



# Fostering the Future of Artificial Intelligence:

Report from the York University  
Task Force on AI & Society

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# EXECUTIVE SUMMARY

Technical advances in the last decade have led to an increasing role for Artificial Intelligence (AI) systems in many dimensions of Canadian society, and York University has identified the integration of AI into society as a key area of opportunity for accelerated research.<sup>1</sup> This report summarizes current AI research, teaching and learning activities at York and makes specific recommendations on how to expand and enhance AI-related initiatives in the near future.

The University currently offers more than 80 AI-related courses across six different Faculties, as well as three AI master's programs supported by the Vector Institute for Artificial Intelligence and two AI certificate programs. More than 90 faculty members at York are currently engaged in AI-related research, contributing to core theory and technological applications while also providing broader perspectives, including the impacts of AI on humanity and society. This interdisciplinary approach to AI is aligned with York's role as a leader in research that crosses disciplinary boundaries and is exemplified by initiatives such as the Centre for Vision Research and the Vision: Science to Applications program (Biological & Computational), the Digital Media program (Computing & Arts), IP Osgoode, Osgoode Hall Law School's Intellectual Property Law and Technology program (Law & Engineering), and the Specialized Honours Major in Cognitive Science (Philosophy & Psychology). This comprehensive approach to AI research draws upon York's expertise in engineering and computing, science, health, business, law, social science, the humanities, arts, media, performance and design.

These substantial activities suggest that York has the potential to be a major Canadian centre of excellence for teaching and research in AI.

The Task Force suggests a number of forward-looking steps for the University to implement to achieve this goal:

- York should focus on expanding its faculty complement whose research interests are focused on core technical topics in AI through strategic cluster hiring.
- York should expand its interdisciplinary curriculum initiatives in AI by offering new academic programs and forming new research partnerships within its ten academic Faculties. Current offerings are largely based in Electrical Engineering and Computer Science, the Schulich School of Business, the School for Continuing Studies, Philosophy and Computational Arts.
- York should establish a University-resourced platform, for example an Organized Research Unit, to serve as a nexus for AI research and as a showcase to attract students, partners and donors.
- York should further increase its web and social media presence to highlight AI activities at York.
- York should develop a pan-university administrative structure dedicated to coordinating, growing, and aligning AI instruction and research, ensuring relevance, quality, and measurable achievement.



**AI research at York is highly collaborative, involving more than 30 partnerships with Canadian companies and public agencies, and more than 120 international organizations and institutions.**

1. For York University's Strategic Research Plan, see <https://research.info.yorku.ca/strategic-research-plan-refresh-2018-2023/>



# MAJOR TASK FORCE RECOMMENDATIONS



The Task Force makes the following major recommendations:

## 1. New Organized Research Units (ORUs)

Promote the creation of new interdisciplinary AI-focused ORUs such as AI & Society; Smart Cities & Mobility; Social Robots; and Ethics of Innovation & Emerging Technologies. At least one of these AI ORUs should involve the new Markham campus and engage directly with the AI industry sector in Markham.

## 2. Faculty Growth

Develop a faculty growth plan in AI, with a focus on strengthening York's research capacity in core technical areas of AI and strengthening interdisciplinary AI research in application areas such as health, as well as business, legal, social and ethical dimensions. Markham hires in AI will help strengthen links to the AI industry sector in the Greater Toronto Area.

## 3. Space & Infrastructure

Launch a space plan for AI with a focus on new state-of-the-art research space at both Keele and Markham campuses. This will serve to bring together AI researchers from diverse disciplines, fostering interdisciplinary training of undergraduate and graduate students in AI.

## 4. Teaching & Learning

Establish new interdisciplinary undergraduate degree programs and an undergraduate certificate in AI & Society, as well as a new undergraduate Digital Media specialization in Creative AI.

## 5. Industry Partnerships

Establish a position within Innovation York focused on the creation and maintenance of industry and public sector partnerships in the AI sector. Use the Markham campus as a nexus for partnerships with the Markham industry sector.

## 6. International Partnerships

Establish a position within York International focused on the creation and maintenance of international partnerships in the AI sector.

## 7. AI Start-ups

Establish a program to support York AI start-ups and commercialization and growth of university-based AI technologies, focused on getting student and faculty-led innovation out into society.

## 8. Digital Presence

Establish an up-to-date, dynamic and compelling AI-focused web and social media presence, and a public directory of AI researchers and labs at York.

## 9. Public Engagement

Establish a pan-university AI seminar series and an annual conference for York AI researchers and their external partners. Establish physical showcase facilities that are visible to the public.

## 10. Governance

Establish an administrative office, co-sponsored by the VP Research & Innovation (VPRI) and the VP Academic & Provost, to oversee pan-university AI initiatives and ensure these address equity, diversity and inclusion (EDI) issues.

These initiatives must be implemented in a manner consistent with York's core values, as identified in the University's Academic Plan.<sup>2</sup> In addition to the pursuit of excellence, we must seek to further our goals of equity, inclusivity and diversity, social justice, and sustainability. Implementation of these initiatives over the next five years will ensure that York is established as a major centre for AI teaching, learning and research.

2. For York University's Academic Plan, see <https://www.yorku.ca/uap2020-25/>.

# TASK FORCE TERMS OF REFERENCE

## Context

AI is of great interest to the research world today, driving innovative problem-solving across all fields of endeavour with the potential to revolutionize our daily lives. Both the federal and provincial governments have imagined this potential and invested in the Vector Institute for Artificial Intelligence, intended to spur economic growth by attracting investments and top researchers from around the world who will help to advance AI research, as well as adopt and commercialize AI technologies across Canada.

York can and should play a leading role in this effort, and in many ways is already forging ahead. Given York's proven interdisciplinary strengths, the University is in a unique position to engage with AI in a socially responsible manner, both contributing to core theory and technological applications and providing a broader human perspective, including the impacts of AI on humanity and society. This holistic approach to AI will draw upon York's expertise in computing, engineering, science, health, business and law, as well as our strengths in social science, the humanities, arts, media, performance and design.

## Mission

The VP Academic & Provost along with the VP Research & Innovation commissioned an academic Task Force to develop ideas and examine options for expanding and enhancing AI teaching and research at York. The goal was to engage the university community in a conversation about the current state of AI research, teaching and learning at York, and to seek advice on guiding its future.

## Mandate

In executing its mandate, the Task Force sought to:

- consult with the relevant communities, reviewing the AI landscape at York to gain a better understanding of current strengths;
- consider the overall institutional landscape and formulate a series of recommendations to coordinate the development of AI scholarship, research and academic program opportunities, both undergraduate and graduate, for the institution;
- identify opportunities to build on current strengths including, in particular, the potential for York to undertake a leadership role within AI scholarship, research and academic programming.





# AI TASK FORCE COMPOSITION

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# TASK FORCE FORMATION & CONSULTATION

The Task Force co-chairs constituted the committee, with advice from VPRI and the Provost's Office. An effort was made to draw from the full diversity of Faculties at York engaged in AI research, teaching and learning, including the Lassonde School of Engineering, the Faculty of Health, the Faculty of Science, the Schulich School of Business, Osgoode Hall Law School, the Faculty of Liberal Arts and Professional Studies (LA&PS), and the School of the Arts, Media, Performance and Design (AMPD).

Once constituted, the Task Force collectively identified  
**10 KEY TOPIC AREAS:**

- areas of research focus
- faculty recruiting
- space & infrastructure
- teaching & learning
- ethics of AI
- intellectual property, commercialization & entrepreneurship
- public & private sector partnerships
- international partnerships
- public engagement: websites, social media & seminars
- governance

For each topic area, a working group consisting of two to five Task Force members was struck. Each working group reported back to the Task Force on its topic, allowing for input from all members on all topics. These working group reports were integrated to form this Task Force report, which has been reviewed and discussed extensively by all Task Force members.

The co-chairs presented the Task Force mission and invited input from the Associate Deans Research. Similar presentations and calls for input were made to Faculty Council meetings in the Lassonde School of Engineering, the Faculty of Health, Osgoode Hall Law School and AMPD, as well as the Department of Electrical Engineering and Computer Science (EECS).

Smaller meetings were held with other York stakeholders, including staff from York International and Innovation York.

A preliminary draft of this report was circulated to the deans for their comments.




## WHAT IS ARTIFICIAL INTELLIGENCE?

Artificial intelligence is “the theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.”<sup>3</sup>

The genesis of the field is often traced back to a workshop held at Dartmouth College in 1956 and attended by many of the leading computational mathematicians and scientists of the day.

3. Definition of “artificial intelligence” from the Oxford Reference, <https://www.oxfordreference.com/view/10.1093/oi/authority.20110803095426960>





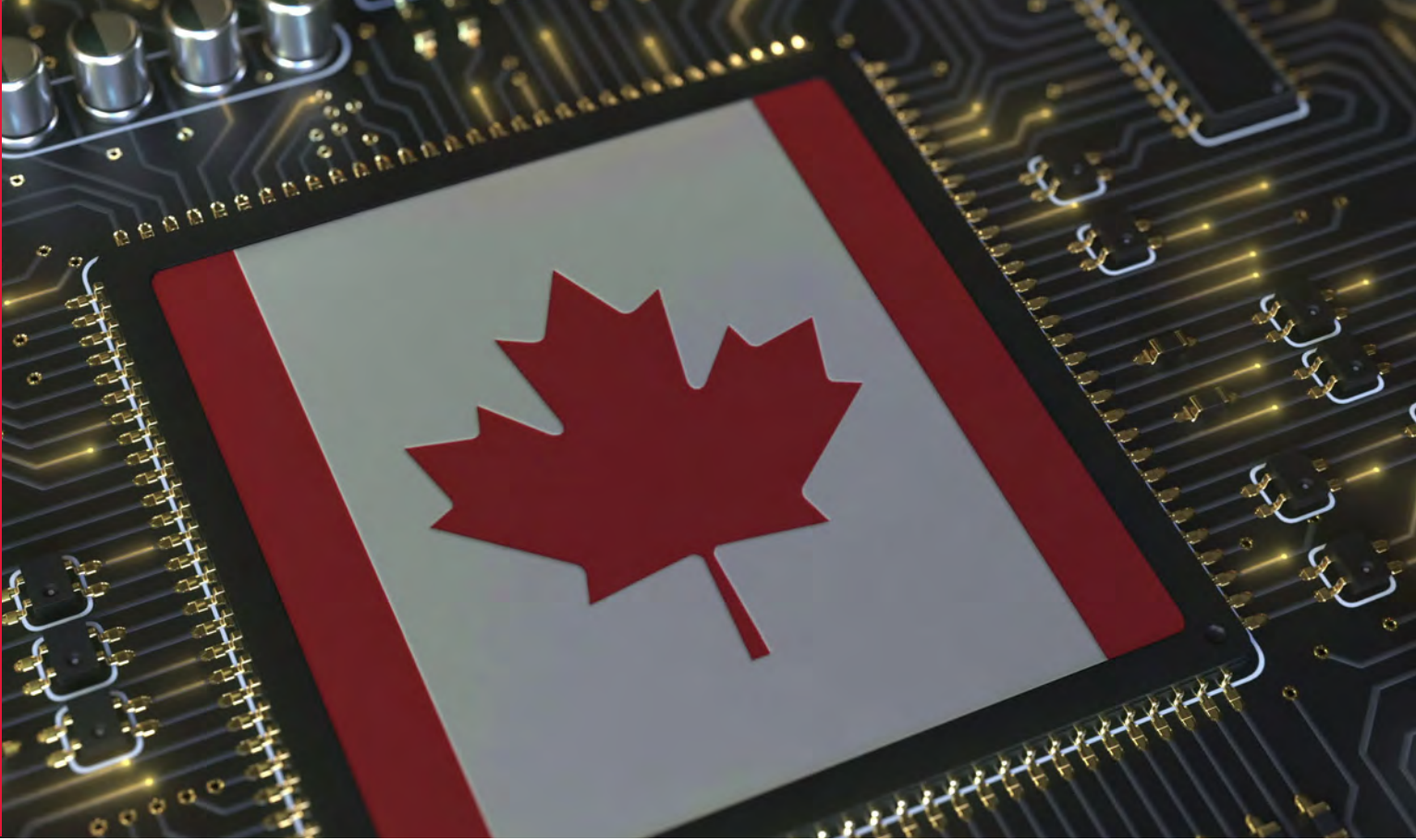
**It is the opinion of the Task Force that in the near and longer term future, important contributions will be made by both reasoning and data-driven approaches to AI, and in particular by a blend of the two, and that unsupervised learning will become increasingly important. In forming this report, the Task Force therefore employed a broad definition of AI, embracing all of these approaches.**

AI systems vary in the degree to which their capacity for inference is explicitly coded by a human versus learned autonomously. In classical rule-based, expert or production systems, knowledge is explicitly entered into a computer system and rules are constructed by human experts. In classical computer vision systems, mathematical knowledge of geometry and probability distributions are coded to make perceptual inferences from raw images.

In machine learning AI systems, inference is made not by rules or mathematical models but by generalizing from training data. In supervised systems, the training data comprises both inputs and desired outputs that should be produced for those inputs. In unsupervised systems, only the inputs are provided, and the system must employ some general principle (e.g. efficient coding) to form representations and useful outputs.

The importance of machine learning within the AI community rose dramatically in the 1990s, partly driven by the availability of larger datasets (“big data”) and faster computers. The last decade has seen an even more dramatic rise to prominence of artificial deep neural networks (DNNs) trained on large labelled datasets to perform classification and regression tasks in fields such as computer vision and natural language processing.

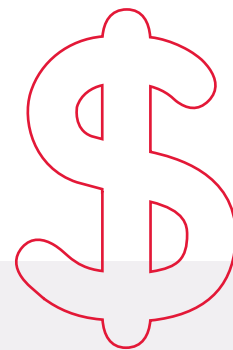
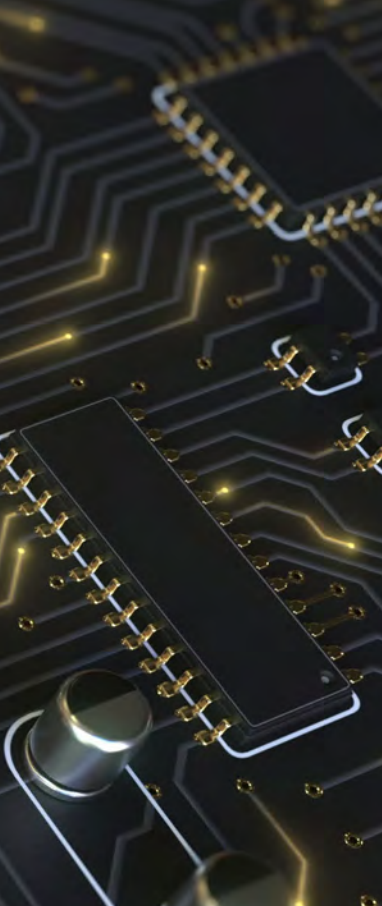
While supervised DNNs have largely driven the current excitement around AI, these systems have drawbacks. For example, they tend to be focused on relatively narrow problems, and it is unclear whether they can scale to produce more general kinds of intelligence. They require enormous amounts of labelled training data, which can be expensive and difficult to acquire. Unlike human intelligence, they may not generalize or adapt well to new inputs that fall outside the range of their training data, making them potentially unreliable, especially for performance-critical applications. Finally, with tens of millions of free parameters, DNNs are not very explainable. This limits the contribution they can make to scientific understanding, and creates social, ethical and legal challenges when DNNs are used to make decisions that affect peoples’ lives.



## CANADIAN CONTEXT

While research on AI stretches back more than 60 years, technical advances in the last decade have led to an increasing role for AI systems in all dimensions of Canadian society, from manufacturing to the financial sector, health care and the creative arts.

The success of these systems has been driven to a substantial degree by the work of Professor Geoffrey Hinton (University of Toronto) and other Canadian researchers. Their successes have provided impetus for federal and provincial funding to ensure the continuing health of the AI research community in Canada, and to promote translation to important application areas. In March 2017, the Government of Canada launched the \$125 million Canadian Institute for Advanced Research (CIFAR) Pan-Canadian AI Strategy, working in partnership with three newly established AI institutes – the [Alberta Machine Intelligence Institute \(Amii\)](#) in Edmonton, the [Montreal Institute for Learning Algorithms \(Mila\)](#) and the [Vector Institute for Artificial Intelligence](#) in Toronto. Located at MaRS, Vector is focused on machine learning and specifically deep learning.



**The CIFAR Pan-Canadian AI Strategy has four major goals:**

- To increase the number of outstanding AI researchers and skilled graduates in Canada.
- To establish interconnected nodes of scientific excellence in Canada's three major centres for AI in Edmonton, Montreal and Toronto.
- To develop global thought leadership on the economic, ethical, policy and legal implications of advances in AI.
- To support a national research community on AI.

## **May 2017**

As part of a \$950 million superclusters initiative, the Government of Canada launched Scale AI, a \$290 million university–industry initiative to utilize AI and robotics to build more intelligent supply chains for Canadian industry

## **October 2017**

Ontario government announced a five-year plan to increase the number of post-secondary students graduating in the STEM disciplines by 25 per cent, investing \$30 million and partnering with the Vector Institute to specifically increase the number of AI-related master's students to 1,000 graduates per year

## **December 2018**

Canada hosted the G7 Multistakeholder Conference on AI in Montreal.

## **March 2019**

University of Toronto announced a \$100 million donation to establish the Schwartz Reisman Innovation Centre, which will focus on AI, biomedicine and the intersections of society and technology.

## **October 2019**

Bank of Montreal (BMO) donated \$5 million to the University of Toronto to establish the BMO Lab for Creative Research in the Arts, Performance, Emerging Technologies and AI.



# TOPIC AREA REPORTS

The following 10 sections summarize the findings of the Task Force in 10 key topic areas judged as critical to expanding and enhancing AI research and teaching at York:

- Areas of Research Focus
- Faculty Recruiting
- Space & Infrastructure
- Teaching & Learning
- Ethics of AI
- Intellectual Property, Commercialization & Entrepreneurship
- Public & Private Sector Partnerships
- International Partnerships
- Public Engagement: Websites, Social Media & Seminars
- Governance

Each section is organized into two parts:

- 1) **STATUS REPORT**,  
summarizing current AI activity at York under the topic area, and
- 2) **RECOMMENDATIONS**,  
providing proposals for how to enhance and expand this activity in the near future.



# AREAS OF RESEARCH FOCUS



## STATUS REPORT

With its interdisciplinary network of scientific, engineering, societal, ethical and legal researchers, York University is harnessing the power of AI to address the many important challenges facing our society today. This research is broadly distributed across Faculties and Departments (see Fig. 1 and Appendix A). AI-related research forms an important dimension of some organized research units (ORUs) at York, including the Centre for Innovation in Computing; the Centre for Research in Earth and Space Science; the Institute for Research on Digital Literacies; Sensorium: Centre for Digital Arts and Technology; and the York Centre for Vision Research. AI-related research is also an important component of many specialized programs at York, including IP Osgoode, Osgoode Hall Law School's Intellectual Property (IP) Law and Technology Program and the IP Innovation Clinic.

Research concentrations range from the development of new brain-inspired AI systems, through application to smart cities, disaster management, emergency planning and disease transmission models, to novel legal and governance frameworks. A key focus is the research and development of next generation intelligent and interactive AI systems that can work closely and adaptively with humans.

AI research at York aligns with the University's emphasis on creativity, innovation and global citizenship, and its reputation as a leader in research that crosses disciplinary boundaries.<sup>4</sup>

**York will continue to build bridges linking breakthroughs in the science and technology of AI to application domains addressing critical societal needs, while advancing our understanding of the ethical, legal and governance dimensions of this transformative technology.**

### **Specific topics for AI research at York include:**

#### **Technical Foundations**

- AI theory
- Machine learning
- Deep learning
- Data mining

#### **Computational Cognition**

- Computer vision
- Speech processing
- Natural language processing

#### **Health & Science**

- Computational neuroscience
- Epidemiology
- Structural chemistry

#### **Engineering**

- Smart cities
- Water resource engineering
- Disaster management

#### **Arts, Media & Design**

- Visualization
- Art & gaming
- Computational creativity

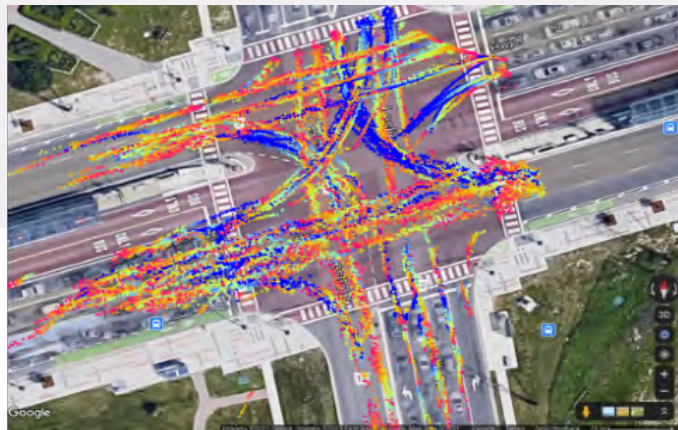
#### **Philosophy**

- Computational theory of mind
- Ethics & fairness of AI
- Cyborg identity and agency

#### **Law**

- Governance, ethics & fairness of AI
- Data policy & intellectual property (IP)
- Surveillance, privacy & AI
- AI tools for IP law
- EDI & human rights issues of AI

4. As noted in the University's Strategic Research Plan, <https://www.yorku.ca/research/strategic-research-plan-2018-2023/>.



Researchers at York have taken advantage of recent AI-targeted research funding opportunities, including the Collaborative Health Research Projects (CHRP) Special Call on Artificial Intelligence, Health and Society.

In the following, we highlight some of the current AI research in selected Faculties and schools at York. This list is far from exhaustive, intended only to provide a flavour of the many diverse AI projects ongoing at York.

## LASSONDE SCHOOL OF ENGINEERING

### Electrical Engineering and Computer Science

In most universities, AI research is centred in departments of Computer Science, Electrical and Computer Engineering. At York, Computer Science, Computer Engineering and Electrical Engineering are housed in the Department of Electrical Engineering and Computer Science (EECS) within the Lassonde School of Engineering. Currently, 14 faculty members are listed as AI researchers on the department's website (<http://eecs.lassonde.yorku.ca/specialization/artificial-intelligence/>). In addition, many EECS faculty members work in closely allied research areas, including big data (10 faculty), computer vision (11 faculty), data science (10 faculty) and robotics (4 faculty). Many other EECS researchers outside these core areas use AI methods in their research on diverse topics such as databases, communications and power systems.

### Other Lassonde Departments

AI plays a prominent role in the research activities within other Lassonde departments as well. Examples include big data research on urban hydrology (Civil Engineering), machine learning for 3D scene understanding (Geomatics Engineering) and stem cell research (Mechanical Engineering).

## Major Research Projects

Many of the large collaborative research projects centred in or closely associated with Lassonde have an AI focus. These include:

- **NCRN (2018-2023)**  
A \$5.5 million NSERC Strategic Partnership Grant is funding the NSERC Canadian Robotics Network (NCRN). The Interactive Autonomy theme of the network is led by Professor Michael Jenkin (EECS, Lassonde).
- **BRAIN (2016-2021)**  
A \$4 million Ontario Research Fund – Research Excellence grant established the Big Data Research, Analytics and Information Network (BRAIN) Alliance, led by Professor Aijun An (EECS, Lassonde).
- **ISSUM (2017-2022)**  
A \$4 million Ontario Research Fund – Research Excellence grant established the Intelligent Systems for Sustainable Urban Mobility (ISSUM) project, led by Professor James Elder (EECS, Lassonde; Psychology, Health).
- **DAV (2015-2021)**  
A \$1.65 million NSERC grant established the NSERC CREATE Training Program in Data Analytics & Visualization (DAV), led by Professor James Elder (EECS, Lassonde; Psychology, Health).
- **DITA (2019-2025)**  
A \$1.65 million NSERC grant established the NSERC CREATE Training Program in Dependable Internet of Things Applications (DITA), led by Professor Marin Litoui (EECS, Lassonde; School of Information Technology, LA&PS).



## FACULTY OF SCIENCE

### Mathematics & Statistics

Researchers in the Laboratory for Industrial and Applied Mathematics (LIAM) focus on the integration of non-linear dynamical mathematical models and big data to address real-world applications in ecology, epidemiology and neural dynamics. LIAM researchers co-founded and sponsored a journal and annual international conference on Big Data and Information Analytics (BigDIA).

### Physics & Astronomy

Researchers in the Department of Physics and Astronomy are using AI to understand information processing in the human brain and to build brain-machine interfaces. In October 2019, physics professor Joel Zylberberg was appointed Associate Fellow in the CIFAR Learning in Machines & Brains program.

### Chemistry

Research in computational chemistry involves high-dimensional non-linear regression methods, including kernel ridge regression, local linear regression and neural networks, as well as unsupervised clustering and classification approaches. Advanced data visualization techniques are also important.

## FACULTY OF HEALTH

In 2016, a \$33 million Canada First Research Excellence Fund established the Vision: Science to Applications (VISTA) research program at York. VISTA is deeply interdisciplinary with a strong AI and neuroscience focus. The central scientific question that drives VISTA is “How can neural and/or machine systems be integrated to provide adaptive visual behaviour in real-world conditions?” The Principal Investigator Doug Crawford and roughly 40 per cent of the core faculty are drawn from the Faculty of Health. (Roughly one quarter are drawn from EECS and the remaining from AMPD, Science, LA&PS and Glendon College.)

VISTA has led to many interdisciplinary AI collaborations. For example, researchers from Psychology and EECS are using AI to understand the brain processes underlying human wayfinding and how such processes are affected by age-related cognitive decline.

In May 2019, Psychology researcher Rebecca Pillai Riddell was awarded a \$1.9 million tri-council grant to fund research on the development of AI methodologies to assess infant pain.



*AI for robot disinfection of clinical and long-term care facilities. Collaboration with CrossWing Inc.*

## OSGOODE HALL LAW SCHOOL

Several research groups are working on legal dimensions of AI, particularly intellectual property (IP), data ownership, data mining, governance and access, privacy, algorithmic accountability, web development and the law, AI and the use of big data, internet policy and the gendered or racialized implications of these areas. Other emerging areas of focus include domestic and international human rights; criminal and business regulation (e.g. financial technology and regulation; “smart” contracts; legal and ethical regulation of AI and robotics; and information and communications technology [ICT] regulation) and the future of legal services; and legal education and research (e.g. use of predictive technology in the justice system; access to justice, including online, virtual and remote legal services; implications for disadvantaged groups; professional responsibility; and metrics, data and evaluation of technology in legal education). Researchers at the Osgoode IP Innovation Clinic have also recently developed an AI-Powered Chatbot that makes IP law information more widely available.

## SCHOOL OF THE ARTS, MEDIA, PERFORMANCE & DESIGN (AMPD)

A number of AMPD faculty members, including two current Canada Research Chairs (CRCs) and one former CRC are actively engaging with AI in their research practice. Current projects include the application of AI to computer music composition and improvised performance, AI in interactive art installations and augmented/virtual reality. Shared concerns include computational creativity, which means both the augmentation of human creativity and the autonomous creativity of artificial systems, as well as broader implications of artificially intelligent systems in larger aesthetic and social environments.

## FACULTY OF LIBERAL ARTS AND PROFESSIONAL STUDIES (LA&PS)

AI is a major topic of research in a number of LA&PS departments and programs, including Philosophy, Cognitive Science, Political Science, the School of Information Technology (ITEC), Public Policy and Administration and Administrative Studies. LA&PS faculty members make important policy contributions in the field, from work on how the introduction of AI into health care impacts privacy and informed consent, to the proper ethical training of autonomous vehicles. Research projects in AI & Society include topics related to the nature of distributed cognition; machine learning; the nature of mental states; learning processes; autonomous machines (e.g. vehicles); quasi-autonomous and social robots (e.g. soldiers, caregivers); cyborgs; the transformational nature of technology; health care ethics; big data surveillance and privacy; the technology impacts of social media; superintelligence; disinformation; robot rights; professional ethics for AI research and businesses; algorithmic biases; and economic consequences of labour automatization.

Current externally funded AI research projects focus on diverse applications, including emergency response and disaster management, microinsurance and food processing.

*In 2020, IP Innovation Clinic client Skygauge Robotics secured a \$3.3 million government grant for their patented drone technology.*



## ✓ RECOMMENDATIONS

### FACULTY GROWTH

With its strong reputation in business, law, social science and the humanities, York is well-placed to become an international academic and research leader in the societal implications of AI. However, this vision will only be realized if York also strengthens its research and curriculum in the technical foundations of AI. To be a serious contender in the field of AI, York needs to hire more high-calibre technical AI researchers.

This will be achieved primarily through the hiring of new AI faculty members in the Department of Electrical Engineering and Computer Science of the Lassonde School of Engineering, although the hiring of technical AI researchers in other Faculties (e.g. Science) and departments (e.g. Mathematics & Statistics, Physics) will further strengthen this technical foundation. Measures to increase collaboration between AI researchers in the Lassonde School of Engineering and the Faculty of Science will help to strengthen this technical core.

The Task Force also recommends that, in building its AI faculty complement, York leverage the strong reputation of its professional schools, including the Schulich School of Business, which is now offering two innovative AI-focused master's programs, and Osgoode Hall Law School, which is a leader in scholarship on governance and intellectual property law for AI. The University should also take advantage of its strengths in the humanities, social sciences and fine arts to hire new faculty members with strong AI-based research programs that address the ethics of AI and its impacts on society.

Finally, the University should focus on hiring AI-informed researchers in key application areas of AI, including health care, transportation systems and environmental science. These researchers will strengthen the AI complement in diverse Faculties, including Health, Science and Environmental Studies. AI hires for the new Markham campus will help the University engage with AI-focused companies in the Markham technology hub.

### NEW ORGANIZED RESEARCH UNITS

There are numerous opportunities for new AI-focused organized research units (ORUs). We identify four examples below, and more ideas will no doubt emerge organically as the York AI community comes together. These ORUs align with societal and institutional priorities while complementing activities in existing ORUs such as the Institute for Research on Digital Literacies and the Centre for Vision Research.

The Task Force recommends that at least one of the new AI ORUs involve the new Markham campus in order to fully engage with AI-focused industry in the Markham technology hub.

### AI FOR SOCIETY

AI technologies have the potential to address many important problems and to broadly benefit society. Achieving these benefits entails the bridging of foundational computational and mathematical research to specific application domains in engineering, science, health, law, business, and other fields. There are also significant potential barriers and risks to the adoption of AI technologies, including issues of fairness, equity, privacy, data and IP governance and ownership.

**An AI for Society ORU will bring together researchers in the computational and mathematical foundations of AI with AI applications researchers, application domain experts in engineering, health, law and business, and with legal, social science and philosophy scholars with expertise on the societal impacts of AI.**

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## SMART CITIES / MOBILITY

AI will transform the way that cities work, and ongoing and proposed research in Lassonde (e.g. ISSUM) is contributing to this revolution. But steering these changes towards the public good will require not just technical AI researchers but also social science, health, business, law, humanities and fine arts researchers and scholars. York is already home to the City Institute (CITY), an organized research unit that brings together urban studies researchers from across the social sciences and humanities. A new ORU on AI & Smart Cities / Urban Mobility that draws in researchers from engineering and the sciences as well as business and law could work closely with CITY on smart cities and mobility research.

## SOCIAL ROBOTS

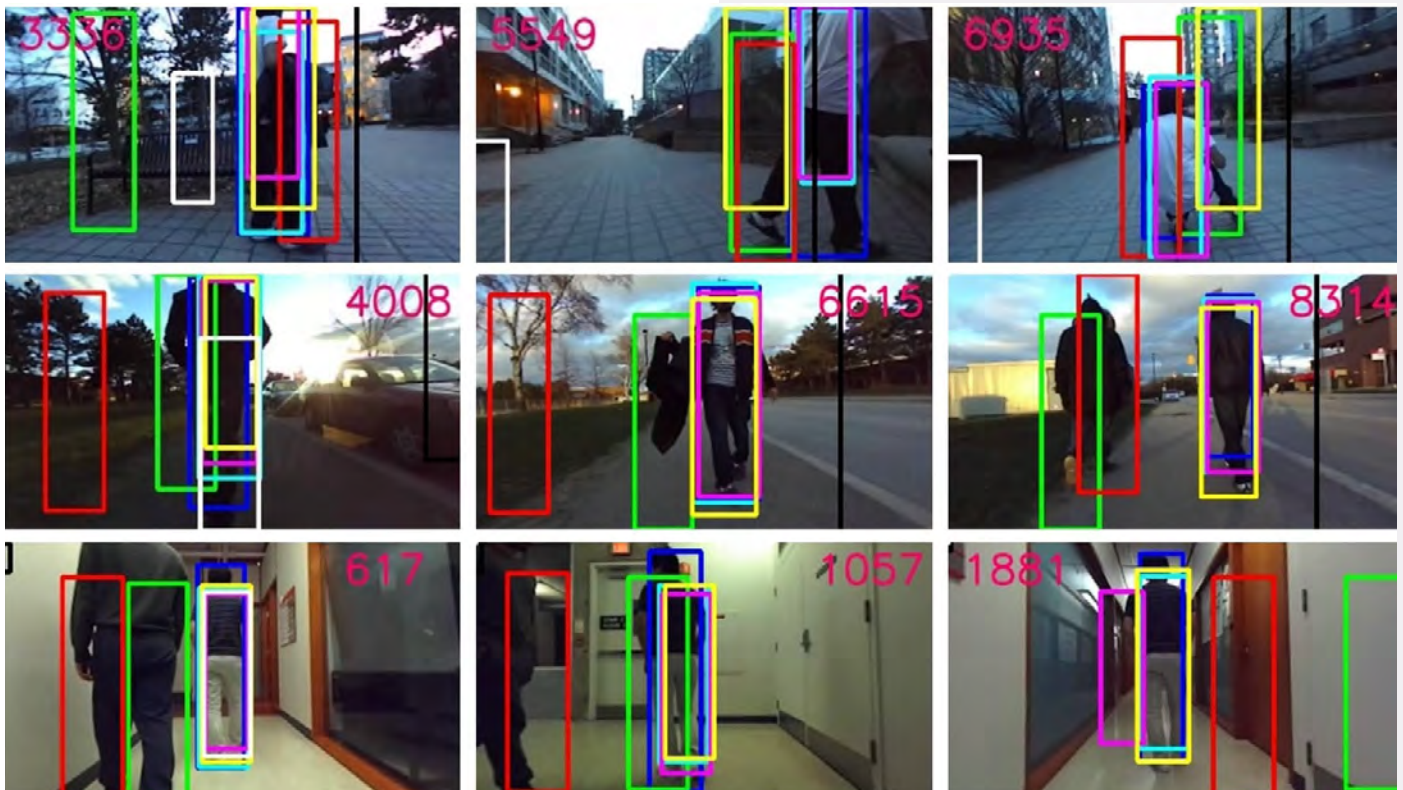
York is home to the Interactive Autonomy Theme of the NSERC Canadian Robotics Network, the Centre for Vision Research and the Vision: Science to Applications program. Together these can form the technical foundation for a new coordinated research effort on social robots. However, some of the most interesting questions in this field are not technical but rather pertain to the opportunities and challenges relating to human health and psychology, and the social, ethical and legal factors that emerge when robots begin working closely with people in their homes and in care facilities. A new ORU on AI & Social Robots will provide an opportunity for researchers to cross disciplinary

boundaries to understand how social robots can have a positive impact on daily lives, particularly for those who need long-term care.

## ETHICS IN INNOVATION AND EMERGING TECHNOLOGIES

Funding opportunities in AI are increasingly tied to the ethical, legal and social implications of the proposed research. This new ORU will allow York to better organize, connect and promote its research expertise across the University in relation to the ethics of innovative and emerging technologies. Beyond providing an institutional platform for cutting-edge policy ideas, this ORU will create and support opportunities for education (e.g. by planning and promoting talks and networking events) and collaboration across disciplines. This ORU will further cement York's commitment to putting ethics first in research and innovation.

*Working with Professor John Tsotsos (Distinguished Research Professor, Canada Research Chair in Computational Vision and VISTA member), students Raghavender Sahdev and Bao Xin Chen built award-winning visually-guided mobile robotics – specifically, a person-following robot that can absorb visual information, then act on it.*



# FACULTY RECRUITING



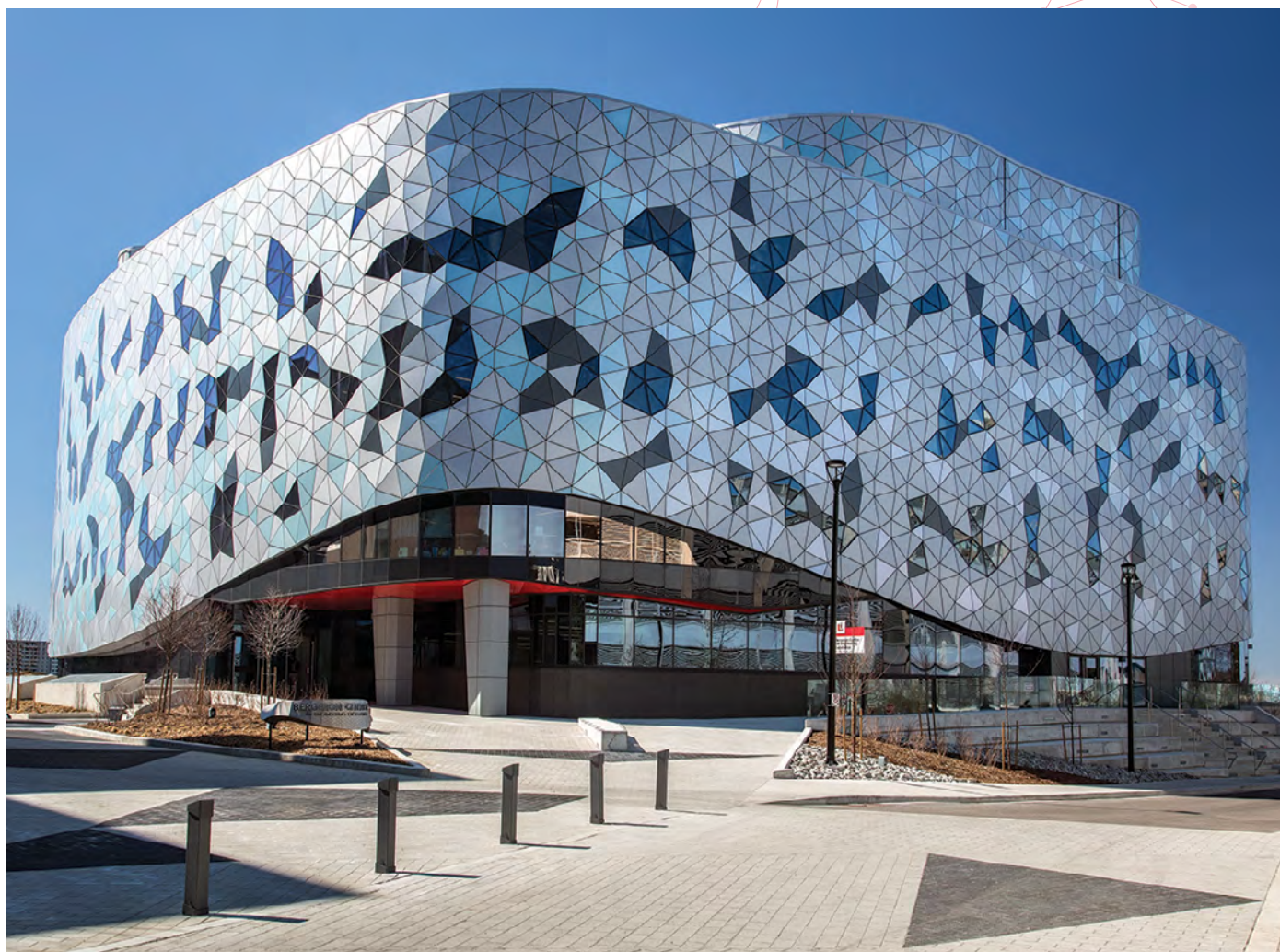
## STATUS REPORT

The deans have been consulted directly on AI-related hiring plans. Individual Faculties have unique recruitment plans and challenges, highlighted below

### LASSONDE SCHOOL OF ENGINEERING

AI is central to research, teaching and learning at Lassonde. While the school seeks to expand in this area, there are a number of challenges it must confront. Several top AI researchers in the school have been recruited by AI labs in the private sector and have taken leaves from York (although some have returned). Recruiting of new faculty members is also extremely competitive for AI researchers in the field of engineering.

Of the seven York professors who are Faculty Affiliates of the Vector Institute for AI, six are in the Lassonde Department of Electrical Engineering and Computer Science (Michael Brown, Marcus Brubaker, Kosta Derpanis, James Elder, Hui Jiang, and Ruth Urner).





## FACULTY OF SCIENCE

Dr. Joel Zylberberg was appointed as an assistant professor of physics and astronomy in 2019. Dr. Zylberberg is a theoretical neuroscientist who uses AI to understand the brain and to build brain-machine interfaces. He is an Associate Fellow of the Canadian Institute for Advanced Research and a Faculty Affiliate in the Vector Institute for AI.

Data science, AI and machine learning are current high-priority hiring areas for the Department of Mathematics & Statistics, and future hires in astronomy and high energy physics are likely to have an AI component. Computational chemistry (e.g. biomolecules, molecular dynamics) employs AI methods, and there is a possibility of expansion in this area.

## SCHULICH SCHOOL OF BUSINESS

Schulich recently hired a data scientist and hopes to hire two new tenure-stream faculty members in AI-related fields in the near future.

## AMPD

The Department of Computational Arts has proposed an AI-related faculty position in “Computational Creativity, Artificial Intelligence in Computational Arts” as a first priority in its complement plan. AMPD has expressed interest in more AI hires.

## LA&PS

The School of Information Technology recently appointed Manar Jamma as an assistant professor. She is an expert on data analytics techniques and machine learning models of network function virtualization and cloud computing.

The Department of Political Science recently recruited Jennifer Pybus as an assistant professor and Tier 2 CRC. She works on the material and representational objects that constitute our lived experiences with AI technologies, and the requirements for creating a civically-minded explainable approach to AI within the context of programmatic advertising.

The Department of Philosophy hired Oisín Deery in 2019 as an Assistant Lecturer. Dr. Deery was awarded a [DECRA \(Discovery Early Career Researcher Award\)](#) by the Australian Research Council for a project on agency and AI in November 2019. The department is also currently recruiting an assistant professor in AI ethics.

## OSGOODE HALL LAW SCHOOL

Osgoode Hall Law School recently recruited a Tier 2 CRC faculty position in Innovation, Law & Society. Joining Osgoode in January 2022, [Professor Valerio De Stefano](#) is a labour law scholar whose research spans areas such as artificial intelligence and work, algorithmic management and digitization and society.



## ♥ RECOMMENDATIONS

A strategic faculty retention and recruitment plan is required to maintain and enhance York's competitiveness in AI. The plan must address the unique challenges associated with AI faculty members, including unprecedented headhunting from industry, the competitiveness of university versus industry salaries, research funding and resourcing.

To meet these challenges, this plan should incorporate mechanisms to facilitate academic–industry co-appointments, increased teaching release to accommodate academic–industry research collaboration, more competitive salaries and spousal hiring. Additional tools that should be explored include earmarking a York Research Chair for AI and collaborating with industry to form an endowed Chair in AI. Collaboration with industry can potentially be incorporated as a positive (but not essential) contribution in unit standards for tenure and promotion. Cross-appointments between Lassonde and the Schulich School of Business in the area of big data and the Department of Mathematics & Statistics (Science) on the mathematical foundations of AI should also be explored.

There are currently 101 Ontario faculty appointed as Affiliates of the Vector Institute for AI. The Task Force recommends that York plan hiring to double the number of York Vector Faculty Affiliates from seven to 14. This will serve to increase York's profile in the AI research community.

The Task Force recommends hiring AI research professors for the new Markham Centre Campus to support research collaborations and internships with AI-focused companies in the Markham technology hub.

# SPACE & INFRASTRUCTURE



## STATUS REPORT

### SPACE

Current AI research at York is scattered across the Keele campus (Fig. 1), with no central hub where faculty members or students can gather. This fracturing of AI activities at York reduces the opportunities for synthesis in interdisciplinary collaborations and community building, diluting the impact that AI at York can have on the campus and the wider community.

### COMPUTING

York has a decentralized computing infrastructure. However, York is a member of the Shared Hierarchical Academic Research Computing Network (SHARCNET), which is a member of the Compute Canada national high-performance computing platform. While originally providing more traditional supercomputing resources, SHARCNET now offers substantial GPU computing resources useful for deep network research.

In its research, the Task Force found that York AI researchers perceive SHARCNET GPU resources to be difficult to access and cumbersome to use, and thus tend to rely on their own local workstation GPUs. However, it is possible that some of the reluctance to access SHARCNET resources may stem from lack of familiarity or outdated experiences.

### ROBOTICS

York professor Michael Jenkin leads the Interactive Autonomy theme of the new Canadian Robotics Network. The facility is based in the Sherman Health Sciences building, and maintains a number of outstations across the Keele campus.

There is strong interest within the LA&PS research community in establishing a centralized laboratory for social robot research that could support the work of researchers studying the social and ethical implications of how AI is used in our homes and workplaces.

### DATA

York's recent IT Strategic Plan *[Towards the Digital University](#)* contemplates the housing of big data and envisages the creation and management of a centralized data warehouse. This is important for data accuracy and governance, including intellectual property ownership, privacy and cybersecurity. In the legal domain, IP Osgoode is already working on these questions together with leading university hubs, including CodeX: Stanford's Center for Legal Informatics and the Berkman Klein Center for Internet and Society at Harvard University.

In taking these next steps, York may wish to look to Simon Fraser University, which already has a big data initiative (<http://www.sfu.ca/big-data>), comprising:

- **a big data consulting service**  
(which includes advanced research computing, data visualization, digital humanities support and research data management)
- **workshops and events**
- **academic programs**
- **partnerships**

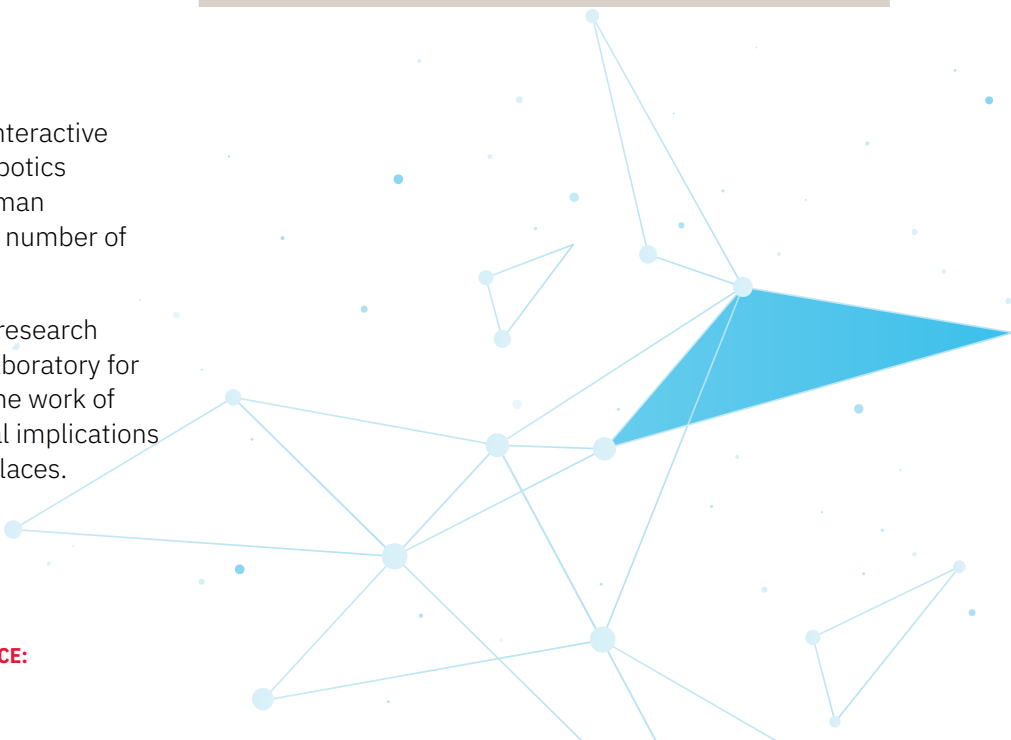
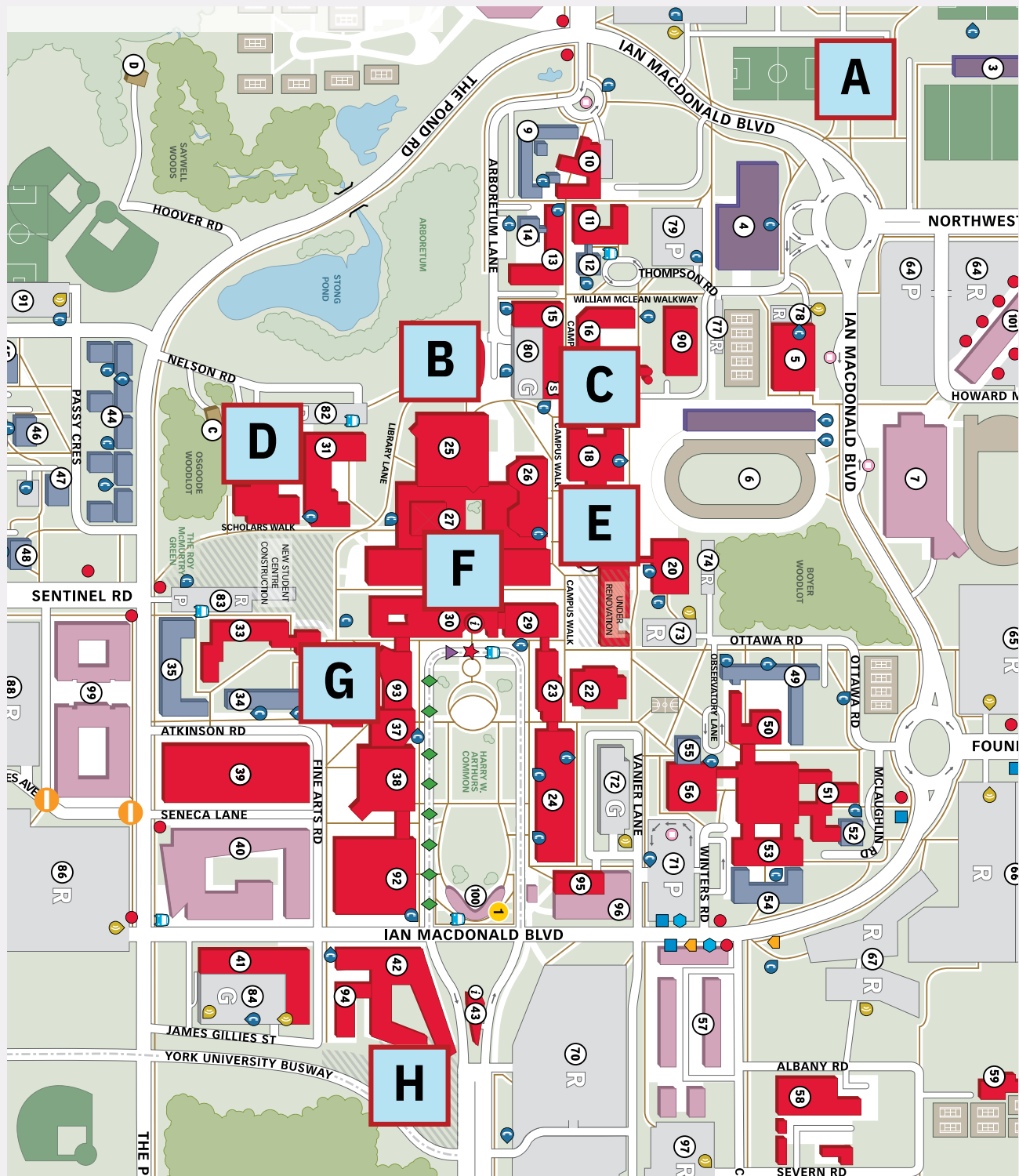


Figure 1. Clusters of current AI research activity at York (Keele campus).  
The legend indicates the building name as well as the Faculty, Department or research activity housed there.



**A Sherman**  
- CVR, Robotics

**B Bergeron**  
- Engineering

**C Petrie**  
- Geomatics

**D Osgoode Hall**  
- Law, IP Osgoode,  
IP Innovation  
Clinic

**E Lassonde**  
- EECS, CVR, VISTA

**F Ross**  
- Philosophy

**G Goldfarb**  
- AMPD

**H Schulich**  
- Business



## ✓ RECOMMENDATIONS

### SPACE

Modern research is an intensely social activity, and the design of space in which researchers from varied disciplines can come together to collaborate is critical to realizing potential synergies.<sup>5</sup> This is particularly important if York's AI strategy is to focus on interdisciplinary collaboration between AI researchers in computing, mathematics, science and health researchers in important application domains, as well as researchers on the social, ethical, legal and management dimensions of AI & Society. This will also be important to support interdisciplinary curricula to train students in both the technical and social dimensions of AI technologies at both undergraduate and graduate levels. Finally, physical space that may be branded as AI@York will be important in establishing and promoting York as a centre for AI research and education.

**For these reasons, the Task Force recommends that the University launch a space plan for AI with a focus on bringing together AI researchers from diverse disciplines and fostering interdisciplinary training of undergraduate and graduate students in AI.**

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The Task Force believes that this plan will accelerate and raise the profile of AI research at York. A comparison can be made to the growth and success of York's interdisciplinary Centre for Vision Research (CVR). Centralized space for the CVR was established in 2000 (Lassonde Building) and 2010 (Sherman Building). This physical foundation was instrumental in securing the \$33 million Canada First Research Excellence Fund award that in 2016 led to the creation of the Vision: Science to Applications (VISTA) program, and to establishing the CVR as one of the leading and best-known centres for vision research in the world.

As another example, the innovative Bergeron Centre for Engineering Excellence has served to enhance the visibility and reputation of the Lassonde School of Engineering.

New AI facilities should provide lab and office space for current and future AI researchers within the Lassonde School of Engineering, serving to strengthen York's reputation as a leader in the technical foundations of AI. These facilities should also accommodate researchers from the other Faculties and schools doing research on applications of AI, as well as the business, management, legal, ethical and societal dimensions of AI. As an example, establishing a central laboratory for social robot research will facilitate collaboration between machine learning, computer vision, robotics, health, psychology, kinesiology and social science researchers and lead to important applications in clinical and industrial sectors. This aligns with York's vision for linking breakthroughs in the science and technology of AI to application domains addressing critical societal needs, while advancing our understanding of the ethical, legal and governance dimensions of this transformative technology.

New facilities should provide space for public engagement, including areas to showcase research and a seminar space that will facilitate interactions with public and private sector partners as well as the wider AI community in the Greater Toronto Area.

The Task Force notes that AI is currently central in the public mind, suggesting that there may be development (donor) opportunities for York. Indeed, a \$100 million donation to create the Schwartz-Reisman Institute for Technology and Society at the University of Toronto was announced in March 2019. While a major focus of this University of Toronto initiative is biomedicine, there are many other dimensions of society where AI is having a major impact, including social robots, urban mobility and the ethics of technologies. The AI@York space plan should be used to attract donations and to formulate AI-based Canadian Foundation for Innovation (CFI) proposals based on these and other areas of impact that may be receiving less attention at other institutions.

5. See, for example, R. N. Goldstein, "Architetur Design and the Collaborative Research Environment," *Cell* 127 (2006): 243–46. See also, Liam Mitchell, "Space Force: Can the Design of Research Space Facilitate Collaboration?" UofTNews, September 24, 2018, <https://www.utoronto.ca/news/space-force-can-design-research-space-facilitate-collaboration>; Amy Adams, "Building Collaboration," Stanford News, December 14, 2015, <https://news.stanford.edu/features/2015/clark/>; David L. Chandler, "An Open, Collaborative Space," MIT News, March 11, 2010, <https://news.mit.edu/2010/media-lab-research>.

*Rendering of  
York Markham Campus*

## **YORK KEELE & YORK MARKHAM: TWO CLOSELY CONNECTED AI HUBS**

To achieve the above goals, the Task Force recommends that York establish two closely connected AI hubs: one at the Keele campus and one at the new Markham campus.



*[Credit: Diamond Schmitt Architect]*

**The new Keele campus AI hub is essential to fully realizing the potential of current AI research and curriculum at York – to better connect existing activities in diverse Faculties and position the University for future interdisciplinary academic programming and large-scale, multidisciplinary collaborative research programs.**

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A natural home for the Keele campus AI hub is the new Engineering and Science building currently in the planning stages. This will be a large building (225,000 square feet or more) in close proximity to other Science, Engineering and Health buildings. The current proposal is based upon [Society 5.0](#) and sustainable development, in which AI plays a central role. The Task Force recommends that York dedicate a portion of this building to research (including space for one or more new AI ORUs), teaching, entrepreneurship and public engagement in the field of AI & Society. Involvement of both Lassonde and the Faculty of Science will catalyze AI collaborations between researchers in the two Faculties. Integrating teaching and research space for AI will bring undergraduate students closer to AI research activities, enhancing their training experience.

As well as synergizing AI research at the Keele campus, the Keele AI hub will serve as York's AI gateway to partners in downtown Toronto such as the Vector Institute for AI and the University Health Network, as well as partners in Vaughan, such as the new Cortellucci Vaughan Hospital at the Vaughan Healthcare Centre Precinct, where York tentatively plans to establish research and training programs in health informatics.

In addition to the Keele campus hub, the Task Force recommends that York dedicate a portion of the new Markham campus for AI research (including space for one or more new AI ORUs), teaching, entrepreneurship and public engagement. The Task Force notes that all four Faculties contributing to the new campus (LA&PS, AMPD, Lassonde and Science) have substantial AI-related curricular and research activity.

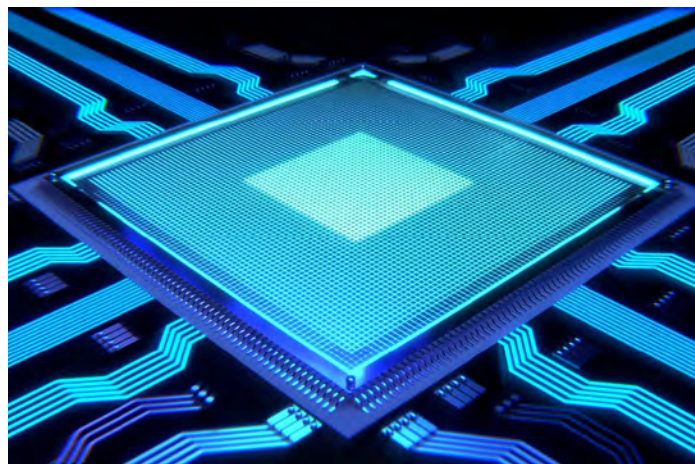
**This hub should have a particular focus on engaging AI companies in the Markham technology hub in collaborative research, internships, professional and micro-credential programs in the AI domain, and working with YSpace Markham and the IP Innovation Clinic on Keele campus to nurture York start-ups in the AI domain.**

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The new campus will include a public gallery on the ground floor, which could serve in part as a showcase facility for York's AI research.

Close connectivity between the Keele and Markham AI hubs can be maintained with regular, convenient shuttles (already planned) and state-of-the-art teleconferencing facilities similar to the "wormhole" portal that provides a virtual connection for staff and students at MIT and Stanford campuses.<sup>6</sup>

Both of these AI hubs will take time to establish. Doors will open at the new Markham Centre Campus in the Fall of 2023, while occupancy of the new Engineering & Science building at York is currently projected to be in the 2025-2028 timeframe. As a bridge to these facilities, the Task Force recommends that York identify interim space at the Keele campus that can serve as a temporary home for AI initiatives such as new ORUs and academic programs.



## COMPUTING

Based on interviews with York AI researchers, the Task Force is confident that over the medium term much of the AI computing at York will involve local GPUs. While these may generally be purchased by individual faculty investigators, there is opportunity to share computing resources across York laboratories within and between research units, and the Task Force recommends that this option be explored.

Deep learning models can be brittle, with software dependencies and incompatibilities that slow research progress as software systems evolve. One advantage of pooling computing resources could be the hiring of expert staff that can assist York researchers with technical issues relating to versioning, mapping between deep learning software environments, optimal mapping to GPU hardware and programming support. The Task Force recommends that the University explore this possibility.

GPU resources are required for technical AI teaching and learning. While currently this is primarily an issue at the graduate level, as AI training migrates into undergraduate programs, demand for GPU computing will increase there as well. The Task Force recommends that the University begin planning for major investments in GPU technology for teaching purposes. The University should also explore whether, given adequate technical staffing, these resources could be shared productively with researchers.

While developing these local computing solutions, the Task Force recommends that the University encourage York AI researchers to increase their familiarity with SHARCNET AI computing resources to ensure that researchers take advantage of this important resource when it makes sense for a project.

6. <https://engineering.stanford.edu/news/wormhole-connects-stanford-and-mit>



# TEACHING & LEARNING



## STATUS REPORT

A university-wide curriculum survey has identified 87 AI-related courses (Appendix B). Roughly 40 per cent of these are offered by the Lassonde School of Engineering, and 30 per cent by the Schulich School of Business. An additional 15 per cent are offered jointly by Lassonde and AMPD through York's Digital Media program. Diverse AI-related courses are also offered by LA&PS, Osgoode Hall Law School and the Faculty of Health.

### LASSONDE SCHOOL OF ENGINEERING

The Lassonde School of Engineering offers many technical AI-related courses at both undergraduate and graduate levels, particularly in the Department of Electrical Engineering and Computer Science (EECS). Topics include AI and machine learning theory and practice, computer vision, robotics, natural language processing and data mining. In addition, EECS offers an Intelligent Systems stream of the BA and BSc Computer Science Honours programs. Many undergraduate and graduate student theses are AI-focused.

In 2018, the Graduate Program in EECS established a Computer Science, Specialization in AI MSc degree. This 20-month program is approved and supported by the Vector Institute for AI. This is not a thesis-based program. Instead, students take six courses, at least five of which are within the area of AI, and complete a practical AI research project in collaboration with a partner in the private or public sector. Graduates are ideally positioned to successfully deploy AI methodologies across many sectors.

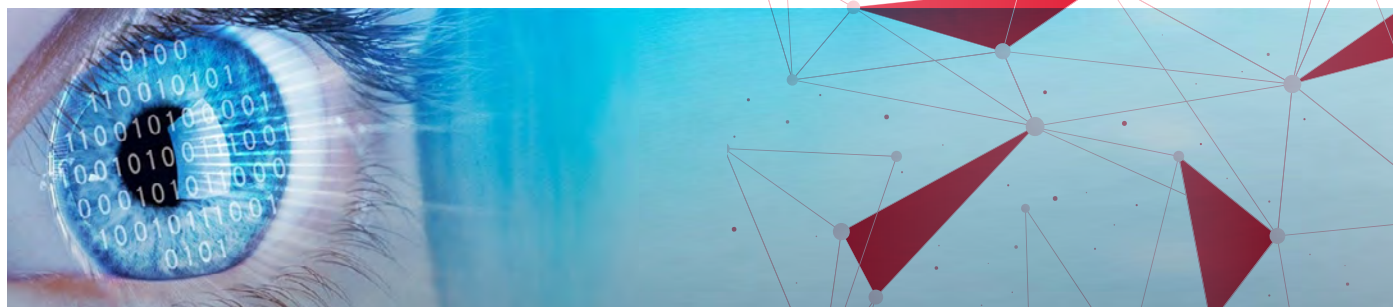
The program has been growing slowly, with two students admitted in 2018, five in 2019 and seven in 2020. The program plans to admit between 10 and 15 students in 2021. Demand is high: last year the program received 167 applications (6 domestic and 161 international).

### FACULTY OF SCIENCE

The Department of Mathematics & Statistics offers many courses that are foundational to AI learning and research. Examples at the undergraduate level include courses in Linear Optimization, Nonlinear Optimization and Stochastic Processes. At the graduate level, there are relevant courses in Data Science and Modern Optimization. The MA Program in Mathematics & Statistics currently offers a Data Science stream and the department is currently proposing a new Honours BSc/BA and Honours Minor BSc/BA in Data Science.

### FACULTY OF HEALTH

The School of Health Policy & Management is currently preparing a proposal for a new field in Health Management and Health Data Analytics and a new professional master's program in Health Informatics within the Graduate Program in Health. These initiatives could lead to future expansion of AI-related health research and curricular programs.





## SCHULICH SCHOOL OF BUSINESS

The Schulich School of Business now offers two AI-related master's programs approved and supported by the Vector Institute for AI: the Master's of Business Analytics (MBAN) and the Master's of Management in AI (MMAI).

The first of its kind in Canada, the MBAN is a 12-month full-time program culminating in a capstone Analytics Consulting Project in which students spend two terms working with real data in service to the community. Mirroring real-world "big data competitions," students complete a hands-on, problem-driven analytics project and develop applicable business solutions. All Schulich MBAN students are awarded the much-coveted SAS™ (Statistical Analysis Software) certification upon completion of the program.

The 12-month full-time MMAI is designed to meet the growing need for professionals with the skills and advanced applied knowledge to develop, evaluate, refine and implement AI-related applications and technologies. The immersive curriculum offers a technical foundation in natural language processing, computational methods and modeling, paired with core business skills. Students explore a critically evolving ethical landscape as they confront moral topics in AI such as algorithmic bias, data privacy and intelligent agent autonomy. The capstone Artificial Intelligence Consulting Project provides students with an opportunity to solve a significant business problem by designing an AI-centred approach.

In both capstone projects, students use the state of the art [Deloitte Cognitive Analytics and Visualization Lab](#) to deliver a solution to a client organization, interacting directly with industry stakeholders.

*Deloitte Cognitive Analytics & Visualization Lab at the Schulich School of Business, York University: The Lab's advanced platforms allow students and researchers to explore advances in predictive analytics, natural language processing, machine learning, artificial intelligence, and visualization.*

## OSGOODE HALL LAW SCHOOL

Osgoode offers several innovative courses covering aspects of AI, and one expressly on AI, dealing with issues such as the impact of AI on democracy, international law and money, payments and cryptocurrencies. The Intellectual Property and Technology intensive program offers sessions on AI and big data, AI and accessibility and AI and disruptive technology. A new pilot Innovation Law program will allow up to 15 Osgoode students to work with the IP Innovation Clinic on AI-related files to help inventors commercialize and scale their IP. Osgoode's new Learning and Leading certificates focus on legal technology and AI. Osgoode Professional Development (Osgoode PD) also regularly offers AI components in its programming, and it offered a master's level course on AI Law & Ethics in the Fall of 2020.

## AMPD

Machine intelligence and creativity is a core theme of the Digital Media BA/MA/MSc/PhD programs, co-run by AMPD Computational Arts and Lassonde EECS, including many AI-related practice-based graduate and undergraduate courses. The Digital Media undergraduate program presents a uniquely integrated and well-established interdisciplinary Art+Science/STEM to STEAM curriculum fusing arts practice and computer science. At the graduate level, two courses fuse AI-related research with practice-based arts pedagogy: Applications of Machine Learning & Artificial Intelligence to the Performing Arts, and Artificial Life, Generative Art and Creative Code. There are several other AMPD graduate courses in which AI has increasing significance, such as Future Cinema.

## LA&PS

The Department of Philosophy offers a Specialized Honours BA program in Cognitive Science that includes a number of courses related to AI. Topics include computational models of cognition, Turing machines, the Turing Test, representation in symbolic and connectionist AI, arguments for and against intelligent or conscious computers and embodied robotics. Core courses required for the program include Minds, Brains and Machines and Philosophy of Artificial Intelligence. The program currently has over 200 students as majors.

The department has also mounted a new graduate course on AI and ethics that services the new AI master's programs in Schulich and Lassonde.

## SCHOOL OF CONTINUING STUDIES

In May 2018, York's School of Continuing Studies announced a Certificate in Machine Learning program. This eight-month program involves a mix of online and in-person courses. Entry into the program requires a minimum second-year undergraduate level understanding of linear algebra, calculus, probability, and inferential statistics, and experience with the programming language Python. The School also offers a certificate in Big Data Analytics.

## ♥ RECOMMENDATIONS

### GENERAL

Curricular initiatives in AI at York should be aligned with York's core values of equity, inclusivity and diversity, social justice and sustainability.<sup>7</sup> As a field, AI tends to be male-dominated. One way to encourage greater involvement of female students in AI at York is to establish interdisciplinary curricular initiatives as collaborations with academic programs that enjoy greater gender diversity. The existing Digital Media program (EECS and AMPD) is a good example. Additional possibilities include undergraduate and graduate programs in computational biology and computational neuroscience. Programs should also be designed to emphasize application of AI in real-world settings, in line with York's increasing focus on experiential education. The Task Force envisions curricular initiatives at multiple scales, including new graduate and undergraduate degree programs, certificates and micro-credential programs.

### GRADUATE

York currently offers three Vector-supported AI programs at the master's level (see above). It should be noted that the MSc in Computer Science with a Specialization in AI is a "terminal" master's program that does not qualify graduates to enter the PhD program in EECS at York. Creation of a thesis-based EECS master's program in AI would serve to attract and recruit top students who wish to continue to the PhD program. At the same time, the Task Force recommends that the university form larger-scale agreements with the not-for-profit national research organization Mitacs in order to expand opportunities for AI graduate students to work with industry during their training.

There is also opportunity for expansion of graduate-level AI training in the Faculty of Science. Many empirical scientists generate large datasets. Graduate students in science programs would benefit from courses in machine learning and data analytics for the natural sciences that provide training on advanced AI methods for extracting key inferences from these datasets. This could be grown into a new master's program, possibly a part-time program that could serve people already working in industry, thus supporting York's objective to expand experiential education.

7. As articulated in the University's Academic Plan, <https://www.yorku.ca/uap2020-25/>





## UNDERGRADUATE

York currently offers some undergraduate-level AI programming (e.g. the Intelligent Systems stream in EECS and the Cognitive Science Honours BA in LA&PS), but does not offer complete undergraduate programs that are explicitly AI.

### New Undergraduate Degrees in AI

To address this gap, the Task Force recommends the creation of two new undergraduate degree programs in AI & Society. One of these will be more technical, focused on the theory and practice of AI, while the other will be more focused on philosophical, societal and legal dimensions of AI. The two programs could share substantial portions of their curricula, leading to graduates with an understanding of both technical and societal dimensions of AI.

#### BSc in Artificial Intelligence.

This program will be rooted in the computer science curriculum offered by EECS, and will prepare students to become technical practitioners of AI. The program will also draw on courses from Science (particularly Math), Health (Psychology), LA&PS (Philosophy), Schulich and Osgoode to provide the required mathematical fundamentals, as well as a broader context on biological forms of intelligence, business applications, and legal, societal and ethical dimensions of AI.

#### BA in Artificial Intelligence & Society.

This will be a broad interdisciplinary program drawing upon courses from the same Faculties as above, providing a level of technical content sufficient for a conceptual understanding of major modes of machine intelligence. The main focus will be on how AI impacts society, how AI systems can be managed to maximize benefits and minimize risks, business applications and ethical and legal dimensions.

### BA in Digital Media (AMPD & Lassonde), specialization in Creative AI

The Task Force recommends a new specialization stream in the Digital Media undergraduate program focused on machine intelligence as it is increasingly applied in, and shapes, the arts and creative technologies. The program currently has three focused specialization streams with distinct curricular pathways, including Digital Media Arts, Digital Media Development and Game Arts. Digital Media faculty members in both Computational Arts (AMPD) and EECS (Lassonde) have expressed excitement and enthusiasm for adding a fourth specialization stream to the Digital Media program, focusing on a spectrum of largely practice-based “creative AI” methods that span creative applications of AI in arts and digital cultures, as well as the design of artificially intelligent systems that are interactively or autonomously creative. This would build upon the extensive AI-related and AI-specific curriculum in the program, both in EECS and Computational Arts. Moreover it aligns with the AI and Arts/Computational Creativity faculty position that is the first-priority in the current Computational Arts departmental hiring plan.

### Cross-disciplinary Undergraduate Certificate in Artificial Intelligence & Society

The Task Force recommends that the University consider a cross-disciplinary certificate in AI & Society, available to a broad cross-section of York undergraduates, which will enhance their marketability in an AI-driven economy. A transcribed undergraduate certificate will help to incentivize students to pursue courses in AI & Society while providing them with a clear map, early in their studies, to navigate the diverse AI-related curricular offerings already available at York (Appendix B).

The Bergeron Entrepreneurs in Science and Technology Cross-Disciplinary Certificate in Technology Entrepreneurship (BEST Certificate) could serve as a blueprint. The BEST Certificate is designed to develop seven key skills in entrepreneurship within a modular framework that can be adapted to multiple Faculties. Analogous skill targets could be identified for AI.

# ETHICS OF AI



## STATUS REPORT

### TEACHING & LEARNING

Ethics is a philosophical discipline and applied ethics is an application of theoretical expertise in a specific context. AI ethics therefore is, and will continue to be, interdisciplinary in nature. Teaching AI ethics requires expertise in AI, theoretical ethics and knowledge of the application area. York's Department of Philosophy has a number of faculty members with this required background.

York currently offers courses with AI and ethics content in Osgoode and Philosophy (LA&PS). Osgoode's popular course, Legal Values: AI, is cross-listed with the University of Waterloo. The new course, Ethics and Societal Implications of Artificial Intelligence, created in collaboration with Philosophy and taught by a philosopher, is a requirement for the MSc in Computer Science, Specialization in AI degree program in EECS and the two new AI-related master's programs at Schulich, the Master's of Business Analytics (MBAN) and the Master's of Management in AI (MMAI).





## ♥ RECOMMENDATIONS

York University, with its expertise in the humanities and the social sciences, has the opportunity to play a leadership role in the development of AI ethics in Canada.

We see three routes for developing AI Ethics@York:

1. Building upon our existing course offerings in AI and ethics to train the next generation of scholars, tech innovators and policy makers by developing new courses in AI ethics.
2. Building upon our existing faculty member strengths in applied ethics by creating a Centre for Ethics in Innovation and Emerging Technologies.
3. Taking a leading role in developing ethical standards for AI research.

## RESEARCH

There are dedicated AI ethics centres in Montreal<sup>8</sup> and Guelph,<sup>9</sup> and the University of Toronto Centre for Ethics has an ongoing lecture series entitled “Ethics of AI Lab.”<sup>10</sup> The University of Toronto also has a Joint Centre for Bioethics (JCB) that is advancing a new initiative called Ethics and AI for Health.<sup>11</sup> This is a series of conferences and events designed to dig deep into the intersection of AI, health and ethics. The JCB has also appointed a research director of AI ethics and health.

Currently, York does not have a centre for ethics or bioethics, and as a consequence, York events related to ethics and AI, such as talks in the Cognitive Science Colloquium series and Schulich’s AI and Ethics symposium, may not receive as much attention as they deserve.

The Task Force recommends that York consider developing an interdisciplinary and introductory undergraduate course focused specifically on AI and ethics. This could be a full-year course, but is more likely to work as two stand-alone half courses (e.g. Intro to AI Ethics I and Intro to AI Ethics II). This would be an innovative and broadly cross-listed elective course with potential for high enrolment. Tutorial leadership/support could be drawn from different departments.

The Task Force recommends that the University consider a new ORU focused on Ethics in Innovation and Emerging Technologies. This new research centre will allow York to better promote events and provide an institutional platform for innovative policy ideas.

The Task Force recommends that the York University Office of Research Ethics be asked to review whether the growth of AI research at York demands any modifications or elaborations of the existing ethics review process.

8. The Montreal AI Institute, <https://montrealethics.ai>.

9. The Centre for Advancing Responsible and Ethical Artificial Intelligence (CARE-AI), <https://www.care-ai.ca>.

10. For more information on the University of Toronto’s “The Ethics of AI Lab” lectures series, see <https://ethics.utoronto.ca/ethics-of-ai-in-context-eaic4e/>.

11. For more information on the JCB Ethics and AI for Health initiative, see <https://magazine.utoronto.ca/research-ideas/health/questions-we-need-ask-about-the-use-of-ai-in-health-care-ethics-of-artificial-intelligence-in-medicine-jennifer-gibson/>.



# INTELLECTUAL PROPERTY, COMMERCIALIZATION & ENTREPRENEURSHIP



## STATUS REPORT

Sound commercialization and entrepreneurship strategies are key to achieving the widest dissemination and societal uptake of new AI technologies and applications.

**Over the last decade, York's strength in the intellectual property, commercialization and entrepreneurship space has been on the rise.**

York's intellectual property policies are inventor-centric, encouraging faculty members and researchers to commercialize their IP.

York University has a thriving AI start-up culture supported by the commercialization experts at Innovation York, YSpace Markham, IP Osgoode, the IP Innovation Clinic and the Bergeron Entrepreneurs in Science and Technology (BEST) labs. Application areas include materials science, drone robotics, attentive vision systems for sports and security, mobility technologies, construction and real estate.

Since 2010, the IP Innovation Clinic at Osgoode has been helping York and the wider community commercialize their AI-related intellectual property. The Federal Government's 2017 National IP Strategy has allocated \$1 million over five years to support such clinics, and additional funds have been deployed for outreach and education through the federal Innovation and Skills Program. IP Osgoode, Osgoode's Intellectual Property Law and Technology Program,

features faculty members and graduate students who are leading research on key IP questions particular to AI; for example, who will actually own and be able to commercialize the products of AI algorithms and AI-generated works? Recent federal funding has supported the development and launch of an AI-powered ChatBot, "Isaac Pewton," to provide free assistance to inventors and entrepreneurs in the IP commercialization process.<sup>12</sup>

## RESOURCES

While York's IP policies are progressive, a recent report identified that additional resources (human and real capital) are necessary for York to ensure that York inventions lead to sustainable business outcomes.<sup>13</sup>

## INDUSTRY

Commercialization of York AI research outcomes involves building relationships with industry. While some researchers have the industry contacts required to maximize the potential of their projects, other do not and rely on York to provide support. In dealing with large companies, outreach to the appropriate technical experts seems to be the primary challenge.

## FUNDING

Venture capital (VC) funding for AI companies in Canada has risen tenfold over the past five years.<sup>14</sup> Still, not all VC companies are friendly to AI start-ups. Other funding models are currently being developed to bolster the start-up and scale-up scene. For example, the University of Waterloo has launched the Velocity program, an investment fund akin to Silicon Valley's YCombinators, which graduated the likes of Reddit, Dropbox and AirBnB.<sup>15</sup>

12. For more on IP Osgoode, see <https://www.iposgoode.ca/>.

13. Pina D'Agostino, *From Start-up to Scale-up: A Report on the Innovation Clinic in Canada*, April 2019, <https://www.iposgoode.ca/2019/04/from-start-up-to-scale-up-a-report-on-the-innovation-clinic-in-canada/>.

14. Isabella Kirkwood, "Another Record Breaking Year for Canadian VC as AI, Fintech, Cybersecurity Reach New Heights," *BetaKit*, February 10, 2020, <https://betakit.com/another-record-breaking-year-for-canadian-vc-as-ai-fintech-cybersecurity-reach-new-heights/>.

15. Terry Pender, "University of Waterloo's Velocity Launches Investment Fund to Support Tech Startups," *Waterloo Region Record*, January 16, 2019, <https://www.therecord.com/news-story/9128477-university-of-waterloo-s-velocity-launches-investment-fund-to-support-tech-startups/>.

## ♥ RECOMMENDATIONS

There are a number of ways in which York can promote the translation of AI innovations to the marketplace.

### YSPACE

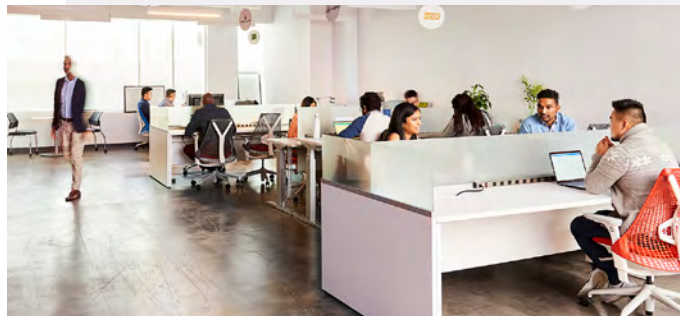
YSpace is York University's entrepreneurship hub. Located at Markham Centre, the home of York's new Markham Centre Campus, YSpace lies at the nexus of the Markham technology hub, the second largest technology cluster in Canada. By establishing a presence in AI research and curriculum at the new Markham campus, York will catalyze collaborative research and internships with AI-focused companies in the Markham technology hub, leading to AI entrepreneurship and commercialization that can be incubated by YSpace.

### IP INNOVATION CLINIC AND IP OSGOODE

The IP Innovation Clinic at Osgoode is increasingly active in commercializing AI-technology and works closely within the University to help support its faculty members and students with very limited resources. Several AI technology-led companies have been founded at York thanks to support from the Clinic. In 2021, York student-led start-up Skygauge Robotics, a client of the Clinic, secured \$3.3 million in seed capital during the COVID-19 pandemic. The Clinic's partnerships with the law firms of Norton Rose Fulbright Canada LLP, Bereskin & Parr and Own Innovation have collectively subsidized almost \$2 million in legal fees, which account for over 6,000 hours of pro bono work.

**IP Osgoode has become a global and domestic brand in all areas of IP and has helped lead the AI conversation with its impactful conferences and initiatives.**

York should continue to support IP Osgoode and the IP Innovation Clinic, which currently lack sustainable operational support, as they continue to forge partnerships and spur further innovation across the AI technology spectrum.



*YSpace Markham, York University's pan-university entrepreneurship hub*

### NEXTAI

York has become increasingly active in NextAI, an accelerator and founder development program for early or idea stage AI-enabled start-ups. Applications from York have increased from 9 in 2017 to 20 in 2018 and 27 in 2019, with one team from York currently enrolled. York should encourage more teams to apply.

### VISTA MODEL

The Vision: Science to Applications (VISTA) program at York has developed an innovative commercialization model that could serve as a template for AI innovation at York. The model involves embedding commercialization experts within the research environment in order to accelerate the translation from bench to market. The Task Force recommends that this model be considered for other AI-focused research centres that develop at York.

### INNOVATION CONFERENCES

York should invest in its own leading innovation conferences, such as IP Osgoode's Bracing for Impact series, and should support AI@York booths at major innovation conferences such as the [Collision Conference](#). These booths will demonstrate the latest AI technologies invented at York, promote York start-ups and foster industry partnerships.

### VENTURE CAPITAL

York should mount an appeal to potential angel investors associated with York University to invest in York AI start-ups. York's Entrepreneurship Council, currently tasked with developing an entrepreneurship strategy for the University, should be consulted specifically about developments and applications in AI.

# PUBLIC & PRIVATE SECTOR PARTNERSHIPS



## STATUS REPORT

The AI industry in Ontario is booming. Ontario is the second largest Information, Communications, and Technology cluster, by number of establishments, in North America. A number of major companies have recently established AI labs in Toronto, including Google, Uber, Samsung, LG, Etsy, Nvidia and Fujitsu. Venture capital funding for Canadian AI companies has risen dramatically from \$51 million in 2016 to \$658 million in 2019.<sup>16</sup>

Many research funding opportunities targeting AI require university–industry collaboration. At York, these collaborations provide internship and employment opportunities for students, contributing substantially to the University’s goal to expand experiential learning.<sup>17</sup> Appendix C lists current AI-related research partnerships between York researchers and the public and/or private sectors. The following are among the more substantial collaborative AI-related projects:

### **VISTA** (2016-2023).

A \$33 million Canada First Research Excellent Fund grant established the Vision: Science to Applications (VISTA) research program at York. The central scientific question that drives VISTA is “How can neural and/or machine systems be integrated to provide adaptive visual behavior in real-world conditions?” The program, led by Professor Doug Crawford (Health) involves 21 industry partners, seven public sector partners, five healthcare partners and 10 institutional partners.

### **NCRN** (2018-2023).

A \$5.5 million NSERC Strategic Partnership Grant is funding the NSERC Canadian Robotics Network (NCRN). The Interactive Autonomy theme of the network is led by Professor Michael Jenkin (Lassonde). The project involves four industry partners and five institutional partners.

### **BRAIN** (2016-2021).

A \$4 million Ontario Research Fund – Research Excellence grant established the Big Data Research, Analytics and Information Network (BRAIN) Alliance. Led by Professor Aijun An (Lassonde), the project involves 12 industry partners, three public sector partners and three institutional partners.

### **ISSUM** (2017-2022).

A \$4 million Ontario Research Fund – Research Excellence grant established the Intelligent Systems for Sustainable Urban Mobility (ISSUM) project. Led by Professor James Elder (Lassonde; Health), the project involves six industry partners, one public sector partner and one institutional partner.

### **DAV** (2015-2021).

A \$1.65 million NSERC grant established the NSERC CREATE Training Program in Data Analytics & Visualization (DAV). Led by Professor James Elder (Lassonde; Health), the project involves 16 industry partners, two public sector partners and three institutional partners.

### **DITA** (2018–2024).

A \$1.65 million NSERC grant established the NSERC CREATE Dependable Internet-of-Things Applications (DITA) Training Program. Led by Professor Marin Litoiu (LA&PS; Lassonde), the project involves 10 industry partners, two public sector partners and six institutional partners.

16. Isabella Kirkwood, “Another Record Breaking Year for Canadian VC as AI, Fintech, Cybersecurity Reach New Heights,” *BetaKit*, February 10, 2020, <https://betakit.com/another-record-breaking-year-for-canadian-vc-as-ai-fintech-cybersecurity-reach-new-heights/>.

17. As identified in the University’s Academic Plan, <https://www.yorku.ca/uap2020-25/>.



There are also opportunities to create AI partnerships with the Cortellucci Vaughan Hospital and Humber River Hospital (HRH), both of which are focused on leveraging data analytics to inform patient care and hospital management. York has entered into a Memorandum of Understanding (MOU) with the City of Vaughan, Mackenzie Health and ventureLAB to identify “transformational opportunities to maximize the best use of the lands surrounding the Cortellucci Vaughan Hospital.”<sup>18</sup> Mackenzie Health and HRH hospitals are not part of the University Health Network and are thus not formally affiliated with another University. A delegation from York led by VPRI visited the Cortellucci Vaughan Hospital in December 2020, and discussions on specific collaboration and partnership opportunities are ongoing.



*Cortellucci Vaughan Hospital*

## ✓ RECOMMENDATIONS

To facilitate growth in AI-related research partnerships, the Task Force recommends that York intensify AI research at the Keele campus to promote participation and partnerships with organizations in Toronto, including the Vector Institute for AI and the University Health Network, as well as health care organizations in the Keele Campus region, including the Cortellucci Vaughan Hospital, the Humber River Hospital and Baycrest Health Sciences.

The Task Force also recommends that York establish a strong program of AI research and curriculum at the new Markham Centre Campus. This will serve to support intensified engagement with AI-focused companies in the Markham technology hub, the second largest technology cluster in Canada. AI entrepreneurship that emerges from this initiative can be managed by YSpace, which is also headquartered at Markham Centre.

In addition, the Task Force recommends the following initiatives to promote public and private sector partnerships in AI research:

- Maintenance of a detailed repository of all past and current partnerships in the AI sector.
- A dedicated Innovation York staff person focused on the creation and maintenance of industry and public sector partnerships in AI.
- An annual AI partnerships conference at York, to which all current and prospective external partners are invited.
- Establishment of a central, shared “AI partnerships” space including meeting rooms and shared labs where York researchers and partner researchers can meet and work together. These spaces should exist both on the Keele campus and also eventually at the Markham campus.

18. City of Vaughan, York University, Mackenzie Health and ventureLAB Sign MOU for Feasibility Study to Create Healthcare Precinct,” YFile, October 2, 2019, <https://yfile.news.yorku.ca/2019/10/02/city-of-vaughan-york-university-mackenzie-health-and-venturelab-sign-mou-for-feasibility-study-to-create-health-care-precinct/>.

# INTERNATIONAL PARTNERSHIPS



## STATUS REPORT

AI research is global in nature. Fig. 2 shows the geographic distribution of papers accepted for the Conference on Neural Information Processing Systems (NeurIPS), widely considered to be the premier AI research conference. The United States is the clear leader, but China, Europe and Canada are all important players.

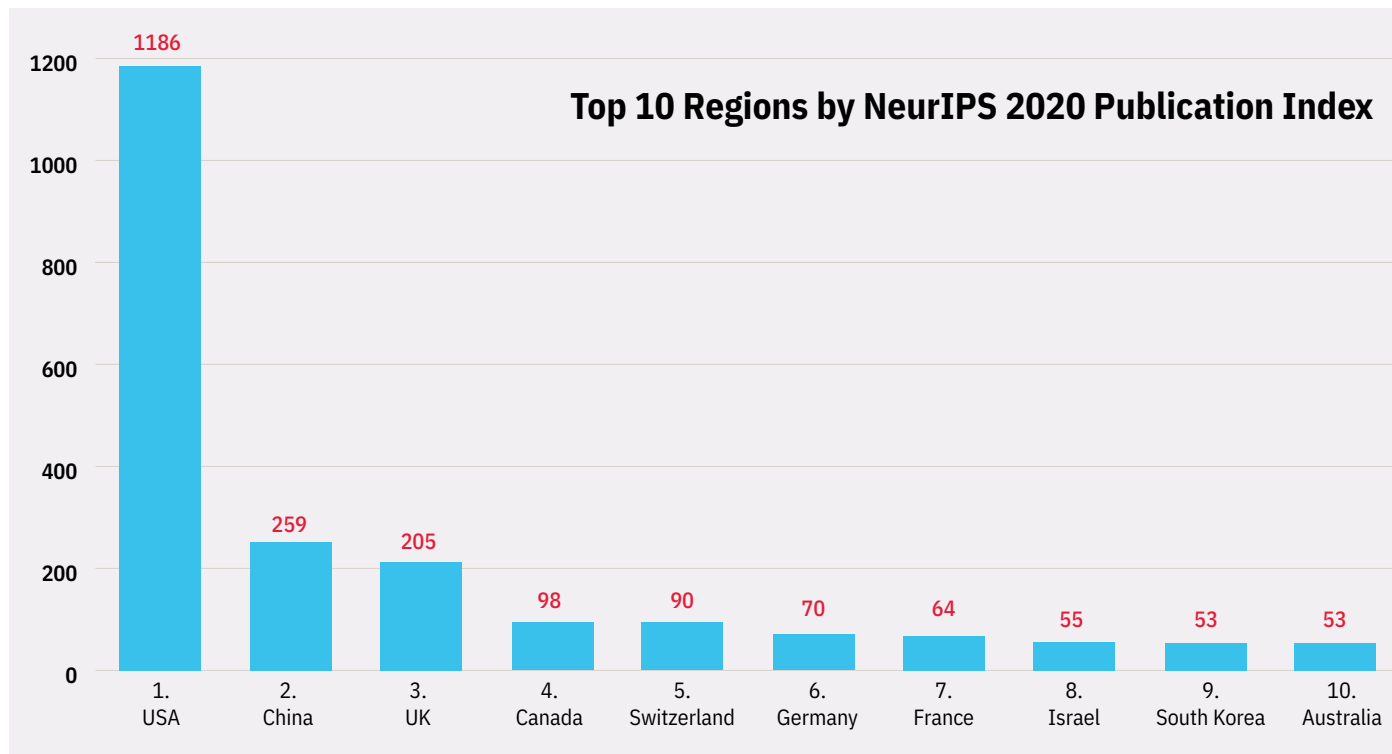


Figure 2. Global distribution of NeurIPS 2020 authors. Source: Sergei Ivanov, “NeurIPS 2020. Comprehensive analysis of authors, organizations, and countries,” *Medium*, October 15, 2020, <https://medium.com/criteo-engineering/neurips-2020-comprehensive-analysis-of-authors-organizations-and-countries-a1b55a08132e>

York researchers currently maintain more than 125 international collaborations and exchange programs on AI-related projects (Appendix D). Students and postdoctoral fellows in the AI sector recognize the international character of AI research and are international in spirit, seeking posts at premier AI research labs in the public and private sectors. Appendix E provides a list of recent international research student visits to York in AI-related research areas.

There have been a number of recent funding opportunities for international AI collaborations. For example, CIFAR, in partnership with France’s [Centre national de la recherche scientifique](#) (CNRS) and [UK Research and Innovation](#) (UKRI), launched an international call for AI & Society workshop proposals in the Fall of 2018, focusing on four themes: 1) working in AI environments; 2) international governance of AI; 3) safety and privacy of AI; and 4) human enhancements. In 2019, the Canadian Tri-Council and UKRI established a program to support joint three-year interdisciplinary AI research projects.

## ♥ RECOMMENDATIONS

The Task Force recommends that York International be resourced to expand and enhance international partnerships in AI research and academic programs. Guiding principles for this effort should include:

- building on existing collaborative efforts and exploring directions of expansion;
- involving multiple faculty members, research clusters and Faculties;
- capitalizing on strengths while also bringing complementary expertise and resources;
- balancing feasibility and sustainability.

These partnerships can involve:

- academic programs: exchanges and joint degree programs at undergraduate, graduate and postdoctoral levels, summer schools and internships, course material exchanges;
- research and technology development: joint scientific workshops, thematic research programs, scientific exchange visits, external funding opportunities;
- reciprocal visits: exchanges among senior administrative teams to discuss management and strategic planning.

There are numerous international institutions that could be good targets for intensified collaboration in AI research. Following are three examples.

### Communications University of China (CUC)

This is a leading centre for digital media research in China, hosting the Key Lab for Media Audio & Video. There are existing collaborations with York University through Matt Kyan (EECS; Lassonde) and Jianhong Wu (Mathematics & Statistics; Science). CUC has expressed interest in creating an MOU and action plan with York, which could include joint degree programs and exchanges. There may be opportunities for collaborations with AMPD and others at York working on virtual and augmented reality and perceptual factors for visual media.

### Xian Jiaotong University

Xian Jiaotong University is one of the top 10 universities in China. The University has a long-term collaboration with York in the areas of Disease Modelling (through the Center for Disease Modelling) and Big Data Analytics. It is one of the three sponsoring and founding universities (along with York and the National University of Defence Technology in China) of an international journal and an international conference series on Big Data and Information Analytics.

The conference series has been held in Xian (2015), Changsha (2016), Toronto (2017), Houston (2018), Kunming (2019), Shenzhen (2020), Chongqing (2021). The conference covers areas such as market and medical data analytics, forced migration and vision data modelling, disaster and emergency information retrieval and rapid simulation.

### University of Bath, UK

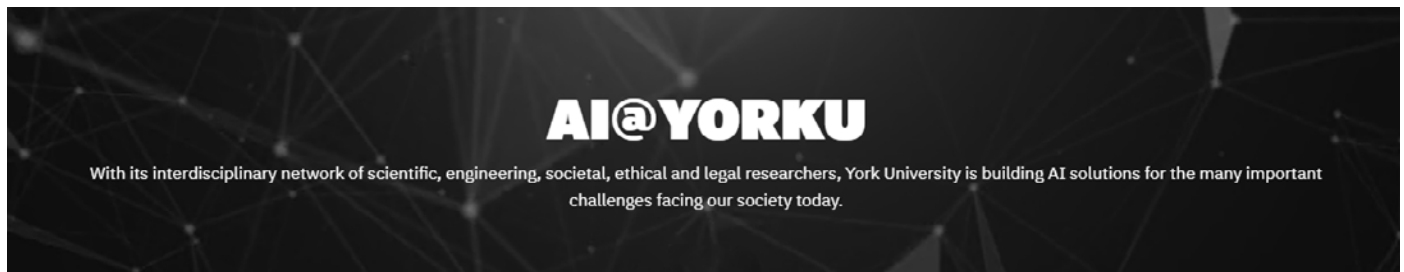
The University of Bath has just received a large amount of funding from the UK government to train 60 to 70 PhD students in AI over the next eight years. The University is also home to the [Centre for the Analysis of Motion, Entertainment Research and Applications \(CAMERA\)](#), which has significant overlap with York's Vision: Science to Applications (VISTA) program. VISTA is currently in discussions with faculty and staff at Bath with a focus on collaboration on AI-related research and PhD training.



# PUBLIC ENGAGEMENT: WEBSITES, SOCIAL MEDIA & SEMINARS



## STATUS REPORT



### WEBSITES

The three externally funded AI institutes in Canada ([Vector](#), [Amii](#), [Mila](#)) have impressive and comprehensive websites. The University of Waterloo, which has formed the Waterloo Artificial Intelligence Institute, has created an associated website ([waterloo.ai](#)) that is also quite substantial.

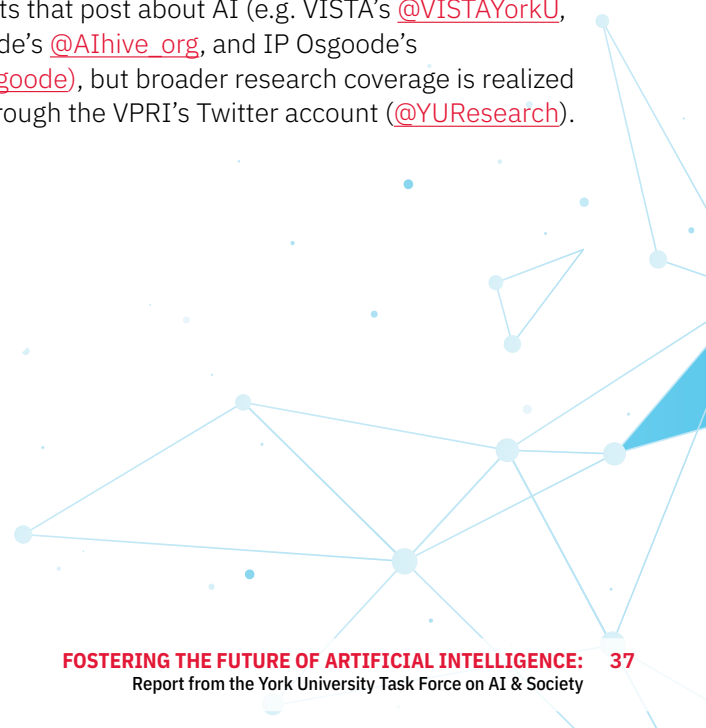
Prior to the work of this Task Force, York did not have a central AI web presence. A search on Google with the keywords “York University Artificial Intelligence” yielded the following ranked results:

1. <https://schulich.yorku.ca/programs/mmai/>. Describes the new MMAI program in Schulich.
2. <http://eecs.gradstudies.yorku.ca/ai/>. Describes the new MSc in Computer Science, Specialization in AI degree within the Graduate Program in EECS.
3. <https://continue.yorku.ca/certificates/certificate-in-machine-learning/>. Describes the new Certificate in Machine Learning offered by York’s School of Continuing Studies.
4. <http://eecs.lassonde.yorku.ca/specialization/artificial-intelligence/>. A list of EECS faculty undertaking AI-related research.
5. <http://research.info.yorku.ca/learn-more-about-ai-at-york/>. A new webpage mounted by VPRI that lists recent AI-related news items at York.

As part of the work of this Task Force, the Public Engagement working group, together with Associate Vice-President Research Rebecca Pillai Riddell, and with the assistance of Jason Miller from University Information Technologies, established York’s first centralized online hub for AI research, teaching and learning: [ai.yorku.ca](#).

### SOCIAL MEDIA

York University does not currently have social media accounts that are dedicated specifically to AI at York. There are project-, department- and group-specific accounts that post about AI (e.g. VISTA’s [@VISTAYorkU](#), Lassonde’s [@AIhive\\_org](#), and IP Osgoode’s [@IPOsgoode](#)), but broader research coverage is realized only through the VPRI’s Twitter account ([@YUResearch](#)).



## SEMINARS

York University does not currently have a general seminar series on AI. Rather, there are a number of more specific seminar series that are AI-related, including:

- The [CVR-VISTA](#) weekly seminar series, about one third of which is AI-related.
- The [York Centre for Innovation in Computing](#) distinguished speaker series, most of which is AI-related. Speakers have included Geoff Hinton (University of Toronto; Google), Antonio Torralba (MIT) and Tom Mitchell (CMU).
- The [Cognitive Science Speaker Series](#), about a quarter of which is AI-related. Speakers have include Chaz Firestone (Psychology, Johns Hopkins University), Steven Piantadosi (Psychology, Berkeley) and Hayley Clatterbuck (Philosophy, Rochester).
- IP Osgoode's [Bracing for Impact](#) webinar series, launched in response to the COVID-19 pandemic, sponsored by Microsoft and all AI-related.

In addition, York frequently sponsors ad hoc AI-related events, including:

### LASSONDE SCHOOL OF ENGINEERING

- AI, Graphics Interface and Computer and Robot Vision Conference 2018: <http://aigicrv.org/2018>
- Ghost in the Machine: <https://lassonde.yorku.ca/articles/ghost-machine-january-24>

### IP OSGOODE

Bracing for Impact: The AI Challenge conference series

- 2018: [AI Governance](#)
- 2019: [AI Data & Innovation Policy](#)
- 2020: [Zooming Out – Emerging Technologies](#) (postponed due to the COVID-19 pandemic)

### LAW COMMISSION OF ONTARIO, HOUSED AT OSGOODE HALL LAW SCHOOL

- AI for Lawyers: [A Primer on Artificial Intelligence](#) (in collaboration with ElementAI)
- AI for Lawyers: [A Symposium with ElementAI](#)

### SCHULICH SCHOOL OF BUSINESS

- [Start-up Night](#)

### OFFICE OF THE VICE-PRESIDENT, RESEARCH & INNOVATION

- [Digital Doings Symposium](#) (with AI focus)

## ✓ RECOMMENDATIONS

The Public Engagement working group of the Task Force, supported by VPRI, launched a new public-facing, centralized web presence for AI research and curriculum at York in the Fall of 2019.

The Task Force notes that to be effective, the website must be adequately resourced with technical and professional staff that can continue to expand its features, keep the content accurate and up-to-date, and ensure appropriate page ranking on search engines such as Google. To be effective, the website must be dynamic and compelling.

The next phase of enhancements to the website should include the following:

- An accessible, searchable and up-to-date directory of faculty members at York working on AI-related topics.
- A mechanism that allows members of the York community to form links with each other and associate with particular research and curricular AI themes.

The Task Force also recommends that a pan-university AI-focused Twitter account be established and actively maintained.

In addition, the Task Force recommends that York establish a more general seminar series focused on AI & Society. The series can include talks for both technical and more general audiences, as long as they are clearly labelled as such. This series will help to strengthen the AI community at York and also better establish York's role in the Greater Toronto Area's AI community.

The seminar series should be held in a central, high-quality venue at the Keele campus, near one of the two York subway stations to encourage more attendance from downtown and other locations in the Greater Toronto Area. A York listserv should be established for all AI-related events. This can be seeded with the list of AI-relevant faculty members that has been created by VPRI (Appendix A). The new York AI website ([ai.yorku.ca](http://ai.yorku.ca)) should maintain an up-to-date list of upcoming AI-related events at York.

In the longer term, dedicated seminar theatres and publicly accessible showcase spaces to highlight current research should be established as part of York's AI space plan (see the "Space & Infrastructure" section above).

# GOVERNANCE

## STATUS REPORT

Currently, York has no pan-university administrative structure dedicated to supporting AI research and academic programs. Instead, there exists a patchwork of individual ORUs and research programs with AI-related activities (e.g. VISTA, the CVR) and new graduate program initiatives (e.g. AI master's degrees in the Lassonde School of Engineering and the Schulich School of Business).

## RECOMMENDATIONS

To establish York as a recognized leader in AI research and academic programs, the Task Force recommends that York establish pan-university AI initiatives and integrate its various AI activities under a single banner: AI@York. These pan-university initiatives will include planning for new centralized AI research space, supporting and promoting new AI-related CFI initiatives, forming a new big data strategy, planning new interdisciplinary AI curricular initiatives, maintaining an accurate and compelling web and social media presence, running a central AI seminar series, supporting new AI partnerships with the public and private sectors and with international institutions and supporting the creation of new AI-focused ORUs.

To achieve these objectives, the Task Force recommends that the University establish an administrative office, co-sponsored by VPRI and the VP Academic & Provost, to oversee these pan-university AI initiatives. Given the broad reach of AI, this structure may not be an ORU, but rather an umbrella structure with both research and academic responsibilities, and with ties to multiple AI-related ORUs and academic programs. The office must be sufficiently resourced to support ongoing and new AI initiatives, and to maintain the AI website, social media presence and seminar series. Alignment with York's goals of equity, inclusivity and diversity, social justice and sustainability can be achieved in part through coordination and collaboration with York resources such as the Centre for Human Rights, Equity and Inclusion and the Senior Advisor on Equity and Representation.







# APPENDICES

## Appendix A.

# York Faculty Engaged in AI-Related Research

First Name	Last Name	Title	Faculty	Department
Farah	Ahmad	Associate Professor	Health	Health Policy & Management
Hossam	Ali-Hassan	Assistant Professor	Glendon	International Studies
Robert	Allison	Professor	Lassonde	Electrical Engineering & Computer Science
Aijun	An	Professor	Lassonde	Electrical Engineering & Computer Science
Ali	Asgary	Associate Professor	LA&PS	Administrative Studies
Amir	Asif	Professor	Lassonde	Electrical Engineering & Computer Studies
Melanie	Baljko	Associate Professor	Lassonde	Electrical Engineering & Computer Science
Marcus	Biehl	Professor	Schulich	Management Science
Michael	Brown	Professor	Lassonde	Electrical Engineering & Computer Science
Marcus	Brubaker	Assistant Professor	Lassonde	Electrical Engineering & Computer Science
Martin	Bunch	Professor	EUC	
Jean-Gabriel	Castel	Professor Emeritus	Osgoode	Law
Gene	Cheung	Associate Professor	Lassonde	Electrical Engineering & Computer Science
Lily	Cho	Associate Professor	LA&PS	English
Natalie	Coulter	Assistant Professor	LA&PS	Communication Studies
Carys	Craig	Associate Professor	Osgoode	Law
Doug	Crawford	Distinguished Research Professor	Health	Psychology
Julia	Creet	Associate Professor	LA&PS	English
Alex	Czekanski	Associate Professor	Lassonde	Mechanical Engineering
Pina	D'Agostino	Associate Professor	Osgoode	Law
Patricio	Davila	Associate Professor	AMPD	Cinema & Media Arts
Valerio	De Stefano	Associate Professor	Osgoode	Law
Konstantinos	Derpanis	Associate Professor	Lassonde	Electrical Engineering & Computer Science
James	Elder	Professor	Lassonde; Health	Electrical Engineering & Computer Science; Psychology
Christo	El Morr	Assistant Professor	Health	Health Policy & Management
Petros	Faloutsos	Professor	Lassonde	Electrical Engineering & Computer Science
Caitlin	Fisher	Associate Professor	AMPD	Cinema & Media Arts
Rene	Fournier	Associate Professor	Science	Chemistry
Xin	Gao	Professor	Science	Mathematics & Statistics
David	Gelb	Associate Professor	AMPD	Design
Markus	Giesler	Associate Professor	Schulich	Marketing
Parke	Godfrey	Associate Professor	Lassonde	Electrical Engineering & Computer Science
Verena	Gottschling	Associate Professor	LA&PS	Philosophy

First Name	Last Name	Title	Faculty	Department
Jane	Heffernan	Associate Professor	Science	Mathematics & Statistics
Zulfikar	Hirji	Associate Professor	LA&PS	Anthropology
Steven	Hoffman	Professor	Health	Health Policy & Management
Ali	Hooshyar	Assistant Professor	Lassonde	Electrical Engineering & Computer Science
Mark-David	Hosale	Associate Professor	AMPD	Computational Arts
Jimmy	Huang	Professor	LA&PS	Information Technology
Jennifer	Hyndman	Professor	EUC	
Michaela	Hynie	Associate Professor	Health	Psychology
Susan	Ingram	Associate Professor	LA&PS	Humanities
Michael	Jenkin	Professor	Lassonde	Electrical Engineering & Computer Science
Jennifer	Jenson	Professor, Director Institute for Research on Digital Literacies (IRDL)	Education	
Hui	Jiang	Professor	Lassonde	Electrical Engineering & Computer Science
Zhen Ming (Jack)	Jiang	Associate Professor	Lassonde	Electrical Engineering & Computer Science
Joel	Katz	Professor	Health	Psychology
Muhammad-Ali	Khalidi	Professor	LA&PS	Philosophy
Murat	Kristal	Associate Professor	Schulich	Management Science
Usman	Khan	Assistant Professor, Graduate Program Director	Lassonde	Civil Engineering
Hyejin	Ku	Associate Professor	Science	Mathematics & Statistics
Fuyuki	Kurasawa	Associate Professor	LA&PS	Sociology
Matthew	Kyan	Associate Professor	Lassonde	Electrical Engineering & Computer Science
Yves	Lespérance	Associate Professor	Lassonde	Electrical Engineering & Computer Science
Marin	Litoiu	Associate Professor	LA&PS	Information Technology
Michael	Longford	Associate Professor	AMPD	Computational Arts
Heather	Lotherington	Professor	Education	
Paul	Lovejoy	Distinguished Research Professor	LA&PS	History
Helene	Massam	Professor	Science	Mathematics & Statistics
Dirk	Matten	Hewlett-Packard Chair in Corporate Social Responsibility	Schulich	Policy
Susan	McGrath	Professor	LA&PS	Social Work
Hélène	Mialet	Associate Professor	Science	Science & Technology Studies
Sayed	Moghadas	Associate Professor	Science	Mathematics & Statistics
Jonathan	Obar	Associate Professor	LA&PS	Communication & Media Studies
Joel	Ong	Assistant Professor	AMPD	Computational Arts
James	Orbinski	Professor	Health	Health Policy & Management
Emmanouil (Manos)	Papagelis	Assistant Professor	Lassonde	Electrical Engineering & Computer Science
Sylvia	Peacock		LA&PS	Social Science
Ronald	Pearlman	University Professor Emeritus	Science	Biology
Jonathon	Penney	Associate Professor	Osgoode	Law
Jennifer	Pybus	Assistant Professor	LA&PS	Politics
Markus	Reisenleitner	Professor	LA&PS	Humanities



First Name	Last Name	Title	Faculty	Department
Regina	Rini	Assistant Professor/CRC	LA&PS	Philosophy
Paul	Ritvo	Associate Professor	Health	Kinesiology & Health Science
Ken	Rogers	Associate Professor	AMPD	Cinema & Media Arts
Shayna	Rosenbaum	Professor	Health	Psychology
Terry	Sachlos	Assistant Professor	Lassonde	Mechanical Engineering
Ali	Sadeghi-Naini	Associate Professor	Lassonde	Electrical Engineering & Computer Science
Dominique	Scheffel-Dunand	Associate Professor/Associate Dean Research	Glendon	French Studies
Craig	Scott	Professor	Osgoode	Law
Lauren	Sergio	Professor	Health	Kinesiology & Health Science
James	Sheptycki	Professor	LA&PS	Social Science
Donald	Sinclair	Associate Professor	AMPD	Computational Arts
Gunho	Sohn	Associate Professor	Lassonde	Earth & Space Science & Engineering
Pirathayini	Srikantha	Assistant Professor	Lassonde	Electrical Engineering & Computer Science
Ian	Stedman	Assistant Professor	LA&PS	School of Public Policy & Administration
Gary	Sweeney	Professor	Science	Biology
Paul	Szeptycki	Professor	Science	Mathematics & Statistics
Kurt	Thumlert	Assistant Professor, member Institute for Research on Digital Literacies (IRDL)	Education	
Niko	Troje	Professor	Science	Biology
John	Tsotsos	Distinguished Research Professor	Lassonde	Electrical Engineering & Computer Science
Ruth	Urner	Assistant Professor	Lassonde	Electrical Engineering & Computer Science
Franck	VanBreugel	Professor	Lassonde	Electrical Engineering & Computer Science
Doug	Van Nort	Associate Professor/CRC	AMPD	Computational Arts/Theatre & Performance Studies
David	Vaver	Professor	Osgoode	Law
Graham	Wakefield	Associate Professor/CRC	AMPD	Computational Arts
Ping	Wang	Associate Professor	Lassonde	Electrical Engineering & Computer Science
Steven	Wang	Professor	Science	Mathematics & Statistics
Jennifer	Wemigwans	Assistant Professor	Education	
Richard	Wildes	Associate Professor	Lassonde	Electrical Engineering & Computer Science
Jianhong	Wu	Professor	Science	Mathematics & Statistics
Dan	Zhang	Professor	Lassonde	Mechanical Engineering
Hongmei	Zhu	Associate Professor	Science	Mathematics & Statistics
Huaiping	Zhu	Professor	Science	Mathematics & Statistics
Detlev	Zwick	Associate Professor	Schulich	Marketing
Joel	Zylberberg	Assistant Professor	Science	Physics & Astronomy

## Appendix B.

# Current AI-Related Course Offerings at York

Faculty	Course Code	Title
Lassonde	EECS 3401	Introduction to Artificial Intelligence and Logic Programming
Lassonde	EECS 4401/5326	Artificial Intelligence
Lassonde	EECS 4402/5311	Logic Programming
Lassonde	EECS 4404/5327	Introduction to Machine Learning and Pattern Recognition
Lassonde	EECS 4412	Data Mining
Lassonde	EECS 4414	Information Networks
Lassonde	EECS 4421/5324	An Introduction to Robotics
Lassonde	EECS 4422/5323	Computer Vision
Lassonde	EECS 4491	Simulation and Animation for Computer Games
Lassonde	EECS 6127	Machine Learning Theory
Lassonde	EECS 6322	Neural Networks and Deep Learning
Lassonde	EECS 6323	Advanced Topics in Computer Vision
Lassonde	EECS 6324	From Control to Actuators: Computational Models of Visual Perception
Lassonde	EECS 6325	Mobile Robot Motion Planning
Lassonde	EECS 6327	Probabilistic Models and Machine Learning
Lassonde	EECS 6328	Speech and Language Processing
Lassonde	EECS 6332	Statistical Visual Motion Analysis
Lassonde	EECS 6333	Multiple View Image Understanding
Lassonde	EECS 6339	Introduction to Computational Linguistics
Lassonde	EECS 6340	Embodied Intelligence
Lassonde	EECS 6412	Data Mining
Lassonde	EECS 6414	Data Analytics and Visualization
Lassonde	ESSE 4630	Image Processing for Remote Sensing and Photogrammetry
Lassonde	ESSE 4600	Geographical Information Systems (GIS) and Data Integration
Lassonde	ESSE 5420	Advanced Geospatial Information Technology
Lassonde	MECH 6503	Disruptive and Exponential Technology Innovations
SSB	ECON 4210/6210	Economic Forecasting and Analysis
SSB	FINE 6310A	Econometrics of Financial Markets
SSB	MBAN 5330	Big Data Fundamentals and Applications
SSB	MBAN 6090	Analytics Consulting Project
SSB	MBAN 6110	Data Science I
SSB	MBAN 6120	Data Science II
SSB	MBAN 6500	Artificial Intelligence in Business I

Faculty	Course Code	Title
SSB	MBAN 6510	Artificial Intelligence in Business II
SSB	MKTG 6326	Retail Analytics
SSB	MKTG 6360X	Marketing Metrics
SSB	MMAI 5000	AI Fundamentals
SSB	MMAI 5040	Business Applications of AI I
SSB	MMAI 5090	Business Applications of AI II
SSB	MMAI 5100	Database Fundamentals
SSB	MMAI 5200	Algorithms for Business Analysis
SSB	MMAI 5300	Numerical Methods and Analysis
SSB	MMAI 5400	Natural Language Processing
SSB	MMAI 5500	Applications of Neural Networks and Deep Learning in Business
SSB	MMAI 6050	AI Consulting Project
SSB	OMIS 3710	Information Systems
SSB	OMIS 3730	Database Management with Access
SSB	OMIS 4000	Models & Applications in Operational Research
SSB	OMIS 5110	Information Systems
SSB	OMIS 6710	Management Information Systems
SSB	SGMT 6800	Strategic Management of Technology Based Firms
LA&PS	AP/COMN 3551	Advanced Issues in Digital Media and Culture
LA&PS	AP/HUMA 2920	Knowledge, Technology and Culture
LA&PS	AP/ITEC 4310	Applied Artificial Intelligence
LA&PS	AP/LING 3800	Language and Mind
LA&PS	AP/PHIL 2160	Minds, Brains and Machines
LA&PS	AP/PHIL 3750	Philosophy of Artificial Intelligence
LA&PS	AP/PHIL 3776	Technology and Ethics
LA&PS	GS/PHIL 5340	Ethics and Societal Implications of AI
LA&PS	STS 3561	History of Computing and Information Technology
AMPD	FILM 6245	Future Cinema
AMPD/Lassonde	DIGM 5010	Foundations of Digital Media (core)
AMPD/Lassonde	DIGM 5020/6020	Advanced Vertical Studio/Lab (core)
AMPD/Lassonde	DIGM 5950	Artificial Life, Generative Art and Creative Code (elective)
AMPD/Lassonde	DIGM 5960	Applications of Machine Learning & Artificial Intelligence to the Performing Arts (elective)
AMPD/Lassonde	FA/DATT 2300	Game Development I (core)
AMPD/Lassonde	FA/DATT 3200	Performing Telepresence (elective)
AMPD/Lassonde	FA/DATT 3300	Game Mechanics (core)



Faculty	Course Code	Title
AMPD/Lassonde	FA/DATT 4071	Interactive Sonic Arts (elective)
AMPD/Lassonde	FA/DATT 4300	Game Development II (core)
AMPD/Lassonde	FA/DATT 4950	Artificial Life, Generative Art and Creative Code (elective)
Osgoode	LW7400.09	Intellectual Property & Technology Intensive Program (includes sessions on AI & student placements at Stanford's CodeX)
Osgoode	ELGC 762	Ethical Lawyering in the Global Community (includes one session on AI)
Osgoode	LAW 2680	Legal Information Technology
Osgoode	LAW 3075	Money, Payments & Crypto-Currencies in the Digital Age
Osgoode	LAW 3592A	Legal Values: AI
Osgoode	LAW 3592M	Legal Values: Digital World, Democracy & International Law
Health	PSYC 6225	Computational Modeling of Visual Perception
Health	PSYC 6256	Principles of Neural Coding

## Appendix C.

# Current Public and Private Sector Partnerships in AI at York

Organization	York Collaborators
Alcohol Countermeasure Systems Corp	Hongmei Zhu, Steven Wang
Applied Recognition	BRAIN
Autodesk Research	CREATE DAV
Bereskin & Parr	IP Innovation Clinic
Bluedot	CREATE DAV
Borealis AI	Marcus Brubaker
CrossWing	Michael Jenkin, James Elder
Dapasoft	BRAIN, CREATE DAV
ElementAI	Law Commission of Ontario at Osgoode
Empress Software	BRAIN, CREATE DAV
Esri Canada	ISSUM, CREATE DAV
Fuseforward Solutions	BRAIN
GestureTex	BRAIN, CREATE DAV
Huawei Canada	Rick Wildes, James Elder
IBM	CREATE DAV, BRAIN
iFLYTEK	Hui Jiang
iNago	BRAIN
ISED	IP Innovation Clinic, Pina D'Agostino
KBM Resources Group	Baoxin Hu
ManagingLife	Jane Heffernan
Manifold Data Mining	BRAIN, CREATE DAV
MDA	BRAIN
Mircom	ISSUM, CREATE DAV
Nlogic	BRAIN, CREATE DAV
Norton Rose Fulbright Canada LLP	IP Innovation Clinic
Ontario Brain Institute	BRAIN
Own Innovation	IP Innovation Clinic
Public Health Agency of Canada	BRAIN
Qualcomm	Laurie Wilcox, Rob Allison, Sebastian Magjerowski
Samsung AI	Michael Brown, Michael Jenkin
St. Michael's Hospital	BRAIN
Teledyne Optech	ISSUM, CREATE DAV
<i>The Globe and Mail</i>	CREATE DAV, BRAIN
TransPlan	ISSUM, CREATE DAV

## Appendix D.

# Current International AI Partnerships

Country	City	Institution	York Partnership
China	Beijing	Beihang University	University-wide Exchange Program and Schulich Exchange
China	Beijing	Beijing Normal University	AMPD Exchange
China	Changzhou	Changzhou University	Ontario–Jiangsu Exchange
China	Shanghai	China Europe International Business School in Shanghai	Schulich Exchange
China	Beijing	Chinese Academy of Social Sciences	University-wide Exchange Program
China	Shanghai	Fudan University	University-wide Exchange Program
China	Harbin	Harbin Institute of Technology	University-wide Exchange Program
China	Hunan	Hunan University	Articulation
China	Wuxi	Jiangnan University – Wuxi	Ontario–Jiangsu Exchange
China	Zhengjiang	Jiangsu University – Zhenjiang	Ontario–Jiangsu Exchange
China	Beijing	Minzu University of China	Ontario–Jiangsu Exchange
China	Nanjing	Nanjing Aeronautics and Astronautics University	Ontario–Jiangsu Exchange
China	Nanjing	Nanjing Normal University	Ontario–Jiangsu Exchange
China	Beijing	Peking University	University-wide Exchange Program
China	Shanghai	Shanghai University of Finance & Economics	University-wide Exchange Program
China	Chongqing	Southwest Institute of Political Science and Law	Osgoode Exchange
China	Beijing	The China Scholarship Council	Scholarship Agreement
China	Beijing	Tsinghua University	Osgoode Exchange
China	Beijing	University of International Business and Economics (UIBE)	University-wide Exchange Program
China	Wuhan	Wuhan University	Lassonde Exchange
China	Suzhou	Xi'an Jiaotong – Liverpool University	Ontario–Jiangsu Exchange
China – Hong Kong, SAR	Hong Kong	Chinese University of Hong Kong	University-wide Exchange Program
China – Hong Kong, SAR	Hong Kong	Hong Kong University of Science and Technology	University-wide Exchange Program
China – Hong Kong, SAR	Hong Kong	University of Hong Kong	Osgoode Exchange and Schulich Exchange
China – Taiwan	New Taipei City	Tamkang University	University-wide Exchange Program
India	Uttar Pradesh	Amity University	University-wide Exchange Program



Country	City	Institution	York Partnership
India	Chennai	Anna University	Lassonde Exchange
India	Goa, Hyderabad, Pilani (India) and Dubai (United Arab Emirates)	Birla Institute of Technology & Science – Goa, Hyderabad, Pilani and Dubai	University-wide Exchange Program
India	Pune	FLAME University	University-wide Exchange Program
India	Howrah	Indian Institute of Engineering Science and Technology, Shibpur (Bengal Engineering and Science University)	University-wide Exchange Program
India	Bengaluru	Indian Institute of Management, Bangalore	Schulich Exchange
India	Pune	Indian Institute of Science Education and Research	Ontario–India Exchange
India	Mumbai	Indian Institute of Technology, Bombay	University-wide Exchange Program
India	Roorkee	Indian Institute of Technology, Roorkee	University-wide Exchange Program
India	New Delhi	Jamia Millia Islamia	University-wide Exchange Program
India	New Delhi	Jawaharlal Nehru University, New Delhi	University-wide Exchange Program
India	Sonipat	O. P. Jindal Global University	Ontario–India Exchange and Osgoode Exchange
India	Puducherry	Pondicherry University	Ontario–India Exchange
India	Kolkata	Presidency University	University-wide Exchange Program
India	Mumbai	SNDT Women’s University	University-wide Exchange Program
India	Pune	Vishwakarma Institute of Technology	Ontario–India Exchange
India	Chandigarh	World NCD Federation	University-wide Exchange Program
Singapore	Singapore	Nanyang Technological University	University-wide Exchange Program
Singapore	Singapore	National University of Singapore	University-wide Exchange Program
Singapore	Singapore	Singapore Management University	Schulich Exchange
South Korea	Seoul	Ewha Womans University	University-wide Exchange Program
South Korea	Seoul	Hanyang University	University-wide Exchange Program
South Korea	Seoul	Korea University	University-wide Exchange Program
South Korea	Seoul	Sogang University	University-wide Exchange Program
South Korea	Seoul	Sungkyunkwan University	University-wide Exchange Program
South Korea	Seoul	Yonsei University	University-wide Exchange Program
Finland	Espoo	Aalto University	University-wide Exchange Program
Finland	Helsinki	University of Helsinki	University-wide Exchange Program

Country	City	Institution	York Partnership
Finland	Tempere	University of Tampere	University-wide Exchange Program
France	Marseille	Aix-Marseille University	Osgoode Exchange
France	Lille	Catholic University of Lille	Schulich Exchange
France	Lyon	École Centrale de Lyon	Ontario–Rhones Alpes
France	Paris	EDHEC Business School	Schulich Exchange
France	Écully	EM Lyon	Schulich Exchange
France	Grenoble	Grenoble INP	Ontario–Rhones Alpes
France	Paris	HEC Paris	Schulich Exchange
France	Lyon	INSA de Lyon	Ontario–Rhones Alpes
France	Aix-en-Provence	Institut d'Administration des Entreprises – Université de Droit, d'Economie et des Sciences d'Aix Marseille	University-wide Exchange Program
France	Avignon	Université d'Avignon	University-wide Exchange Program
France	Pessac	Université Bordeaux Montaigne	University-wide Exchange Program
France	Lyon	Université Claude Bernard Lyon	Ontario–Rhones Alpes
France	Grenoble	Université Grenoble Alpes	Ontario–Rhones Alpes
France	Saint-Etienne	Université Jean Monnet	Ontario–Rhones Alpes
France	Lyon	Université Jean Moulin Lyon 3	Ontario–Rhones Alpes
France	Paris	University of Paris - Dauphine	Schulich Exchange
France	Paris	University of Paris-Sorbonne (Paris IV)	University-wide Exchange Program
France	Strasbourg	University of Strasbourg	Glendon Exchange
Germany	Weimar	Bauhaus-Universität Weimar	AMPD Exchange
Germany	Bielefeld	Bielefeld University	Collaborative Agreement
Germany	Sankt Augustin	Bonn-Rhein-Sieg University of Applied Sciences	Tri-university Exchange Agreement
Germany	Bremen	Bremen University	Collaborative Agreement
Germany	Hamburg	Bucerius Law School, Hamburg	Osgoode Exchange
Germany	Darmstadt	Darmstadt University of Applied Sciences	AMPD Exchange
Germany	Tübingen	Eberhard Karls Universität Tübingen	Ontario–Baden–Württemberg Exchange
Germany	Oestrich-Winkel	EBS Universität für Wirtschaft und Recht	Schulich Exchange
Germany	Berlin	Freie Universität Berlin	University-wide Exchange Program
Germany	Frankfurt	Goethe University Frankfurt	University-wide Exchange Program

Country	City	Institution	York Partnership
Germany	Berlin	HTW Berlin (Hochschule für Technik und Wirtschaft Berlin)	University-wide Exchange Program
Germany	Berlin	Humboldt-Universität Zu Berlin	University-wide Exchange Program
Germany	Mainz	Johannes Gutenberg University of Mainz	University-wide Exchange Program
Germany	Karlsruhe	Karlsruher Institut für Technologie	Ontario–Baden–Württemberg Exchange
Germany	Heidelberg	Ruprecht-Karls-Universität Heidelberg	Ontario–Baden–Württemberg Exchange
Germany	Stuttgart	Universität Hohenheim	Ontario–Baden–Württemberg Exchange
Germany	Stuttgart	Universität Stuttgart	Ontario–Baden–Württemberg Exchange
Germany	Ulm	Universität Ulm	Ontario–Baden–Württemberg Exchange
Germany	Bonn	University of Bonn	University-wide Exchange Program
Germany	Konstanz	University of Konstanz	University-wide Exchange Program
Germany	Mannheim	University of Mannheim	University-wide Exchange Program
Germany	Marburg	University of Marburg	Collaborative Agreement
Germany	Oldenburg	University of Oldenburg	Faculty of Health Exchange
Germany	Potsdam	University of Potsdam	LA&PS Exchange
Germany	Düsseldorf	WHU – Otto Beisheim School of Management	Schulich Exchange
Sweden	Malmö	Malmö University	University-wide Exchange Program
Sweden	Umeå	Umeå University	University-wide Exchange Program
Sweden	Uppsala	Uppsala University	University-wide Exchange Program
United Kingdom – England	Staffordshire	Keele University	University-wide Exchange Program
United Kingdom – England	Newcastle upon Tyne	Northumbria University	University-wide Exchange Program
United Kingdom – England	Oxford	Oxford Brookes University	University-wide Exchange Program
United Kingdom – England	London	Queen Mary University of London	Osgoode Exchange
United Kingdom – England	Bath	University of Bath	Schulich Exchange
United Kingdom – England	Leeds	University of Leeds	University-wide Exchange Program
United Kingdom – England	Nottingham	University of Nottingham	University-wide Exchange Program
United Kingdom – England	Coventry	University of Warwick	Schulich Exchange
United Kingdom – England	York	University of York	University-wide Exchange Program
United Kingdom – Scotland	Glasgow	University of Glasgow	University-wide Exchange Program (for renewal)
United Kingdom – Wales	Swansea	Swansea University	University-wide Exchange Program

Country	City	Institution	York Partnership
United States of America	Tempe	Arizona State University	Killam Fellowships Program
United States of America	Cleveland	Case Western Reserve University	Schulich Exchange
United States of America	Washington	Howard University	Schulich Exchange
United States of America	Bloomington	Indiana University	Schulich Exchange
United States of America	New York	New York University	Osgoode Exchange
United States of America	Northampton	Smith College	Killam Fellowships Program
United States of America	Palo Alto	Stanford University, CodeX Centre for Legal Informatics	IP Intensive Program, IP Osgoode
United States of America	Plattsburgh	State University of New York College at Plattsburg	Killam Fellowships Program
United States of America	Amherst	University at Buffalo, SUNY	University-wide Exchange Program
United States of America	Honolulu	University of Hawaii at Manoa	Killam Fellowships Program
United States of America	Orono	University of Maine	Killam Fellowships Program
United States of America	Austin	University of Texas at Austin	Killam Fellowships Program
United States of America	Seattle	University of Washington	Killam Fellowships Program
United States of America	Nashville	Vanderbilt University	Killam Fellowships Program
United States of America	Wellesley	Wellesley College	Killam Fellowships Program



## Appendix E.

# International Visiting Research Trainees at York: AI Related Research Projects (2016–2019)

Faculty	York Supervisor	Academic Year	Research Topic
Lassonde	Armenakis, Costas	2016–2017	Separation of remote sensing alteration information from background under fractals
Lassonde	Elder, James	2017–2018	Counting objects per category
LAPS	Litoiu, Marin	2017–2018	Adaptive software system
Lassonde	Sharma, Jit	2017–2018	Optimizing bio-retention cell design for extreme events
Lassonde	Urner, Ruth	2017–2018	Domain adaptation and causality
Lassonde	Zhang, Dan	2017–2018	Robotics and mechatronics
Health	Fruend, Ingo	2018–2019	Prediction of fixated image regions during memory encoding using recurrent neural networks
Lassonde	Jenkin, Michael	2018–2019	Autonomous surface craft project
Lassonde	Wang, Jianguo	2018–2019	High-precision SLAM with multi-source sensor fusion

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