

Artificial Intelligence in Durham Region:

Talent, R&D and Business at Work

Ubiquitous adoption of artificial intelligence (AI) is becoming a reality and as it continues to transform the way organizations and their people work, advanced AI capabilities are rapidly emerging as a strategic imperative.



Durham Region is a hotbed of innovative thinking.”

John Henry,
Regional Chair and Chief Executive Officer
of The Regional Municipality of Durham.

As this plays out, AI researchers, talent, and companies are increasingly choosing Durham Region.

In Durham Region, we are seeing:

- The development of AI programs at our colleges and universities
- Local researchers driving AI research and applications forward
- Innovative technology companies, large and small, establishing labs and commercializing AI

Durham Region is innovating to solve big problems by focusing on some of the world’s biggest challenges. We are building a robust innovation ecosystem that translates research and development assets into jobs and investment.

By supporting innovators in everything from AI, autonomous vehicles, and clean tech to agriculture, life sciences and health we are evolving our business ecosystem, so Durham Region continues to be home to businesses that innovate for good.

We’re full of optimism about what we can do next.

Creating a pipeline of new experts and attracting the world's most talented graduate students

The need for highly skilled workers to develop and maintain a wide range of AI applications is growing rapidly. Research suggests the share of jobs requiring AI skills in Canada has grown by 1,069% since 2013; a faster growth rate than both the UK and US. These jobs are in a variety of industries including finance, cybersecurity, marketing, healthcare and manufacturing. As the technology matures and finds new ways to be used, it is conceivable all industries will have some element of AI in them.

Durham College is on the leading edge of AI talent development. It's **Artificial Intelligence Analysis, Design and Implementation Program**, the first of its kind in Canada, launched in September 2019. With a focus on enterprise AI, including both off-the-shelf solutions and proprietary AI, the program places an emphasis on hands-on learning and training.

Students gain real work experience while solving actual business problems in two ways: work-term assignments with established companies on projects aimed at applying AI in industry and applied research opportunities with the Hub for Applied Research in Artificial Intelligence for Business Solutions, (AI Hub).



The AI Hub was established in 2018 and has since undertaken 16 projects with 35 partners. It offers industry access to technical expertise, state-of-the-art facilities and platforms, and student talent. It helps uncover business insights and provides intelligent and autonomous solutions that increase companies' productivity and growth.

The AI Hub has worked with small and medium enterprises from start-ups to veterans across a range of sectors. When a company has an idea or a challenge, the AI Hub team scopes the possibilities, develops a project plan, and puts together a team of four to five students (plus a faculty lead).

This team typically works four to six months, but sometimes longer, to execute the research and create a prototype.

The AI Hub includes a GPU accelerated computing lab employing leading AI deployment platforms from major cloud and on-premise providers.



Students using AI to teach robots empathy

A group of Ontario Tech University students are using artificial intelligence to train a robot to recognize human emotions and “empathize” with its companion.

If the project is successful, the robot could one day theoretically understand when someone is going through a mental health crisis and could then alert a caregiver, as an example.

“This development of empathy is going to enable the robot to respond to a particular situation,” explained Miguel Vargas Martin, a computer sciences professor at the university. “It learns your state of mind and all the situations you could be in.”

The project is using a Zenbo, a robot companion designed by the technology

company Asus, to read and react to human emotions. The students are utilising a program within the robot that allows developers to code additional features, including added dialogue, expressions and actions. Using this programming application, the students are hoping to “train” the robot to understand human emotions and react to them appropriately.

“We’re trying to combine facial expression with the vocals of the human companion, and the robot should be able to pick up the potential emotions of the human,” Martin said. “We are confident that with AI we should be able to tell with certain margin of error what the human is feeling in any particular time.”

World class institutions lead to transformative R&D projects

The quality and quantity of AI talent in Durham has led to its rise as a destination for leading researchers. Their projects are setting the stage to transform industries and aim to help answer some of the biggest questions the world faces. Two AI projects from Durham Region serve to highlight the synergy between our institutions and researchers.



Lakeridge Health and Durham College team up to predict emergency room wait times

Lakeridge Health (the health system and hospital network serving the Region) and Durham College launched a pilot project to look at whether AI can be used to predict emergency room wait times.

The project's goal is to create a prototype system that can make individual wait-time predictions based on a person's condition, what hospital they are visiting and the time of day and year. The predictions would also consider a person's individual health and factors like staffing, the number of people waiting for care and the urgency of everyone's needs.

“People waiting in the emergency department often feel frustration and anxiety because they don't know how long they will be there or what to expect,” says Dr. Ilan Lenga, Chief Information Officer and Chief Medical Information Officer of Lakeridge Health. “We are pleased to be able to harness the ingenuity of the students and faculty at Durham College to develop a system that will benefit the community and improve people's experiences in the emergency departments.”

The project is led by Durham College faculty researcher, Amit Maraj, and a team of four research assistants from the computer programmer analyst program. The President of Durham College, Don Lovisa, says the collaboration is a chance to showcase how AI can solve real-world problems and has the potential to be “tremendously helpful” for patients.

Enabling Early Diagnosis of Life-Threatening Infection in Premature Infants

Vector Institute (an independent, not-for-profit research institute focused on leading-edge machine learning) and Ontario Tech University in Durham are working on a project to use predictive analytics to detect sepsis in infants through machine learning.

Sepsis is a life-threatening condition where bacteria grows in the blood stream, resulting in a severe widespread inflammatory response. It is one of the leading causes of infant mortality globally. Premature babies have underdeveloped immune systems making them acutely susceptible to infections, which can lead to sepsis. Symptoms appear rapidly and unpredictably and can become fatal within hours. A quarter of preterm infants will develop an episode of sepsis during their stay in the Newborn Intensive Care Unit (NICU) and 10% of cases are fatal.

The project, led by Dr. Carolyn McGregor at Ontario Tech University, is using Artemis, a predictive analytics platform that applies machine learning to help physicians with the critical care of newborns. Once fully implemented, the Artemis system will monitor infants in NICUs, alerting clinicians when sepsis develops before it would otherwise be clinically apparent. Ultimately, Artemis will reduce mortality, morbidity and average length of stay in NICUs.

Early detection of sepsis in newborns has the potential to save many lives. Artemis data can help NICUs better manage the use of antibiotics and reduce the frequency of blood draws from patients. Additionally this research will lead to a new understanding of numerous other conditions and contribute to better outcomes for infants and their families.

Research Spotlight

Dr. Carolyn McGregor, Canada Research Chair (Alumni) in Health Informatics

PhD (Comp Sc), B. App. Sc (Comp Sc, 1st Hons), SMIEEE, MACM

Dr. Carolyn McGregor is the Canada Research Chair (Alumni) in Health Informatics based at Ontario Tech University. Dr McGregor has led pioneering research in Big Data analytics, cognitive computing, and patient journey modelling.

Dr. McGregor has been awarded over \$11 million in research, consultancy and infrastructure funding and has led multiple large research programs including a multi-million dollar First of A Kind (FOAK) research program with IBM. She has over 160 refereed publications, 3 patents in multiple jurisdictions and has established



two start-up companies resulting from her research. She has extensive research collaborations in Canada, the US, Russia, Australia and India. She has also been called upon to advise various government working groups in Canada. Dr. McGregor has received many awards for her research.



Durham Region has emerged as a place the world's scarce AI talent wants to be.”

Business

Artificial Intelligence is the new cornerstone of competitiveness in business. To build their AI capabilities, companies need to attract the best talent and Durham Region has emerged as a place the world's scarce AI talent wants to be. Leading companies are taking notice.

Here is a sample of the companies that have invested in our AI community:

General Motors

Oshawa, ON

Automotive / Mobility - Autonomous Vehicle Systems

GM has an autonomous test circuit slated for Oshawa which will support GM's Canadian Technical Centre (CTC) McLaughlin Advanced Technology Track campuses in Oshawa and Markham. The circuit will enable CTC engineers to develop and test advanced new autonomous vehicle systems like lane-keeping technology to fully-autonomous prototypes. General Motor's product development, infotainment, active safety and trailering teams will also use the track for extensive in-vehicle testing in a safe, effective and controlled environment.



Smartarm

Pickering, Ontario

Healthcare – Machine Learning

Founded by two graduate students, including Hamayal Chaudry of Ontario Tech University in Durham, smartARM has created a robotic hand prosthetic. The robot uses a camera embedded in its palm to recognize objects and calculate the most appropriate grip for an object. Based on machine learning, the more the model is

used, the more accurate it becomes. Smartarm were also winners of Microsoft's 2018 Imagine cup, a global competition with more than 40,000 student competitors.

Ontario Power Generation

Pickering, Ontario

Energy - Artificial Intelligence

Planned maintenance outages are an annual occurrence for OPG nuclear facilities. Each outage requires the scheduling of around 25,000 individual tasks with the majority of these tasks being similar to previous outages. OPG developed their Outage AI solution to predict tasks, including their logical predecessors and successors in order to automatically create the first version of the schedule with all tasks populated.

Using a custom-built, cloud-hosted application that integrates seamlessly with the existing IT infrastructure at OPG, the Outage AI solution leverages elements of AI, machine learning, neuro-linguistic programming and intelligent automation. The Outage AI solution uses eight years of past outage data to create predictions and can also incorporate upcoming outage schedules. This creates a robust solution that actively learns and gets more intelligent as more and more data is processed, delivered and consumed by its underlying algorithms.

ConnexHealth Inc.

Cobourg, Ontario

Home Healthcare – Machine Learning

Launched by Durham College students with support from the AI Hub, Connect Health helps vulnerable citizens (e.g., seniors) connect with a personal support worker, who provides homecare and other services. PSWs can be hard to find in some areas, especially on-demand. Connect Health is employing AI as a key part of a digital platform to help with this problem. Like an Uber driver, PSWs can make themselves available where and when they want to, and like an Uber customer, people who need a PSW can request a PSW at any time. AI, using gathered data, will provide both PSWs and patients with individualized interfaces (like Netflix, etc.) so they can see only what they need to see and easily connect. A beta trial of this technology is currently being conducted in Durham Region (in Ajax).

People and Places

Whitby, Ontario

Information Technology – Cybersecurity Artificial Intelligence

People and Places is using AI to make large-scale cybersecurity available to small / medium-size businesses that otherwise couldn't afford it. Rather than hiring a dedicated employee to monitor what's coming into the network and identify patterns, SMB's can use People and Places's plug and play solution, AEYE, which automates network tracking, network monitoring and threat remediation.



Durham is leading the way in developing technology to solve some of the world's biggest challenges.”

Conclusion

By supporting the companies, investors, entrepreneurs, and researchers that join our AI community, Durham Region continues to encourage innovation.

With AI (and other pioneering programs), Durham is leading the way in developing technology to solve some of the world's biggest challenges. We are building a robust innovation ecosystem that translates R&D assets into jobs and investment while also benefitting society overall.

We're excited to continue playing an important role in the evolution of AI and other emerging technology solutions. Alongside our partners in innovation hubs, post-secondary institutions, and industry, Invest Durham is here to be the magnet pulling everyone together to be a next-generation innovation community.

We're full of optimism about what we can do next.



Invest Durham is committed to working with others who share our vision of building an innovation economy in Durham Region. Alongside our partners in innovation hubs, post-secondary institutions and industry, Invest Durham is here to be the magnet in our community, pulling everyone together to build a next-generation innovation economy.

We are your one-stop shop for business information in Durham Region and are a liaison between the business community, educational institutions and government. Our priorities are to lead, facilitate and support investment attraction and expansion initiatives. Our goals are to create and retain jobs, increase non-residential assessment and promote the region.



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