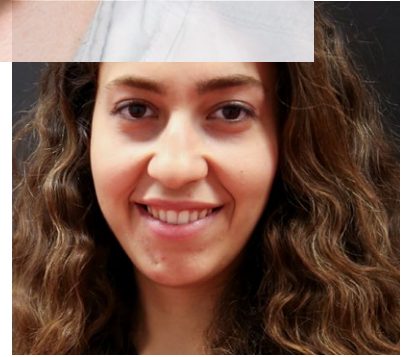




# Mila

## Quebec Artificial Intelligence Institute

Annual Report  
April 1, 2019, to March 31, 2020



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# Summary

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# Mission and Values

Since 2017, Mila - Quebec Artificial Intelligence Institute has been the result of a collaboration between Université de Montréal and McGill University, with close links to Polytechnique Montréal and HEC Montréal. This not-for-profit organization brings together nearly 700 people, including close to 600 leading researchers, professors and students in artificial intelligence (AI).

## Our mission

Mila's mission is to be a global pole for scientific advances that inspires innovation and the development of AI for the benefit of all.

## Our strategic pillars

### AI talent

We strive to attract, train and retain a growing and diverse pool of talent recognized for their extensive expertise in machine learning.

### Cutting-edge research

We aim to achieve the highest levels of scientific leadership in the development of innovative approaches to machine learning for AI.

### Collaborative projects

We contribute to projects and platforms, and partner with a range of organizations to accelerate economic and social innovation.

### Social influence

We seek to stimulate a democratic dialogue on the potential of AI and the importance of ethical and responsible development.

# Our values

Mila's values are the cornerstone of our vision and feed the DNA of our organization.





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# Messages from the Directors

## Message from the Chair of the Board Pierre Boivin



For nearly four years now, I have been involved in an effort to place artificial intelligence (AI) at the heart of Quebec's development strategy, of which Mila is the cornerstone. Since the beginning of its activities in the spring of 2018, Mila has been striving to build a global hub of AI development in Montreal with the objective of benefitting all of society. In times of crisis, its contribution has been crucial: from day one of the COVID-19 pandemic, Mila's research community mobilized to participate in the collective and civic effort to fight the virus.

This young organization has the largest concentration of university researchers in machine learning in the world, with Yoshua Bengio as Scientific Director and a group of close to 600 researchers, professors and students who have chosen to settle in Quebec. This expertise is generating benefits that are only just beginning to be measured, and which undoubtedly contribute to making Montreal number one among the 20 largest metropolises in terms of the quality and vigour of its AI sector and the availability of its workforce.

The Mila effect is also felt in the choice of Montreal by world leaders such as Samsung, Ericsson, Facebook and Microsoft to develop their AI expertise. In Quebec,

investment in AI is considerable, giving many industries the potential to achieve productivity gains in sectors as diverse as health care, education, communications, retail, transportation, logistics, agriculture and entertainment.

As Chairman of the Board of Directors of Forum IA Québec, I am involved so that we can allow a greater number of players to adopt AI and strengthen Quebec's position. Mila contributes greatly to this effort by welcoming both large companies and cohorts of start-ups on its premises in order to move their projects forward.

On behalf of the members of the Board of Directors, I would like to express my sincerest gratitude to the governments of Quebec and Canada for their invaluable support as well as to all of Mila's partner companies and institutions.

Finally, I would like to highlight the extraordinary work and dedication of Mila's team, which remains more united and committed than ever during this pandemic. Thank you as well to all the members of the Board of Directors for their generous contribution to the success of this project.

## Message from the President and CEO Valérie Pisano



It is with a renewed sense of pride that I present Mila's second annual report, which summarizes a year of extraordinary growth in several respects. Now that our institute has been successfully established, led by a seasoned team and bringing together several hundred researchers in our new premises at Mile-Ex, Mila has focused on solidifying all of its organizational structures and achieving a promising strategic vision.

Pursuing its mission to be "a global hub of scientific advancement that inspires innovation and the growth of artificial intelligence for the benefit of all," we have made significant investments in developing our teams of applied AI researchers and innovation, development and technology specialists, in addition to strengthening Mila's professional team.

We have also established important partnerships with a consortium of companies committed to Mila's success. Over the past year, the number of partnerships has increased dramatically and, as at March 31, 2020, Mila had a total of 42 industry partnerships.

The innovation and vitality of our ecosystem depends a great deal on the life that goes on there, the work that is done there and the events that take place there. Designed to stimulate the exchange of ideas, our spaces have allowed us to welcome, during this past period, seven start-ups launched by Mila students and 15 Quebec start-ups thanks to Espace CDPQ | Axe IA. Mila's spaces have been energized by the numerous events and scientific exchanges that have taken place in partnership with industry, attracting some 15,000 participants.

While March 2020 put an abrupt end to our physical presence at Mila, we quickly mobilized from the beginning of the pandemic to design scientific projects, secure their funding and get partner companies involved. In this report, we present some of these COVID-19 projects as well as the AI for Humanity projects that stood out this year.

In conclusion, I am deeply grateful to the entire team for all of our achievements during this second year. Thank you to my colleagues on the executive team, to all the talented people working at Mila, and to the Board of Directors for their contribution to our success.



## Message from the Scientific Director Yoshua Bengio



The year 2019-2020 has been particularly productive for our research community, despite the fact that it ended with the start of the COVID-19 pandemic.

First, in order to strengthen our collective efforts to innovate and explore new avenues of research, we intensified our recruitment of leading professors and researchers in artificial intelligence (AI), notably by awarding 19 Canada CIFAR AI Chairs and one Canada Excellence Research Chair, for a total of 36 at the end of this fiscal year. As a result, the number of Mila faculty members jumped from 41 to 64, an increase of 56%, and the number of student researchers increased from 265 to 389. This depth of talent allows Mila to maintain the highest concentration of university researchers in machine learning in the world.

The year came in like a lion with a remarkable harvest and visibility at the NeurIPS 2019 conference, held in Vancouver from December 8-14. Mila researchers presented 35 scientific papers and shared their results in numerous workshops. Our institute organized several workshops of its own: "AI for Social Good," "AI and Climate Change," "Retrospectives Workshop" (focusing

on the quality of science produced in our community) and "Deep Reinforcement Learning Workshop," in addition to its biologically inspired counterpart, "Biological and Artificial Reinforcement Learning." In terms of theoretical contributions, we also co-organized the "Bridging Game Theory and Deep Learning" workshop.

Challenges such as the ones we are currently experiencing often reveal - through action - the true nature of people and organizations. Our values of solidarity, co-operation, transparency, humanism and social conscience have been reflected in the efforts of many members of the Mila community to fight the pandemic. Several projects are under way, including using AI to improve contact tracing (COVI mobile app), sharing information about COVID-19 (Chloe chatbot) and accelerating the identification of new antivirals (LambdaZero).

More than ever, our researchers are making their mark on the international scene and contributing to multiple projects to advance science and stimulate innovation both at home and abroad.

# Mila in Numbers

During the period covered by this report, the Mila effect was felt at many levels, as these results show!

**5 000**

Mila has been mentioned in the Canadian and international media nearly 5,000 times, including more than 1,000 unique mentions.

**121%**

Mila's industrial partnerships and memberships have increased by 121%, from 19 to 42.

**36**

There are 36 active Canada CIFAR AI Chairs.

**154**

The number of research projects jumped from 87 to 154.

# 260

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More than 260 scientific articles have been published, including more than 90 with co-authors from industry.

# 600

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Some 600 researchers, professors and students form Mila's active community.

# 15,000

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Training sessions, seminars, reading groups and other events attracted approximately 15,000 participants.

# 56 %

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The number of professors has increased by 56% over the previous year.

# 1<sup>st</sup>

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Montreal is ranked the number one city in North America for the quality of its AI sector.

# 349

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A total of 349 scholarships were awarded to students.

# 500

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More than 500 students (master's, doctorate, postdoctorate, interns, visitors, professional master's, DESS) are part of Mila.

# 39

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In all, 39 start-ups are Mila members.



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# AI Talent

**“Mila stands out from other institutes by, of course, the international reputation of its academic members, but also through the multidisciplinary research embodied in the students from different backgrounds, each contributing in his or her own way to the advancement of AI.”**

Arsène Fansi-Tchango,  
applied research scientist, Mila

In keeping with its mission to recruit and retain talent in Canada, Mila continued its efforts throughout the year to acquire the best and brightest researchers in artificial intelligence (AI) and increase the professional talent pool. Working with affiliated universities, Mila increased its faculty membership from 41 to 64, an increase of 56%.

Of the 23 new professors as at March 31, six are core academic members and 17 are associate academic members, for a total of 23 core academic members and 41 associate academic and industry members. Mila has been enriched by the depth of their expertise covering a wide range of fields, including psychology, astrophysics, natural language, medicine, biology and public health.

Mila has the highest concentration of academic researchers in machine learning in the world. Several are recognized for their scientific breakthroughs and the excellence of their work. Mila’s ability to attract talent and create a rich community of renowned researchers plays a key role in the attractiveness of Montreal and Quebec for AI investment. This is why Montreal ranks first among the 20 largest North American cities for the quality of its AI sector, according to benchmarking analysis carried out by the Financial Times’ fDi Benchmark.

## New faculty

### Core academic members



#### Aishwarya Agrawal

Assistant Professor, Department of Computer Science and Operations Research  
Université de Montréal  
Canada CIFAR AI Chair

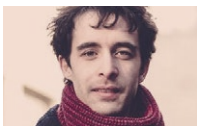
Aishwarya Agrawal is a former researcher for British AI company DeepMind and a pioneer in the new sub-field of Visual Question Answering (VQA). Her research focuses on deep learning and natural language processing.



#### Prakash Panangaden

Full Professor, School of Computer Science  
McGill University

Prakash Panangaden went from associate member status to that of a core member. His research focuses on the mathematical foundations of machine learning and automata. His work explores logics for probabilistic systems, Stone duality for Markov processes, and programming languages.



#### Pierre-Luc Bacon

Assistant Professor, Department of Computer Science and Operations Research  
Université de Montréal  
Facebook CIFAR AI Chair

Through his research, Pierre-Luc Bacon aims to find solutions to the problem of representation learning for sequential decision-making with long-term consequences, relying throughout on optimization methods.



#### Siamak Ravanbakhsh

Assistant Professor, School of Computer Science  
McGill University  
Canada CIFAR AI Chair

Siamak Ravanbakhsh is a graduate of the University of Alberta in machine learning and an Assistant Professor at the McGill University School of Computer Science. He is interested in the problems of representation learning and inference in AI. His research focuses on symmetry as an alternative inductive bias.



#### Sarath Chandar

Assistant Professor, Department of Computer and Software Engineering  
Polytechnique Montréal  
Canada CIFAR AI Chair

Sarath Chandar is a recipient of the IBM PhD Fellowship and a graduate of Université de Montréal. He is interested in automatic language processing, recurrent neural networks and reinforcement learning. He now teaches the basics of deep learning at Polytechnique Montréal.



#### Siva Reddy

Assistant professor, Computer Science and Linguistics  
McGill University  
Facebook CIFAR AI Chair

Siva Reddy did his postdoctoral studies at the Stanford NLP Group, which develops algorithms that allow computers to process and understand human language. He has expertise in the building of symbolic (linguistic and induced) and deep language learning models.



#### Guillaume Lajoie

Assistant Professor, Department of Computer Science and Operations Research  
Université de Montréal

A graduate of the University of Washington in applied mathematics, Guillaume Lajoie has moved from associate to core member status. He conducts research at the intersection of AI and neuroscience. His work focuses on the ability of a neural network (biological and artificial) to perform complex computations and on the development of algorithms for optimizing bidirectional brain-machine interfaces (BMIs).



#### Irina Rish

Associate Professor, Department of Computer Science and Operations Research  
Université de Montréal  
Canada CIFAR AI Chair and Canada Excellence Research Chair

After university studies in Moscow and California as well as a long career at IBM in New York, Irina Rish moved to Canada to join the faculty at Université de Montréal and Mila. Her current research focuses on continuous learning and optimization algorithms for deep neural networks.

“Mila provides us with the perfect conditions to conduct world-class research by attracting the best students from here and abroad. Mila also provides us with many funding opportunities that allow us to focus on research. Finally, Mila provides us with a complete environment that supports us in developing ideas for research, training and technology transfer.”

Laurent Charlin,  
Assistant Professor, HEC Montréal

## Associate academic members

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### David Buckeridge

Assistant Professor, Department of Epidemiology, Biostatistics and Occupational Health  
McGill University

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### Danilo Bzdok

Associate Professor, Department of Biomedical Engineering  
McGill University  
Canada CIFAR AI Chair

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### Christophe Dubach

Associate Professor, Department of Electrical and Computer Engineering  
McGill University  
Canada CIFAR AI Chair

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### Audrey Durand

Assistant Professor, Department of Computer Science and Software Engineering, Department of Electrical and Computer Engineering  
Université Laval  
Canada CIFAR AI Chair

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### Amin Emad

Assistant Professor, Department of Electrical and Computer Engineering  
McGill University

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### Christian Gagné

Full Professor, Department of Electrical and Computer Engineering  
Université Laval  
Canada CIFAR AI Chair

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### Pascal Germain

Assistant Professor, Department of Computer Science and Software Engineering  
Université Laval  
Canada CIFAR AI Chair

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### Warren Gross

Professor and Chair, Department of Electrical and Computer Engineering  
McGill University

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### Karim Jerbi

Associate Professor, Department of Psychology  
Université de Montréal

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### François Laviolette

Full Professor, Department of Computer Science and Software Engineering  
Université Laval  
Canada CIFAR AI Chair

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### Yue Li

Assistant Professor, School of Computer Science  
McGill University

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### Aditya Mahajan

Assistant Professor, Department of Electrical and Computer Engineering  
McGill University

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### AJung Moon

Assistant Professor, Department of Electrical and Computer Engineering  
McGill University

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### Courtney Paquette

Assistant Professor, Department of Mathematics and Statistics  
McGill University  
Canada CIFAR AI Chair

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### Laurence Perreault-Levasseur

Assistant Professor, Department of Physics  
Université de Montréal

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### Martin Vallières

Assistant Professor, Department of Computer Science  
Université de Sherbrooke  
Canada CIFAR AI Chair

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### Guy Wolf

Assistant Professor, Department of Computer Science and Operations Research  
Université de Montréal

# Training

Through its unique model, Mila contributes to the development of a stimulating research and innovation environment and the creation of a thriving artificial intelligence ecosystem.

Mila welcomes master's and doctoral students, research interns and postdoctoral trainees from Université de Montréal, McGill University, Polytechnique Montréal, HEC Montréal, Université Laval and Université de Sherbrooke, all supervised by Mila faculty members.

**In addition to training programs, here is a list schools organized or co-organized by Mila:**

- **AI4Good Lab (May-June 2019)**  
Since 2017, this project initiated by McGill University Professor Doina Precup has been welcoming some thirty STEM graduates from across Canada with the goal of creating a more diverse pool of high-potential young talent to fuel the AI research ecosystem. Held on Mila's premises, the 2019 edition consisted of lectures, workshops and team projects.
- **International Summer School on Bias and Discrimination in AI**  
In June 2019, Mila welcomed about a hundred attendees to this school organized in collaboration with IVADO, during which several members, including Joëlle Pineau, William Hamilton, Audrey Durand and François Laviolette, shared their expertise and provided attendees with strategies to mitigate bias and guide the ethical development and evaluation of algorithms.
- **CIFAR Deep Learning and Reinforcement Learning Summer School**  
Co-organized by Amii and CIFAR in collaboration with Vector Institute and Mila, the summer school in Edmonton brought together more than 300 graduate students, postdoctoral trainees and industry professionals from 36 countries. Several professors, including Yoshua Bengio, have taught there.
- **IVADO/Mila Deep Learning Summer School (4<sup>th</sup> edition)**  
From September 9-13, 2019, IVADO and Mila provided training to nearly 200 professionals with basic knowledge of mathematics and programming. During that week, attendees were taught the methodology for carrying out a deep learning project.
- **IVADO/Mila/UBC Data Science Institute Deep Learning Winter School (5<sup>th</sup> edition)**  
From December 2-6, 2019, at the University of British Columbia, some 60 attendees deepened their knowledge of deep learning during hands-on sessions and tutorials under the supervision of several Mila researchers and employees.
- **African Masters of Machine Intelligence (AMMI)**  
In January 2020, Mila took part in the AMMI program by teaching reinforcement learning for one week. AMMI provides cutting-edge training in machine learning in order to prepare the next generation of researchers in artificial intelligence to meet Africa's current and future needs.

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## Massive Open Online Courses (MOOC)

In partnership with IVADO, Mila prepared two online courses accessible on the IVADO website and EdX platform. These free courses contribute to the dissemination and accessibility of knowledge in artificial intelligence.

- MOOC Deep Learning Essentials
- MOOC Bias and Discrimination in AI

## Internships

**“The students analyzed satellite images to compare predictions of solar radiation levels on the ground using an AI model with those generated by other existing models. Initial results are encouraging. Thanks to their work, we will be able to manage our network more efficiently.”**

**Patrick Jeandroz,**  
Head, Expertise - Data Science  
and High-Performance Computing, IREQ

The Mila community benefits from a variety of internship opportunities that foster collaboration between members of the ecosystem and bring together academia and industry.

### Professional Masters Program

Launched in 2018, the Professional Masters in Machine Learning program allows students to complete their mandatory internship with a Mila start-up or their own start-up if they have one. During the period covered by this report, Mila has contributed to create 47 internship opportunities. Indeed, 13 students were able to discover the entrepreneurial world and apply the technical knowledge acquired during their course; while 34 companies have benefited from the knowledge and talent of a Mila intern. Through its corporate internship program, Mila makes sure to identify relevant internships with its partners, to create twinning between business projects and students, as well as to offer scientific support during the entire duration of the internship.

### Technology transfer projects

In addition, about thirty students at all levels contributed to technology transfer projects such as le Projet fonds de l'œil pour la rétinopathie diabétique, in collaboration with Polytechnique Montréal and Université de Montréal, and the project to predict global solar radiation using satellite imagery from Hydro-Québec's research institute (IREQ).

### Mentorship Program

In the spring of 2020, in collaboration with Mentorat Québec, Mila launched a nine-month mentorship program during which each mentee is paired with a researcher who supports the mentee in his or her personal and professional development. The first cohort of 16 mentees includes students at all levels (postdocs, PhDs, master's) supported by 10 mentors comprising professionals and entrepreneurs in Montreal's AI industry, senior researchers, professors, alumni and employees of the Mila community.

**“Mila is a unique institution with an ideal environment for conducting high-quality research. As a postdoctoral trainee, I really appreciate the exceptional freedom, competence, enthusiasm and long-term vision that characterize Mila. At Mila, we have all the basic ingredients to conduct fruitful research, including adequate computing resources that are not easily found in any other university laboratory.”**

**Mirco Ravanelli,**  
postdoctoral trainee, Université de Montréal





# Cutting-edge Research

Mila's culture enables it to push the boundaries of machine learning research. Mila stands out in the scientific community due to the impressive track record of its research professors working at four major affiliated universities and other Canadian institutions. These authorities in their field have numerous cutting-edge research projects closely linked with current events, several research chairs as well as awards and distinctions.

Over the past year, our professors have garnered prestigious awards and nominations for the excellence of their work.

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## Yoshua Bengio

- **November 2019** – Recipient of the A.M. Turing Award from the Association for Computing Machinery – equivalent to the “Nobel Prize in computing” – for his work as the “father of the deep learning revolution,” with Yann LeCun and Geoffrey Hinton.
- **April 2020** – Elected to the Royal Society, becoming one of 62 new members admitted to the prestigious British Association of Scientists, which includes distinguished members such as Isaac Newton, Robert Boyle and Paul Nurse.
- **April 2019** – Awarded the Killam Prize in the Natural Sciences, which honours distinguished scholars in the humanities, social sciences, natural sciences, health sciences and engineering.
- **April 2020** – Appointed President Emeritus of the Advisory Board of AI Impact Alliance, an NGO created in 2017 to democratize artificial intelligence (AI).

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## Guillaume Lajoie

- **March 2020** – Recipient of Google’s Focused Research Award, a fellowship program supporting professors beginning their careers and those working on positive societal initiatives.

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## Derek Nowrouzezahrai

- **January 2020** – Appointed Director of the Centre for Intelligent Machines at McGill University. Established in 1985, this centre facilitates and promotes research on intelligent systems.

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## Joëlle Pineau

- **May 2019** – Awarded the Governor General’s Innovation Award, which recognizes the excellence of researchers and highlights their contribution to society.
- **March 2020** – Named on the 2020 list of 10 women advancing AI in Canada in 2020.

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## Doina Precup

- **March 2020** – Named on the 2020 list of 10 women advancing AI in Canada in 2020.

“This is a wonderful opportunity for my team and I at Mila. This chair will allow us to explore the frontiers of AI research the crossroads of machine learning and neuroscience, and to advance toward a more autonomous, human-scale artificial intelligence by developing new models and methods for large, robust AI systems.”

Irina Rish

## Intelligence on a human scale

For almost 40 years, Irina Rish has been pursuing very specific goals: to stimulate her brain and teach computers to think. Her quest, which began very early in the former Soviet Union, has brought her to us, where she has been an associate professor since October 2019 at the Department of Computer Science and Operations Research at Université de Montréal, and a key member of Mila.

The recognition of her work does not end there: already a Canada CIFAR AI Chair, Irina Rish was awarded a Canada Excellence Research Chair in the summer of 2020, along with a budget of \$34 million over seven years.

### Dedicated to science

The daughter of mathematics teachers in Uzbekistan, Irina Rish discovered artificial intelligence (AI) as a teenager by reading the book *Can Machines Think?* The book inspired her to develop her own intelligence and teach computers to solve problems. Her passion for AI was born!

The young scientist obtained her undergraduate degree at the National University of Oil and Gas in Moscow.

The collapse of the Soviet Union in 1991 allowed her to pursue graduate studies at the University of California, Irvine. Armed with a master’s degree (1994) and PhD (1999) in computer science with a specialization in AI, she had a bright future as a university professor. Instead, she chose to pursue a career at IBM’s huge laboratory in New York, where she stayed for 20 years before moving to Canada with her family following a meeting at a conference with Joëlle Pineau, a researcher at Mila, an Associate Professor at McGill University and the head of Facebook’s AI research laboratory.

Irina Rish holds 64 patents and has published more than 90 research papers as well as a study on sparse modeling, an important area of statistical machine learning in bioinformatics and neuroimaging.





CO>i

**In motion. Together.**

*En mouvement. Ensemble.*

English

Français

# AI in search of covid-19 solutions

Since the start of the pandemic, a group of researchers at Mila have been rolling up their sleeves to help combat the virus by putting their expertise at the service of the scientific community, along with some of our partners.

## Three major projects deserve special mention:

### Discovery of antiviral agents for COVID-19 using deep reinforcement learning

Drug discovery is a lengthy and extremely costly process, requiring an average of \$2.6 billion per approved drug.

To speed up the process, teams working with Yoshua Bengio (Université de Montréal), Jian Tang (HEC Montréal) and graduate student Maksym Korablyov (Université de Montréal) developed a deep reinforcement learning system called "LambdaZero," which is capable of quickly evaluating billions of candidate molecules.

Using this approach, it is possible to progressively modify the molecular structure by adding or removing building blocks in order to discover new molecular structures capable of binding to a target protein.

### Development of the COVI contact tracing app

Imagine an app that automatically records interactions between users on their mobile devices so that messages can be exchanged if a user experiences symptoms or tests positive. And one that does so completely anonymously.

This is the challenge that was taken on by a group of researchers and experts led by Yoshua Bengio at Mila with the design of COVI, a contact tracing app for Quebec and Canada which uses artificial intelligence (AI) to limit the spread of the virus and facilitate the safe lifting of physical distancing measures while protecting privacy and human rights.

Using AI, COVI takes several factors into consideration such as health status, age, gender, symptoms, the network of interactions and the exposure to a COVID-positive person to estimate the level of risk. This personalization allows targeted notices to be sent to

each user to help the person make decisions in real time – reducing the number of contacts, self-isolating or getting tested – often well before symptoms appear. Although it was not retained by the Government of Canada, the COVI project has been the subject of scientific publications and is helping to advance science.

### Participation in the development of the Chloe chatbot

Since the COVID-19 outbreak in Canada, information has changed from day to day, even hour to hour. Across the country, 811 lines are overwhelmed. A growing number of people are turning to telemedicine in order to get information or consult a health care professional.

Several leaders in information technology and the development of artificial intelligence, including Mila, have joined forces to improve the automated public chatbot service called "Chloe for COVID-19," which aims to support Canadians in the fight against the coronavirus by facilitating quick and secure access to truthful, timely and accurate information. This open source project is available on the Dialogue website ([covid19.dialogue.co](https://covid19.dialogue.co)).

Siva Reddy, Assistant Professor of Computer Science and Linguistics at McGill University and a Mila member, is contributing to this project to improve the functioning of the chatbot. The goal is to automate as many steps as possible in a patient's approach to the virus by

- providing up-to-date and verified information about COVID-19
- providing clear answers to specific questions on the subject
- evaluating symptoms by answering individuals' questions
- following up with persons in confinement to find out how their condition is progressing

At the end of last year,  
Mila had 593 researchers,  
professors and students

64

faculty members

40

postdoctoral trainees

57

interns

12

visitors

**"Working at Mila allows me to contribute to the understanding of fascinating scientific problems. These problems are not just fundamental and stimulating, but also the basis for innovations that are changing our society."**

Kaba Sékou-Oumar,  
master's student, McGill University

**182**

doctoral students

**95**

master's students

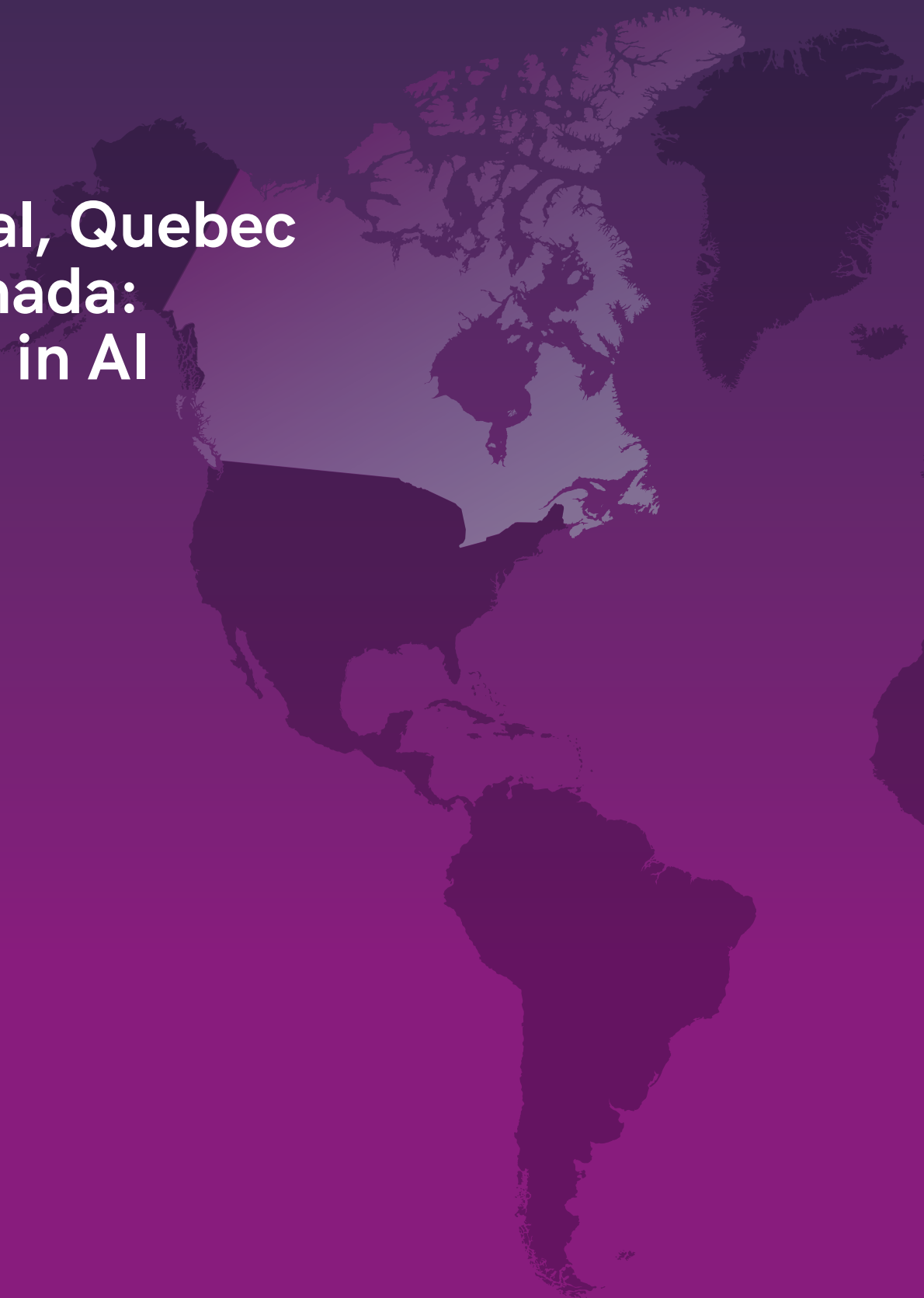
**10**

researchers on applied research teams  
and teams specializing in innovation,  
development and technology

**+**

In addition to these  
researchers, there are  
130 students completing  
their professional masters  
and diploma of higher  
specialized studies.

# Montreal, Quebec and Canada: Leaders in AI







In 2019, Montreal was voted "Best City for AI Investment."<sup>1</sup>

In 2019, Montréal International had a record year with 89 direct foreign investment projects, accounting for a 20% contribution to Quebec's economic growth.<sup>2</sup>

Since April 2019, five major players have developed their AI activities in Montreal: CORNING, Ericsson, Unity, Novartis and Google.

Greater Montreal has more than 5,000 information technology (IT) companies and more than 179,000 professionals working in this field.<sup>3</sup>

The metropolis is home to the new International Centre of Expertise in Montréal for the Advancement of Artificial Intelligence, established under the Global Partnership on Artificial Intelligence.

Montreal is also home to Scale AI, an AI supercluster, whose role is to identify multi-sectoral collaborative projects and provide funding and expert advice to ensure that Canada maintains its leadership in AI; and Forum IA Québec, whose mission is to help Quebec take full advantage of artificial intelligence.

Thanks to the Pan-Canadian Artificial Intelligence Strategy, Mila, Vector Institute and Amii had more than 1,000 AI researchers as at March 2019. The three institutes have supported more than 75 start-ups over the last three years, representing more than 12% of all active AI start-ups in 2020.<sup>4</sup>

Based on the measurement of talent inflows and outflows in 55 countries, Canada ranks fourth in terms of AI skill migration. In 2019, Canada moved up 20 spots to fourth place.<sup>5</sup>

According to CSRankings, Canadian universities, including Université de Montréal and McGill University, rank among the top 100 IT institutions in the world.<sup>6</sup>

Since 2017, more than 45 companies have invested in AI research laboratories in Canada, including Microsoft, DeepMind and Thomson Reuters.<sup>7</sup>

1. <https://www.montrealinternational.com/en/news/montreal-best-place-in-north-america-for-ai-investment/>

2. <https://www.montrealinternational.com/en/news/new-records-for-montreal-international/>

3. [https://www.montrealinternational.com/app/uploads/2020/09/profil\\_startup\\_2020.pdf](https://www.montrealinternational.com/app/uploads/2020/09/profil_startup_2020.pdf) (in French)

4. Pan-Canadian AI Strategy Impact Report

5. <https://jfgagne.ai/talent-2019/>

6. [https://www.timeshighereducation.com/world-university-rankings/2019/subject-ranking/computer-science#!page/0/length/25/sort\\_by/rank/sort\\_order/asc/cols/stats](https://www.timeshighereducation.com/world-university-rankings/2019/subject-ranking/computer-science#!page/0/length/25/sort_by/rank/sort_order/asc/cols/stats)

7. Pan-Canadian AI Strategy Impact Report

# Collaborative Projects

Partner relationships play a major role in Mila's development and foster a strong and sustainable ecosystem. Over the past year, their number has risen sharply thanks to the renewal of historic partnerships and the addition of new companies of various sizes. As at March 31, 2020, Mila had a total of 42 formal partnerships with industry (23 more than last year). This number is expected to increase in 2020-2021, given Mila's numerous Quebec-based partners seeking to develop solution-driven research and the growing group

of mostly foreign companies wishing to support Mila's curiosity-driven and open source research.

Mila is benefitting from an unprecedented industry appetite for open source basic research collaborations, resulting in strategic partnerships with major players such as Microsoft, Google, Samsung, Facebook, IBM, NVIDIA, Hitachi, DiDi, Panasonic, Nuance, Element AI, CN, Manulife, Hydro-Québec, the City of Montreal and the Caisse de dépôt et placement du Québec.

**"Our partnership with Mila allows Dialogue to focus on what we do best: provide excellent care and create exceptional experiences for our members. Working with Mila allows us to be more efficient at integrating AI into our products. This collaboration improves the protection of patients and helps health care professionals in the delivery of care."**

Alexis Smirnov,  
co-founder, Dialogue



BIOS



ELEMENT AI

FACEBOOK

Google



grokvideo

HITACHI



IBM Research AI



keatext



SAMSUNG



wrneh

"At Novartis, we are undertaking an ambitious transformation to become the world's leading pharmaceutical company by leveraging data science and digital technology. As part of our commitment to reinventing medicine, we are using data to create transformative medications that improve people's lives. We are delighted to partner with Mila, an organization recognized worldwide for its achievements in deep learning, and look forward to collaborating on the creation of AI initiatives that will benefit both patients and health care systems."

Christian Macher,  
President, Novartis Canada

## From the lab to industry

To bridge the gap between academic and industrial research, Mila relies on a team of experts whose goal is to solve industrial problems with approaches based on machine learning. These applied research scientists work in collaboration with partners on concrete projects for which artificial intelligence provides solutions.

In addition, as part of its Industrial Research Assistance Program, the National Research Council Canada calls upon Mila to support small and medium-size businesses in the use of machine learning. During the period covered by this report, 43 companies took advantage of this program.

### Here are three applied research projects currently under way:

- **Institut de recherche d'Hydro-Québec (IREQ)**  
Mila's applied research scientists work with researchers at IREQ to more accurately predict solar irradiance over a given territory, which is the amount of energy the sun releases when it reaches the ground. The goal is to obtain forecasts that are better than those of weather models over a period of zero to six hours. This improvement in forecasting will primarily improve our understanding of the potential for electrical production using solar energy and provide tools to manage the electrical grid, given that its production fluctuates greatly over time.

- **Dialogue Technologies**

A virtual health care provider, Dialogue provides a telemedicine platform that aims to facilitate diagnosis thanks to a chatbot that collects all relevant information about a patient's symptoms by asking questions. Mila is helping the company make the chatbot more effective using reinforcement learning. The first goal is to collect all relevant information through effective dialogue to provide a health care professional with the elements to identify the pathologies from which the patient suffers. The second goal is to have a chatbot that can be easily modified to incorporate new pathologies or medical knowledge.

- **Natural Resources Canada**

Mila is collaborating with the Geological Survey of Canada, a scientific agency of Natural Resources Canada, to build machine learning models that can predict the composition of minerals and other rock types in the substratum using reflective seismology data. This project poses major scientific challenges due to the noise in the data, the very limited amount of tagged data and the distribution of data that can vary significantly across geographic regions.



## Start-ups

Mila acts as a catalyst for promising start-ups within its research community and supports them by providing space, scientific advice, entrepreneurial workshops and access to technological and material resources, while allowing them to benefit from its vast network of contacts. InVivo AI, Korbit AI and Ubenwa are among the companies benefitting from Mila's support.

### **InVivo AI: A start-up on the move**

In April 2018, three students - Daniel Cohen, Therence Bois and Prudencio Tossou (who is completing his PhD at Mila) - designed the technology behind InVivo AI in an effort to simplify and accelerate the process of developing drugs from small data sets. Specializing in machine learning, bioinformatics and molecular biology, the InVivo AI start-up was selected to be part of the Espace CDPQ | Axe IA incubator. In the summer of 2019, the team joined Mila's laboratories, growing from six to 16 people.

**"Mila plays an important role in research and development. Working closely with Mila's researchers allows us to create a range of AI tools more quickly and deploy our technology in large pharmaceutical companies, which is even more critical during a pandemic."**

**Therence Bois,**  
co-founder, InVivo AI

**“Our goal is to provide an interactive, personalized and high-quality education to students around the world at a low cost.”**

**Iulian Vlad Serban,**  
co-founder of Korbit AI  
and Mila PhD student

### **Korbit AI: From student start-up to burgeoning educational enterprise**

Korbit AI has developed an intelligent tutor that gives online courses through interactive conversations and exercises. Using artificial intelligence (AI), the Montreal-based start-up adapts to each student's profile and offers targeted studies in real time. What's more, the AI tutor has the capacity to adapt to thousands of courses and participants.

Several of Mila's professors, including Yoshua Bengio, Joëlle Pineau, Aaron Courville and Laurent Charlin, contributed to the development of the prototype. In partnership with Mila, Korbit AI has been providing data science and AI courses for over a year, in addition to various educational conferences. To date, more than 10,000 students have benefitted from these free courses.

In October 2019, the start-up obtained \$2.8 million in capital thanks to fundraising efforts and now offers in-company training. Its success has led to the company being named one of the top 100 AI start-ups in the world in March 2020 by CB Insights.

### **Ubenwa: A student start-up with a humanitarian focus**

The Ubenwa mobile app uses artificial intelligence to record and analyze a newborn's cries to detect any risk of neonatal asphyxia, which is responsible for many cases of infant mortality and serious disabilities every year, particularly in developing countries.

The company is working on collecting 10,000 cries from 2,500 newborns. Eventually, Ubenwa will have the largest database of its kind, with clinical indications corresponding to each recording.

Since its creation in 2017, the start-up has brought together students and researchers from Mila, including Charles C. Onu and Jonathan Lebensold, doctoral students that are supervised by Professor Doina Precup and advised by Scientific Director Yoshua Bengio.

**“Ubenwa's commitment to saving lives, combined with Mila's social mission to develop artificial intelligence for the common good, made our collaboration a natural fit. Our mission is to leverage our skills in engineering, artificial intelligence and medical research to make clinical-grade diagnostic tools widely available.”**

**Charles C. Onu,**  
founder of Ubenwa and doctoral student,  
McGill University





# Ecosystem Activities



Mila's ecosystem is based on a community of more than 600 researchers, professors and students from Université de Montréal, McGill University, HEC Montréal and Polytechnique Montréal, along with researchers from major companies, institutions and start-ups as well as partner companies housed in the O Mile-Ex complex or nearby buildings. This ecosystem is a true artificial intelligence (AI) hub in Montreal, which moves to the rhythm of numerous events and scientific exchanges.

**The rich schedule of activities organized by Mila encourages meetings and the collision of ideas between all players.**

### Large gatherings

In 2019-2020, Mila helped organize flagship events in collaboration with industry, attracting an estimated total of 15,000 participants.

### TechAide

Initiated by Montreal-based NPO OSMO and sponsored by Professor Hugo Larochelle, TechAide brings together the technological community, researchers and industry members in support of local NPOs. All profits are donated to Centraide of Greater Montreal.

- April 26, 2019 - The second edition of the TechAide AI Conference, organized in collaboration with Mila, featured a line-up of speakers presenting their latest work in AI. Among them were Yoshua Bengio ("A Meta-Transfer Objective for Learning to Disentangle Causal Mechanisms") and Joëlle Pineau ("Temporal Regularization in Reinforcement Learning").
- June 7, 8 and 9, 2019 - At the AI4Good conference, organized by TechAide in Mila's offices, speakers shared their expertise in AI to solve problems experienced in the Montreal community. A hackathon punctuated the event by offering AI researchers the opportunity to address important challenges faced by not-for-profit organizations in order to forge future collaborations.

### Montreal AI Symposium 2019

- September 6, 2019 - Several Mila members attended the Montreal AI Symposium, which brought together more than 600 researchers and experts from academia and industry interested in the advances in basic research and AI applications carried out in Montreal.





# Social Influence

The development of socially responsible artificial intelligence (AI) for the benefit of all is at the heart of Mila's mission. As a leader, Mila contributes to social dialogue and the development of applications that will benefit society, in accordance with the principles in the Montreal Declaration for a Responsible Development of Artificial Intelligence.

## **AI for Humanity**

The AI for Humanity community brings together researchers and stakeholders with diverse skills who wish to harness the potential of AI and advanced machine learning algorithms to create a better world.

## **Montreal Declaration**

Aware of the issues raised by AI, the architects of the Montreal Declaration for a Responsible Development of Artificial Intelligence drafted ethical principles based on ten core values. Understanding that actions speak louder than words, Mila actively promotes the ethical use of its research applications.

## **Algora Lab**

Founded by Marc-Antoine Dilhac, a professor at Université de Montréal, Algora Lab is an interdisciplinary university laboratory that develops deliberative ethics of AI and digital innovation and analyzes the societal and political aspects of the emerging algorithmic society.



### Three AI for Humanity projects stood out this year:

- **Visualizing climate change: A glimpse of the future**  
Under the direction of postdoctoral intern Sasha Luccioni, this project using cutting-edge artificial intelligence techniques aims to raise public awareness of the impact of climate change. In 2021, an interactive website will help make the consequences of climate change more concrete.
- **Biasly AI: Eliminating gender bias in written text**  
Researchers Yasmeen Hitti, Carlyne Pelletier, Andrea Eunbee Jang and Ines Moreno are designing a computer tool to track gender bias in AI data and “clean” it to be as neutral as possible. The idea is to train an algorithm with different data by asking different questions to avoid gender discrimination in written text.
- **Detecting trolls on social media: Identifying the misuse of social media to influence the course of political events**  
A Canada CIFAR AI Chair, Reihaneh Rabbany and her team at the McGill University School of Computer Science use data mining and graph integration techniques to detect anomalies and suspicious behaviour online on social networks during political events.



**“Mila provides an open and welcoming research environment by supporting and caring about groups that are under-represented. The constant communication between the management team and researchers promotes an inclusive ecosystem that’s always evolving.”**

Taoli Cheng,  
postdoctoral trainee, Université de Montréal

## Equity, diversity and inclusion

Mila is committed to promoting equity, diversity and inclusion in all facets of its activities. This is reflected first and foremost within the team, which includes women at all levels – Valerie Pisano (President and CEO), Émélie Brunet and Danielle Langlois (Vice-Presidents) and Joumana Ghosn (Director) – as well as on the Scientific Council with Professors Doina Precup and Joëlle Pineau. Very conscious of the fact that the artificial intelligence sector attracts more men than people from designated groups, especially women, Mila is intensifying its efforts to increase their representation, not only among core members but also associate members and students.

### Twelve female members

- Five core academic members awarded Canada CIFAR AI Chairs: Doina Precup, Joëlle Pineau, Reihaneh Rabbany, Aishwarya Agrawal and Irina Rish
- Three associate members awarded Canada CIFAR AI Chairs: Tal Arbel, Courtney Paquette and Audrey Durand
- Four associate members: Jin L.C. Guo, AJung Moon, Emma Frejinger and Laurence Perreault-Levasseur

**“Gender bias is a prejudice or stereotype based on gender. You have to explain to the computer what bias is. To do so, you label each word. This work involves computer science and linguistics.”**

Yasmeen Hitti,  
doctoral student, McGill University

In the past year, three graduate students (including one woman) became professors of machine learning at leading Canadian universities, and two students from the community (including one woman) were offered such positions in Canada.

### Other examples of commitments made this year that are expected to continue:

- Mila was hoping to be awarded three “diversity chairs” as outlined in its April 2019 strategic plan. In total, it was awarded five (Aishwarya Agrawal, Irina Rish, Tal Arbel, Courtney Paquette and Audrey Durand).
- Mila established a committee dedicated to equity, diversity and inclusion. The purpose of the committee is to participate in defining a frame of reference, in collaboration with IVADO, in order to foster an inclusive culture. This framework became operational in the fall of 2020.
- In June 2019, Mila hosted the International Summer School on Bias and Discrimination in AI. Ten students from nine less-developed or developing countries worked on two projects: one aimed at raising awareness of the impacts of climate change and the other at improving traditional models of epidemic spread using AI and machine learning tools.
- Of the 16 students mentored as part of the Mentorat Québec program, nine are from groups under-represented in the AI community: women, Blacks, Asians, Arabs and Latin Americans. Women alone make up 31% of the participants.

# Financial Statements

Mila – Quebec Artificial Intelligence Institute  
March 31, 2020

## Extrait des états financiers de Mila

	2020	2019
<b>ASSETS</b>	\$	\$
<b>Current</b>		
Cash	54,517,658	6,441,339
Trade and other receivables	1,152,220	1,138,696
Prepaid expenses	409,544	89,382
	<b>56,079,422</b>	<b>7,669,417</b>
<b>Long-term</b>		
Tangible capital assets	9,841,365	9,007,384
	<b>65,920,787</b>	<b>16,676,801</b>
<b>LIABILITIES</b>		
<b>Current</b>		
Trade payables and other operating liabilities	1,871,645	3,400,953
Advance from a not-for-profit organization, without interest	1,200,000	1,200,000
Deferred revenue	1,078,880	376,785
	<b>4,150,525</b>	<b>4,977,738</b>
<b>Long-term</b>		
Deferred revenue	91,479	—
Deferred contributions related to tangible capital assets	6,748,006	2,954,062
Other deferred contributions	52,456,619	6,264,168
Lease incentives	2,216,719	2,238,114
	<b>65,663,348</b>	<b>16,434,082</b>
<b>UNRESTRICTED NET ASSETS</b>	257,439	242,719
	<b>65,920,787</b>	<b>16,676,801</b>

**Mila** – Quebec Artificial Intelligence Institute  
For the year ended March 31, 2020

	<b>2020</b>	<b>2019</b>
	\$	\$
<b>Revenues</b>		
Grants	11,207,942	5,966,583
Research contracts	439,435	264,003
Industry sponsorships	2,332,919	194,465
Leasing	889,012	—
Training and other	354,285	1,200
Interest income	726,777	48,241
Amortization of deferred contributions related to tangible capital assets	1,026,810	594,498
	<b>16,977,180</b>	<b>7,068,990</b>
<b>Expenses</b>		
Research	5,979,939	1,967,663
Research support, Innovation and computing power	1,933,735	878,733
Ecosystem projects and training	2,377,908	873,447
Industry relationships and corporate laboratories	2,142,850	1,028,578
AI for humanity	135,650	56,758
General administration	2,543,629	1,416,438
Amortization of tangible capital assets	1,848,749	604,654
	<b>16,962,460</b>	<b>6,826,271</b>
<b>Excess of revenues over expenses</b>	<b>14,720</b>	<b>242,719</b>
Net assets, beginning of year	<b>242,719</b>	—
Net assets, end of year	<b>257,439</b>	<b>242,719</b>

# Board of Directors and Management Team

## Board of Directors

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**Pierre Boivin**

President  
President and Chief Executive Officer – Claridge

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**François Bertrand**

Chief Academic and Research Officer –  
Polytechnique Montréal

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**Frédéric Bouchard**

Dean, Faculty of Arts and Science Doyen –  
Université de Montréal

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**Benoit Boulet**

Associate Dean, Research & Innovation –  
McGill University

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**Eugénie Brouillet**

Vice Rector, Research, Creation and  
Innovation – Université Laval

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**Magaly Charbonneau**

Associate – Inovia Capital

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**Martha Crago**

Vice-Principal of Research and Innovation –  
McGill University

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**Marie-Josée Hébert**

Vice Rector, Research, Discovery, Creation  
and Innovation – Université de Montréal

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**Anne-Marie Hubert**

Quebec Managing Partner – Ernst & Young

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**Alexandre Le Bouthillier**

Co-Founder & Chief Corporate Officer –  
Imagia

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**Josée Morin**

Company Administrator

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**Thomas Birch**

Vice-President, Venture Capital and  
Technologies, Caisse de dépôt et placement  
du Québec

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**Mathieu Gervais**

Assistant Deputy Minister for Science and  
Innovation at the Ministère de l'Économie et  
de l'innovation

## Management team

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**Valérie Pisano**

President and CEO

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**Yoshua Bengio**

Scientific Director

---

**Danielle Langlois**

Vice-President, Finance

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**Stéphane Létourneau**

Vice-President, Partnerships and  
Corporate Affairs

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**Émélie Brunet**

Vice-President, Talent and Ecosystem

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**Joumana Ghosn**

Director, Applied Research Team

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**Frederic Osterrath**

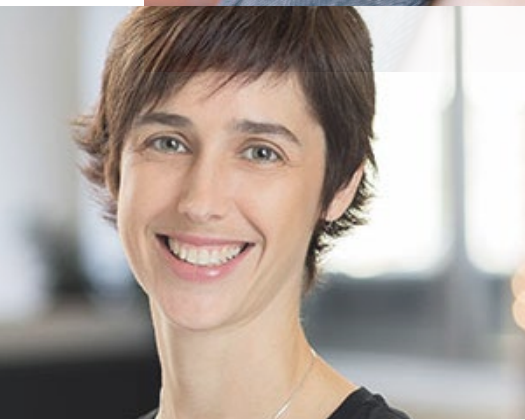
Director, Innovation, Development and  
Technologies

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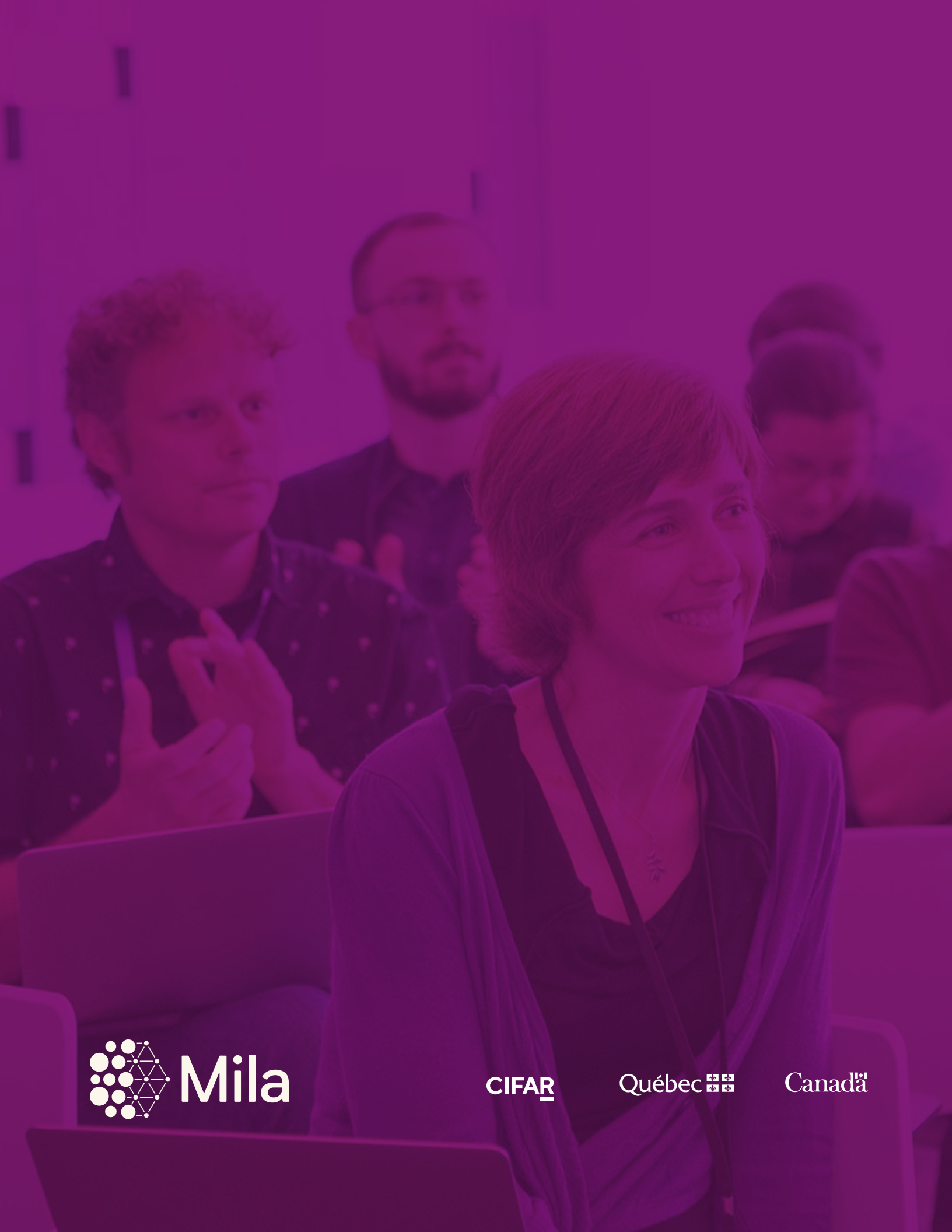
**Benjamin Prud'homme**

Director, AI for Humanity





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