FUTURE DIRECTIONS:

ARTIFICIAL INTELLIGENCE

University of Ottawa

ARTIFICIAL INTELLIGENCE ADVISORY COMMITTEE

November 1, 2019

COVER PAGE

Author of the artwork : Priya Gurnani

Title of the artwork: Sacred Mind

Describe how your work of art represents innovation:

"Sacred mind" is inspired by Leonardo da Vinci's "Vitruvian Man". The Vitruvian Man is believed to represent the beauty, complexity, and symmetry of the human frame. So why are the normative metrics of excellence attributed to male intellect and physiology?

The ideal depiction of the human body and mind, as per da Vinci, and our reverence for this image suggests we have associated human excellence to one gender. It's well past time that we move on from that narrative. We must diversify our beliefs and encourage those outside of historical norms of excellence to engage in the dialogue of innovation. We must be innovative in our efforts to ensure diverse representation in our contributions to society.

The mind is sacred, and its expression should not be limited based on one's physiological state.

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Artificial Intelligence (AI) Advisory Committee

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EXECUTIVE SUMMARY

The University of Ottawa (uOttawa) is one of the top research-intensive universities in Canada and leads the world in many areas. The university's strategic plan - *Transformation 2030* - slated to be completed by the end of this year, will include research strategic directions for the future.

The university's Vice-President, Research (VPR) has the overarching responsibility of leading the development and effective implementation of uOttawa's research strategy. This includes identifying institutional strategic research priorities while acknowledging and respecting the perspectives and needs of diverse disciplines and the innovative ideas and unique talents of researchers across faculties and research institutes/centres.

There is a general recognition that artificial intelligence (AI) is transforming many areas of society and economic sectors. While AI presents tremendous opportunities, it also raises many challenges and issues. In order to be competitive in the highly transformative and competitive field of AI, uOttawa needs to define its niche based on its strengths and in alignment with its strategic research directions.

In the summer of 2018, a delegation of Deans, Vice-Deans, researchers and the VPR from uOttawa met to discuss the status of AI research at the university. At a follow-up meeting in the fall of 2018, representatives from across the faculties met to discuss the university's AI-related activities. At this meeting, many of the faculties confirmed that they had identified AI as a priority for resource allocation and growth over the next three to five years. An AI Advisory Committee with representation from faculties as well as research centres/institutes was established in the spring of 2019. The Office of the VPR (OVPR) commissioned a consultant in May 2019 to facilitate the work of the committee with the goal of developing a report with recommendations to assist the university in determining its best course of action in moving forward.

This report summarizes the work of the AI Advisory Committee and presents the recommended AI vision and mission for uOttawa going forward. The report makes **16 recommendations** to capitalize on existing strengths and immediate opportunities and for changes relating to a number of key factors important for enabling a vibrant and world-class AI-related research and training ecosystem. uOttawa believes that solutions to complex issues require the deep integration of ideas, approaches and perspectives from across disciplines. The Committee identified **two principles** that should guide future AI activities. The first principle is that research should use a problem-based transdisciplinary approach; and the second, that AI research initiatives should incorporate dimensions of inclusiveness, equity and diversity to effectively inform the responsible development of AI technologies defined by the populations and societies for which they are intended. Furthermore, the report identifies preliminary **AI thematic areas of research** including Learning Health Systems; Smart Societies; Sustainable Environment and Climate Change; and Governance, Regulatory Frameworks and Standards.

Finally, to ensure more effective research collaboration, coordination and promotion of AI-related activities, the Committee recommends that research institutes, centres, laboratories and researchers working on AI-related projects be regrouped in a university-wide federated AI entity, through a phased implementation approach. In the immediate first phase, uOttawa should establish a federated AI research network on a voluntary opt-in basis. An invitation should be sent by the OVPR to all researchers and research groups. The research network should be created quickly to begin the process of organizing and aligning AI-related expertise, resources and opportunities at uOttawa. A Steering Committee should be established for the oversight and management of the network. Once the federated AI research network is operational, the Steering Committee should make recommendations to the OVPR regarding its next phase of evolution and transition towards a more structured and

integrated uOttawa AI Institute for transdisciplinary research and education programs.

The approach taken by the OVPR, including its timeliness, in collaboration with the faculties, research institutes and centres in addressing the recommendations in this report will play a significant role in uOttawa's overall success in achieving its strategic research directions in AI.

1. Introduction

uOttawa is one of Canada's leading universities and the world's largest bilingual (French and English) university. The university has consistently ranked among the top 2% of universities in the world and was one of the founding universities behind the U7 Alliance, comprised of the top institutions from G7 countries.

uOttawa has had a long, successful track-record in world-class research, training and innovation. Total uOttawa research funding, including for affiliated institutions, increased 32.4% from $236.2M in 2009 to $312.7M in 2018, with most of the increase in funding coming from foundations and non-for-profit organizations. For the university only, federal government sources such as NSERC, SSHRC and CIHR remained the largest sources of funds over the period, alongside a significant increase in uOttawa's internal funds.(1)

In 2018, uOttawa launched a new strategic planning exercise to build on its legacy of achievements and its core values. Referred to as *Transformation 2030,* the plan's framework is designed to effectively respond to the complexity of challenges and opportunities facing the university, and to define its aspirations for the future. *Transformation 2030* will be released by the end of 2019 and will identify strategic areas for research. One area identified by the VPR requiring further attention by uOttawa is research activities related to AI.

AI technologies will play a significant role in transforming our lives, society and every economic sector. Google, Facebook, Microsoft and thousands of other companies are making significant investments in AI and are already using sophisticated AI technologies.

In 2017, Canada was the first country in the world to adopt a national AI Strategy. The Pan-Canadian Strategy funded by the Federal Government ($125M) and led by the Canadian Institute for Advanced Research (CIFAR) supports programmes to expand Canada's AI human capital, build on existing areas of AI research excellence across the country, notably in Toronto (Vector Institute), Montreal (Mila) and Edmonton (Amii), and facilitate the translation of AI research into public and industrial applications.(2) In 2017, the federal government invested another $150M to support AI in areas such as technologies that include AI-assisted design, engineered cell and gene therapies, faster and more secure digital networks, clean and sustainable energy, and $950M support for Superclusters.(3) Worldwide, China, France, Germany, India, Sweden, the UK and the USA also have targeted AI research strategies. Australia, Finland, Israel, Italy and Spain are developing strategies, and Denmark, Japan and Korea include AI-related strategies within broader plans.(4)

In Canada, by far the majority of investments have been in the Province of Québec, starting with $100M from the Québec government in 2018 to support a Québec AI cluster that will leverage the expertise developed by the Institute for Data Valorization (IVADO) (5); a $7.5M investment in 2018 through Les Fonds de recherche du Québec (FRQ) to create a world observatory on the social impacts of AI and digital technologies (6); and finally $23.4M (7) to support the NRC funded Supercluster SCALE.AI to create intelligent supply chains through AI. In Ontario, the provincial government provided $50M to the Vector Institute, and then another $10M to help accelerate the growth in graduates from masters'

programs in AI (8). In 2019, the Alberta government announced plans to spend $100M to attract investment from AI-focused technology companies (9). The investment is an effort to diversify the Alberta economy beyond oil and gas. The money will go to Alberta Innovates, the province's research development agency, and the Edmonton-based Amii with some of the funds to set-up an Amii office in Calgary.

uOttawa recognizes that to be competitive in the highly transformative and competitive field of AI, the university needs to define its niche based on its strengths and ensure its alignment with its strategic research directions. It was in this context that a delegation of Deans, Vice-Deans, researchers and the VPR from uOttawa met in July 2018 to discuss the status of AI research at the university. It was recognized at this meeting that while there was AI research underway at the university, further work needed to be done to understand the full breadth of AI activities. A follow-up meeting was held on October 15, 2018 with representatives from across the faculties to discuss in more detail uOttawa's efforts in AI. At this meeting, many of the faculties confirmed that they had identified AI as a priority for resource allocation and growth over the next three to five years.

An environmental scan was completed by the OVPR, and an AI Advisory Committee with representation from faculties as well as research centres and institutes across the university was established in the spring of 2019. The OVPR commissioned a consultant in May 2019 to facilitate the work of the Committee with the goal of developing a report with recommendations to assist the university in determining its best course of action in moving forward.

2. About the report

The purpose of this report is to identify future directions for uOttawa in AI research. The report:

- summarizes the work of the AI Advisory Committee and presents the recommended AI vision and mission for uOttawa;
- makes recommendations designed to capitalize on immediate opportunities and for changes relating to factors important for enabling a vibrant and world-class AI-related research and training ecosystem;
- identifies underlying principles that should guide future uOttawa AI activities;
- makes preliminary recommendations for thematic areas of research linked to the university's strategic research plan; and
- presents the recommended governance model for going forward.

The report's scope is focused primarily on research and the factors important for enabling a vibrant AI research and training environment. Moreover, given the importance of education programs to the development of AI talent and to uOttawa's overall research ecosystem, the project included education programs where relevant.

It was beyond the scope of the project to conduct extensive consultations beyond the AI Advisory Committee. Finally, while the report is not a business plan, the Committee recognizes that the successful implementation of the report's final recommendations will require additional investments by the university.

3. Project Approach

The project was carried out from May 7, 2019 to November 1, 2019, and was facilitated by Christine Fitzgerald under the direction of the Associate Vice-President, Research (AVPR), Promotion and Development. The AI Advisory Committee met nine times and provided advice throughout the duration of the project. In addition to receiving input at Committee meetings, the consultant had a number of

one-on-one meetings with individual Committee members to follow-up on issues and/or to obtain further input and clarification of meeting discussions. The VPR and the consultant held an introductory meeting with the AI Advisory Committee in May 2019 to review the project's terms of reference developed by the OVPR, and to answer questions from the Committee members. The environmental scan earlier completed by the OVPR was reviewed by the AI Advisory Committee and AI research priorities across the country and abroad were considered. uOttawa's research strengths, opportunities and challenges were identified. Options for implementing the recommended AI mission were considered and the preferred approach identified.

The Consultant led the drafting of the report summarizing Committee's discussions. The report underwent many stages of contributions and revisions by the Committee before it was finalized.

4. Current Situation

Building on the analysis of the environmental scan results and of the current situation at uOttawa, the main strengths and opportunities and the major challenges were identified and are described below.

Strengths & Opportunities

A summary of the main strengths and opportunities follows below.

Location in the National Capital

uOttawa's potential for forming collaborative partnerships is unique because of its location in the heart of the nation's capital. uOttawa researchers have ready access to federal government departments and agencies, to embassies and to national offices of non-governmental organizations. Many uOttawa researchers and scholars have well-established relationships with these stakeholders. This presents opportunities for partnerships as well as for co-locating students, research trainees, researchers and equipment with local partners to create collaboration hubs anchored in research themes of shared mutual interest.

Largest bilingual (French and English) university in the world

uOttawa is the largest bilingual university in the world connecting the institution to many countries of La Francophonie around the world. This presents researchers from uOttawa with many opportunities for collaborative partnerships. For example, in 2018, Canada and France signed a Declaration "promoting a vision of human-centric AI grounded in human rights, inclusion, diversity, innovation and economic growth". In this context, Canada and France will emphasize the need to develop the capacity to anticipate impacts and coordinate efforts in order to encourage trust and promote the development of responsible AI. uOttawa researchers are well positioned to contribute to these efforts.

Kanata North

In 2018, uOttawa announced a partnership with Kanata North, Canada's largest research and technology park, to become a major provider of talent, research-based solutions and training. Located in Ottawa's west end, Kanata North is home to more than 500 companies employing over 21,000 skilled workers. Having a physical presence in the park provides a collaborative space for uOttawa researchers and students to meet with industry representatives. Kanata North provides tremendous collaborative opportunities for uOttawa researchers and students to work on problems identified by industry experts in evolving fields such as cybersecurity, autonomous vehicles, biotechnology, medical devices and other AI-driven technologies. It also provides valuable opportunities for co-op placements and internships, enabling students to work directly with industry. To date, uOttawa has held just a few, but highly successful, events at Kanata North and is now moving to a more sustained presence with two full time staff and regular presence of other staff from uOttawa's Innovation Support Services and Professional Development Institute. A more comprehensive program is expected to be in place this fall, with the first faculty members (likely from the Faculty of Engineering) having their research labs operational on site in Kanata by the end of the year.

Research, Training & Education

uOttawa is recognized internationally and considered a leader nationally for its research on the ethical, legal and societal implications of AI. uOttawa researchers are frequently consulted to provide advice on the societal dimensions of AI by governments, by researchers from the Vector Institute, Mila and Amii, by industry and by other stakeholders. uOttawa researchers with expertise in these areas currently sit on the Canadian Statistics Advisory Council (Chair), the federal government's Advisory Council on Artificial Intelligence, the Canadian Council of Academies' Expert Panel on Connected and Automated Vehicles and Shared Mobility, and until recently, the CIFAR Advisory Committee on AI & Society (Chair). Two uOttawa researchers were invited to speak about enabling the responsible adoption of AI to more than 150 international technology leaders and experts assembled at the G7 Multi-stakeholder Conference on Artificial Intelligence, in Montreal in December 2018. Last February, uOttawa researchers from the Faculty of law were one of eight international teams that were successful in receiving CIFAR funding to host an AI and Society international workshop in Ottawa (AI & Health Care: A Workshop for the Fusion of Law & Science). Further, last May, an internationally recognized uOttawa researcher in the ethics of robotics and AI was invited to participate at a roundtable between Fellows of CIFAR's Learning in Machines & Brains program and other invited international experts, to discuss tangible actions to address ethical issues surrounding AI research and applications.

A review of funding databases by the OVPR using relevant AI key words identified 126 principal investigators currently conducting AI research from nine faculties. Research areas included robotics and manufacturing (Engineering, Medicine), healthcare technologies (Engineering, Medicine, Law, Telfer, and Arts), cybersecurity (Engineering, Medicine, and Law), autonomous vehicles (Engineering, Law, and Telfer), financial and retail services (Engineering, Telfer, Science, and Law), data analytics (Engineering, Medicine, Health Sciences, Law, and Telfer) and Education (Engineering, Arts, Education, and Law). Funding for this research represents in excess of $20M from national and international sources.

In 2019, uOttawa introduced a Master's in Computer Science program with a concentration in applied AI. The objective of this program is to graduate computer science cohorts with broad AI knowledge and

the ability to apply their knowledge across numerous domains. Students pursuing the applied AI concentration will become experts in applied machine learning algorithms and methodologies, and will possess the necessary knowledge to manage, assess and explore a variety of data across multiple application areas, while gaining an understanding of the potential of bias in AI technologies, and the ethics and impacts of AI on society.

In addition, the School of Electrical Engineering and Computer Science is in the process of creating an integrated Applied AI concentration for the Master's of Applied Science in Electrical and Computer Engineering and the Master's of Engineering in Electrical and Computer Engineering programs. The plan is for these programs to be recognized by the Vector Institute.

Further, the university is spearheading two multidisciplinary/interdisciplinary AI training initiatives. First, the OVPR recently selected a Math-AI CREATE (Collaborative Research and Training Experience) proposal as part of its CREATE quota. This Master's program will train a small cohort of outstanding students in Math, Stats and Computer Science. The second initiative led by the Office of Graduate and Postdoctoral Studies is to design a new Master's degree program that would encourage greater interdisciplinary and interfaculty graduate-level training in AI. This latter Master's program will bring together candidates from STEM disciplines, humanities and social sciences, as well as health and medicine, to examine the scientific, social, political, ethical and legal dimensions of AI. While candidates will normally specialize in areas that are closest to their disciplinary background, this program is focused on creating an interdisciplinary learning experience that will provide students with humanities backgrounds, for example, an exposure to the basic science of AI, and provide students with STEM backgrounds with an introduction to the social, political, ethical and legal dimensions of the issues surrounding AI. The new Multidisciplinary Master's degree program in AI as envisioned would be the only one of its kind in Canada.

If all of the aforementioned plans are successfully implemented, uOttawa will have five Master's programs with a concentration in AI.

The Vector Institute has recently entered into an agreement with Mitacs to provide researchers affiliated with the Vector Institute, including program directors and faculty teaching in recognized programs, with a streamlined process for accessing funding under Mitacs' Accelerate program. The agreement is designed to assist in the recruitment of graduate students and post-doctoral fellows and facilitate research collaborations between academic AI research and the industrial sector by supporting internships. This includes strategically placing interns to help health sector organizations derive valuable insights from their health data holdings. This is an opportunity that uOttawa needs to capitalize on, especially in the context of its plans to expand its Master's programs with an AI concentration.

AI technologies present tremendous opportunities and challenges for education. Not only does uOttawa need to prepare its students for AI technologies in the workplace, but students also need to be taught the skills (e.g., data management, data visualization, coding) that are increasingly required. There is a great need for developing optimal learning environments for students in this new world of AI. The Faculty of Education has deep and broad strengths in research on teaching and learning, and in the areas of pre-service and in-service teacher education. This expertise should be leveraged to inform uOttawa transdisciplinary research teams on the implications of AI for the training of teachers, and for the design of new cultures of teaching and learning that leverage AI insights while critically evaluating the limitations of AI systems. Further, the Faculty of Education has relevant strengths in social justice-oriented research within schools, in digital literacies teaching and learning, and in work that advocates for systems serving francophone linguistic minority communities in Canada and around the world.

Affiliated Health Research Institutions

uOttawa has collaborative agreements with six affiliated health research institutions namely:

- Ottawa Hospital Research Institute,
- University of Ottawa Heart Institute,
- Children's Hospital of Eastern Ontario Research Institute,
- Bruyère Research Institute,
- Institut du savoir Montfort,
- Institute of Mental Health Research.

These institutions are not only doing internationally recognized research, but hold a tremendous amount of health data that can be used as part of AI research initiatives. Examples include Ottawa Hospital Data Warehouse, BORN, Cardiocore data, and ICES@uOttawa. uOttawa researchers knowledgeable in the use of these data sets are some of the best in the country. Complementing this strength are research methods centres' scientists and uOttawa researchers who are internationally recognized for their expertise in implementation science, predictive analytics, data management and biostatistics. The availability of the research methods centres such as the Ottawa Methods Centre and the Cardiovascular Research Methods Centre to provide expertise and support to health professionals and researchers at all stages of a research project has been instrumental in the recognition of the Ottawa Hospital Research Institute and the University of Ottawa Heart Institute, for example, as leading centres for clinical research in Canada.

Further, The Ottawa Hospital's vision for the future includes a new campus in the heart of the nation's capital that will deliver 21St-century health care to the communities it serves. The new campus will be one of the Canada's leading healthcare facilities, offering critical care services, education programs, world-class biomedical, clinical, health services and population health research. The new campus will be the location of eastern Ontario's Regional Trauma Centre, and will be the centre for complex, specialized care for patients from Ottawa, eastern Ontario, western Québec, and Nunavut. This will create innumerable opportunities for creating state-of-the-art infrastructure that facilitates groundbreaking AI research and innovations.

Strong Ties with External AI Stakeholders

uOttawa researchers have many active working relationships with Mila, the Vector Institute, Amii, federal research departments and agencies, international governmental and non-governmental organizations, and many companies. uOttawa researchers also have affiliations with Statistics Canada, the custodian of vast amounts of data such as education, social services and justice-related data, that are invaluable for AI research.

Challenges

A summary of the major challenges identified is provided below.

AI Talent

There is general agreement that uOttawa needs to enhance its AI talent pool and work is underway to achieve this objective. These efforts should support education and research training programs that advance equity, diversity and inclusion in AI at both the graduate and undergraduate levels. This is especially important given that there is a critical shortage of AI talent and only 18% of AI researchers in the world are females (10). Further, uOttawa needs to facilitate transdisciplinary approaches to AI

education, including providing greater opportunities for students and research trainees to work in different faculties and to pursue co-op/internship placements with policy-makers, industrial partners and others.

Three CRCs were recently appointed in the Faculty of Engineering (Ethical Engineering of Robotics and AI, Intelligent Software Dependability and Compliance, and AI-enabled Next-Generation Wireless Networks) and efforts are underway to recruit three new CRCs in AI by the Faculty of Medicine, as well as a joint CRC between the Telfer School of Management and the University of Ottawa Heart Research Institute (Managing AI-powered Technologies for Value Creation in Cardiac Care). Further, uOttawa has a number of CRCs that lead a research program addressing legal, societal and ethical challenges that are raised by AI (e.g. Information, Law and Policy; Internet and e-Commerce Law; and Ethics, Law and Technology). The university currently has 38 active university research chairs (URC). A cursory review of the URCs by the OVPR identified two URCs actively pursuing AI as part of their research (in Law: AI in health care systems, and in Science: AI and computational tools and platforms). The need for greater joint appointments of CRCs/URCs was identified.

The demand for the Master's in Computer Science program with a concentration in applied AI is strong and the admission process is highly competitive. The total number of applicants for the fall 2019 intake was 338, with a total of 30 offers made, of which 20 (<6%) were accepted. (*Note: A breakdown by gender was not available*.) Of those accepted in the program, 11 (>50%) received scholarships from the Vector Institute. To date, two students have graduated, and 28 are currently active in the program. This is with little promotion or marketing of the new program. The total number of applications in computer science graduate programs this year was 1,553, representing an 84.4% increase in total applicants from the previous year (842).

Last summer, Amii hosted a CIFAR AI Summer Institute in conjunction with its Summer School. The AI Summer Institute focused on AI in Society, and was open to graduate students and early-career researchers in any disciplinary area who demonstrate interest in the societal impacts, governance and ethics of AI and machine learning. AI Summer Schools and AI Summer Institutes provide a great opportunity for students and new investigators to network and learn from some of the world's top AI experts. Surprisingly, only two students (300 enrolled) from uOttawa participated in the 2019 AI Summer Institute. uOttawa faculties should aggressively promote these opportunities to promising students when they come up. Further, there is no reason why uOttawa cannot host its own AI Summer Institutes in the future.

Financial and Non-financial Incentives

A combination of financial and non-financial incentives should be pursued to encourage and facilitate transdisciplinary AI research and training. Examples cited included recognizing participation in relevant administration responsibilities such as participation on AI committees, recognizing collaborative activities in annual merit assessments, providing course relief for researchers involved in AI research and in supervising AI research trainees, reallocating internal URC funds for dedicated AI-related URCs, and providing a fund for seed grants for AI graduate students and research trainees, for CRCs pursuing research in AI and for transdisciplinary research teams. Finally, uOttawa should provide incentives for transdisciplinary AI research for the purpose of promotion and tenure.

Recognizing and Measuring Performance

Currently, uOttawa faculties do not, for the most part, recognize and reward collaborative research. The success of the university in achieving its AI vision requires rethinking how it recognizes the efforts

of researchers involved in transdisciplinary research. For example, the Ottawa Hospital Research Institute (OHRI) has performance evaluation policies in place for researchers that recognize collaborative research activities such as the joint supervision of students and research trainees, joint grant applications/publications, and collaborative partnerships. It was recognized however, that while this will require a change in institutional culture and practices that was beyond the scope of the OVPR's authority and of this report, the OVPR should initiate discussions with the university's Research Commission about how the university can better reward collaborative research activities.

At the institutional level, it was challenging to identify relevant data on uOttawa's AI activities and existing AI human capital. To track progress and overall success from implementing its AI mission, uOttawa needs to identify key performance metrics and collect relevant data to measure whether the institution has successfully achieved expected outcomes. Without a focal point for coordinating AI activities such as performance measurement and reporting, it will be difficult to assess the university's progress in this area and to make informed decisions regarding AI-related investments.

Space for Collaborative Research

Currently, access to space that is specifically designed for multi-faculty collaborative research at uOttawa is limited. The amount of space available for collaborative meetings varies considerably across faculties, and while the responsibility for research space for institutional initiatives lies with the OVPR; its access is administered by each faculty. While new collaborative education space exists in the *Learning Crossroads* at uOttawa, there is a critical need for shared workspaces, such as dedicated *AI Collaboratories*, where researchers, students and research trainees from various disciplines, as well as external partners can meet to discuss and work on transdisciplinary AI research initiatives. Further, suitable space to host workshops and events is essential to building internal collaboration as well as to improving uOttawa's profile in AI.

Point of Contact for Coordination of AI Activities

Currently, there is no visible point of contact at uOttawa for coordinating AI-related activities such as:

- communications and marketing;
- identifying and coordinating of responses to crosscutting funding opportunities;
- coordinating of the measurement, evaluation and reporting of uOttawa's performance in AI activities;
- facilitating outreach and engagement for AI activities; and
- brokering solutions to common issues and concerns raised by researchers and others.

Without a focal point for coordinating AI-related activities, uOttawa is continually in a responsive mode, with external requests related to AI activities directed randomly, and often dropped.

Access to methods and technology support

The increase in AI research is putting significant pressures on existing resources. uOttawa experts in machine learning and algorithm development in the Department of Mathematics and Statistics and the School of Electrical Engineering and Computer Science (EECS) are overwhelmed with requests from uOttawa researchers needing tailored AI tool development for research projects. There are many exciting possibilities for transdisciplinary research collaboration between uOttawa researchers in AI methods and applications. However, at uOttawa there are significantly fewer methods and technology support experts than researchers wishing to apply AI in their research. AI methods experts have reasonable access to computing resources, notably through *Compute Canada*, but additional dedicated local compute servers could greatly facilitate AI research. It was suggested that uOttawa should explore being a beta site for remote access to the NRC's computing services. A more pressing need in the short

term however is for additional senior researchers and personnel (postdocs, research associates/assistants and computing-related staff) with the relevant AI skills sets.

Similar pressures are likely to be felt by research methods and technology resources that support health research initiatives at the research institutes of affiliated health research institutions. The increase in AI research is expected to place additional pressure for providing support from core research resources like computing, data centres and data storage systems that are already operating on thin overhead expenses.

Access to Communications & Marketing Support

Communications and marketing of research at uOttawa was identified as a source of great frustration for researchers. The range of audiences including the public, potential benefactors, governments and funding sponsors, among others, make this especially important to uOttawa's reputation and for sensitizing its stakeholders to its work in AI and the importance of research more broadly. The level of support for researchers for the dissemination of research results as well as for facilitating the coordination of AI research information among researchers internally varies significantly across faculties. Little information is currently available internally and on uOttawa's external website regarding AI research currently underway. This significantly hampers efforts to form collaborative partnerships internally and with potential external partners.

5. Future Directions

uOttawa Strategic Research Plan

Recently, uOttawa has launched a strategic planning exercise to shape the future directions of the university. The strategic planning exercise has involved the university community's participation in creating a new vision for the institution's future. A Strategic Framework – *Transformation 2030* - was presented and approved by the Board of Governors in the late spring of 2019. The intent of uOttawa is to release *Transformation 2030* by the end of 2019.

Under the leadership of the VPR, the university's research and planning department is currently developing, in collaboration with the university's faculties, research institutes and centres as well as affiliated health research institutions and other research stakeholders, a Strategic Research Plan for the years 2020-2025. This plan will define the specific actions to be undertaken to achieve the objectives outlined in the university's Strategic Framework. It will include a dashboard to assist the university community in tracking its progress towards achieving those objectives.

View a diagram outlining uOttawa's key Strategic Areas of Research (which are part of Transformation 2030) and examples of specific research in each area.

In the context of uOttawa's strategic planning exercise, the work of the AI Advisory Committee described in this report is timely in mapping out the institution's future in the AI space.

6. AI at uOttawa

AI is evolving at a rapid pace and is already reaching human or super-human performance levels in many areas, such as robotics, industrial optimization and health technologies. At the core of many of these successes are machine-learning techniques such as deep learning and reinforcement learning

that augment and sometimes replace rules-based reasoning. New machine learning algorithms designed to further advance the state of the art are being developed every day. The range of intelligent functions is vast and includes pattern recognition and detection, optimization, natural language processing and translation, decision-making, and many others.

AI impacts our core legal, economic and social fabric, and disrupts historic frameworks that have guided morally and legally acceptable behaviour. As AI capabilities and technologies are still evolving, there are numerous opportunities to shape this evolution in a manner that improves the lives of a diversity of Canadians and people around the world. In this regard, uOttawa views *responsible AI research* as research that ensures the ethical, transparent and accountable design of AI technologies consistent with societal expectations, laws and norms. Developing responsible AI that reflects a diversity of needs, concerns and values requires applying methods from across disciplines to create a shared understanding of, and response to, AI and its effects.

uOttawa is committed to a problem-driven research approach that transcends disciplinary boundaries to integrate knowledge, theories, methods, data, languages and communities, in order to address society's most pressing needs. This "transdisciplinary" approach allows uOttawa to capitalize on the synergies inherent in its extensive network of researchers to generate AI knowledge and applications, and a better understanding of the societal, educational, ethical and legal implications of AI.

The recommended AI vision and mission are presented below, followed by the main expected results in AI research.

AI Vision

uOttawa is a leader in research, training and innovation that integrates disciplines and communities to develop responsible AI for the benefit of Canada and the world.

AI Mission

uOttawa will achieve its vision by:

- leading in the understanding and framing of the ethical, legal and societal implications of AI technologies and their uses;
- leveraging a transdisciplinary approach to advancing AI methods and tools, with a focus on their responsible applications, and collaborating with community, government and industry partners; and
- harnessing the unique opportunities in the heart of the National Capital to recruit and develop top AI talent in a bilingual environment.

Expected Results

The expected results for uOttawa in achieving its vision and mission in AI include:

- significantly enhanced local, national and international uOttawa profile in AI research and training;
- enhanced capacity to generate world-class responsible AI research and innovation;
- increase in productive, collaborative partnerships in AI research and innovation;
- increase in the attraction and retention of AI talent;

- increase in the timely and effective translation and dissemination of AI research knowledge to the public, policy makers, industry and community organizations; and
- increased investments in uOttawa AI research from funding bodies, governments, industrial partners and other sources.

AI Research Themes

The success of uOttawa's future directions in AI research, training and innovation efforts rests on two fundamental principles: 1) research is *problem-driven and transdisciplinary* in approach; and 2) issues of *inclusion, equity and diversity* are front and centre in AI research and training.

These key principles should guide uOttawa research and training efforts in AI. The principles cut across uOttawa's four strategic research areas highlighted earlier and are the foundation upon which all AI research efforts are built.

uOttawa believes that solutions to humanity's complex issues require the deep integration of ideas, approaches and perspectives from across disciplines - from the social sciences and humanities, health and biomedical sciences, and natural sciences and engineering – to develop novel frameworks and more intellectually compelling research questions. Moreover, a transdisciplinary approach can more effectively inform the responsible development of AI technologies defined by the populations and societies for which they are intended. Research can be used to uncover inherent biases in the data used to create AI decision systems, as well as biases in the design of AI innovations. Responsible design and governance of AI can be used to harness innovations that benefit many instead of only the interests of a few.

Preliminary AI thematic areas of research were identified based on the consideration of the following criteria:

- there is an existing uOttawa critical mass of nationally and internationally recognized research excellence;
- there are existing or potential collaborative partnerships with policymakers, industry, community-based organizations, and researchers at CIFAR AI Institutes (Vector, Mila and Amii), among others; and
- researchers have access to relevant data sets.

Based on the above considerations, four key AI research themes were identified for uOttawa to initially focus its AI strategy on, namely: Learning Health Systems, Smart Societies, Sustainable Environment and Climate Change, and Governance, Regulatory Frameworks & Standards.

For purposes of this report, only an initial outline of each theme is provided, but it was recognized that the themes will need to be developed into more detail, identifying the compelling research questions that need to be addressed. While there was no agreement as to which approach is best for achieving this objective, one suggested approach is for the OVPR to co-lead with a lead investigator theme-specific brainstorming sessions with researchers wishing to be part of crosscutting faculty research teams. To offer further support to these brainstorming efforts, the OVPR should consider providing seed grants for graduate and post-graduate students to support the work of crosscutting research teams. It was also recognized that other AI research themes will be identified over time; however the underlying principles of *problem-driven transdisciplinary* research and *inclusion, equity and diversity* should still be used to guide future research efforts and investments.

The four AI Research Themes are described below.

Learning Health Systems

(This theme relates to uOttawa's Transformation 2030 Strategic Research Area: Enabling Lifelong Health & Wellness.)

We are in a new era of big data. AI and superhuman tools are bringing about a new generation of collaborators and skill sets beyond the traditional health disciplines. The implications for patients and health systems will be profound. For example, AI will enable greater patient involvement in decisions affecting their health. However, the availability of new knowledge historically has not been sufficient to ensure that patients and societies optimally benefit. Better knowledge needs to be linked with implementation approaches that address the real-world barriers that patients, health professionals and others face.

Given the challenges, we need learning health systems that increase the likelihood that patients and societies benefit maximally from innovations such as AI. Specifically, learning health systems can leverage large data sets and scientific evidence to identify opportunities for responsible AI innovation. Learning systems aim to improve clinical practice by actively implementing and constantly monitoring the impacts of innovations to drive new learning cycles. Effective changes to practice, programs, products and services may also require changes in organizational structures, processes and culture. In order for learning health systems to successfully act as the backbone of AI innovations at uOttawa, many issues will need to be addressed through transdisciplinary research, including those related to data, ethics, literacies, sociology, information sciences, law, security and real-world implementation. Leveraging the benefits of responsible AI in health is more than developing, modifying or adopting existing algorithms. It includes the implementation and evaluation of algorithms in real world settings for clinical practice changes, building on uOttawa's historic strength in medical decision-making and implementation science.

At the same time, learning systems can stimulate basic biomedical research, which is another great strength of uOttawa. As new patterns emerge from patient data on disease, mechanisms or treatments are generated that can be tested in the lab.

Smart Societies

(This theme relates to uOttawa's Transformation 2030 Strategic Research Area: Shaping the Digital World.)

As AI and the use of computers transform our everyday world, there is an urgent need to shape this digital future by contributing innovative and ethical tools that will address the needs of a variety of stakeholders across society. This will involve not only the creation of technologies but also standards to study and address the social and ethical, governance and legal questions relating to these technologies. uOttawa has a number of initiatives underway that could be enhanced to benefit from AI research and innovations relating to smart societies – both rural and urban. AI is not only applied to smart cities, but is being applied to food production and hospitals in the form or smart agriculture and smart hospitals.

Ottawa was the first Canadian city to test an on-street autonomous vehicle (AV) communicating with live infrastructure. uOttawa has an opportunity to leverage local innovation and industry leadership in information and communications technologies (ICT), next-generation networks, wireless, and related hardware and software. The Ottawa region has the expertise and capabilities required to develop, commercialize and adopt new vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) solutions that incorporate responsible AI systems. These technologies can be integrated into global supply chains.

uOttawa researchers in algorithmic foundations also have joint projects on "safe AI" with leading researchers out of the three CIFAR AI Institutes, and these researchers can be a source of algorithmic

innovations in the local AI technology projects of uOttawa's Smart Society initiatives. The way in which AI algorithms are designed will determine how the autonomous vehicle in the example above makes its decisions in a responsible way. Further, there is great interest in applying smart innovations—specifically data and machine intelligence— applied to the agriculture sector and aquaculture sectors to boost the overall sustainability and economic productivity of the food supply. Social science is needed to anticipate the societal implications of these innovations – say, of autonomous vehicles and tractors – as well as how the innovations will be received by stakeholders. The impact of uOttawa AI research will be a smart societal revolution that engenders justice as well as equity.

uOttawa researchers studying the social, ethical and legal impacts of smart societies need to continue to build on uOttawa's reputation in this field by ensuring that AI research explores digital and data governance mechanisms such as data trusts, standards, algorithmic impact assessment methods and tools, data mobility, and data sharing infrastructures. All of these approaches need to be developed in collaboration with civil society groups, industry, the public and other relevant stakeholders. Other dimensions important to address include digital and technological literacy, privacy, cybersecurity, algorithmic governance, data localization and sovereignty as well as new data divides.

Environment Sustainability and Climate Change

(This theme relates to uOttawa's Transformation 2030 Strategic Research Area: Creating a Sustainable Environment)

AI is a powerful tool that helps to address one of the biggest challenges of our era, namely the sustainability of societies, of economies, and of the environment. With the abundant data flowing from smart cities, ocean and fishery monitoring systems, as well as meteorological centers, AI emerges as a necessity to process and produce meaningful information out of the chucks of data coming from those heterogeneous resources.

uOttawa has strong research expertise focused around machine learning based energy trading for microgrids, intelligent charging of connected electric vehicles, AI-enabled device-to-device communications for distributed energy generation, and evolutionary algorithms for device design in the field of solar/photovoltaics (PV) systems. For instance, AI can be used to preserve grid connection reliability through distributed control of local PV generation, electrical storage, and electrical loads. From basic machine learning of local and aggregate electricity demand, to more advanced ensemble learning approaches for weather forecasting, AI finds increased utility not only in PV power forecasting aiming to reduce waste, but especially in the fusion of energy forecasting problems.

AI and sustainability research requires transdisciplinary collaborations that are readily established among many colleagues at uOttawa from energy, communications, computer science, economics and social science disciplines. Further, AI research should be pursued to enhance the award-winning uOttawa work in the biological (genetic, neurological, behavioral, endocrine) effects of pollutants in the environment, as well as mathematical patterns of population dynamics to understand how habitat fragmentation and change can lead to stability, or at the opposite extreme, extinction.

Sustainability and climate change are immediate priority areas for Canada and for the rest of the world. AI techniques for sustainability are promising but also immature and in need for more research. uOttawa has existing strength both in AI and sustainability that uniquely identifies it from the other institutions in the region, which should be leveraged to further strengthen the research and the programs within that area.

Governance, Regulatory Frameworks & Standards

(The main uOttawa's Strategic Plan strategic research area that this theme relates to is: *Advancing Just*

Societies).

There are great benefits to AI but also risks. While promising important benefits, unchecked AI development raises significant challenges, from creating uncertainty surrounding the future of work, to shifts in power to new structures outside the control of existing and understood governance and accountability frameworks. Particularly problematic is how these challenges can have a disproportionate impact on marginalized populations, amplifying existing injustices. Similarly, emerging AI tools are increasingly complicating previously straightforward areas of domestic and international policy.

In the fast-paced world of AI innovations, there is a critical need to research the ethical, legal and social dimensions of AI to ensure that these innovations align with well-established and robust societal norms and values to protect privacy, public trust and human rights. For example, as AI depends upon the use of vast quantities of data, the governance for data sharing becomes much more complex where the data contains personal information. It may require changes to laws and policies to facilitate access while safeguarding the privacy and ethical reuse of data.

There is also a need to ensure that the benefits and risks coming from innovations in AI are equitably distributed. Research is needed to develop effective, inclusive and participatory ethical design and engineering frameworks for AI systems to avoid the risk of amplifying global digital injustices. Research that supports the development of responsible methods and tools, standards, and regulatory frameworks to mitigate the risks of AI technologies, will ensure the transparency, privacy and security, as well as the responsible procurement and deployment of AI algorithms in real-world settings. Adequate solutions will only be realized through transdisciplinary research. Moreover, the ubiquity of the global and digital economy calls for comparative studies to design responsible frameworks.

7. Going Forward

Required Functions & Implementation Models Considered

Achieving uOttawa's AI Vision and implementing its AI Mission will require that important governance and administrative functions be addressed. These are considered to be key enabling functions that should be performed centrally and include:

- management and coordination of uOttawa AI enabling activities;
- communication and marketing of uOttawa AI research;
- facilitation of outreach and engagement on AI activities with stakeholders (e.g., government, industry, community-at-large);
- coordination of the reporting of performance metrics;
- identification and brokering internal and external collaborative opportunities;
- drafting proposals for crosscutting funding opportunities in collaboration with relevant faculties; and
- access to AI methods and technological support.

A number of models for moving forward were considered including:

- the creation of a new AI Institute located in a faculty;
- the modification of the mandate of an existing uOttawa research institute/centre to include AI;

- the creation of an AI Research Network (e.g., Network Centres of Excellence).

After discussing the advantages and disadvantages of each model over several months, the Committee recommended that uOttawa links research institutes, centres, laboratories and researchers working on AI-related projects in a university-wide federated AI entity, through a phased implementation approach. In the immediate first phase, uOttawa should establish a federated AI research network of researchers, centres, institutes and research groups on a voluntary opt-in basis. An invitation should be sent by the OVPR to all researchers and research groups. The federated research network should be created quickly to begin the process of organizing and aligning AI-related expertise, resources and opportunities at uOttawa. The research network should be branded as an AI Institute without being subject to the current institute structure at uOttawa.

A Steering Committee should be established for the oversight and management of the network (i.e. programming and funding decisions on allocated internal funds). This Steering Committee should be composed of one representative (researchers in AI) from each faculty and should be chaired by the VPR or delegate (such as AVPR, Promotion and Development). One or more representatives from the Steering Committee should be involved in the OVPR Meetings of Directors of Research Institutes and Centres to discuss strategy, programming and network strengthening initiatives. To maintain momentum and continuity, consideration should be given by the OVPR to appointing some members of the current AI Advisory Committee as initial members of the Steering Committee. Moreover, to ensure coordination, consideration should also be given to making cross appointments on the Steering Committee and relevant AI working groups/committees of the Office of the Vice-Provost, Graduate and Postdoctoral Studies.

While there was agreement that a federated AI research network model presented a number of attractive features in the short term such as ease of implementation, agility and flexibility for making future changes as the university continues to enhance its AI capacity, there was also recognition that a more structured and integrated focal point for uOttawa's AI-related research, training and education activities was required. This included providing a future home for the university's new Multidisciplinary Master's degree program in AI currently under development.

Once the federated AI research network is operational, the Steering Committee should make recommendations to the OVPR regarding its transition towards a more structured and integrated uOttawa AI Institute for transdisciplinary research and education programs.

8. Final Recommendations

The recommendations of the report, grouped by main categories, follow.

Leadership

1. The AI vision, mission, and research themes in this report are rooted in a transdisciplinary approach that is foundational for creating a world-class AI research and training environment. The Committee identified many current institutional barriers and disincentives to effectively achieving this approach that require cultural changes in institutional structures and processes, notably related to funding, accounting, hiring and merit assessment of researchers.
   1.1 While it was recognized that these changes are beyond the scope of this report and of the OVPR's mandate, it is recommended that the OVPR initiates discussions with Deans and university executives to facilitate and promote greater multi-, inter- and transdisciplinary education, research and training initiatives at uOttawa.

1.2 The OVPR should convene a small working group with representatives from central administrative services and faculties to develop an implementation framework designed to provide guidance on topics such as the accounting treatment of shared expenses, performance reporting and human resource services.

2. An explicit commitment and support from the OVPR, Deans and uOttawa executives is required throughout the process of implementing the recommendations in this report.

2.1 An implementation action plan should be developed and discussed with university executives and the Research Commission.

2.2 The action plan should articulate the investments that uOttawa will allocate to become a leader in Responsible AI. Investments should be positioned in the context of the university's Strategic Research Plan to keep all those concerned motivated throughout the implementation of the changes so that the university can continue to excel in research and education.

2.3 To ensure continuity and momentum going forward, members of the Committee should be consulted in developing the implementation action plan.

Governance

3. To ensure more effective research collaboration, coordination and promotion, uOttawa research institutes, centres, laboratories and researchers working on AI-related projects should be regrouped in a university-wide federated AI entity, through a phased implementation approach.

3.1 In the immediate first phase, uOttawa should establish a federated AI research network of researchers, centres, institutes and research groups on a voluntary opt-in basis. An initial invitation should be sent by the OVPR to all researchers and research groups. The research network should be created quickly to begin the process of organizing and aligning AI-related expertise, resources and opportunities at uOttawa. Once operational, the network should then transition to a more structured and integrated federated entity. The research network should be branded as an AI Institute without being subject to the current institute structure at uOttawa.

3.2 A dedicated budget and team located within the OVPR should be established to support the network, providing key functions such as branding, communications and marketing, planning of events such as uOttawa AI Days and training workshops, summer schools and other strategic outreach activities.

3.3 The federated research network should be responsible for supporting, coordinating and administering university-wide funding requests for large crosscutting strategic grant/fund submissions.

3.4 A Steering Committee should be established for the oversight and management of the network (i.e. programming and funding decisions on allocated internal funds). This Steering Committee should be composed of one representative (researchers in AI) from each faculty and should be chaired by the VPR or delegate (such as AVPR, Promotion and Development). One or more representatives from the Steering Committee should be involved in the OVPR Meetings of Directors of Research Institutes and Centres to discuss strategy, programming and network strengthening initiatives.

3.5 To maintain momentum and continuity, consideration should be given by the OVPR to appointing some members of the current Committee as initial members of the Steering Committee. Consideration should also be given in ensuring coordination through cross

appointments on the Steering Committee and relevant AI working groups/committees of the Office of the Vice-Provost, Graduate and Postdoctoral Studies.

3.6 Once the federated research network is operational, the Steering Committee should make recommendations to the OVPR regarding its next phase of evolution towards a more structured and integrated uOttawa AI Institute for transdisciplinary research and education programs.

Building Capacity

4. There is currently much untapped potential for internal AI research collaborations at uOttawa. There is an urgent need to create opportunities for researchers from across uOttawa's faculties and research institutes and centres to meet to discuss transdisciplinary AI research initiatives. Recommended opportunities to pursue should include a range of activities such as, weekly/monthly university-wide state-of the art AI-related seminars.

5. uOttawa should encourage and facilitate more joint recruits, appointments and cross appointments of CRCs and URCs to facilitate greater collaboration between faculty researchers and research trainees.

6. uOttawa should develop a critical mass of expertise in foundational AI in EECS and Sciences (Math, Statistics and Physics) by recruiting more professors to ensure uOttawa has a solid foundation in AI theory and algorithm development, to maintain strong relationships with CIFAR AI Institutes and to attract outstanding students. uOttawa has lost AI talent in the last few years and this trend needs to be reversed.

7. Incredible work has been done to-date at uOttawa with the resources available, but the increasing pressure of demands for admission to new programs such as the Master's program in Computer Science with a concentration in applied AI is not sustainable in the long run. The increasing demand for AI talent, and the university's initiatives to develop graduate-level training in AI by adding four additional Master's programs in AI, will only add greater pressures to existing professors with AI expertise.

   7.1 There is a critical need for the Faculties of Engineering and Science to increase the number of professors with a strong research record in AI, not only to teach the relevant courses, but also to act as research supervisors.

   7. 2 The increased need for additional professors with AI expertise applies to all the faculties. uOttawa should determine priorities for addressing these needs.

8. uOttawa should establish a Data Science Core Facility/Shared Services that would offer on-campus AI methods and technological consultation services to its researchers and others based on a break-even economic model.

   8.1 uOttawa AI consulting service would be responsible for: hiring staff, especially one or more data scientists and/or experts in advanced research computing; acquiring a dedicated on-campus compute cluster with appropriate GPUs, and a staff member to administer and assist researchers using it and supporting faculties and others on their AI research projects.

   8.2 uOttawa should explore with the NRC the feasibility of this core facility/shared services to act as a beta site for remote access to the NRC's high-speed computing services for AI research purposes initially and then research more broadly in the longer term.

9. There is an urgent need for dedicated resources to create and maintain a social media and website

(AI@uOttawa) and online presence. This includes:

9.1 Providing a repository of uOttawa AI research containing information on AI-related research projects, researcher profiles and features.

9.2 A dedicated media relation staff person responsible for actively promoting and coordinating information on uOttawa AI research, events (e.g. AI Research Days) and important research partnerships.

9.3 A research communication plan with clear goals for promoting the success and excellence of the university's research in AI. This plan should be developed and aggressively pursued.

10. A combination of financial and non-financial incentives should be pursued to encourage and facilitate transdisciplinary AI research. Examples are cited in the report including providing seed funding and greater recognition, career-path (i.e. promotion and tenure) incentives and rewards to researchers participating in transdisciplinary AI-related activities.

11. To track progress and overall success from implementing its AI mission, uOttawa needs to identify key performance metrics and collect relevant data to measure and report progress over time on whether the institution has successfully achieved expected outcomes.

Collaboration & Exchange

12. The key to the university's success in fully realizing its AI Vision will be the ability of its researchers to form productive partnerships with governments, community-based organizations, industry, and other researchers. It is recommended that beyond its current activities, uOttawa ensures that it is well positioned to provide policy support to governments by establishing a cross-faculty team of research experts (e.g., Quick Response AI Team) that can meet with policy-makers and other government officials to address emerging AI issues and provide a better understanding of the next generation of technologies that incorporate elements of AI.

13. Researchers at uOttawa's affiliated health institutions are integral players in the university's strategy for enhancing its AI research and training activities. Great opportunities for collaborations are next door, however they are often forgotten. Conversely, affiliated health research institutes need to engage more in transdisciplinary research that involves a variety of disciplines from different faculties.

14. uOttawa needs to capitalize on opportunities created by Kanata North. This includes creating a greater AI-focused presence on its website and at the uOttawa Kanata offices. It also includes stepping-up its efforts to provide opportunities and incentives for researchers to form partnerships with industry on AI research and training and reduce the trend from the last decade of declining funding from industry sources.

15. uOttawa needs to more pro-actively promote and facilitate links between researchers and initiatives such as Superclusters, particularly SCALE.AI, as well as CIFAR initiatives for students and new investigators, and other NRC programs like the AI Challenge program.

16. AI Collaboratories should be established with dedicated and shared workspaces to facilitate transdisciplinary AI research, where researchers, students, research trainees and external partners can meet to work on transdisciplinary AI research initiatives. uOttawa should explore opportunities for creating these spaces, such as including new space development in uOttawa's Campus master plan, expanding on site space in Kanata North industrial park, and supporting AI Collaboratories by pursuing funding support for collaborative space for transdisciplinary research through a CFI

submission.

8. Summary

The OVPR established an AI Advisory Committee and commissioned a consultant in the spring of 2019 to review uOttawa's AI activities in the context of the institution's research strengths, opportunities and challenges and to make recommendations on its future directions. This report summarizes the deliberations of the AI Advisory Committee and identifies actions requiring immediate attention, recommends preliminary research thematic areas and changes relating to a number of key factors important for enabling an effective research, training and innovation environment for going forward. The report makes 16 recommendations relating to leadership, governance, capacity building and collaboration and exchange. How the university manages the approach for addressing the recommendations in this report will play a significant role in its overall success in achieving the AI vision and mission presented in this report.

9. References

(1) Office of the Vice-President, Research.

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(6) https://nouvelles.umontreal.ca/en/articlE/2017/05/15/100m-for-a-new-quebec-research-cluster-in-ai/

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(10) https://betakit.com/alberta-commits-100-million-to-ai-companies/

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APPENDIX A. AI Advisory Committee Terms of Reference & Membership

1. Purpose

The AI Advisory Committee is an advisory committee to the Vice-President, Research. It is responsible for developing and recommending a vision, mission and objectives for AI research at University of Ottawa. The committee should address a number of topics including:

- Brainstorm on the the primary purpose of AI research/initiatives in relation to existing initiatives across the country
- Review existing research capacity on AI at uOttawa
- Brainstorm on the key strategic research areas to be developed and determine the types of projects and activities that could be initiated as well as the anticipated impacts
- Brainstorm on the potential partnerships that could be established
- Discuss various approaches to be pursued in the possible creation of an AI Research Institute/Centre.

A facilitator appointed by the Vice-President, Research will provide support in the planning and coordination of the committee's work.

2. Background

The University of Ottawa is looking to support research/initiatives on Artificial Intelligence as a way to engage more actively in the AI revolution. Artificial Intelligence will change people's lives around the world and have major impacts on many aspects of our society from technological, legal, social and economic perspectives, among others. The University of Ottawa can play an important role in the development of new AI technologies as well as in the understanding of AI's impact on society and individuals. Initiatives on AI are well aligned with our Strategic Areas of Development of Research. It will bring together researchers with expertise in a range of disciplines from all Faculties and affiliated institutes across the institution.

3. Membership

D. Amyot (Eng); *K. Bronson* (Social Science); *K. Eltis* (Droit civil); *P. Fallavollita* (Health Science); *M. Fraser* (Science); *S. Grosjean* (Arts); M. *Schira Hagerman* (Education); *L. Lessard* (Telfer); *J. Millar* (Eng); *D. Manuel* (Med); *F. Martin-Bariteau* (Law); *T. Perkins* (Med).

4. Terms

Committee members will serve for the period required to complete the process, starting in April 2019 and ending no later than November 1ST 2019. Delegates are not permitted to attend a meeting instead of committee members.

5. Meetings

The committee is expected to meet on a regular basis (i.e. minimum once per month). An agenda will be prepared and distributed to the committee at least three days prior to the meetings. The Office of the Vice-President, Research will contact members to confirm day/time, organize suitable meeting facility, distribute the agenda and any additional materials, take minutes of the meeting and distribute the minutes as soon as possible following the meeting.

6. Responsibilities

The AI Advisory Committee members will actively participate in meetings, facilitated by [TBD], and provide recommendations on:

- A vision, mission and objectives for AI research/initiatives at uOttawa
- Academic members at uOttawa and external partners who have shown interest for AI research and would have expertise to contribute to new initiatives
- Types of projects that could be initiated at uOttawa
- Suggestions on the development of a major AI initiative, including the possible creation of an AI Research Institute/Centre

These recommendations should be part of a report to be submitted to the Vice-President, Research no later than *November 1st 2019*. The facilitator will provide the support in the drafting and finalization of the report. Additionally, the members will validate the mapping of the research capacity in AI at uOttawa and provide an environmental scan of related AI initiatives in Canada and across the world. This information will be provided to them at the initial stage to guide the discussions around the vision, mission and objectives