing photogrammetry techniques instead of painstakingly modelling an object from reference, developers can scan real-world objects into 3D game engines. This results in extremely realistic assets for a comparatively low amount of effort. The purpose of this project was to find a workflow that enables developers to effectively utilize photogrammetry techniques in order to have access to photo-realistic assets on a small budget. Using a combination of consumer grade, open source and custom-built software & hardware, different techniques were tested & compared. These techniques include laser scanning, as well as traditional photogrammetry. Different methods are being compared by scanning identical objects and comparing the results. Preliminary results have shown that extremely detailed models can be attained through the use of open source software and a relatively inexpensive camera.

FACULTY OF EDUCATION

POSTER 8

Research Team: Keisha Deoraj

Supervisor: Dr. Diana Petrarca

Title: Tale of a Two-Year Initial Teacher Education Program: Investigating Self-Efficacy Development of Teacher Candidates

Teacher self-efficacy refers to a teacher's judgment of their ability to foster student learning. Understanding and developing teacher self-efficacy is important because there are many implications, including an ability to foster student self-efficacy, achievement, motivation, persistence, and positive behaviour (Hoy and Spero, 2005). This multiphase study investigates how UOIT's enhanced Initial Teacher Education Program (ITEP) facilitates the development of teacher candidate (TC) self-efficacy. In this research phase 222 TC participants, drawn from three cohorts enrolled in UOIT's ITEP, completed Bandura's Teacher Self-Efficacy Scale, comprised of 28 Likert-scale questions. Findings suggest that participants believed more in their ability to provide pedagogical supports for their future students, than in their abilities to deal with disruptive students. The UOIT's ITEP benefits directly from this research by incorporating findings into future programming. Current and future enrolled TCs, and the students and school communities with which they will interact will also benefit. The next phase of this research will explore specifically how UOIT's ITEP facilitates TC self-efficacy via focus groups and semi-structured interviews.

POSTER 9

Research Team: Michelle Hoskins

Supervisor: Dr. Shirley van Nuland

Title: An Investigative Look at Plans for Implementation of Canadian Teacher Codes of Conduct & Ethics

The objective of this research is to explore teacher codes of conduct and ethics ("codes") outlined by each Canadian province and to identify which certifying bodies of educators have complemented their codes with strategies and/or activities that will facilitate effective implementation of said codes. A grounded theory approach has been taken for this research, and consists of concept- and theory-building that is grounded in the currently available research and data, along with a series of steps in data collection, analysis, and coding that lead towards a fuller understanding of a given problem and the social implications that surround it. Our findings have culminated in very few implementation directives outlined among the provinces' codes, leading us to consider why so few plans for effective implementation are available and to suggest strategies and activities that could be used or included to ensure that educators thoroughly understand and properly apply the codes that have been established. This research is beneficial and informative for all stakeholders in education who deem compliance with and implementation of codes, to be valuable and compulsory.

FACULTY OF ENERGY SYSTEMS AND NUCLEAR SCIENCE

POSTER 10

Research Team: Michael Rolph, Dr. Akira Tokuhiro

Supervisor: Dr. Jennifer McKellar

Title: Investigating the Role of Small Modular Reactors in Remote Mining Applications

Remote off-grid mines currently rely on diesel generators to power energy intensive processing equipment and surface infrastructure. Not only are diesel generators expensive to operate, they also pollute heavily in the form of greenhouse gas emissions. This research builds on a previous study by Enzo Diependaal and focuses on the financial feasibility of deploying a small modular reactor (SMR) in place of a diesel power plant at Eagle's Nest mine site, to be located in Northern Ontario's Ring of Fire. The energy demands of the Eagle's Nest mine were identified in order to assess which SMR technologies would be most suitable for this application, as well as to estimate the lifecycle costs of each alternative for a levelized cost of energy (LCOE) calculation. Based on this analysis, it would seem SMRs are the more affordable option for the Eagle's Nest mining project, offering electricity savings up to $130/MWh. As a developing technology, the costs associated with SMRs remain uncertain; however, they may present an opportunity to retire the use of diesel generators in off-grid mining applications in exchange for clean and more affordable energy.

POSTER 11

Research Team: Peter Sercl, Mohamed Aboughaly, Zachariah Zoepel

Supervisor: Dr. Hossam Gaber

Title: Plasma Sources for Waste-to-Energy Systems

The research project focused on the use of plasma systems in Waste-to-Energy (WTE) reactions instead of using incinerators. Plasma systems generate less harmful emissions than incinerators and can be more efficient when properly developed. The primary plasma of interest in this research is inductively coupled plasma (ICP) at atmospheric pressure. The specific form of WTE reactions is the pyrolysis/gasification of waste plastics, such as low-density polyethylene (LDPE). These reactions produce synthetic gases (syngas), which can be used as fuel in turbines or further refined to re-create oil-based fuels. Experiments were done using a 2500 W and 3000 W RF ICP system consisting of a generator, matching network, and an inductive coil. Two of the RF generators in the lab was discovered to be malfunctioning and non-operational for the experiments. The purchasing process for new equipment is underway. DC plasma cutters were used for initial plasma testing and use in WTE reactions. The world has been inundated with waste plastics ever since modern petroleum manufacturing caught on, recycling and disposing of these plastics has proven to be an immense challenge. Plastics have been increasingly polluting our environment and poisoning species.

FACULTY OF ENERGY SYSTEMS AND NUCLEAR SCIENCE

POSTER 12

Research Team: Eyad Tamimi

Supervisor: Dr. Igor Pioro

Title: Increasing Plant Cycle Efficiency in Conventional PWRs

The objective of this research is to broadly examine the effect of secondary cycle engineering parameters on the gross cycle efficiency of a nuclear plant. An open-sourced application developed for thermodynamic calculation of Rankine-Cycle plant parameters by IAEA was used. The steam-tables module coded within that application had to be re-written to draw data from the national institute of standard's own thermo-physical property calculation software. The effect of coolant on the cycle was also examined with helium being more thermodynamically favourable than water, but due to helium ingress, a mixture of 20% Helium and 80% Nitrogen was still found to be more preferable than water. This was demonstrated through a basic one-dimensional iterative heat transfer coefficient calculation using Matlab.

POSTER 12

Research Team: Kaitlyn Brown

Supervisor: Sharman Perera

Title: Development and Verification of Americium-Beryllium Neutron Source Facility Model Using MCNP

The objective of this research project was to develop a model of the Americium-Beryllium neutron source facility at UOIT that could be used to determine the impact of the addition of a fourth neutron source on worker dose rates. The model and simulations were done using MCNP, a neutron transport code from Los Alamos National Laboratory. The model was validated through the comparison of the MCNP code output with physically measured values in the facility. With a validated model of the current source configuration, the addition of a 40 mCi Americium-Beryllium neutron source was modeled into the existing 120 mCi Americium-Beryllium facility. The surrounding occupied areas with the addition of the 40 mCi source were proven to have a dose rate lower than 2.5 μSv/h, complying with the University's storage limit policy. The developed model of the facility will be of great use to the faculty in streamlining the experimentation process, increasing use of ALARA principles, and improving facility security. Future work will involve transferring the fourth source into the neutron source facility and commissioning it for future undergraduate teaching and research.

FACULTY OF ENERGY SYSTEMS AND NUCLEAR SCIENCE

POSTER 14

Research Team: Richard Carlisle

Supervisor: Dr. Glenn Harvel

Title: Assessment of Decontamination Technologies

Decontamination of components during Nuclear Power Plant (NPP) decommissioning activities allows for radiologically contaminated components to be treated as a lower level waste items. The large variety of situations where decontamination is needed combined with the large variety of conventional and emerging decontamination technologies results in a need for a mapping between the scenarios and the decontamination technologies. To approach this problem, technology selection criteria were identified, such as decontamination factor, secondary waste generation, and space constraints. A literature review was conducted to characterize the advantages and limitations of each technology. A list of over 30 decontamination technologies have been identified. The majority of the technologies have been categorized as ones using either a mechanical or chemical means for decontamination. Some technologies have been identified as “emerging,” such as the microwave spallation of concrete, electromechanical decontamination, and supercritical fluid extraction. The relative performance of these technologies have been sufficiently characterized to allow for screening of components based on inputs relating to decontamination situation.

POSTER 15

Research Team: Jonathan Chang, Ahmed Abdeklmaksoud, Taylor Egan

Supervisor: Dr. Hossam Gaber

Title: Resilient Energy Storage System for Sustainable Subway Transport

Subway systems are large consumers of electricity; however, the problem arises when most of the energy is wasted as heat and continuously uses a large amount of energy from the grid. The purpose of this research is to explore the benefits of recapturing the kinetic energy of a train onto an on-board flywheel. It is expected that an onboard flywheel will lessen grid dependency and total energy usage by storing and reusing energy. Using Mathwork's Simulink, a subway model was constructed and simulated under multiple scenarios to record and compare energy consumed, energy salvaged and total energy used. Lowering energy usage translates to decreased capital and operating cost and will also reduce stress on the main grid. Switching the power source to the flywheel during peak usage will aid with voltage regulation and power management. Simulation and results show that over 56% of energy can be reused while dropping grid dependency to 43% versus the conventional total reliance on the grid. Train services such as the TTC can profit from this research as it significantly decreases capital and operating cost. Additionally, the electric power industry will benefit from this outcome as reusing energy will assist with grid stress.

FACULTY OF ENERGY SYSTEMS AND NUCLEAR SCIENCE

POSTER 16

Research Team: Umer Shahid

Supervisor: Dr. Markus Piro

Title: Thermogravimetric Oxidation Analysis of Carbon Tokamak Dusk and Flakes

Carbon co-deposition with hydrogen is a problem in carbon-walled nuclear fusion devices. It results from plasma eroding the wall, carbon entering the plasma, and then being re-deposited on the wall along with hydrogen isotopes. Since the co-deposits can grow to the hundreds of microns before flaking off, they can be important tritium (fuel) trapping mechanism, adding significantly to the radiological inventory. After flaking and decomposition, the co-deposits form dust, which is both a radiation and explosion hazard. Thermo-oxidation, in which vessel surfaces are heated in the presence of oxygen [1], has been demonstrated as a means of destroying co-deposits and dust by converting the C to CO and CO2 and the H to H2O [2-4], which can then be removed by the vacuum pumps. We present here for the first time a thermogravimetric analysis of the oxidation of tokamak dust, under 98% Ar / 2% O2 atmospheric pressure. The percentage mass loss obtained as a function of time could be used to optimize the parameters of a thermo-oxidation application and predict the rate of co-deposit destruction, and also to describe the oxidation kinetics. Isothermal thermogravimetric measurements are also performed at 350 °C, for kinetics and also as a demonstration of thermo-oxidation for destroying dust and flake material.

FACULTY OF ENGINEERING AND APPLIED SCIENCE

POSTER 17

Research Team: Nabilah Alhaji, Nadim Arafa, Ali Saudy, Waleed Ahmed

Supervisor: Dr. Atef Mohnay

Title: Development of an Innovative Pulse-Electro Thermo De-Icing for Automotive Application

The purpose of this research is to develop an innovative Pule-Electro Thermal De-Icing (PETD) techniques for automotive applications where the ice can be efficiently removed in a few minutes from a windshield of a car, or from other applications such as planes or even bridges, high voltage power lines or wind turbines. A wooden chamber has been modelled using NX and built. The system is tested with a DC power source or with an electric vehicle car battery which is connected to a control unit to convert the DC signal into short pulsation. The system is being tested under many different conditions such as different outside/inside temperature, different ice thickness and different control levels. This research addressed the problem of the ice formation on many applications during the winter, which can cause many severe problems in our daily life. Problems such as the limited visibility while driving a car, flying a plane, delaying the flights for hours, or even power outage; all of which can cause accidents or loss of lives. The development of the PETD techniques can solve all these problems; solving such a problem will save time, effort and even save lives.

POSTER 18

Research Team: Matthew Efthimiades

Supervisor: Dr. Ahmad Barari

Title: Design and Optimization of a Modular Vacuum EOAT

Vacuum End of Arm Tools (EOATs) are often used in manufacturing and packaging industries as pick-and-place machines. These tools use vacuum suction to lift heavy objects faster and more safely than human operators. The objective of this research project was to design a 3D-printed, modular, vacuum efficient tool that is lighter and more versatile than conventional EOATs. To achieve this, various computational methods were utilized, including Finite Element Analysis (FEA), Topology Optimization, and Computational Fluid Dynamics (CFD). FEA and Topology Optimization were used in conjunction to effectively design a rigid, lightweight structure, with organic shapes that take advantage of the 3D-printing process. CFD was used to optimize the flow through the system. This was done through a parametric study, finding values for various simulation setups – vacuum port sizes, chamber heights, and actuator stroke lengths were selected based on the results.

FACULTY OF ENGINEERING AND APPLIED SCIENCE

POSTER 19

Research Team: Amanjot Gulshi

Supervisor: Dr. Carlos Rossa

Title: Development of Robotic System for Rehabilitation of Musculoskeletal Disorders

The purpose of the research project was to develop a robotic rehabilitation system to assist patients with musculoskeletal disorders regaining functional control of affected limbs. Both a hospital-based therapist and a home-based patient are provided with the same force-feedback device. In the research, we implemented a method to control these devices remotely and process all activities in the interacting systems so that the patient and the therapist can interact as if they were in the same room. The research addressed the problem of having a system accessible to patients without having to make a trip to the hospital frequently. We then extended the concept to using a robotic arm to aid patients by providing resistance in rehabilitation exercises. This allows a patient to go through stages of recovery at the hospital for a short while before being able to carry out exercises from the comfort of their home through video conferencing with the therapist. From this research, patients will benefit from this system that gives them the ability to rehabilitate from their home and for therapists to be able to treat multiple patients from just their office.

POSTER 20

Research Team: Chunhui Guo

Supervisor: Dr. Shahram ShahbazPanahi

Title: Optimal Multi-Carrier Relay-Assisted Wireless Communications

The purpose of this research is to find the optimal resource (power) allocation and network beam-forming matrix in a relay-assisted communication structure. Due to the fact that there are two covariance matrices to optimize, I have two methods to optimize over these two matrices. On the one hand, by fixing the beam-forming matrix, I am able to optimize the source power covariance matrix. After optimizing the source power matrix, the beam-forming matrix can be optimized. On the other hand, by fixing the source power matrix, I can deal with the beam-forming matrix first; and then, the source power matrix can be solved. I mainly utilized three methods, which are the Lagrange multiplier, Water-filling algorithm and convex optimization, to solve the optimization. The result of this research will help developers, such as engineers and scientists, to optimally allocate fixed power resources to transmitters and relays in order to have maximum data transmission rate.

FACULTY OF ENGINEERING AND APPLIED SCIENCE

POSTER 21

Research Team: Alfonse Ly, Ghassan Chehade, Murat Demir, Burak Yuzur

Supervisor: Dr. Ibrahim Dincer

Title: Investigation of a Novel Solar Hydrogen Production System

In a generation facing global warming and excess emission of harmful gases into the atmosphere, a clean source of energy is needed to power industries and transportation of today. For centuries, conventional energy sources such as fossil fuels and coal have powered industrial machinery and transportation modes. Using this process, harmful gases are emitted as by-products and is poisoning the Earth. With that said, some photo-electrochemical hydrogen production experiments are performed. Using a Fresnel lens, solar radiation is concentrated onto a 6"x 6" PEC hydrogen reactor, where water splitting occurs, and hydrogen gas is produced. Through this, readily abundant resources are obtained such as sunlight and water. Not only are the resources of abundance, but the process in which hydrogen is made also emits no harmful toxins to the environment, as compared to conventional means. By cleanly producing hydrogen as fuel, other processes can reduce harmful emissions as well. Ammonia is a compound mass produced in many industries, such as farming, plastics and fuel. With hydrogen being an element in such a compound, by using the reactor, ammonia production can be paired with such a hydrogen reactor to reduce harmful emissions.

POSTER 22

Research Team: Conor McDermott

Supervisor: Dr. Brendan MacDonald

Title: Prototype Design of a MR Fluid Valve

The objective of this research project was to design and develop a flow control system using magnetorheological (MR) fluids' magnetic properties to mimic the blood flow control system in the human body based on vasodilation/vasoconstriction. MR fluids have the added benefit of excellent heat transfer properties. The research was carried out by first running magnetostatic simulations using FEMM software, which was verified with hand calculations. A prototype was then designed and optimized for increased magnetic strength and manufactured. An open loop control system was built to verify and automate the system. Relating current (and magnetic field strength) to flow rate was accomplished by measuring the volume flow rate of fluid that was pumped for different magnetic field strengths. Experimental testing revealed a quick response of the MR fluid flow when the magnet was activated. Further, a relation was developed to relate the current through the electromagnetic coils (and magnetic field strength) to the flow rate. The impact of this research was to demonstrate the accurate flow control that is possible with MR fluids. Potential applications include biomimetic thermal management systems for industrial and commercial use.

FACULTY OF ENGINEERING AND APPLIED SCIENCE

POSTER 23

Research Team: Anshuman Sharma

Supervisor: Dr. Mohamed Youssef

Title: Single-Stage Solar Battery Charger with Maximum Power Point Tracking for Energy Harvesting Applications

Maximum Power Point Tracking (MPPT) technique is employed in Photovoltaic (PV) systems to extract maximum available power from the PV module irrespective of temperature, solar irradiation and load anomalies. A DC-DC converter is a key component in achieving this target. A single-stage DC-DC buck converter that extracts maximum power form the connected PV module and controls the output battery state of charge (SoC), as well, is a critical requirement. The introduced circuit consists of three subsystems: a PV module, a Buck converter and an MPPT plus voltage regulation controller. MPPT is achieved via a novel methodology, not only applies to maximum energy extraction of the PV module but also combined with a feedback optimization of the battery charging and discharging modes. The developed system targets the Internet of Things (IoT) based sensor nodes. In the proposed solution, power harvested from the PV module is combined with the battery power; to guarantee that the connected load receives a full supply of power. The key advantages of this design are cost effectiveness, compact size, and high efficiency. Consequently, an important step towards new market product is fulfilled, through this summer scholarship.

FACULTY OF ENGINEERING AND APPLIED SCIENCE

POSTER 24

Research Team: Max Sun, Chirag Paladiya

Supervisor: Dr. Amirkianoosh Kiani

Title: Conductivity Manipulation of Graphene-Infused PCL Electrospun Nanofiber

For peripheral nerve repair after an injury, nerve autografts and tubular prostheses are used with disadvantages, such as rejection for autografts and a removal surgery for tubes. This project introduces a new method in nerve cell repair by controlling the conductivity of graphene-infused nanofibers with varying graphene content such that it mimics the conductivity of a nerve for possible uses in aiding nerve growth. This research generates nanofibers by electrospinning poly(e-caprolactone) (PCL) dissolved in acetone and acetic acid mixed with graphene nanoplatelets. Electrospinning is a method for generating nanoscale polymer fibers using high-voltage electrical difference. Biocompatible nanofibers with varying conductivity produced. PCL nanofiber doped with graphene successfully generated and measured for conductivity. Improved conductivity measured as graphene content increases. If implemented as tubular prosthesis, no removal surgery is necessary, unlike in conventional silicone tubes. Patients suffering from peripheral nerve damage will enjoy an improved treatment in nerve regeneration without a need for a donor tissue nor a removal surgery.

FACULTY OF ENGINEERING AND APPLIED SCIENCE

POSTER 25

Research Team: Hao (Rick) Tan, Sébastien Davoust

Supervisor: Dr. Scott Nokleby

Title: Development of an Autonomous Unmanned Aerial Vehicle (AUAV) for an Autonomous Amphibious Robot (AAR)

The goal of this research project was to develop an Autonomous Unmanned Aerial Vehicle (UAV) that will launch and land from the back of an Autonomous Amphibious Robot (AAR). The UAV will provide aerial imaging to allow the AAR to navigate through the littoral zone between land and water. The research project was carried out in three phases: (1) literature review; (2) hardware development; and (3) software development. The literature review involved gathering information on building a custom UAV as well as programming with the Robot Operating System (ROS). The hardware development phase involved constructing the physical prototype. The software development phase involved configuring and programming the UAV with ROS. The research project addresses the problem of launching and landing a UAV from a mobile station. A UAV with both the hardware and software capabilities addressing the problem was constructed. The UAV will send images to the AAR to help it navigate through the littoral zone. Navigation of the AAR will be steady, safe, and efficient.

POSTER 26

Research Team: Brett Van Mierlo

Supervisor: Dr. Brendan D. MacDonald

Title: Measuring Stirling Engine Substrate Heat Transfer

The objective of this research project was to determine the amount of heat transferred from the Stirling engine heat source, through the substrate and into the hot side of the engine. The project was carried out by building a mock of the top end of an experimental Stirling engine. Inside the moving engine, thermocouples cannot be placed to determine the heat being generated, so a stationary apparatus was built keeping as close as possible to represent the conditions inside the Stirling engine, including the turbulent flow. The apparatus sends compressed air through the stationary mock displacer into the heated top end of the cylinder. Inside the cylinder are three thermocouples measuring the temperature change that is viewed as well as the temperature gradient. This research is of interest because in the Stirling engine the greatest drawback, in comparison to internal combustion engines, is the amount of heat be transferred to the working fluid from the external heat source. If we can find the amount of heat being produced and find ways to increase this, then Stirling engines could become a more viable option. Results show the temperature change of inlet air during the 0.08s cycle time of the Stirling engine displacer.

FACULTY OF ENGINEERING AND APPLIED SCIENCE

POSTER 27

Research Team: Shengqian Wang, Gao Boyu

Supervisor: Dr. Haoxiang, Lang

Title: Integrated Localization System with Passive UHF-RFID and SLAM

Passive UHF- Radio frequency identification (RFID) deliveries a reliable solution capable of guaranteeing easy-to-implement, high accuracy localization and low energy consumption. Simultaneous localization and mapping (SLAM) represent an effective method that can generate real-time maps. The objective of this poster is to report experimental summer research results that develop a concept of an integrated localization system, combining UHF-RFID and graph-based SLAM technologies together, which generates a human-friendly and easy-to-understand 3D map of surroundings integrated with real-time locations of target objects demonstrated by attached RFID tags. Simulations and real-world experiments with Turtlebot 2, Kinect v2 (Xbox one edition) and RFID system, including a UHF RFID reader and several passive RFID tags, are carried out to illustrate the efficiency of the system and also practical issues arising in the dead zone of vision and potential signal interference of RFID.

POSTER 28

Research Team: Brayden T. York

Supervisor: Dr. Brendan D. MacDonald

Title: Maintaining a Temperature Gradient in Stirling Engine Regenerators

The objective of this research project was to successfully maintain a temperature gradient across a regenerator. Regenerators are the key component that enables external heat engines such as Stirling engines to function, and maintaining a temperature gradient across a regenerator can improve their effectiveness. An experimental apparatus was created to simulate the air moving across a regenerator in a Stirling engine. A stacked regenerator was built with thermal isolation to accomplish the temperature gradient. Pneumatic pistons were used to pass a constant volume of air from a hot chamber past the regenerator to the cold chamber, and back again, cyclically. Fine gauge thermocouples were placed in the regenerator, and read every 8 ms to produce graphs displaying the temperatures after the system reached steady state. The experiment ran successfully, and a 25C temperature gradient was maintained across the regenerator with the hot temperature fixed at 80C. This proved that a temperature gradient could be maintained during cycling, which can be used to enhance the effectiveness of regenerators and Stirling engine performance.

FACULTY OF ENGINEERING AND APPLIED SCIENCE

POSTER 29

Research Team: Michael Currie

Supervisor: Dr. Martin Angelin-Chaab

Title: Active Aerodynamic Drag Reduction Devices for Road Vehicles

The purpose of the research project was to develop an active aerodynamic drag reduction system for road vehicles to reduce fuel consumption. To accomplish this, research was done on the major causes of drag on a vehicle as well as a variety of different types of existing active aerodynamic technologies. It was determined that the area around the wheels produce a significant amount of drag which can be reduced with an appropriate active aerodynamic system. A purely mechanical system was pursued simplicity and to ensure its independence of an external power source. A computational fluid dynamics simulations were first performed to improve and optimize the conceptual model. After that, a scaled-down model will be built for lab testing. This research can assist in reducing drag, and thereby fuel consumption, of consumer vehicles. With the associated range anxiety of electric vehicles, this has the potential to improve the driving range and reduce the anxiety of drivers. Additionally, this reduction in fuel consumption also results in lower emissions from standard gasoline powered vehicles. Overall, this research benefits industry, the consumer and the environment.

POSTER 30

Research Team: Paul Femi-Gege

Supervisor: Dr. Akramul Azim

Title: Operating System Test Case Generation

Generating test cases for operating systems using combinatorial methods (reducing the number of test cases using combinatorial test case generation). Operating system tests can be performed many ways, the method used was testing through system calls. Generating combinatorial test suites based on system call parameters. It is hard testing operating systems; there are many combinations of values that may cause failures for the OS, testing the OS with as many relevant combinations to find failures is the goal. Operating System users or developers benefit from the research because combinations that cause failures may be caught, resulting in developers working towards fixing such issues, so it does not cause any catastrophic failures for users

FACULTY OF HEALTH SCIENCES

POSTER 31

Research Team: Margaret Grylls, Kathy Lavis, Marsha Townsend, Sandra Mairs

Supervisor: Dr. Manon Lemonde

Title: Medicinal Cannabis: A Growing Health Care Landscape

This project aims to provide nursing students with relevant knowledge regarding the legalization of recreational marijuana as well as the conferred expansion of medicinal cannabis as a therapeutic agent. The legalization of recreational marijuana in Canada potentiates greater freedom of cannabis in medical research, while also inspiring an increased patient request for medicinal cannabis for symptomatic relief. As a result, the recommendation of cannabis as a pharmacotherapeutic agent is expected to surge in the upcoming months and into the future. Health care providers must be abreast of current research and policy, including but not limited to; a process of accessing medicinal cannabis, pharmacokinetics, therapeutic indications, and adverse effects of use. Examination of gray literature informed the findings of this research project, and it is acknowledged that health care providers must consult their workplace policy regarding considerations of hospital storage, preparation, administration, and documentation. A primary objective of this research is to support nursing students in communicating with and caring for patients who are inquiring about and/or using cannabis as a therapeutic agent.

POSTER 32

Research Team: Amina Mahmood, Jacqueline Brown

Supervisor: Dr. JoAnne Arcand

Title: What's in a Nutrition App? A Critical Review of the Content of Child Nutrition Apps

A large number of apps have been developed to teach children about nutrition. The objective of this project is to critically review the content of educational child nutrition apps to determine if they are in alignment with public health nutrition priorities. A search of the Apple App Store and Google Play Store was conducted with the aim of identifying all relevant child nutrition apps (n=20575) using chosen keywords (e.g. nutrition game). Two reviewers reviewed the apps. Apps were included if they contained the keyword of 'food' or 'nutrition' in the title or description, contained nutrition education content, targeted children as users, and were in the English language. Apps were excluded if they focused solely on food preparation and recipes. Eligible apps were downloaded (n=226). The content analysis included an evaluation of the type of foods, nutrients, and healthy eating messages presented in each app. It is important to understand the quality and content of existing nutrition education resources. Ideally, app developers would incorporate guidelines set forth by public health authorities into child nutrition apps to ensure consistent messaging and adoption of healthy eating behaviours.

FACULTY OF HEALTH SCIENCES

POSTER 33

Research Team: Victoria Berkers. Mahboobeh Zabihosseinian, Ushani Ambalavanar, Rufeyda Cosgun

Supervisor: Dr. Bernadette Murphy

Title: The Effect of Changing Neck Sensory Input on Neural Plasticity and Sensorimotor Integration Following Motor Skill Acquisition Task

Sensory feedback to the CNS is affected by cervical extensor muscle (CEM) fatigue displaying altered upper limb proprioception (Zabihhosseinian et al., 2015). Cerebellum disinhibition (CBI) is a notable response for motor skill learning (Baarbé et al., 2015). This study aims to determine if the CBI response to motor learning is affected by CEM fatigue. Sixteen healthy individuals were randomly assigned to either a CEM fatigue or control intervention. Transcranial magnetic stimulation (TMS) was applied over the ipsilateral cerebellum 5 ms prior to the stimulation over the contralateral primary motor cortex (M1) area supplying the first dorsal interosseous muscle. 50% motor evoked potential inhibition (CBI50) was found through increasing cerebellar stimulation, while also finding 5% and 10% above CBI50. Both groups completed a motor tracing task using their right index finger immediately after and 24-hours following five minutes of neck fatigue or rest. Greater disinhibition was shown at CBI50 versus CBI50+10% ($P < 0.008$) and at CBI50+5% versus CBI50+10% ($P < 0.009$). Although motor training led to significant disinhibition, CEM fatigue did not affect demonstrating that CEM fatigue does not alter the cerebellar-M1 pathway.

FACULTY OF SCIENCE

POSTER 34

Research Team: Jonathan Adams

Supervisor: Dr. Hendrick de Haan

Title: Bundling of Rod-Like Colloids

The purpose of this research is to examine the effects of the depletion force on rod-like colloids. The depletion force is an attractive force between colloids in a solution with depletants, the clustering of colloids together produces an increase in the entropy of the system, which yields an attractive entropic force between colloids. With rod-like colloids, this force causes the formation of bundles of colloids. To investigate this process, we use Molecular Dynamics computer simulations to model the colloids and their behaviour. Results show that depletion forces can be used to bundle rod-like colloids together in a solution. By more closely examining the effects of depletion forces on rod-like colloids, it's possible to selectively bundle colloids based on certain characteristics such as length or stiffness. In addition, many biological systems experience depletion forces naturally, and we can gain insight into the nature of these systems.

POSTER 35

Research Team: Gibran F. Edun

Supervisor: Dr. Janice L. Strap

Title: Investigating the Role of Two Component Signaling Pathways in Komagataeibacter hansenii

Two-component signalling (TCS) pathways are ubiquitous in bacteria and are responsible for their ability to sense and respond to the environment. The sensory component of the TCS pathway contains a conserved protein histidine kinase component that is responsible for the conversion of extracellular signals to intracellular signals passed onto response regulators via phosphorylation reactions. Although the mechanism by which the intracellular signals are relayed are somewhat understood and their protein sequences predicted in silico, it has proved much more difficult to predict which extracellular signals will elicit a given response. The aim of this study was to examine the role of histidine kinases found in Komagataeibacter hansenii, a gram-negative, a-proteobacterium most recognized for its ability to produce extracellular cellulose. To accomplish this, we attempted to knock-out the genes encoding histidine kinases using overlap extension polymerase chain reaction (PCR) mutagenesis. This work will further our understanding of the regulatory factors that influence the growth, development and cellulose biosynthesis in these bacteria which will ultimately enable optimal cellulose production for industrial applications.

FACULTY OF SCIENCE

POSTER 36

Research Team: Claire Gibbs, Denin Gray

Supervisor: Dr. Andrea Kirkwood

Title: Lake in Transition: Characterizing the Lower Aquatic Foodweb in Lake Scugog

Lake Scugog is a large, but shallow lake located within the boundaries of Durham Region and the City of Kawartha Lakes. Historically, Lake Scugog has supported the local economy through its popular sports fishery and tourism activities. However, in recent years, Lake Scugog has been experiencing notable changes in water quality and ecological community structure. In particular, nutrients, algal blooms, and invasive species have increased. The objective of this study was to further understand the ecology of the lake by focusing on the lower aquatic food-web. Specifically, we investigated the role of invasive species in promoting algal blooms, as well as elucidating community composition and structure of the lower food web. We collected water samples, as well as biological samples (phytoplankton, macroinvertebrates and aquatic plants) at 12 sites across the lake over a 5-month sampling period (May to September 2017). Analysis indicates a correlation between the invasive species Nitellopsis obtusa (Starry Stonewort) and Dreissena polymorpha (zebra mussel) and Cyanobacteria. These two invasive species have had negative impacts on species richness within all communities sampled. In contrast, another non-native invasive species Myriophyllum spicatum (Eurasian Watermilfoil), was shown to have positive effects on species richness. The increase in cyanobacteria is cause for concern because some cyanobacteria secrete harmful toxins that may pose a risk to animal and human health. Further research and implementing management strategies for invasive species could potentially decrease harmful algal blooms benefiting both the aquatic ecosystem and the people who utilize the lake.

FACULTY OF SCIENCE

POSTER 37

Research Team: Happy Inibhunu

Supervisor: Dr. Greg Lewis

Title: Implementation of the Single-Point Method for Macromolecular Proton Fraction Mapping

Macromolecular proton fraction (MPF) is a potential biomarker for various neurological conditions associated with myelin density, e.g., multiple sclerosis and mild traumatic brain injury. However, the lengthy MRI scan-time required for its measurement prohibits it from being considered in the clinical setting. MPF measurement has been based on determining four unknown parameters by fitting data from several MRI scans to a two-pool model of magnetization transfer (MT). A way to decrease the number of scans required to obtain an MPF mapping was proposed by Vasily L. Yarnykh, in 2012, as the single-point method. This is done by reducing the number of unknown parameters from four to one, thus requiring only a single off-resonance MT measurement, the usual Bo, T1, and B1 maps, and approximations for the previous three unknown parameters. As a result, this method can focus on solving for MPF (the only unknown parameter) for each voxel of the MRI whole-brain image. In this work, we use Yarnykh's single-point procedure to find MPF maps by fitting the required MRI data to the two-pool model, in Matlab, via two different optimization methods, the Gauss-Newton method and the Levenberg-Marquardt method (used in Matlab's fsolve function).

POSTER 38

Research Team: Mona Almaghrabi

Supervisor: Dr. Yuri Bolshan

Title: Brønsted Acid-Catalyzed Alkynylation of Benzhydrol

A Brønsted acid-catalyzed carbon-carbon bond forming methodology was developed for the preparation of alkyne-functionalized benzhydrols. Within this reaction, trimethylsilyl phenylacetylene was reacted with para-substituted benzhydrol in the presence of a catalytic amount of tetrafluoroboric acid diethyl ether complex to afford an internal alkyne in moderate yields. This transformation has the advantage of short reaction times with all reactions completed in 15 to 60 minutes. Additionally, tetrafluoroboric acid is air and moisture stable which eliminates the need for anhydrous conditions. The particularly appealing features of this reaction are the mild reaction conditions and the absence of transition metals, which are commonly toxic and highly unstable. Internal alkyne units are frequently used as intermediates for the preparation of pharmaceuticals and natural products, and there is a need for the rapid preparation of internal alkynes in drug design when screening the bioactivity of potential drug candidates.

FACULTY OF SCIENCE

POSTER 39

Research Team: Nicole Krysa

Supervisor: Dr. Julia Green-Johnson

Title: Effects of Galactooligosaccharide and Fructooligosaccharide Supplementation during Infancy on Immune Activity in Wistar Rats

Currently, there is controversy over the potential benefits of fermentable carbohydrate (prebiotic) supplements presently being added to infant formula. Two of the most commonly used prebiotic supplements are fructooligosaccharides (FOS) and galactooligosaccharides (GOS). It has been proposed that when these two prebiotics are added to the formula, they promote the growth of bifidobacteria and lactobacilli in the infant's gut, ultimately fostering a microbial and immunological environment similar to that which results from ingesting human milk oligosaccharides. To determine whether these dietary interventions result in a permanent impact on the immune system, two cohorts of Wistar rats each ingested either FOS, GOS or a control diet for ten days in early infancy. Systemic and mucosal immune tissues were collected from these rats at 16 or 70 days of age and were subsequently examined to compare cytokine and chemokines concentrations, key markers of immunological activity. The findings resulting from this study indicated differences in immune activity between sexes but did not demonstrate a benefit of FOS or GOS feeding during infancy on the immune system.

FACULTY OF SCIENCE

POSTER 40

Research Team: Kaitlyn Lemay

Supervisor: Dr. Cecilia Hageman

Title: Genetic Structure of Ontario Populations. Part 1: Sample Collection

The purpose of this research is to evaluate Ontario's human population genetic structure. Current forensic genetic databases, created mostly in the 1990's, do not provide allelic data on many short tandem repeat loci contained in new "megaplex" kits and do not include a male haplotype database. Our project is the first of a three-part research project (followed by DNA profiling and statistical testing) to measure and describe autosomal and Y STR substructure in Ontario's Caucasian, African-Canadian, Asian, East Asian and First Nations populations. Part 1, begun in the summer of 2018, involved the collection of random and unrelated volunteer samples. We created buccal swab kits and necessary consent and sampling information forms and set up a booth at various campus locations. Samples collected so far include: Caucasian= 34; North American Aboriginal= 3; SubSaharan African and Caribbean= 7; South Asian and East Indian= 6; Asian= 5. We will continue sampling, and then partner with forensic laboratories to begin STR profile analysis. This research aims to impact forensic scientists by giving them access to an improved autosomal STR and Y-STR database that will allow for better statistical analysis in casework.

POSTER 41

Research Team: Michael N. Lombardo

Supervisor: Dr. Faisal Z. Qureshi

Title: Content Aware Video Summarization

Video has rapidly become one of the most common and largest sources of visual information. This explosion of accessible video data through many mediums such as smartphones, video cameras, webcams, etc. has brought us to an age of big video data. Although merely effortless to record large amounts of video data, raw videos often require significant editing until being best suited for viewing. User-edited videos often only include segments of the raw video, which are deemed to be interesting by the editor. State-of-the-art video summarization methods have accomplished generating high-quality summaries from raw videos. How can we use frame-level features to improve the summarization by changing the velocity of the video at different segments? To carry out the research, a novel framework needed to be created. The video summarization framework includes; Whole Raw Video -> Feature Extraction -> Segmentation -> Optimal Frame Selection -> Final Summary. At the current stage of research, there is no outcomes/results due to the framework still being worked on. The parties which will benefit from this research is likely the video editing industry, as well as sports editing industry.

FACULTY OF SCIENCE

POSTER 42

Research Team: Hajra Naeem, Kristen Nazareth, Sarah Abdelmassih

Supervisor: Dr. Sean Forrester

Title: Cloning of Lgc-41 Gene Encoding for Inhibitory Ligand-Gated Chloride Channels in Parasitic Nematode Haemonchus Contortus

Haemonchus contortus is a commonly known parasitic nematode that infects animals such as sheep, cattle and goats. A key component of the nervous system are ligand-gated chloride channels that function to control neuron firing in worms. This ultimately controls the worm's movement and feeding. The objective of this research was to isolate and clone a known gene, lgc-41, that codes for a ligand-gated chloride channel in H. contortus to identify a potential drug target. To target this specific gene, a segment of previously sequenced gene was amplified through polymerase chain reaction and a fragment of amplified DNA was obtained. The DNA was purified and cloned through traditional cloning into the pGEMHE vector. An lgc-41 expression test was conducted using end-point PCR analysis in larvae and adult H. contortus DNA. Cloning of known genes that code for ligand-gated chloride channels in the nervous system can be further characterized, which allows for potential antiparasitic drug targets. Researchers can develop new drugs to prevent parasitic diseases commonly seen in humans and animals by targeting this gene. Parasitic worms can obtain resistance against drugs over time and the demand to develop new and effective drugs is essential

POSTER 43

Research Team: Omar Nusrat, Eduardo Mendez-Villuendas

Supervisor: Dr. Hendrick de Haan

Title: Coarse-Grained Simulations of Phytoglycogen Nanoparticles Using the Martini Force Field Model

Phytoglycogen is a dendritic nanoparticle consisting of repeated branching units of glucose. PhytoSpherix™ is a phytoglycogen nanoparticle found in plants, functioning as a form of energy storage. PhytoSpherix™ can be utilized in a variety of ways. For example, it is proposed that PhytoSpherix™ can be used as a biodegradable means of delivering medicine, as it can interact with a variety of biomolecules and can be broken down by enzymes in the body. The precise structure of this particle is unknown and difficult to determine experimentally. In this work, we explore the simulation of PhytoSpherix™ using the Martini force field, a simple model that is computationally fast, easy to use, and flexible enough to apply to a large range of biomolecular systems.

FACULTY OF SCIENCE

POSTER 44

Research Team: Jade Poisson, Nadia O. Laschuk, Simone Quaranta, Iraklii I. Ebralidze, Franco Gaspari, E. Bradley Easton

Supervisor: Dr. Olena Zenkina

Title: “Smart” Self-Assembled Chromogenic Materials on Enhanced Nanosurfaces for Energy Storage

Electrochromic devices have been a subject of particular interest to material scientists recently. These devices not only can be used in smart windows and self-dimming mirrors but they also have applications in energy storage devices. A change in colour upon oxidation state changes of the metal center can allow the user to determine when the device is fully charged. To prepare such a device semiconductive nanoparticles were screen-printed to act as a support for transition metal complexes with terpyridine ligands to allow more molecules to adsorb to the surface. A common issue in the field of electrochromics is that transition metals commonly have a small number of colour combinations. By incorporating multiple metal centers into a single device, the colour can easily be tuned, and different colours can be observed depending on the potential being applied. Herein, osmium (II), iron (II) and cobalt (II) were used to produce many different colour combinations. The prepared devices were characterized via electrochemistry, spectrophotometry and spectroelectrochemistry.

POSTER 45

Research Team: James Regush

Supervisor: Dr. Yuri Bolshan

Title: Blue Light Mediated Preparation of Biphenyl from Tetravalent Borates and Aryldiazonium Fluoroborate

The goal of this research project was to develop a novel synthetic methodology for forming bonds between sp2-hybridized carbons, specifically aromatic systems. Biphenyl was formed from sodium tetraphenylborate in the presence of 4-methoxydiazonium tetrafluoroborate, Eosin Y and blue light emitting diodes. The reaction conditions were optimized for mild conditions: 20-25°C, under air, and 1.5hr irradiation. Dimethylformamide was determined to be the best solvent for the system thus far with yields of up to 50% assuming 1:1 molar equivalence of borate to biphenyl and shortest reaction time of all solvents studied. The reaction is thought to proceed by a radical mechanism initiated by a reduction of one equivalent of the diazonium salt. The presence of the photocatalyst appears to be suppressing biphenyl production; however, without a diazonium salt present, the photocatalyst increases yield of biphenyl compared to photolysis of sodium tetraphenylborate. It was also shown that biphenyl was formed from diphenyl pinacol borate ester salts allowing access to asymmetrical biphenyl derivatives. The use of an alternate borate, potassium tetrakis-(2-thioeneyl) borate, produced 2-bithiophene in low yield largely due to the influence of the potassium..

FACULTY OF SCIENCE

POSTER 46

Research Team: Mason Sullivan

Supervisor: Dr. Fedor Naumkin

Title: Exploring the Effects of Ion-Pair Trapping on IR Spectra and Isomerization of Polar Molecules

Novel molecule-insertion complexes, M–mol–X, with a polar organic molecule trapped between counter-ions of an alkali-halide MX, are studied and compared to the common MX–mol complexes, with the molecules attached to one another. A notable possible application of such systems involves strong radiation-matter interactions, of practical importance in, e.g., light sensors. This study considers a few isomers of a cyclic molecule and a few conformers of its complexes with MX. The species are investigated via a computational modelling at a reliable level of electronic-structure theory using a professional quantum-chemistry software. The complexes are characterized by their structure, stability to dissociation and barriers to conformations, dipole moments, molecular vibrations and IR spectra. Of interest are also the potential energy barriers to isomerization of the molecule in the complexes. Ion-trapping alters the molecular shape yields higher-energy conformers with remarkably increasing dipole moments, up to 23 D. The IR spectra offer a means to experimentally detect the complexes. In the complexes, the potential barriers are predicted to alter weakly or significantly (up to ~ 2 times) depending on the direction of the isomerization.

FACULTY OF SCIENCE

POSTER 47

Research Team: Harrish Thasarathan, Kamyar Nazeri

Supervisor: Dr. Mehran Ebrahimi

Title: Perceptual Loss for Image to Image Translation

In fine art and animation, a complex relationship exists between the content and style of the image being produced. Until recently, automating the process of creating art was an extremely difficult task due to visual stimuli like texture and style being innately human affairs. Perceptual Loss is one method of artificially creating artistic imagery through learning both content and style representations within a pre-trained neural network. An optimization problem is then devised in which the style difference between two images is minimized. Perceptual Loss is relevant to image translation tasks as it provides a method to preserve structure while translating high-frequency features. To gauge the ability of Perceptual Loss for application in grayscale image colorization, style transfer of paintings to real photos was implemented along with a Conditional Generative Adversarial Network (CGAN) to colourize animations. From the results, it is evident that CGAN can be implemented with Perceptual Loss for further improved results. Colorization and Perceptual Loss will have an impact in a variety of industries like photo restoration and work-flow streamlining for animators.

POSTER 48

Research Team: Leanna Calla, Dr. Helene LeBlanc

Supervisor: Dr. Sean Bohun

Title: MOO-che Out

Flies are a nuisance at dairy farm facilities. Stable flies, in particular, are known to bite cows, which not only irritates the cows but may also spread disease among livestock. Moo-che out is an interdisciplinary research project that combines mathematical modelling and forensic science. UOIT's forensic science department has determined, from a variety of farm visits and lab work, a list a volatile compounds common in dairy barns that tend to yield strong responses in flies. This research began by estimating concentration profiles for "attractive" and "repulsive" chemicals in a barn. Then, the fly's movement can be modelled within the known concentration profiles. With a mathematical model used to estimate the diffusion of the chemical through the barn, the fly's movement as a response to the concentrations can be estimated. With the implementation of attractants and repellents at particular locations, fly's can be driven in or out of the barn, or to a particular location where a trap can be placed. This fly control can help to reduce the damage that fly populations have on dairy farms. Reduction of flies would be safer for the cows, allow for larger dairy yields, and be of economic benefit for dairy farms.

FACULTY OF SCIENCE

POSTER 49

Research Team: Jacob Morra

Supervisor: Dr. Mehran Ebrahimi

Title: Analysis of Deep Convolutional Neural Network Architectures for Medical Image Segmentation

The purpose of this research project was to first gain an understanding of Deep Convolutional Neural Networks (CNNs) for medical image segmentation, and after that to provide some analysis on the gold standard medical image segmentation architecture (U-net) with some modifications and ensembling on a particular dataset. The dataset chosen for this analysis is from a Kaggle competition entitled "Ultrasound Nerve Segmentation," for identifying nerve structures in ultrasound images of the neck. The research was carried out by storing datasets on a shared remote workstation and training CNNs using an Nvidia GeForce Titan X graphics card. This research hopes to provide analysis on U-net as a standalone architecture and in an ensemble for the same dataset, and is meant to benefit researchers and educators interested in the areas of medical image segmentation and imaging whereby an ideal Deep CNN architecture is desirable for optimal accuracy and efficiency in various segmentation problems.

POSTER 50

Research Team: Adaobi Obua, Nadia O. Laschuk, Jade Poisson, Jacquelyn G. Egan, Holly M. Fruehwald, Iraklii I. Ebralidze, Bradley Easton, Franco Gaspari,

Supervisor: Dr. Olena Zenkina

Title: Monolayer Terpyridine-Based Electrochromic Materials on Fluorine doped Tin Oxide (FTO) Nanosurfaces: Effect of Fluorine Doping and Extended Conjugation.

This study presents the development of a series of novel electrochromic materials (ECM's) that demonstrate excellent colouration efficiency, redox activity and significant lifetime stability. The novel ECM's were designed using monolayers of various 2,2': 6',2-terpyridine (Tpy) Fe(II) complexes on fluorine-doped tin oxide nanoparticles (FTO NP's) solid supports. Each terpyridine ligand contained a 4'-phenyl pyridine-derived substituent on the 4'position including pyridin-4-yl vinyl and pyridin-4-yl ethyl substituents. The terpyridine core was used due to its well documented high affinity for iron. The conductive thick solid supports were prepared by screen-printing FTO NP's onto FTO/glass substrates. Functionalization of the FTO solid support allowed chemisorption (also facilitated by the pyridine group) of the Fe(Tpy)2(II) complexes onto a chlorobenzyl-terminated silane layer. Cyclic voltammetry, chronoamperometry, UV-visible spectrophotometry and spectroelectrochromic analysis were used to characterize each ECM. CV results indicate good reversibility and fast switching kinetics for the ECM's. The ECM's also showed distinct colour changes depending on the oxidation state of iron in the metal terpyridine complex.

FACULTY OF SCIENCE

POSTER 51

Research Team: Spencer Bryson, Lachlan Johnston, Mehdi Kargar, Morteza Zihayat

Supervisor: Dr. Jaroslaw Szlichta

Title: Robust Team Formation in Expert Networks over Big Graph Datasets

An expert network is a social network containing professionals who provide specialized skills or services. Expert network providers include the employment-oriented service LinkedIn, the software repository hosting service GitHub, and bibliography-based websites such as DBLP and Google Scholar. There has been a recent interest in the problem of finding teams of experts from such networks. Given a project whose completion requires a set of skills, the goal is to find a set of experts which collectively have the required skills and also minimizes the communication cost. We developed a robust team formation model based on random walk with restart. We also provide a fast approximation and a distributed computing model for achieving timely results over big graph datasets. We argue that considering the shortest path measure used in previous works might fail to capture some preferred characteristics for expert networks and might not be an effective indicator to measure the robustness of a relationship in an expert network. We conduct extensive experiments on DBLP and GitHub dataset to evaluate the performance of the proposed approach in various scenarios and compare the quality of results against the traditional shortest path approach.

FACULTY OF SOCIAL SCIENCE AND HUMANITIES

POSTER 52

Research Team: Jennifer Calver

Supervisor: Dr. Hannah Scott

Title: Extending the Duluth Model to Workplace Bullying: A Modification and Adaptation of the Workplace Power-Control Wheel

Bullying in the workplace can have negative implications for the health and wellness of those who have been victimized/targeted by bullying behaviour. Scott's workplace bullying project explores the motivations behind bullying behaviour in the workplace and seeks to assist individuals in identifying and describing bullying behaviour in the workplace by using elements of the workplace bullying Power Control Wheel. The Power and Control Wheel was originally designed to help victims identify patterns of abuse in domestic relationships. This study developed a comprehensive online survey that invites interested participants to share their experiences with bullying in the workplace using both quantitative and qualitative formats. The workplace bullying survey is available to interested participants from August 15th to September 15th, 2018.

POSTER 53

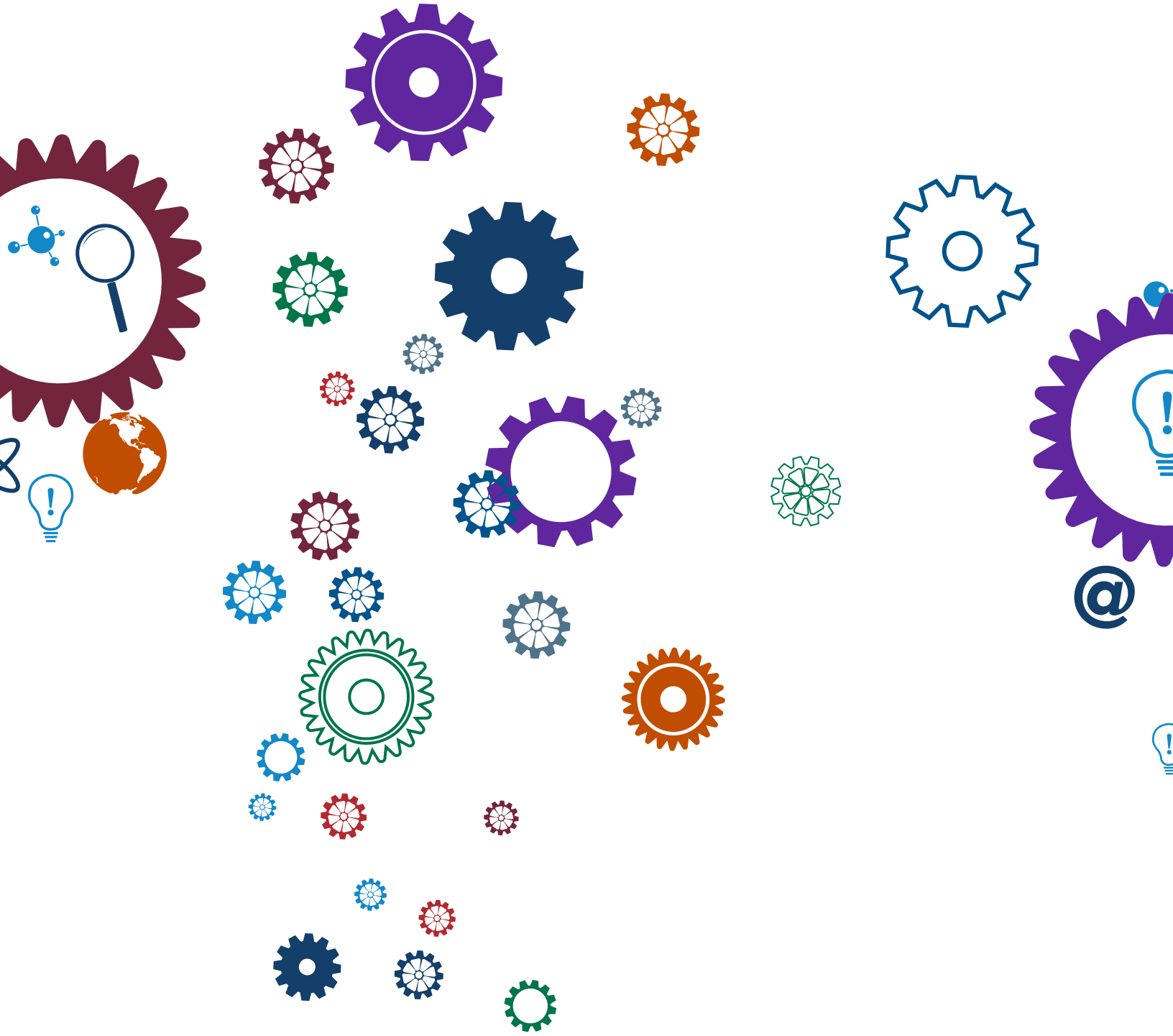
Research Team: Gabrielle Caron

Supervisor: Dr. Kimberley Clow

Title: Public Perceptions of Financial Compensation for Wrongfully Convicted Individuals

With the growing number of exonerations across both the United States and Canada (over 2,000; National Registry of Exonerations, 2018), researchers have taken an interest in the lives of exonerees post-incarceration. As such, studies have been conducted on compensation statutes, stigmatization, and employment difficulties. However, little research has investigated public perceptions of these issues. Public opinion can influence government policies, and thus, one step toward improving assistance for exonerees post-incarceration is to determine whether the public is supportive of such efforts. An online survey, which was part of a larger-scale study investigating public perceptions of wrongful convictions, was answered by 165 participants. The current research project focused on a single question: "What are your thoughts about financial compensation from the government (in the context of wrongful convictions)?" Thematic analysis identified the major themes expressed by respondents, revealing that most respondents share similar opinions on financial compensation as organizations advocating for exonerees' rights (e.g. Innocent Project). The implications for exonerees are discussed, and suggestions for future research are made.

Thank-you for joining us today!



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