Contact:
Dr. Ed Sykes, Director, CMI
905-845-9430 x2490
Ed.Sykes@sheridancollege.ca

Sheridan | Centre for Mobile Innovation

Current Research Projects in the Centre for Mobile Innovation

Clinic of the Future: Augmented Reality for Doctors and Nurses using the HoloLens

Faculty Researchers: Prof. Magdin Stoica, Prof. Sasiprya Arun, Prof. David Horachek, Dr. Rachel Jiang, Dr. Ed Sykes
Student Researchers: Mark Beauchamp, Connor Pick, Christopher Campanelli, Samantha Akulick, Mark Beauchamp, Anh Nguyen, Nicholas Dass, Ethan McTague, Chris Remacle
Industry Partner: Cloud DX (clouddx.com)
Project Description: This research project involves making the Clinic of the Future a reality. Designed for doctors and nurses on the ward, this Augmented Reality (AR) app and supporting patient care centre uses Microsoft technologies and the HoloLens. Industry partner Cloud DX is a progressive medical company led by Anthony Kaul, Robert Kaul and Dr. Sonny Kohli. Dr. Kohli, a physician in Internal Medicine/Critical Care at Oakville Hospital, is co-founder and Chief Medical Officer for Cloud DX. Since August 2017, our CMI research team has worked on this project involving the MS HoloLens and a Clinic of the Future UWP app. The app uses Cloud DX's Vitaliti wearable device to collect a patient's vitals in real-time and presents the information in the HoloLens as augmented panels and holograms. Our work has been aired on the Discovery Channel: https://www.youtube.com/watch?v=uQ5MolP4wxI&feature=youtu.be

A Low-Cost Portable Medical Assessment and Monitoring Kit for Low-Resource Settings

Faculty Researchers: Dr. Tarek El Salti
Student Researchers: Warren Zajac, Cory Da Silva, Chen Tong, Javier Nievas, Skylar Garland
Industry Partner: Tech4Life (tech4lifeenterprises.com)
Project Description: Pneumonia is the leading infectious cause of death in children worldwide. In one year, pneumonia kills an estimated 900,000 children under five years of age, with most of these deaths occurring in developing countries. In this project we are developing a novel and low-cost easily deployed monitoring system (NewPneu). The goal of this system is to assist positively community-based health workers to monitor key signs of pneumonia in children. Especially, the focus is on low-resource settings. Among these signs, SpO2 levels and breathing rates are the crucial factors for the detection of this disease. To meet this important requirement, a new and portable designed board as part of NewPneu collects this data and sends it via Bluetooth 5 to our Android app. Our real life analysis reveals that there are more than 70% significant correlations between NewPneu and a Contec device (i.e., gold standard device). The system costs approximately $10 USD in comparison to other devices that cost thousands of dollars. Currently, we are working on revising NewPneu for COVID-19 due to the strong relationship between pneumonia and COVID.

Fall Detection using Computer Vision, AI and Human Pose Analysis

Faculty Researchers: Dr. Aeiman Gadafi
Student Researchers: Brigham Moll, Muhammad Saleem, Harrison Ubadinobi-Ebili, Alec Di Vito, Jayce Merinchuk, Taha Ifitkhar
Industry Partner: PointClickCare (pointclickcare.com)
Project Description: Aging demographics is a world-wide phenomenon. Increasing pressures from healthcare systems and society are encouraging people to live and stay as long as possible in their homes. However, at home the elderly is especially susceptible to falls and typically the environment does not offer suitable supervision available to respond in a timely manner if a fall has occurred. Often after a senior has fallen many hours may pass before help arrives while the senior lies helpless on the floor. The CMI has created an accurate Fall Detection algorithm with an Natural Language Interaction that uses Computer Vision, AI and Human Pose Analysis to unobtrusively detect if a person has fallen in a home environment and uses natural language processing to talk with the person to either confirm s/he is okay or to notify emergency services and caregivers as appropriate, based on the verbal response.

An Objective Method for Diagnosis of Chronic Pain

Faculty Researchers: Dr. Rachel Jiang
Student Researchers: Nathan Faber-Good, Diana Butek, Harvey Ho, Kellen Evoy
Industry Partner: Karmy Pain Clinic
Project Description: Workplace and Motor accident fraud is a significant problem in Canada. The sums paid out for workplace and motor claims was $15 billion in 2013 in Canada and is substantially higher in other countries. In terms of fraudulent claims, experts have assessed that this represents at least 20% of the total of all such claims. Beyond the ethical, social and financial impacts, these fraudulent claims lead to higher insurance rates for all Canadians as insurance companies pass on the cost to consumers. The ability to accurately distinguish real from fake pain is crucial in the determination of the appropriate level of compensation for a patient that claims to be suffering from chronic pain. In this research project we will address the problem of accurately detecting authentic pain by creating an *Objective Method for Diagnosis of Chronic Pain* system. We will develop and evaluate an automated chronic pain diagnostic system that will output a computer diagnosed pain score with the ability to accurately distinguish real from fake pain. The proposed *Automatic Pain Diagnosis System* (APDS) will enhance patient care and improve clinical practice efficiencies compared to the current use of the manual Facial Action Coding System (FACS) procedure, which is laborious and difficult to use in busy clinical settings. The proposed APDS will outperform a human observer in accuracy and efficiency by using the most advanced 3D technologies and Artificial Intelligence (AI) algorithms such as Deep Convolutional Neural Networks (DCNNs). The Sheridan team, in collaboration with Karmy Clinics, will carry out the design, develop, and evaluate the proposed APDS in the clinic setting of Karmy Clinics.

Addressing critical shortages in health work force through efficient and effective mobile based training for healthcare workers

Faculty Researchers: Dr. El Sayed Mahmoud
Student Researchers: Luiz Fernando Costa, Samina Khaliq
Industry Partner: Nevvon
Project Description: Increasing attention has been drawn to the critical shortages in trained healthcare personnel throughout the world. In North America, there critical shortages in health work force density with a projected deficit of millions of home health care workers Investing in the training and ongoing development of the healthcare work force is considered among the most effective means of improving health outcomes. The scope of this project is to improve healthcare education using advanced technologies through Business Intelligence and developing new mobile apps.

Transforming last-minute care worker capacity into on-demand care for families

Faculty Researchers: Dr. Syed Tanbeer
Student Researchers: Nedaa Alaji, Brigham Moll, George Kopti, Andrew Bordin
Industry Partner: Caribou Health Technologies
Project Description: At Caribou, we are on a mission to improve the lives of everyone in home care. Our technology helps home care agencies transform last-minute care worker capacity into on-demand care for families. We are looking for a passionate part-time developer to join our engineering team. Your work will directly impact the lives of people receiving care, people delivering care, and the families that are often left struggling to care for their loved ones.
Subprojects:
Care Worker Rewards program within existing app, which allows care workers to earn gamified achievements for: Responding quickly to requests, Providing extra availability, Completing their profile details, Recruiting and onboarding families, Posting their agency's job openings to Facebook, and Completing other tasks like mandatory training or COVID-19 screening.
Nurse Field App, which allows home care nurse supervisors and managers to: Monitor care worker performance, See recommended actions they can take to improve care worker performance, Onboard new
Quality Assurance, quality assurance activities for all of Caribou's technologies. The current technologies include Caribou's PRO app, CLIENT app, ADMIN dashboard, and CSA Booking Tool.

Machine Learning in Networking: Network Adaptation and Performance Analysis

Faculty Researchers: Dr. Khaled Mahmud
Student Researchers: Daniel Butts
Industry Partner: Rogers
Project Description: For network operators both 5G and IoT offer huge potential as well as immense challenge. With expected numerous network-connected devices, and orders of magnitude increased available bandwidth to these devices, network operators must plan their network properly to handle the deluge of traffic generated by unforeseen and unpredicted applications of future. Facilitated by advanced processing power, sophisticated algorithms and abundance data, artificial intelligence and machine learning has come to forefront of research and real-life problem-solving applications. This research aims to explore the use machine learning techniques for traffic classification and prediction to assist in network planning and operation.

Enhancing local ambient temperature accuracy using vehicle data

Faculty Researchers: Dr. Alex Babanski
Student Researchers: Harrison Ubadinobi-Ebili
Industry Partner: Geotab
Project Description: High-resolution gridded temperature datasets are extremely important for many modeling applications such as regional climate prediction models, agriculture, and surface transportation systems. Currently, the primary method for gathering air temperature readings is via irregularly spaced weather stations. Most high-resolution datasets use interpolation algorithms to fit temperature curves to the station data or incorporate some models of physical processes into the interpolation methods. One of the most promising possibilities to improve the temperature datasets is the potential to use vehicles as local weather observation systems. Geotab, a Canadian based company, is a global leader in commercial fleet telematics that collect a wealth of information from Geotab's GO device connected to vehicle's computer including the vehicle's location, speed, acceleration, temperature, barometric pressure, and detailed engine diagnostics. Geotab continuously collects temperature data from over two million vehicles in real-time. Due to potential errors in GO device sensor readings, the accuracy of the dataset must be analyzed and improved. In this proposal, Sheridan College's Centre for Mobile Innovation (CMI), with its experience and expertise in the field of data analytics and cloud computing teams will create high accuracy real-time high-resolution temperature datasets desirable for ecological research, weather predictions, and surface transportation systems.

Lifecycle management of phones and mobile devices

Faculty Researchers: Dr. Abdul Mustafa
Student Researchers: Taha Ifitkhar
Industry Partner: SOTI
Project Description: SOTI Inc. develops world-leading technology that solves the unique challenges involved in managing, securing, supporting and tracking remote mobile and desktop computing devices. Today, more than 12,000 customers around the world – in retail, manufacturing, healthcare, government, logistics and numerous other industries – rely on SOTI software products within the mobile device management industry. Companies strive to reduce costs by enabling the central management, security and support of remote mobile field-forces. However, despite the rapid growth and recent success SOTI has had, there are many applied research problems yet to be solved. One of the areas in which SOTI is interested in is *Lifecycle management* of mobile devices. SOTI's main functionality is in their SOTI One app. The platform is an integrated suite of solutions designed to reduce the cost, complexity and downtime related to business-critical mobility. This helps businesses remove functional silos, eliminate downtime, build apps faster, manage all mobile and IoT devices in one place and deliver actionable insights. As the SOTI's platform runs mostly on mobile devices, it is important for SOTI to look after the health of the said devices. The proposed research in lifecycle management of mobile devices will help in two ways: a) monitor the *physical health* of devices using built-in sensors of a smartphone and b) monitor *network security* and safeguard from malicious threats using on-device computing in the form of fog or edge computing.

Tracking and organizing medication information using machine learning

Faculty Researchers: Dr. Ghassem Tofighi
Student Researchers: Ditij Ganguly
Industry Partner: Restech Global

Project Description: In this research project "*Tracking and organizing medication information using machine learning",* we will build a virtual assistant as a mobile application, called *Therapy Tracker*, which will allow smartphone users to detect prescription information on medicine bottles or other containers as well as schedule and track prescriptions to improve the quality of independent living. Despite the rapid growth and recent successes, creating such auto-assistant systems remains a challenging task. The proposed application offers a solution to build such a system that can track and alert users especially elderly about their medications by simply scanning their medication prescription using the smartphone's camera. The application will detect and capture prescription information and provide automated assistance in scheduling, reminders and tracking medications by keeping a list of medications, dosages, refill information, and prescribing documents. Augmented Reality (AR) technologies will be used to provide virtual information that combines real world situations, with virtual information, such as detecting and highlighting the correct medication from a group of them. The virtual assistant will also guide the user through both visual and auditory alerts. The proposed research will be conducted in collaboration with ResTech Global, a company focused on building cutting edge healthcare solutions. Outcomes from this research will include solutions built on the latest machine learning technologies for our industry partner, and training opportunities for Sheridan Computer Science students.

Past Research Projects in the Centre for Mobile Innovation

A Comprehensive Videoconferencing System Designed for Doctors and Patients for Authentic Health Care Service

Faculty Researchers: Dr. El Sayed Mahmoud
Student Researchers: Jayce Merinchuk, Blake Eram, Jaimin Patel, Amiel Satvedi, Ryan Send
Industry Partner: mHealth Solutions (m-healthsolutions.com)
Project Description: This work aims to identify and develop mobile computing services to benefit patients and physicians, while improving health outcomes and reducing healthcare costs. In this project we are developing a healthcare-focused video-conferencing platform that enables online doctor appointments and nursing at distance. This secure custom videoconferencing system promotes ease of use, facilitates exchanging data with EMR(s), and preserves privacy. The system also includes a novel Machine Learning module that assists the physician for diagnosis based on video snippets or images taken during the call.

Using an Innovation EMS (Electrical Muscle Stimulation) Suit for Rehab and Sports Athletic Development

Faculty Researchers: Dr. Alex Babanski, Prof. Paul Bonenfant, Dr. Volodymyr Voytenko
Student Researchers: Harrison Ubadinobi-Ebili, Meggan Do, George Kopti
Industry Partner: Eleway Labs (elewaylabs.com)
Project Description: This research involves using an Electrical Muscle Stimulation (EMS) suit and creating a comprehensive leading-edge user interface for occupational therapists, physiotherapists and/or trainers to record Electromyography (EMG) signals, edit them appropriately for a specific patient or athlete and play them back for effective and safe treatment. There are 3 main challenges: 1) the approach to acquire good EMG waveforms that represent specific training regimes (e.g., bicep curl), 2) the creation of a suitable UI that enables editing of these waves forms in preparation for playback and 3) a playback mechanism that permits manipulation that can be personalized for the recipient receiving treatment (e.g., lower intensity, increased repetitions, etc.).

Innovative Client Portal for Closing the Gap Clientele

Faculty Researcher: Dr. Syed Tanbeer, Prof. Samar Haddad
Student Researchers: George Kopti, Andrew Bordin, Anthony Rella, Nikolai Timan
Industry Partner: Closing the Gap (closingthegap.ca)
Project Description: Closing the Gap Healthcare has been delivering high-quality health care in communities

since 1990. Closing the Gap (CTG) offers a range of services for clients of all ages and are a leader in complex care cases. The CMI developed a responsive client portal which provides a mobile- friendly view for patients to see their upcoming appointments, and details about their care providers. This research involved creating an innovative Mobile Client App Portal using MS Dynamics and leading web technologies. The client portal is currently being pilot tested with CTG's healthcare providers and clients.

IRIS FaceMatch: A Secure and Racial-free Technology for Face-based Identity Search

Faculty Researchers: Dr. El Sayed Mahmoud
Student Researchers: Siraj Hamza, Vanessa Li
Industry Partner: IRIS
Project Description: The significant role of facial recognition technologies in promoting identity-based services and protecting communities is recognized by research and industry sectors. However, the current face recognition solutions can be racially biased. This bias negatively affects the accuracy of recognizing identities based on their face photos. Additionally, the current solutions don't meet the security and privacy requirements of Canadian organizations such as police departments. This project aims to develop a new biometric face recognition model that is able to fix this technology and to allow implementing the security and privacy requirements of such organizations. The ultimate goal of this project is to develop a secure, dynamic and mobile automated system that determines the identity of a person in a photo database efficiently without racial bias. The proposed system will be abstract enough to be used for several applications such as authenticating people to access places based on their face; validating passports by automatic comparison of the actual face photo and the photo in the passport; authenticating people in video conferences to enable remote signatures.