

# AICan<sup>🍁</sup> 2019

Annual Report of the CIFAR  
Pan-Canadian AI Strategy

---



## ABOUT CIFAR

CIFAR is a Canadian-based, global charitable organization that convenes extraordinary minds to address science and humanity's most important questions.

By supporting long-term interdisciplinary collaboration, CIFAR provides researchers with an unparalleled environment of trust, transparency and knowledge sharing. Our time-tested model inspires new directions of inquiry, accelerates discovery and yields breakthroughs across borders and academic disciplines. Through knowledge mobilization, we are catalysts for change in industry, government and society. CIFAR's community of fellows includes 19 Nobel laureates and more than 400 researchers from 22 countries. In 2017, the Government of Canada appointed CIFAR to develop and lead the Pan-Canadian Artificial Intelligence Strategy, the world's first national AI strategy.

### EDITOR

Elissa Strome

### CONTRIBUTORS

Brent Barron, Nabilah Chowdhury, Krista Davidson and Kurt Kleiner

### DESIGN

Emma Tarswell

Special thanks to our partners at Amii, Mila and the Vector Institute for their support and contributions.

CIFAR's leadership of the Pan-Canadian AI Strategy is funded by the Government of Canada, Facebook and the RBC Foundation.

Canada

facebook



Foundation

## TABLE OF CONTENTS

Message from CIFAR President & Board Chair	1
Message from the Executive Director	3
The CIFAR Pan-Canadian AI Strategy	4
Canada CIFAR AI Chairs 2018-2019	10
National Program of Activities	22
CIFAR AI & Society Program	26
CIFAR AI Partners	30
Appendices	31



## MESSAGE FROM CIFAR PRESIDENT & BOARD CHAIR

For more than 45 years, Canadian researchers have been at the forefront of advancing artificial intelligence (AI) research. The first Canadian Society for Computational Studies of Intelligence (now Canadian Artificial Intelligence Association, CAIAC) workshop was held at Western University in 1973. Over the next few decades, research clusters were established in computer science departments at universities across the country, and Canadian researchers contributed early pioneering work in fundamental areas of computer vision, knowledge representation, learning and robotics.

CIFAR's mission is to bring together the world's best researchers, across disciplines, to tackle questions of importance to the world. Recognizing that machine intelligence is one of those hard problems that requires long-term sustained investment and multiple perspectives, CIFAR's very first program in 1983 was Artificial Intelligence, Robotics and Society. We established a network of some of the leading thinkers across Canada's three major centres for AI at the time, McGill University, the University of British Columbia and the University of Toronto. The network included established and emerging Canadian researchers, who accelerated their thinking and their research through their collaborations within the CIFAR program. The group made many significant contributions to advance AI research, and laid the foundation for the successes that we have today.

Fast forward to 2004. CIFAR launched a new program, Neural Computation and Adaptive Perception, with the idea of bringing together computer scientists, neuroscientists and others, to take what we knew about how the human brain learns and apply it to machines. The Program (now called Learning in Machines and Brains) was instrumental in developing the deep neural network (deep learning) approach to machine learning.

Over this period, three major research centres for machine learning were established in Canada, built around CIFAR program members at the University of Alberta (Richard Sutton), the Université de Montréal (Yoshua Bengio) and the University of Toronto (Geoffrey Hinton). These researchers attracted great students and colleagues to work on the challenges of machine learning, and established the three centres as amongst the world's leading centres for research and training in machine learning.

Thanks to advances in computational power and an abundance of data, machine learning, and more specifically deep learning and reinforcement learning, now



form the basis of the AI-based technologies and services that are transforming everything from disease diagnosis to banking, agriculture, materials discovery and self-driving cars.

This report describes the next chapter in the history of AI in Canada. With generous support from the Government of Canada, CIFAR is leading the Pan-Canadian AI Strategy, working with our partners and stakeholders to sustain and advance Canada's leadership in AI research and innovation. AI has the power to open up tremendous social, economic and environmental opportunities, as well as creating new ethical, economic and social challenges. At CIFAR, our goal is to ensure that Canada is at the centre of both the scientific advances in AI, as well as addressing the challenges that AI raises for society.

**Alan Bernstein, OC, OOnt, PhD, FRSC**  
**President & CEO**

**Barbara Stymiest**  
**Chair, CIFAR Board of Directors**



## MESSAGE FROM THE EXECUTIVE DIRECTOR

In Budget 2017, the Government of Canada asked CIFAR to lead the Pan-Canadian AI Strategy, a \$125-million investment in AI research and innovation in Canada. The goal of the strategy is to provide deep investment in Canada's early leadership in machine learning research and training to ensure that we continue to hold our place on the world stage.

AICan 2019 is the first Annual Report of the CIFAR Pan-Canadian AI Strategy. In the following pages we provide highlights of the past year, focusing on the four pillars of the Strategy. One year in, we are already seeing significant acceleration of AI research in Canada, including the establishment of three new independent research institutes, major expansions of our training programs and increased collaboration with industry. We have also launched CIFAR's AI & Society Program, which brings together academic researchers, thought leaders and policymakers to examine the social, legal, economic and ethical implications of AI.

None of this would have been possible without the strong partnership and collaboration between CIFAR, Amii, Mila and the Vector Institute. My sincere thanks to all of the staff at each of the four organizations, whose hard work and commitment to the vision of the Strategy has already resulted in advancing Canada's leadership in AI. Special thanks also to the members of CIFAR's International Scientific Advisory Committee (page 9), our National Program Committee (page 23) and our AI & Society Advisory Council (page 27), who have generously contributed their time and expertise in this first year of the Strategy to ensure that we are building research capacity and programs that will enable us to reach our goals.

The breadth of activity in AI research in Canada goes far beyond what is covered here. From fundamental research in areas beyond machine learning to the launch of new AI-based startups, researchers, trainees and entrepreneurs from coast to coast are advancing our understanding of machine intelligence and making a difference in the world.

As the CIFAR Pan-Canadian AI Strategy continues to build and expand, we will be adding many more activities to bring the community together and maintain Canada's position as a world leader



in AI research and innovation. We were thrilled to host our first annual AICan meeting in Montreal in December 2018. At AICan, we announced our first cohort of 29 Canada CIFAR AI Chairs. In spring 2019, we will name additional CCAI Chairs, bringing the Program total to 46, with more to come later in the year (page 10). We will also launch a call for proposals for AI workshops and training programs in the months ahead.

The success of Canada's national AI strategy rests on two fundamental components: people and partnerships. This report showcases some of the amazing researchers and leaders from across our AI ecosystem, who believe deeply in the opportunity that AI has to make a real difference in people's lives around the world. The only way that we will fully realize that opportunity is by working together, and that is why partnerships between government, academia and industry, as demonstrated across the CIFAR Pan-Canadian AI Strategy, will be the key to our success.

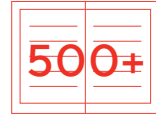
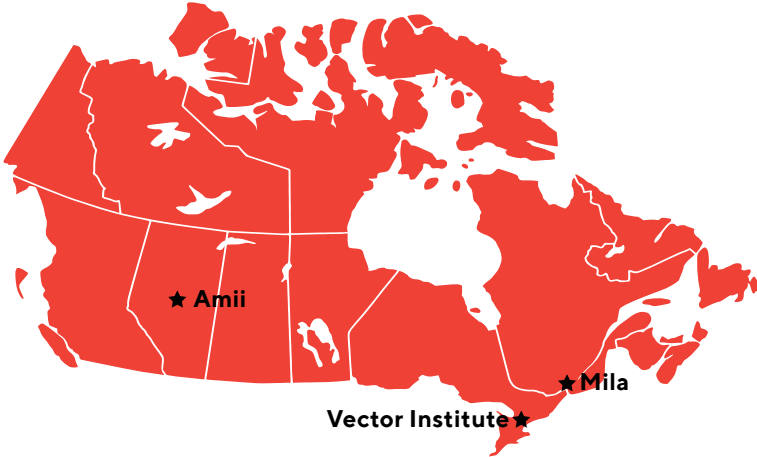
**Elissa Strome, PhD**  
**Executive Director**  
**CIFAR Pan-Canadian AI Strategy**  
[elissa.strome@cifar.ca](mailto:elissa.strome@cifar.ca)

# THE CIFAR PAN-CANADIAN AI STRATEGY

In March 2017, Canada was the first country to announce a national AI strategy. Here is what we've accomplished so far:

## RESEARCH EXCELLENCE

Established three independent AI research institutes

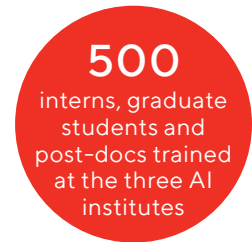
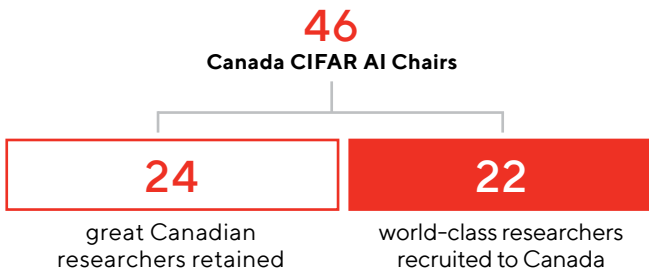


peer-reviewed papers published



national and international research awards won

## TALENT



## COLLABORATION AND EXCHANGE



Expanded our CIFAR Deep Learning/Reinforcement Learning Summer School to **250** students from **20** countries



partnerships with industry



AI research workshops & events

## CIFAR AI & SOCIETY PROGRAM



CIFAR has engaged more than 150 researchers and policy leaders to examine the social, economic, ethical and legal implications of AI.



# CANADA'S AI ECOSYSTEM

The CIFAR Pan-Canadian AI Strategy is catalyzing the growth and development of Canada's entire AI ecosystem.

## IN 2017-18, WE SAW:



announcements of major new investments by multinational companies to create dedicated AI R&D labs in Canada and thousands of tech jobs

## Major growth in Canada's AI startup ecosystem:



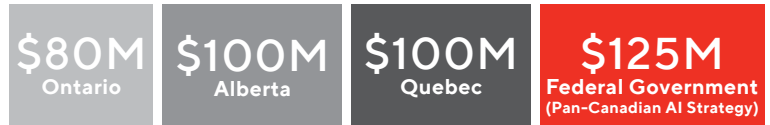
AI startups across the country  
(27% increase year over year)



raised in venture capital investment  
(51% increase year over year)\*

## SIGNIFICANT COMPLEMENTARY INVESTMENTS BY GOVERNMENTS ACROSS THE COUNTRY

\$405 M



The Provinces of Alberta, Ontario and Quebec have all made significant investments in their provincial AI ecosystems to augment the funding from the federal Pan-Canadian AI Strategy.



Three are focused on AI:

1. Canada's Digital Technology Supercluster (BC)
2. NGen (Ontario)
3. scale.ai (Quebec)

## CANADIAN CITIES BECOME THE FASTEST GROWING TECH MARKETS IN NORTH AMERICA\*\*

Toronto was the **4th** largest tech talent market in North America in 2017 (added 30,000 tech jobs; more than the San Francisco Bay Area, Seattle and Washington, D.C. combined)

Ottawa is the **fastest growing** tech market in North America

\* CB Insights MoneyTree Report  
\*\* 2018 CBRE Scoring Tech Talent Report

## AI INSTITUTES

Since 2017, three independent research institutes have been established, each designed to build on the academic excellence at their affiliated universities and to interact with and strengthen their associated innovation ecosystems. The three AI Institutes are: the Alberta Machine Intelligence Institute (Amii) in Edmonton; Mila in Montreal; and the Vector Institute in Toronto. All are in the process of building impressive leadership and research teams and establishing dedicated research and administrative facilities within the hearts of their respective innovation ecosystems. This year, CIFAR executed funding agreements with all three AI Institutes. The AI Institutes operate in close partnership with their local universities and receive significant additional funding from their provincial governments. While each of the AI Institutes has its own research priorities and strengths, they are all dedicated to advancing Canada's research excellence in AI, training the next generation of students, and working closely with industry and other partners to implement AI applications for positive social impact.

**Amii President & CEO  
John Shillington (left) and  
Chief Scientific Advisor  
Richard S. Sutton (right)**



**Mila President & CEO Valérie  
Pisano (left) and Scientific  
Director Yoshua Bengio (right)**

**Vector Institute President &  
CEO Garth Gibson (left) and  
Chief Scientific Advisor  
Geoffrey Hinton (right)**



## AMII

The Alberta Machine Intelligence Institute (Amii) at the University of Alberta in Edmonton aims to enhance understanding and innovation in machine intelligence. Amii was founded as a research cluster (the Alberta Ingenuity Centre for Machine Learning) in 2002, and over the past 15 years, researchers at Amii have made pioneering contributions in a diversity of subfields of AI and machine learning, most notably in the area of reinforcement learning and its applications. Today, Amii researchers continue to advance machine learning approaches and their applications, with expertise in game theory, reinforcement learning, health applications of AI, computational linguistics, robotics and data mining and visualization. As part of the CIFAR Pan-Canadian AI Strategy, Amii is expanding its research, industry partnership and training activities to help businesses realize the potential of machine intelligence and grow Canada's leadership in AI.

### AT A GLANCE

**President & CEO:** John Shillington

**Chief Scientific Advisor:**  
Richard S. Sutton

**Faculty:** 14 (for the full list, see [www.amii.ca/researchers/](http://www.amii.ca/researchers/))

**Supporters:** Government of Canada, CIFAR, Province of Alberta, Alberta Innovates, Alberta Ministry of Economic Development and Trade

**Partners:** University of Alberta, Borealis AI, DeepMind

**Expertise:** Reinforcement learning, machine learning, algorithmic game theory, bio-/medical informatics, medical imaging, data mining, deep learning, human-machine interaction, natural language processing, privacy, robotics, social network analysis.

**Contact:** [hello@amii.ca](mailto:hello@amii.ca)

## MILA

Mila, the Quebec institute for AI, is a partnership between the Université de Montréal and McGill University and was founded in 2017 by Prof. Yoshua Bengio. Mila is world-renowned for many pioneering breakthroughs in developing novel deep learning algorithms and applying them to various domains. These include neural language modeling, neural machine translation, object recognition, structured output generative modelling and neural speech recognition. Through investments from the CIFAR Pan-Canadian AI Strategy and the Province of Quebec, Mila acts as a central hub for deep learning and machine learning research in Montreal and Quebec, including providing a platform for collaboration and training, and partnering with industry and not-for-profit organizations to deliver state-of-the-art research to advance the application of AI for economic and social good.

### AT A GLANCE

**President & CEO:** Valérie Pisano

**Scientific Director:**  
Yoshua Bengio

**Faculty:** 23 (for the full list, see [mila.quebec/en/mila/team/](http://mila.quebec/en/mila/team/))

**Supporters:** Government of Canada, CIFAR, Province of Quebec

**Partners:** McGill University, Université de Montréal

**Expertise:** Deep learning, reinforcement learning, computer vision, generative adversarial networks, medical imaging, machine translation, natural language processing, object recognition, societal implications of AI.

**Contact:** [info@mila.quebec](mailto:info@mila.quebec)

## VECTOR INSTITUTE

The Vector Institute was established in 2017 and is dedicated to advancing AI through world-class research and applications in the areas of deep learning and machine learning. Located in Toronto, the Vector Institute was launched in partnership with the University of Toronto, the Province of Ontario and dozens of industry sponsors. As part of the CIFAR Pan-Canadian AI Strategy, Vector is attracting and retaining a team of world-class researchers to Canada and supporting their research through the provision of computing resources and trainee funding. Vector is the centre of Toronto's AI ecosystem and brings together universities, governments and industry to deliver AI training, advance pure and applied research, attract new talent and new investments to Ontario and enable the widespread application of machine learning in health care.

### AT A GLANCE

**President & CEO:** Garth Gibson

**Chief Scientific Advisor:**  
Geoffrey Hinton

**Research Director:**  
Richard Zemel

**Faculty:** 27 (for the full list, see [vectorinstitute.ai/#people](http://vectorinstitute.ai/#people))

**Supporters:** Government of Canada, CIFAR, Province of Ontario, University of Toronto

**Partners:** 40+ corporate sponsors (For the full list, see [vectorinstitute.ai/#partners](http://vectorinstitute.ai/#partners))

**Expertise:** Machine learning, deep learning, AI for health, probabilistic models, statistical theory, quantum computing, computational biology, computer vision and natural language processing.

**Contact:** [info@vectorinstitute.ai](mailto:info@vectorinstitute.ai)

## AI RESEARCH AND INNOVATION ACROSS CANADA

Great AI research is happening not only at the three AI Institutes but across the country from St. John's to Victoria. Notably, both Vancouver and Waterloo have exceptionally strong AI ecosystems.

### VANCOUVER, B.C.

The University of British Columbia has a long history of advancing our understanding of and approaches to machine intelligence and launched the Centre for Artificial Intelligence Decision-making and Action (CAIDA) in fall 2018. Led by Kevin Leyton-Brown, CAIDA brings together over 60 faculty from dozens of academic departments, and focuses on the development, analysis and application of AI systems for decision making and action. Simon Fraser University also has a strong focus on AI research, with particular expertise in natural language processing, computer vision and robotics. Building on its long history of tech innovation, Vancouver also boasts an incredibly rich AI startup ecosystem.

### WATERLOO, ONT.

In April 2018, the University of Waterloo launched the Waterloo Artificial Intelligence Institute (Waterloo.ai), which brings researchers from across disciplines together to advance both fundamental and applied AI research. Researchers at Waterloo.ai also work closely with industry, including large Canadian companies and multinationals, as well as spinning out and supporting dozens of Waterloo-based AI startup companies. Waterloo.ai is co-led by Peter van Beek and Fakhri Karray.

The CIFAR Pan-Canadian AI Strategy is helping to bring AI researchers from across the country together to collaborate, exchange ideas and train the next generation of researchers. The three AI Institutes, Amii, Mila and the Vector Institute, act as centres of excellence to bring researchers together and are fostering new collaborations and partnerships across Canada's AI ecosystems, including in Waterloo and Vancouver.



**The 2018 Vancouver AI Workshop brought together researchers from across Alberta and British Columbia to explore opportunities for collaboration.**

# CIFAR AI INTERNATIONAL SCIENTIFIC ADVISORY COMMITTEE

---

CIFAR has established a prestigious International Scientific Advisory Committee (ISAC), which has responsibility for making recommendations on Canada CIFAR AI Chair appointments and providing overall advice and guidance on the CIFAR Pan-Canadian AI Strategy.

The members of ISAC are international scientific leaders from major institutions and companies around the world, including Google, DeepMind, Facebook and the French national science research agency.

**PROF. SHIRLEY TILGHMAN  
OC, FRS (CHAIR)**

President Emerita, Princeton University; United States

**DR. JENNIFER CHAYES**

Technical Fellow & Managing Director, Microsoft Research New England, New York City and Montreal; United States

**DR. VICTORIA KRAKOVNA**

Research Scientist, DeepMind; Co-Founder, Future of Life Institute; United Kingdom

**PROF. YANN LECUN**

Co-Director, CIFAR Program in Learning in Machines and Brains; Chief AI Scientist, Facebook; Professor, New York University; United States

**PROF. FEI-FEI LI**

Director, Stanford Artificial Intelligence Lab; Associate Professor, Stanford University; Advisor, Google; United States

**PROF. ANTOINE PETIT**

Member, CIFAR Research Council; President, National Centre for Scientific Research (CNRS); France

**PROF. SEBASTIAN SEUNG**

Advisor, CIFAR Program in Learning in Machines and Brains; Evnin Professor in Neuroscience, Professor of Computer Science, Princeton Neuroscience Institute; United States

**PROF. MAX WELLING**

CIFAR Fellow, Program in Learning in Machines and Brains; Research Chair in Machine Learning, University of Amsterdam; Netherlands

The Canada CIFAR AI (CCAI) Chairs Program is the cornerstone program of the CIFAR Pan-Canadian AI Strategy. A total of \$86.5 million over five years has been earmarked for this program. The goal of the CCAI Chairs Program is to recruit and retain in Canada some of the world's leading researchers in AI and provide them with long-term, dedicated research funding to support their research programs and help them train the next generation of AI leaders. In the first year of the program, CIFAR and the AI Institutes, in partnership with twelve university and hospital partners across the country, have named forty-six Canada CIFAR AI Chairs.

### ALÁN ASPURU-GUZIK



**CCAI Chair Category:** Recruitment

**Affiliations:** Faculty Member, Vector Institute; Professor, Dept. of Chemistry and Dept. of Computer Science, University of Toronto; Canada 150 Research Chair in Quantum Chemistry; CIFAR Senior Fellow, Bio-Inspired Solar Energy Program

**Expertise:** AI for materials discovery, self-driving labs, clean energy, quantum chemistry

**Major Contributions/Awards:** Pioneering work in quantum chemistry, renewable energy materials and AI for materials discovery; Vannevar Bush Fellow (2015); Fellow APS (2013); Fellow AAAS (2018); Google Focused Award for Quantum Computing (2018)

---

### JIMMY BA



**CCAI Chair Category:** Recruitment

**Affiliations:** Faculty Member, Vector Institute; Assistant Professor, Dept. of Computer Science, University of Toronto

**Expertise:** Deep learning, reinforcement learning, algorithm development, optimization

**Major Contributions/Awards:** Developed the Adam Optimizer, one of the go-to algorithms to train deep learning models; Facebook Fellowship (2016)

## MARC G. BELLEMARE



**CCAI Chair Category:** Recruitment

**Affiliations:** Faculty Member, Mila; Research Scientist, Google Brain; CIFAR Fellow, Program in Learning in Machines and Brains; Adjunct Professor, School of Computer Science, McGill University

**Expertise:** Deep reinforcement learning, continual learning, exploration in reinforcement learning

**Major Contributions/Awards:** Initiator of the Arcade Learning Environment, which combines reinforcement learning with the most widely used benchmark for deep reinforcement learning algorithms

## YOSHUA BENGIO



**CCAI Chair Category:** Retention

**Affiliations:** Scientific Director, Mila; Professor, Dept. of Computer Science and Operations Research, Université de Montréal; Canada Research Chair in Statistical Learning Algorithms; CIFAR Senior Fellow, Program in Learning in Machines and Brains; Co-Director, CIFAR Program in Learning in Machines and Brains

**Expertise:** Pioneering contributions in deep learning and reinforcement learning, including speech recognition, object recognition, neural language modelling, unsupervised learning and generalized adversarial networks

**Major Contributions/Awards:** Google Faculty Research Award (2012); Fellow of the Royal Society of Canada (2017); Marie-Victorin Prix du Québec (2017); Officer of the Order of Canada (2017); Radio-Canada Scientist of the Year (2017); Medal of the 50th Anniversary of the Ministry of International Relations and Francophonie (2018); Canadian AI Association Lifetime Achievement Award (2018)

## JUAN FELIPE CARRASQUILLA



**CCAI Chair Category:** Recruitment

**Affiliations:** Faculty Member, Vector Institute; Assistant Professor (Adjunct), Department of Physics and Astronomy, University of Waterloo

**Expertise:** Condensed matter physics, quantum computing, machine learning for quantum physics

**Major Contributions/Awards:** Pioneering contributions at the intersection of machine learning and quantum physics; Perimeter Institute Postdoctoral Fellowship (2013); Perimeter Institute Visiting Fellow (2018)

## ANGEL CHANG



**CCAI Chair Category:** Recruitment

**Affiliations:** Associate Faculty Member, Amii; Assistant Professor, Simon Fraser University; Hans Fischer Fellow, TUM-IAS (Technische Universität München Institute for Advanced Study)

**Expertise:** Natural language processing, 3-D visualization, computer vision, computer graphics

**Major Contributions/Awards:** Pioneering work in text2scene, converting a natural language string (e.g., "office with a red chair") into a 3-D scene; contributed to key datasets for semantic understanding of shapes (ShapeNet - SGP 2018 dataset award) and scenes (ScanNet, SUNCG, Matterport3D)



## LAURENT CHARLIN



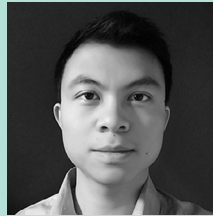
**CCAI Chair Category:** Retention

**Affiliations:** Faculty Member, Mila; Assistant Professor, Department of Decision Sciences, HEC Montreal; Adjunct Professor, Dept. of Computer Science and Operations Research, Université de Montréal

**Expertise:** Deep learning, probabilistic graphical models, machine learning for complex human decisions, dialogue systems, recommender systems

**Major Contributions/Awards:** Co-creator of the Toronto Paper Matching System, used by top-tier machine learning and computer science conferences to match reviewers and submissions; Google Focused Research Award (2017)

## JACKIE CHEUNG



**CCAI Chair Category:** Retention

**Affiliations:** Faculty Member, Mila; Assistant Professor, School of Computer Science, McGill University

**Expertise:** Computational linguistics, natural language processing, automatic summarization, computational semantics

**Major Contributions/Awards:** NSERC Alexander Graham Bell Canada Graduate Scholarship (2012); Facebook Fellowship (2013); Best Paper Award, Association for Computational Linguistics (2018)

## AARON COURVILLE



**CCAI Chair Category:** Retention

**Affiliations:** Faculty Member, Mila; Associate Professor, Dept. of Computer Science and Operations Research, Université de Montréal; CIFAR Fellow, Program in Learning in Machines and Brains

**Expertise:** Deep learning, reinforcement learning, generative adversarial networks, novel generative models

**Major Contributions/Awards:** Co-author of the primary textbook in the field, *Deep Learning* (with Goodfellow and Bengio); co-creator of generative adversarial networks; Google Faculty Research Award (2013)

## MURAT ERDOGDU



**CCAI Chair Category:** Recruitment

**Affiliations:** Faculty Member, Vector Institute; Assistant Professor, Depts. of Computer Science and Statistical Sciences, University of Toronto

**Expertise:** Machine learning, optimization, statistics, data analysis

**Major Contributions/Awards:** Developed novel optimization algorithms for machine learning (Newton-Stein Method, Scaled Least Squares), which are computationally more efficient than existing methods (NIPS Spotlight presentation 2015)



## AMIR-MASSOUD FARAHMAND



**CCAI Chair Category:** Recruitment

**Affiliations:** Faculty Member, Vector Institute

**Expertise:** Reinforcement learning, machine learning, industrial applications of machine learning

**Major Contributions/Awards:** Pioneered the design and theoretical analysis of reinforcement learning algorithms with high-dimensional data; NSERC Postdoctoral Fellowship (2012)

## SANJA FIDLER



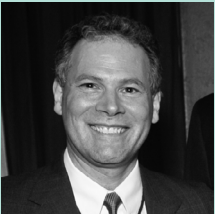
**CCAI Chair Category:** Retention

**Affiliations:** Faculty Member, Vector Institute; Assistant Professor, Dept. Computer Science, University of Toronto; Director of AI, NVIDIA

**Expertise:** Computer vision, biological vision, detection and segmentation (2D and 3D), object class recognition, social AI (AIs that act and react to humans in a meaningful way), AI for fashion

**Major Contributions/Awards:** NVIDIA Pioneer of AI Award (2016); Facebook Faculty Award (2016); Amazon Academic Research Award (2017); Best Paper Honourable Mention Computer Vision and Pattern Recognition Conference (2017)

## DAVID FLEET



**CCAI Chair Category:** Retention

**Affiliations:** Faculty Member, Vector Institute; Professor, Dept. of Computer and Mathematical Sciences, University of Toronto Scarborough, and Dept. of Computer Science, University of Toronto; CIFAR Senior Fellow, Program in Learning in Machines and Brains

**Expertise:** Computer vision, image processing, visual perception, visual neuroscience, algorithms for 3-D imaging of biomolecules (cryo-EM)

**Major Contributions/Awards:** Pioneering contributions to computer vision, particularly optical flow estimation and vision-based tracking; Sloan Research Fellowship (1996); Konderink Prize in Computer Vision (2010)

## ALONA FYSHE



**CCAI Chair Category:** Retention

**Affiliations:** Faculty Member, Amii; Assistant Professor, Dept. of Computing Science, University of Alberta; CIFAR Azrieli Global Scholar, Program in Brain, Mind and Consciousness

**Expertise:** Computational linguistics, EEG, MEG, machine learning, neuroscience

**Major Contributions/Awards:** Pioneering contributions to our understanding of meaning and representation in language through the unique combination of machine learning and brain imaging

## MARZYEH GHASSEMI



**CCAI Chair Category:** Recruitment

**Affiliations:** Faculty Member, Vector Institute; Assistant Professor, Depts. of Computer Science and Medicine, University of Toronto

**Expertise:** Machine learning for health; developing and applying machine learning methods that leverage the structure of data and problems in health, including representation learning, reinforcement learning and inverse reinforcement learning, prediction, risk stratification and model interpretability.

**Major Contributions/Awards:** MIT Technology Review “35 Innovators Under 35” (2018)

## GEOFFREY J. GORDON



**CCAI Chair Category:** Recruitment

**Affiliations:** Associate Faculty Member, Mila; Adjunct Professor, School of Computer Science, McGill University; Director of Research, Microsoft Research, Montreal; Professor, Carnegie Mellon University (on leave)

**Expertise:** Artificial intelligence, decision-theoretic planning, spectral methods, structured graphical models, reinforcement learning, optimization

**Major Contributions/Awards:** Best student paper award, International Conference on Educational Data Mining (2013); International Conference on Automated Planning and Scheduling 10-year Influential Paper Award (2017)

## ROGER GROSSE



**CCAI Chair Category:** Recruitment

**Affiliations:** Faculty Member, Vector Institute; Assistant Professor, Dept. of Computer Science, University of Toronto; Canada Research Chair in Probabilistic Inference and Deep Learning

**Expertise:** Algorithms for deep learning, efficiency in deep learning, automating the configuration of machine learning systems, uncertainty modelling

**Major Contributions/Awards:** Best Student Paper, Conference on Uncertainty in AI (2012); NSERC Banting Postdoctoral Fellowship (2015); Connaught New Researcher Award (2017); Ontario Early Researcher Award (2018)

## WILLIAM HAMILTON



**CCAI Chair Category:** Recruitment

**Affiliations:** Faculty Member, Mila; Assistant Professor, School of Computer Science, McGill University

**Expertise:** Representation learning, network analysis, natural language processing, computational social science

**Major Contributions/Awards:** NSERC Alexander Graham Bell Canada Graduate Scholarship (2013); Best Master’s Thesis Award, Canadian Artificial Intelligence Association (2014); SAP Stanford Graduate Fellowship (2014); Cozzarelli Prize, PNAS (2017)

## SIMON LACOSTE-JULIEN



### **CCAI Chair Category:** Retention

**Affiliations:** Faculty Member, Mila; Assistant Professor, Dept. of Computer Science and Operations Research, Université de Montréal; CIFAR Fellow, Program in Learning in Machines and Brains; Lab Scientist, CDL Montreal; Faculty Fellow, Element AI

**Expertise:** Machine learning, optimization, statistics, high-dimensional data analysis, structured prediction

**Major Contributions/Awards:** Google Faculty Research Award (2014); Google Focused Research Award (2016)

## HUGO LAROCHELLE



### **CCAI Chair Category:** Retention

**Affiliations:** Associate Faculty Member, Mila; Research Scientist, Google Brain; Adjunct Professor, Dept. of Computer Science and Operations Research, Université de Montréal; Associate Director, CIFAR Program in Learning in Machines and Brains

**Expertise:** Deep neural networks, meta-learning (a.k.a learning to learn), one-shot learning, reinforcement learning

**Major Contributions/Awards:** Pioneering contributor to the development of deep neural networks, now leads the Google Brain group in Montreal; Google Faculty Research Award (2012, 2013)

## KEVIN LEYTON-BROWN



### **CCAI Chair Category:** Retention

**Affiliations:** Associate Faculty Member, Amii; Professor, Dept. of Computer Science, University of British Columbia

**Expertise:** Machine learning, algorithm design, computational game theory, economic market mechanisms, deep learning, AI for social impact

**Major Contributions/Awards:** CACS/AIC Outstanding Young Computer Science Researcher (2013); Google Faculty Research Award (2013); NSERC E.W.R. Steacie Memorial Fellowship (2015); Facebook Research Award (2018); AAAI Fellow (2018); Franz Edelman Award for Achievement in Operations Research and the Management Sciences (Team Award; 2018); ACM Distinguished Member (2018)

## ALIREZA MAKHZANI



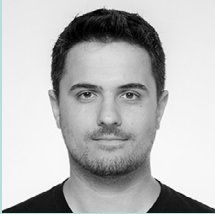
### **CCAI Chair Category:** Recruitment

**Affiliations:** Faculty Member, Vector Institute

**Expertise:** Unsupervised learning, generative models

**Major Contributions/Awards:** Developed adversarial inference methods for learning generative models

## IOANNIS MITLIAGKAS



**CCAI Chair Category:** Recruitment

**Affiliations:** Faculty Member, Mila; Assistant Professor, Dept. of Computer Science and Operations Research, Université de Montréal

**Expertise:** Statistical machine learning, optimization, large-scale and distributed learning systems, making machine learning broadly accessible

**Major Contributions/Awards:** Discovered interaction between optimization and system dynamics in large-scale systems; work on adaptive momentum optimizers was selected for an oral presentation at the inaugural SysML conference (2018)

## QUAID MORRIS



**CCAI Chair Category:** Retention

**Affiliations:** Faculty Member, Vector Institute; Professor, Donnelly Centre for Cellular and Biomolecular Research, University of Toronto

**Expertise:** Computational biology, machine learning, RNA, cancer evolution, precision medicine, cancer genomics, RNA-binding proteins, post-transcriptional regulation

**Major Contributions/Awards:** Co-creator of the GeneMANIA community resource, which draws genetics data from multiple public databases and uses machine learning to predict function, and has over 220,000 active users; NVIDIA Compute the Cure Award (2017); Clarivate Highly Cited Researcher (2018)

## SARA MOSTAFAVI



**CCAI Chair Category:** Retention

**Affiliations:** Associate Faculty Member, Vector Institute; Assistant Professor, Depts. of Statistics Medical Genetics, University of British Columbia; Canada Research Chair in Computational Biology; CIFAR Fellow, Child and Brain Development Program

**Expertise:** AI for genomics and disease prediction, AI for gene/environment interactions, psychiatric disorders and neurodevelopment

**Major Contributions/Awards:** Co-creator of several highly utilized machine learning algorithms, including GeneMANIA, GNAT and xQTLServer, for combining different types of genomics data for understanding gene function and networks

## SAGEEV OORE



**CCAI Chair Category:** Recruitment

**Affiliations:** Faculty Member, Vector Institute; Associate Professor, Faculty of Computer Science, Dalhousie University

**Expertise:** Deep learning and computational creativity, generative music models, human-AI interaction

**Major Contributions/Awards:** While at Google Brain, co-developed the Performance RNN system, which uses machine learning to compose music; NIPS Best Demo Award (2016); AAAI Best Demo Award (2017)

CHRISTOPHER PAL



**CCAI Chair Category:** Retention

**Affiliations:** Faculty Member, Mila; Associate Professor, École Polytechnique de Montréal; Adjunct Professor, Dept. of Computer Science and Operations Research, Université de Montréal; Principal Research Scientist, Element AI

**Expertise:** Deep learning, computer vision, natural language processing, medical image analysis

**Major Contributions/Awards:** Leader in the area of machine learning and computer vision for multimedia and medical image analysis

NICOLAS PAPERNOT



**CCAI Chair Category:** Recruitment

**Affiliations:** Faculty Member, Vector Institute; Assistant Professor, Dept. of Electrical and Computer Engineering, University of Toronto

**Expertise:** Security and privacy in machine learning

**Major Contributions/Awards:** Pioneering work in the development of black-box attacks against machine learning; Google PhD Fellowship in Security (2016); Best Paper Award, ICLR (2017)

LIAM PAULL



**CCAI Chair Category:** Recruitment

**Affiliations:** Associate Faculty Member, Mila; Assistant Professor, Dept. of Computer Science and Operations Research, Université de Montréal

**Expertise:** Robotics, autonomous vehicles, deep learning for autonomous vehicles

**Major Contributions/Awards:** Co-founder of Duckietown, an autonomous vehicles research, education and outreach project

JOELLE PINEAU



**CCAI Chair Category:** Retention

**Affiliations:** Faculty Member, Mila; Associate Professor, School of Computer Science, McGill University; CIFAR Senior Fellow, Program in Learning in Machines and Brains; Research Scientist and Site Lead, Facebook AI Research, Montreal

**Expertise:** Reinforcement learning, robotics, deep learning, natural language processing, AI for health

**Major Contributions/Awards:** Facebook Research Award (2017); NSERC E.W.R. Steacie Memorial Fellowship (2018); Fellow, Association for the Advancement of Artificial Intelligence (2018)

## PASCAL POUPART



**CCAI Chair Category:** Retention

**Affiliations:** Faculty Member, Vector Institute; Professor, David R. Cheriton School of Computer Science, University of Waterloo

**Expertise:** Machine learning and reasoning under certainty, natural language understanding, health informatics

**Major Contributions/Awards:** Best main track solver and best application solver (2016) and runner-up best student paper award (2017), International Conference on Theory and Applications of Satisfiability Testing

## DOINA PRECUP



**CCAI Chair Category:** Retention

**Affiliations:** Faculty Member, Mila; Associate Professor, School of Computer Science, McGill University; CIFAR Senior Fellow, Program in Learning in Machines and Brains; Associate Scientific Director, Healthy Brains for Healthy Lives, CFREF; Research Team Lead, DeepMind, Montreal

**Expertise:** Machine learning, reinforcement learning, Markov decision processes, applications of machine learning and AI

**Major Contributions/Awards:** AAAI Senior Member (2015); Creative Destruction Lab Ideas Award (2017); AAAI Outstanding Student Paper Award (two awards to her students in 2017); Google Focused Research Award (2017); founder, AI for Social Good Summer Lab

## REIHANEH RABBANY



**CCAI Chair Category:** Recruitment

**Affiliations:** Faculty Member, Mila; Assistant Professor, School of Computer Science, McGill University

**Expertise:** Data mining, network science, computational social science, AI for social good

**Major Contributions/Awards:** Developed principled ways for comparing, quantifying and modelling the modular structure of complex networks

## GUILLAUME RABUSSEAU



**CCAI Chair Category:** Recruitment

**Affiliations:** Faculty Member, Mila; Assistant Professor, Dept. of Computer Science and Operations Research, Université de Montréal

**Expertise:** Theoretical foundations of machine learning, tensor networks for machine learning, learning with structured data

**Major Contributions/Awards:** Best paper award, Conference sur l'Apprentissage Automatique (France, 2014)

## BLAKE RICHARDS



### **CCAI Chair Category:** Retention

**Affiliations:** Faculty Member, Mila; Faculty Associate, Vector Institute; Assistant Professor, Dept. of Computer Science and Dept. of Neurology and Neurosurgery, McGill University; CIFAR Fellow, Program in Learning in Machines and Brains

**Expertise:** Neuroscience, reinforcement learning, animal intelligence, memory, machine learning for neuroscience

**Major Contributions/Awards:** NSERC Banting Postdoctoral Fellowship (2012); Human Frontiers Science Program Young Investigators Grant (2015); Google Faculty Research Award (2016); Ontario Early Researcher Award (2018)

## DANIEL ROY



### **CCAI Chair Category:** Retention

**Affiliations:** Faculty Member, Vector Institute; Assistant Professor, Dept. of Computer and Mathematical Sciences, University of Toronto Scarborough, Dept. of Statistical Sciences and Dept. of Computer Science, University of Toronto

**Expertise:** Probabilistic programming languages and systems, machine learning, statistical learning theory, network models, computational statistics

**Major Contributions/Awards:** Best Poster, Canadian Statistics Student Conference (2015); Best Poster, Conference on Bayesian Nonparametrics (2015); Ontario Early Researcher Award (2017); Google Faculty Research Award (2017)

## FRANK RUDZICZ



### **CCAI Chair Category:** Retention

**Affiliations:** Faculty Member, Vector Institute; Scientist, University Health Network; Associate Professor, Dept. of Computer Science, University of Toronto; Director of AI, Surgical Safety Technologies Inc.

**Expertise:** Speech, language, machine learning, health care, entrepreneurship

**Major Contributions/Awards:** Founded WinterLight Labs, a startup company that uses AI to track, screen and predict the onset of dementia and psychiatric illness; Ontario Early Researcher Award (2016); Excellence in Applied Research Award, National Speech-Language & Audiology Canada (2016); Connaught Innovation Award (2018)

## MARK SCHMIDT



### **CCAI Chair Category:** Retention

**Affiliations:** Associate Member, Amii; Assistant Professor, Dept. of Computer Science, University of British Columbia; Canada Research Chair in Large-Scale Machine Learning; CIFAR Senior Fellow, Program in Learning in Machines and Brains

**Expertise:** Numerical optimization, machine learning, computer vision, machine learning applications

**Major Contributions/Awards:** NSERC Postdoctoral Fellowship (2012); Sloan Research Fellowship (2017); Lagrange Prize in Continuous Optimization (2018)



## LEONID SIGAL



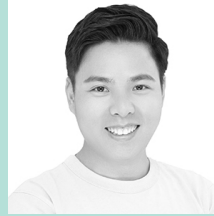
**CCAI Chair Category:** Recruitment

**Affiliations:** Associate Faculty Member, Vector Institute; Associate Professor, Dept. of Computer Science, University of British Columbia; Canada Research Chair in Computer Vision and Machine Learning

**Expertise:** Computer vision, machine learning, computer graphics, object recognition, scene understanding, motion capture, motion modelling, animation

**Major Contributions/Awards:** Best Paper Award, IEEE Winter Conference of Applications of Computer Vision (2018)

## JIAN TANG



**CCAI Chair Category:** Recruitment

**Affiliations:** Faculty Member, Mila; Assistant Professor, HEC Montréal; Adjunct Professor, Dept. of Computer Science and Operations Research, Université de Montréal

**Expertise:** Network analysis, deep learning, natural language processing, AI for drug discovery, reinforcement learning, statistics

**Major Contributions/Awards:** Best Paper Award, ICML (2014); Most-Cited Paper, World Wide Web Conference (2015); Best Paper nomination, World Wide Web Conference (2016)

## GRAHAM TAYLOR



**CCAI Chair Category:** Retention

**Affiliations:** Faculty Member, Vector Institute; Associate Professor, School of Engineering, University of Guelph; Canada Research Chair in Machine Learning; CIFAR Azrieli Global Scholar, Program in Learning in Machines and Brains; Academic Director, NextAI

**Expertise:** Deep learning, representation learning, image and video understanding, motion capture and analysis, unconventional applications: remote sensing, water resources, agri-food

**Major Contributions/Awards:** Pioneering work in generative modelling of time series and deconvolutional neural networks; Canada's Top 40 Under 40 (2018)

## PASCAL VINCENT



**CCAI Chair Category:** Retention

**Affiliations:** Faculty Member, Mila; Associate Professor, Dept. of Computer Science and Operations Research, Université de Montréal; Research Scientist, Facebook AI Research, Montreal; CIFAR Associate Fellow, Program in Learning in Machines and Brains

**Expertise:** Pioneering contributions in deep learning and natural language processing

**Major Contributions/Awards:** Developed the denoising autoencoder (DAE), a widely used, simple, yet powerful framework for machine learning



## BO WANG



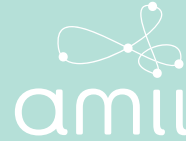
**CCAI Chair Category:** Recruitment

**Affiliations:** Faculty Member, Vector Institute; Lead Artificial Intelligence Scientist, Peter Munk Cardiac Centre and the Techna Institute at the University Health Network; Assistant Professor, Dept. of Medical Biophysics, University of Toronto

**Expertise:** Machine learning, computational biology, computer vision, genomics, medical imaging

**Major Contributions/Awards:** Developed novel machine learning methods in data fusion and network analysis for single-cell genomics and cancer subtyping, which are being adopted widely in medical research.

## MARTHA WHITE



**CCAI Chair Category:** Recruitment

**Affiliations:** Faculty Member, Amii; Director of RLAI, University of Alberta; Assistant Professor, Dept. of Computing Science, University of Alberta

**Expertise:** Reinforcement learning, representation learning, optimization

**Major Contributions/Awards:** Several algorithmic contributions for off-policy learning in reinforcement learning, with a recent contribution for an open problem for policy gradient methods; NSERC Alexander Graham Bell Canada Graduate Scholarship (2012)

## FRANK WOOD



**CCAI Chair Category:** Recruitment

**Affiliations:** Associate Faculty Member, Mila; Associate Professor, Dept. of Computer Science, University of British Columbia

**Expertise:** Probabilistic programming, probabilistic machine learning and artificial intelligence, particularly Bayesian methods; unsupervised learning

**Major Contributions/Awards:** Initial developer of the Anglican probabilistic programming language and an author of the first graduate textbook on probabilistic programming

## JAMES WRIGHT



**CCAI Chair Category:** Recruitment

**Affiliations:** Faculty Member, Amii; Assistant Professor, Dept. of Computing Science, University of Alberta

**Expertise:** Machine learning to predict human behaviour, behavioural game theory, computational game theory

**Major Contributions/Awards:** NSERC Alexander Graham Bell Canada Graduate Scholarship (2012); ACM SIGecom Doctoral Dissertation Award (honourable mention, 2017)

## **NATIONAL PROGRAM OF ACTIVITIES**

A key component of the CIFAR Pan-Canadian AI Strategy is the National Program of Activities. These are a series of workshops, training programs, conferences and other events to bring AI researchers from across Canada together to foster collaboration and partnerships, increase the number of highly skilled graduates in AI and advance AI research and innovation.

This year CIFAR named a National Program Committee with membership across the AI Institutes, CIFAR and the Waterloo and Vancouver ecosystems.

## NATIONAL PROGRAM COMMITTEE

---

**PROF. DOINA PRECUP  
(CHAIR)**

CCAI Chair; CIFAR Senior Fellow; Mila Faculty Member; Assoc. Professor of Computer Science, McGill University; Research Team Lead, DeepMind, Montreal

**PROF. MICHAEL BOWLING**

Amii Faculty Member; Professor of Computing Science, University of Alberta

**DR. MYRIAM CÔTÉ**

Director, AI for Humanity, Mila

**DR. GARTH GIBSON**

President and CEO, Vector Institute

**PROF. RANDY GOEBEL**

Amii Faculty Member; Professor of Computing Science, University of Alberta

**DR. ROGER GROSSE**

CCAI Chair; Vector Institute Faculty Member; Asst. Professor of Computer Science, University of Toronto

**PROF. GREG MORI**

Research Director, Borealis AI, Vancouver; Professor of Computing Science, Simon Fraser University

**VALÉRIE PISANO**

President and CEO, Mila

**DR. ELISSA STROME**

Executive Director, Pan-Canadian AI Strategy, CIFAR

**PROF. PETER VAN BEEK**

Co-Director, Waterloo AI Institute; Professor of Computer Science, University of Waterloo

## TRAINING THE NEXT GENERATION

Helping the next generation of young Canadians to develop key skills and expertise in artificial intelligence and machine learning is one of the primary goals of the CIFAR Pan-Canadian AI Strategy. This past year, CIFAR worked closely with Amii, Mila, the Vector Institute and universities across the country to develop and support a series of AI Summer Schools to inspire young people and to give them the tools they need to launch careers that leverage AI technologies.

- » In May and June 2018, McGill University and Mila held their annual AI for Social Good Summer Lab, a program focused on providing women with machine learning skills and practical experience to increase their career opportunities.
- » In July 2018, the annual CIFAR Deep Learning/Reinforcement Learning Summer School was hosted by the Vector Institute, the Rotman School of Management and CIFAR, and provided 250 graduate and post-graduate trainees from 20 countries with an opportunity to learn from some of the world's leading researchers.
- » In Vancouver, the University of British Columbia's Data Science for Social Good Fellowship Program brought together multidisciplinary teams of students to tackle real-life data challenges faced by the not-for-profit sector.
- » Finally, CIFAR also supported AI4All's Invent the Future, a two-week summer camp held at Simon Fraser University, which brought Grade 11 girls from across British Columbia and across Canada to Vancouver to learn the basics of machine learning and how it is being applied in real-world settings.

Together, these programs inspired students from high school to graduate school to gain the exposure and skills they need to become Canada's next generation of leaders in the development and implementation of AI technologies.



Scenes from the 2018 Deep Learning/Reinforcement Learning Summer School in Toronto

***The 2018 CIFAR Deep Learning/Reinforcement Learning summer school has been packed with energy since day one. Bringing in 250 students from around the world has been a real achievement. Students need a personal connection to their mentors.***

---

Graham Taylor, Canada CIFAR AI Chair;  
 Faculty Member, Associate Professor,  
 University of Guelph; Vector Institute;  
 Academic Director, NextAI



The CIFAR Pan-Canadian AI Strategy supports training programs in AI for all levels, including the AI4All Invent the Future Summer Camp for high school girls (top) and the AI4Good Summer Lab (middle, bottom), for undergraduate women.

# CIFAR AI & SOCIETY PROGRAM

## LEADERSHIP

CIFAR's AI & Society Program is led by Rebecca Finlay, VP, Engagement & Public Policy, and Brent Barron, Director, Public Policy. Under their leadership, CIFAR has developed a range of programs to support inquiry on the social, ethical, legal, and policy implications of artificial intelligence in Canada and around the world.



Top: Rebecca Finlay  
Bottom: Brent Barron

***AI & Society is an international program that engages diverse perspectives from the social and computer sciences, humanities, law, public policy and civil society. Bringing these disciplines and sectors together is critical to deepening our understanding of the impact of AI in our everyday lives as well as its responsible and inclusive development.***

---

Rebecca Finlay, VP, Engagement  
& Public Policy,  
CIFAR

# CIFAR AI & SOCIETY ADVISORY COUNCIL

---

CIFAR's AI & Society programming is guided by an Advisory Council of respected researchers from a wide variety of disciplines, who blend technical expertise with a deep commitment to promoting human well-being.

**PROF. IAN KERR (CHAIR)**

Canada Research Chair in Ethics, Law & Tech.; Professor, University of Ottawa

**DR. JOANNA BRYSON**

Reader, Department of Computer Science, University of Bath

**DR. MARIO MARINIELLO**

Digital Adviser to the European Political Strategy Centre, European Commission

**PROF. DOINA PRECUP**

CCAI Chair; CIFAR Senior Fellow; Mila Faculty Member; Assoc. Professor of Computer Science, McGill University; Research Team Lead, DeepMind, Montreal

**MEREDITH WHITTAKER**

Co-Director, AI Now Institute, New York University



## EXPLORING IMPORTANT QUESTIONS ABOUT AI IN OUR WORLD

AI is expected to have profound effects on our society, affecting everything from business to government, working life to personal time. CIFAR's AI & Society Program has been examining some of the major questions that have started to arise in response to the flood of new AI developments in society.

In the past year, CIFAR designed inclusive and international collaborations and engagements, bringing together research perspectives from across various disciplines, including the social and natural sciences, the humanities, law, engineering and the arts. These activities engaged academic researchers, community leaders, innovators and policymakers.

On April 9th, 2018, CIFAR launched its first Call for Proposals for research workshops for diverse international, interdisciplinary and intersectoral teams to study emerging topics at the intersection of AI and society. The Call for workshops closed on May 28, 2018; CIFAR received 39 applications across a variety of disciplines, and members of the application teams originated from 81 organizations located in 21 countries around the world. The following workshops were selected in the first competition:

- » **AI-powered information ecosystems and democracy** - Led by Derek A. S. Ruths, McGill University
- » **Indigenous protocol and AI** - Led by Jason Edward Lewis, Concordia University
- » **Generation AI: Reducing inequality and enhancing digital inclusion via smart design and developmental science** - Led by Candice Odgers, University of California, Irvine
- » **Regulating defense and security AI technologies: Options beyond traditional arms control** - Led by Kerstin Vignard, UN Institute for Disarmament Research (UNIDIR)

In August 2018, CIFAR launched a second international Call for Proposals in partnership with France's Centre national de la recherche scientifique (CNRS) and U.K. Research and Innovation (UKRI) to fund proposals led by experts in Canada, France and the U.K. on important societal questions arising from new technologies.

The Call closed in October 2018; the following workshops were selected and will be held from July 2018 to June 2019:

- » **AI and the curation of culture** - Led by Ashton Anderson, University of Toronto, Canada
- » **AI & health care: The fusion of law & science** - Led by Colleen Flood, University of Ottawa, Canada
- » **AI and future Arctic conflicts** - Led by Stephanie Carvin, Carleton University, Canada
- » **Sustainability in the digital age** - Led by Amy Luers, FutureEarth, Canada
- » **Trust in AI systems** - Led by Cristina Conati, University of British Columbia, Canada
- » **Social dynamics & culture of AI** - Led by Marie-Hélène Parizeau, Université Laval, Canada
- » **Ethical futures & AI medicine** - Led by Heather Draper, University of Warwick, United Kingdom
- » **Fairness, interpretability and privacy of algorithmic systems** - Led by Adrian Weller, The Alan Turing Institute, United Kingdom



## AI FUTURES POLICY LABS

As part of our AI & Society Program, this past year, CIFAR also hosted its first AI Futures Policy Labs workshop series in partnership with the Brookfield Institute for Innovation + Entrepreneurship (BII+E). The purpose of the Policy Labs is to engage emerging policy leaders inside and outside the civil service to explore the public policy implications of AI, and highlight future challenges and opportunities for governments. The first Lab took place in Toronto on June 25th, 2018, and brought together representatives from municipal and provincial government, non-profit and public agencies, academia and the private sector. Attendees discussed real-life AI scenarios and potential solutions. A total of four more Labs have since taken place in Ottawa, Montreal, Edmonton and Vancouver, engaging a broader spectrum of representatives from public, private, academic and non-profit organizations. Hosted in partnership with organizations like Microsoft, ATB Financial and Element AI, these workshops engaged a total of 125 policy innovators, representing organizations such as:

- » Governments of Canada, Ontario, Alberta, Quebec and British Columbia
- » Cities of Toronto, Edmonton and Vancouver
- » Deloitte Future of Canada Centre
- » Canadian Human Rights Commission
- » National Research Council Canada

A bilingual publication will be released in 2019 that will include insights from these five Policy Labs, supporting national and international conversations about the future of policy in a world where AI-driven technologies are widespread.



The AI Futures Policy Labs promoted informed and thoughtful discussions across Canada about the future of AI technology.

## CIFAR AI PARTNERS

AI is a field of research and innovation that is of broad interest to both the public and private sectors. While the potential for positive impact of AI applications in health care, transportation, clean energy and many other areas is significant, there are important societal implications that also must be considered. CIFAR is working with partners across sectors to advance AI research and innovation in a socially responsible manner.

In September 2017, Facebook and CIFAR announced a new partnership as part of Facebook's establishment of its first Canadian AI research lab in Montreal. The partnership also includes funding for a Montreal-based Facebook CIFAR Chair in AI, as part of the CCAI Chairs Program.

In October 2018, the RBC Foundation announced a \$1-million contribution to CIFAR to support our national activities to support and advance AI research and training, with a particular focus on the social and ethical implications of AI. This new funding expands the long-standing partnership between CIFAR and RBC, and complements the deep investments RBC has made in establishing Borealis AI research and development labs in Canada's major AI centres.



**CIFAR was proud to announce partnerships with Facebook and the RBC Foundation (Borealis AI). Pictured L-R: Yoshua Bengio, Mike Schroepfer, Prime Minister Justin Trudeau, Joelle Pineau, Alan Bernstein, Yann LeCun.**

## APPENDIX A: AWARDS AND HONOURS

Major national and international awards received by Canadian AI researchers from April 1, 2017 to June 30, 2018.

AWARD/HONOUR	RECIPIENT
Association for the Advancement of AI, Fellow	» Kevin Leyton-Brown (Amii, University of British Columbia) » Joelle Pineau (Mila, McGill University, Facebook AI Research)
Best Paper Award, IEEE Winter Conference of Applications of Computer Vision	» Leonid Segal (Vector Institute, University of British Columbia)
Bloomberg 50	» Geoffrey Hinton (Vector Institute, University of Toronto, Google Brain)
Canadian Artificial Intelligence Association, Lifetime Achievement Award	» Yoshua Bengio (Mila, Université de Montréal) » Robin Cohen (University of Waterloo) » Geoffrey Hinton (Vector Institute, University of Toronto, Google Brain) » Rich Sutton (Amii, University of Alberta)
Canada 150 Research Chair	» Alàn Aspuru-Guzik (Vector Institute, University of Toronto)
Canada Research Chair (new)	» Michael Brown (York University) » David Duvenaud (Vector Institute, University of Toronto) » Roger Grosse (Vector Institute, University of Toronto) » Anna Goldenberg (Vector Institute, Hospital for Sick Children, University of Toronto) » Graham Taylor (Vector Institute, University of Guelph)
Canada's Top 40 Under 40	» Graham Taylor (Vector Institute, University of Guelph)
Clarivate Highly Cited Researcher	» Geoffrey Hinton (Vector Institute, University of Toronto, Google Brain)
Cozzarelli Prize, PNAS	» William Hamilton (Mila, McGill University)
Creative Destruction Lab Ideas Award	» Doina Precup (Mila, McGill University, DeepMind) » Yoshua Bengio (Mila, Université de Montréal)
Facebook Emerging Scholars Award	» Michael Abebe (University of Waterloo)
Facebook Research Award	» Yoshua Bengio (Mila, Université de Montréal) » Kevin Leyton-Brown (Amii, University of British Columbia) » Joelle Pineau (Mila, McGill University, Facebook AI Research)
Fellow of the American Association for the Advancement of Science (AAAS)	» Alàn Aspuru-Guzik (Vector Institute, University of Toronto)

Franz Edelman Award for Achievement in Operations Research and the Management Sciences (Team Award)	» Kevin Leyton-Brown (Amii, University of British Columbia)
Google Faculty Research Award	» Fahiem Bacchus (University of Toronto)
Google Focused Research Award	» Alàn Aspuru-Guzik (Vector Institute, University of Toronto)
International Conference on Automated Planning and Scheduling 10-year Influential Paper Award	» Geoffrey J. Gordon (Mila, McGill University, Microsoft Research)
Jacobs Foundation Young Scholar	» Sara Mostafavi (Vector Institute, University of British Columbia)
LaGrange Prize in Continuous Optimization	» Mark Schmidt (Amii, University of British Columbia)
MIT 35 Innovators Under 35	» Marzyeh Ghassemi (Vector Institute, University of Toronto)
NSERC E.W.R. Steacie Memorial Fellowship	» Joelle Pineau (Mila, McGill University, Facebook AI Research)
NVIDIA Compute the Cure Award	» Quaid Morris and David Duvenaud (Vector Institute, University of Toronto)
Order of Canada (Companion)	» Geoffrey Hinton (University of Toronto)
Order of Canada (Officer)	» Yoshua Bengio (Mila, Université de Montréal)
Marie-Victorin Prix du Québec	» Yoshua Bengio (Mila, Université de Montréal)
Radio-Canada Scientist of the Year	» Yoshua Bengio (Mila, Université de Montréal)
Royal Society of Canada, Fellow	» Yoshua Bengio (Mila, Université de Montréal)
Sloan Research Fellowship	» Mark Schmidt (Amii, University of British Columbia) » Angela Schoellig (University of Toronto)
Toronto Region Builder Award by the Toronto Region Board of Trade	» Geoffrey Hinton (University of Toronto)
Varma Family Chair of Medical Bioinformatics and Artificial Intelligence	» Anna Goldenberg (Hospital for Sick Children)

## APPENDIX B: PRIVATE SECTOR INVESTMENT

Since 2017, many multinational enterprises have established new AI research and development labs in Canada, including:

- » Amazon
- » ATB Financial
- » Borealis AI (RBC Institute for Research)
- » DeepMind
- » Facebook
- » GM Canada
- » Google
- » LG Electronics
- » Microsoft Research
- » Nvidia
- » Samsung
- » Thomson Reuters
- » Uber

## APPENDIX C: CANADA'S AI STARTUP ECOSYSTEM

Canada's AI ecosystem has seen tremendous growth in the last two years. In particular, the number of AI-related startup companies has increased dramatically, with more than 650 startups currently operating across all of Canada's largest tech centres.

### ECOSYSTEM IN NUMBERS\*

650+ Startups      40+ Accelerators & incubators  
60+ Investor groups      60+ Public research labs

[\\*jfgagne.ai](http://jfgagne.ai)

## APPENDIX D: MEDIA COVERAGE

Google News has indexed more than 130 articles on artificial intelligence in Canada since the announcement of the CIFAR Pan-Canadian AI Strategy on March 28, 2017. Some of the highlights include:

PUBLICATION	ARTICLE	DATE
The Economist	How Canada's unique research culture has aided artificial intelligence	November 4, 2017
Maclean's	Is Canada ready for the radical change Artificial Intelligence will unleash?	November 26, 2017
MaRS Magazine	Future of AI	December 12, 2017
Bloomberg Businessweek	Apple and its rivals bet their futures on these men's dreams	May 17, 2018
Forbes	An insider's look into the summer school training the world's top AI researchers	September 3, 2018





