AI Futures Policy Lab:
Vancouver

November 2018

brookfield institute
for innovation + entrepreneurship

CIFAR

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In January 2018, CIFAR and the Brookfield Institute for Innovation + Entrepreneurship (BII+E) formed a partnership to develop and host five AI Futures Policy Labs aimed at generating greater awareness of the long-term implications of AI. These workshops were also designed to build capacity among emerging policy leaders to produce agile AI policy in Canada. Between June and September 2018, CIFAR and BII+E hosted two labs in Toronto, Ontario and Edmonton, Alberta, engaging a total of 41 emerging policy leaders from the public, private, academic, and not-for-profit sectors.

On October 18, 2018, BII+E and CIFAR hosted the third AI Futures Policy Lab in Vancouver, British Columbia. This event brought together 22 emerging policy leaders from Vancouver and Victoria with the aim of:

+ Increasing the capacity of future public service leaders to understand the policy implications of AI;
+ Cutting through the myths and hype surrounding AI to provide policymakers with a direct line of sight into the AI sector, current capabilities, and potential applications;
+ Facilitating early thinking around appropriate government responses to emerging AI technologies.

The design of this lab was largely informed by participant feedback gathered at the Edmonton lab in September 2018. Alongside the AI 101 talk and guest speaker, an AI Policy 101 talk was incorporated into the morning's agenda. This provided participants with a better understanding of the current policies and initiatives in place to address AI's societal implications, both in Canada and abroad. In the afternoon, each group was provided with an example of a current AI application that would serve as the basis of their analysis and discussions. Potential future scenarios that had been used in the previous labs were discarded due to previous feedback from former participants, which indicated lack of flexibility in future-thinking discussions. This change was made to enable participants to imagine and discuss their own scenarios with greater latitude. During the final session of the day, participants were supplied with a template that prompted them to collectively produce policy recommendations related to the scenario they explored. The agenda developed for the day is provided in appendix A.

CASE STUDY POLICY DOMAINS

Prior to the lab, four profiles of current AI applications were developed, each associated with a specific domain. This included housing, legal, education, and health. Groups of 4-5 participants, led by a facilitator, were each assigned a different domain to focus on during the afternoon sessions. These are listed below.

HOUSING

AI is impacting the housing sector in multiple ways, from smart-home devices like Nest to intelligent tools that help to curb energy use, and services that even act as the middle-man between landlords and tenants. Advancements in this domain afford residents with potential benefits, but also create challenges regarding privacy and safety in a domestic environment. Within this domain, participants examined Naborly (appendix B), a tenant screening application that generates risk scores to help landlords make smarter letting decisions.

JUSTICE

The legal sector is being impacted by recent developments in AI and machine learning capabilities that have enabled applications to automate legal research, due diligence processes, contract review and management practices, and help to predict legal outcomes. Participants within this domain were given the chance to explore the policy impacts of ROSS intelligence (appendix C), an artificially intelligent legal research tool that applies natural language processing to increase lawyer's ability to identify relevant information.

EDUCATION

There is vast potential for AI to transform education in ways that make learning more accessible, provide personalized curriculum, and support educators in delivering content. Participants in this group analyzed Nestor (appendix D), an artificially intelligent class assistant that uses machine learning algorithms and advanced facial recognition to analyze the attention of students listening to online lectures.

HEALTH

Advancements in AI capabilities hold enormous opportunities for delivering more efficient health care services in areas such as diagnosis, health monitoring, and treatments. However, this also raises challenges related to patient privacy and discrimination. Participants within this group explored InnerEye (appendix E), a research initiative led by Microsoft that applies computer vision and machine learning algorithms to automatically analyze three-dimensional medical CT (computer tomography) and MR (magnetic resonance) images to identify tumours.

POLICY LAB ACTIVITIES

1. ACTIVITY: THE AI THING FROM THE FUTURE

The lab was kicked off with *The 'AI' Thing from the Future*[1], a game that requires participants to combine card prompts to imagine a future thing. Each group was led by a facilitator who presented four cards, each containing a specific prompt: *ARC*, to signify the time frame; *terrain*, to define the thematic context or location of the "thing"; *object*, specifying the type of artifact participants need to focus on; *and AI*, indicating the technological capability or application that needs to be integrated in your future "thing" (appendix F). This game was modified to exclude the "mood" card based on participant feedback that suggested a simpler approach to the activity using fewer card prompts.

Each participant was instructed to individually imagine a future object, or "thing" utilizing all card prompts, and record their ideas on a template provided (appendix G). This was followed by an opportunity to share these ideas with the rest of the group.

2. AI 101

Following this warm-up activity, Dr. Mark Schmidt, CIFAR Senior Fellow and Associate Professor in the Department of Computer Science at the University of British Columbia, provided an overview of terminology and history of the field, including the emergence of machine learning and deep learning. His presentation included an overview of current AI capabilities, such as speech recognition and motion detection, as well as applications like fraud detection and image annotation.

3. THE LEGAL IMPLICATIONS OF AI

With the foundational knowledge of AI capabilities and applications fresh in participants minds, a second speaker, Maya Medeiros, Partner at Norton Rose Fulbright LLP, provided insight into some of the legal implications associated with the rise of artificial intelligence. Her presentation stressed the legal considerations necessary for the ethical development and use of AI, specifically human rights, transparency, explainability, and accountability. Following the presentation, participants were given the opportunity to ask questions to further their understanding of these issues, including those related to data privacy, liability, intellectual property, and cybersecurity.

1 Adapted from Stuart Candy and Jeff Watson (Situation Lab).

4. AN OVERVIEW OF AI POLICY

For the final presentation, Brent Barron, Director of Public Policy at CIFAR, provided a brief overview of the current AI policy landscape. His presentation highlighted national initiatives in Canada, including the Pan-Canadian AI Strategy, the Treasury Board Directive on Automated Decision Making, the Standard Council of Canada's newly established Ethics and Data Privacy Committees, federal supercluster funding (e.g. SCALE.AI), and the Montreal Declaration. This presentation also touched upon international examples such as the General Data Protection Regulation (GDPR) in the European Union, the introduction of the AI in Government Act in the United States, and the British government's investment in skills and commitment to be a leader in ethical data use, among others.

5. ANALYZING CURRENT AI APPLICATIONS

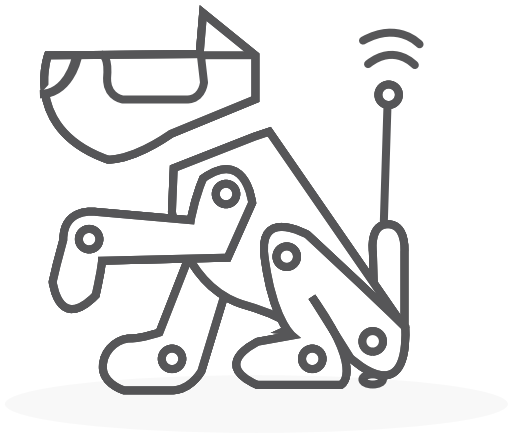
Following lunch, participants returned to their pre-assigned groups to examine a current AI application. Each group was led by a facilitator who presented one of the four case studies (Naborly, ROSS Intelligence, Nestor and InnerEye). Groups were each given a different case study. Participants had time to read through the case study and ask the facilitator any clarifying questions before turning to the first canvas (appendix H). Canvas 1 prompted participants to consider which individuals and/or groups are impacted within this case study, how they are being affected (positively and/or negatively), the impacts of this technology at the local, national, and global levels, as well as what existing policies and programs are affected by this case study. Facilitators encouraged participants to actively contribute by writing their ideas on sticky notes and placing them on the canvas, both individually and as a group.

6. IMAGINING AI IN 2028

This session took the form of a discussion where participants were asked to consider how the current AI application they were analyzing may look in 2028. Unlike previous labs, which provided participants with curated potential future scenarios, this discussion enabled participants the freedom to dream up the possibilities themselves. This included imagining how this technology may develop and impact individuals, communities, policies, as well as social, cultural, political, and economic processes in the future. This was a facilitated, open-ended discussion with the purpose of encouraging emerging policy leaders to apply their knowledge of current state of AI capabilities and applications on the long-term implications of a particular case study.

7. TAKING ACTION TODAY

In their respective groups, participants were presented with a second canvas (Appendix I), which prompted them to reflect on discussions from their two previous sessions. Participants were asked to identify which individuals and/or groups experience the most notable impacts (both positive and/or negative), as well as highlight the most significant positive and negative socio-political impacts pertaining to the current AI case study. Each group was provided with one template (Appendix J) requiring them to write a description of the case study they examined, the associated opportunities and challenges, and their top 3 policy recommendations to address them.



POLICY RECOMMENDATIONS[2]

DOMAIN: HOUSING

Participants within this domain pointed towards the potential for Naborly to mitigate existing systemic biases, increase diversity of renters (because the application removes the ability for landlords to discriminate on socio-economic or demographic grounds), record more data about the rental market, improve security for landlords, and incentivize smaller landlords to enter the market (due to the elimination of paperwork).

However, while Naborly may reduce existing systemic biases, participants noted that not all forms of discrimination will be mitigated. In fact, Naborly may introduce new types of bias through its scoring mechanism pertaining to digital literacy and rental history (those who do not have a paper trail will have a difficult time getting a low risk score). This may also increase the competition and reduce the availability of affordable housing. Additionally, there were concerns over the privacy and security of personal information that is uploaded to the application.

In light of these opportunities and challenges, participants provided the following recommendations:

+ Increase transparency about how risk scores are generated for prospective tenants.
+ Government should develop and implement an offsetting mechanism or redistribution scheme to ensure accessibility and social diversity within the rental market.
+ Government should strengthen privacy and discrimination laws to protect users of applications that require users to upload sensitive, personal information.

DOMAIN: EDUCATION

Participants within this group discussed the opportunities associated with an AI system that monitors student attention. Specifically, they pointed to the opportunity for personalized learning and teaching, as well as the ability to identify learning disabilities or exceptional students. They also spoke about the potential for the data collected on student attention and learning outcomes to inform the design of government educational strategies.

However, participants were concerned about student privacy, particularly in terms of video footage and academic results being used to identify students.[3] Participants were also concerned about the potential misuse of data, specifically, if it were to eventually be passed on to third parties.[4] Finally, participants pointed to the possibility for educational institutions to over-rely on data generated by these types of systems, and disregard other means of evaluating student capabilities and aptitudes.

With these benefits and risks in mind, participants presented the following recommendations:

+ Promote awareness of data protection regulations and rights with general public.
+ Ensure data is anonymized when shared publicly.
+ Provide parents the right to view their child's data.

DOMAIN: JUSTICE

Participants within this group recognized the range of benefits associated with AI-driven legal applications. These include the ability to improve the efficiency of legal processes by increasing access to information, and the speed at which information can be summarized. Along with having more accurate and relevant information, participants saw the use of these systems as having the potential to decrease appeals in court.

Alongside these benefits, participants acknowledged the potential for AI-driven tools to increase inequality within the legal sector, specifically if these tools are only accessible to some lawyers, and not others. Participants also recognized that the use of this technology requires a certain level of trust in the system to provide accurate information. Finally, participants were concerned with

2 *Disclaimer: The following policy recommendations were developed by participants through an exercise designed to help emerging policy makers explore existing policy levers in relation to specific case studies. These do not represent the views of CIFAR and BII+E.*

3 Note that Nestor does not currently store video footage. This concern only came about by discussing potential future scenarios of educational AI-driven applications.

4 Note that Nestor does not currently sell/trade data to third parties. This concern only came about by discussing potential future scenarios of educational AI-driven applications.

the potential for these kinds of applications to reinforce the status quo, preventing the development of new norms or outcomes that might otherwise arise and influence the system.

To mitigate the potential harms and maximize the opportunities of this kind of application, participants recommended:

+ Lawyers should be required to disclose their use of these tools.
+ Government should provide public access to these kinds of AI-driven applications in order to ensure equality within the legal system.
+ Encourage the development of AI-driven applications to supervise parolees, with a particular emphasis on mental health to promote rehabilitation.

DOMAIN: HEALTH

Participants within this group recognized the advantages InnerEye offered to the health sector in the form of democratizing access to care, increasing efficiency within the health care system, and improving patient outcomes.

However, while participants noted the democratizing potential for AI-driven health applications, they also realized the possibility for this technology to create asymmetrical access to care between urban and rural communities. Additionally, participants were concerned with the potential for data misuse. They also cited regulatory uncertainty as a barrier to managing these types of applications within the health care sector.

Upon careful consideration, participants proposed the following recommendations:

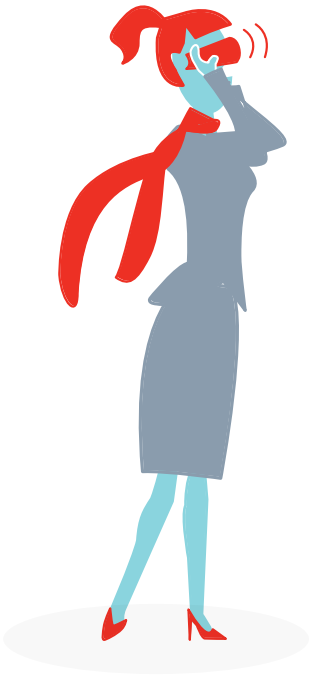
+ Government should modernize the privacy legislation surrounding health information to address uncertainties around the collection and use of personal health data.
+ Develop AI principles to guide thoughtful implementation within the healthcare sector, which encourage open source algorithms to mitigate unequal access to service.
+ Increase engagement with stakeholders, such as health practitioners and patients, when developing policy frameworks.

GENERAL REMARKS

Vancouver participants expressed that the event provided the opportunity to network with colleagues and contacts in their field of work and related areas. This has become a large trend in participant feedback from these engagements, indicating both the appetite and value of engagements that bring together individuals from different sectors and industries. In fact, attendees stressed the need for more conversations that connect policymakers with industry, academia and civil society to formulate strategies for effectively addressing these issues. Participants also indicated that the event increased their awareness of current AI capabilities and the pervasiveness of these technologies within our everyday lives.

NEXT STEPS

BII+E and CIFAR will be hosting the next AI Futures Policy Labs in Ottawa on November 22, 2018 and Montreal in January 2019. If you are interested in attending one of these labs, please contact Gaga Boskovic. A final report describing all insights generated throughout the series will be published in early 2019.



APPENDICES

APPENDIX A: AGENDA

Time	Activity
9:00am	**Light Breakfast + Networking**
9:30am	**Opening Remarks** + Brent Barron, Director of Public Policy, CIFAR + Heather Russek, Director, Policy Innovation Platform, The Brookfield Institute for Innovation + Entrepreneurship
9:40am	**Activity: AI Thing From the Future**
10:00am	**AI 101**: Mark Schmidt, CIFAR Senior Fellow, University of British Columbia
10:45am	**Break**
11:00am	**AI and the Law:** Maya Medeiros, Partner, Norton Rose Fulbright LLP
11:30am	**AI Policy:** Brent Barron, Director of Public Policy, CIFAR
12:00pm	**Lunch**
1:00pm	**Activity: Analyzing Current AI Applications** In small groups, participants will dive deeper into a current application of AI, analyzing its social, economic, and political impacts. Groups will also be asked to forecast what this technology might look like in a year, and what new implications this may have.
2:00pm	**Discussion: Examining AI in 2028** Reflecting on the previous sessions, participants will brainstorm relevant forms of government interventions that can be used to support the ethical development and beneficial use of AI. In small groups, attendees will collaboratively draft a short policy recommendation based on the case studies that have examined throughout the day.
2:30pm	**Break**
2:45pm	**Activity: Taking Action Today** Reflecting on the previous sessions, participants will brainstorm relevant forms of government interventions that can be used to support the ethical development and beneficial use of AI. In small groups, attendees will collaboratively draft a short policy recommendation based on the case studies that have examined throughout the day.
3:45pm	**Activity: Presentations & Closing** Each group will have the opportunity to present their policy recommendation to the larger room and reflect on the day.case studies that have examined throughout the day.
4:30pm	**Social & Networking (Off-Site)**

APPENDIX B: *NABORLY*

Founded in 2015, Naborly is a tenant screening application that generates risk scores, enabling landlords to make smarter letting decisions.

Naborly serves as a free online application for property rentals. Landlords send prospective tenants a link to the online application to fill in their rental history, employment, and financial information. Naborly then analyzes and produces an applicant risk score based on the applicant's income, identity and employment, credit ratings, criminal records, and rental history. Naborly's Applied Artificial Intelligence system, SHERLY, an inductive, deductive, and reductive reasoning system, continuously learns from thousands of rental applicants and their tenancy outcomes, allowing it to better identify patterns of risk.

Through this process, Naborly removes traditional factors of discrimination stemming from landlord biases relating to tenant finance, social class, or race. Additionally, Naborly adjusts its scoring for each unique applicant, taking current rental property characteristics and the market prices into consideration. Results are delivered to the landlord within minutes of the application being submitted.

After an application is submitted, Naborly automatically creates a personal private profile, which stores information for future applications. This helps tenants build a verified rental history without the need for printing, scanning, and faxing documents. All information collected by Naborly on prospective and current tenants, landlords, as well as API Partners is protected by a state-of-the-art data security infrastructure. This ensures that the data held by Naborly remains accessible only to authenticated users and recipients with expressed permission from the user. Tenants can then use Naborly to apply to landlords that do not yet use the system.

Naborly democratizes rental record keeping though the use of its global open_DOOR database system, which allows tenants, landlords and property managers to share feedback, evictions, judgements, and verified disputes. This provides both prospective applicants and tenants with an added layer of transparency before entering into a rental contract. While Naborly is fully compliant with Privacy and Fair Housing laws across the US and Canada, and its algorithms are regularly audited to ensure it continues to meet the requirements for compliance, this does not mean its system is verified beyond its compliance to these laws.

APPENDIX C: *ROSS INTELLIGENCE*

ROSS is an artificially intelligent legal research tool that applies cutting-edge natural language processing (NLP) to increase lawyer's ability to sort through and find information relevant to their cases. Lawyers need to do substantial legal research to prepare for a case, normally taking days, weeks, or even months to source out information - but ROSS can now automate this process. Using a combination of advanced keyword search and machine learning, ROSS enables lawyers to identify relevant information faster and more efficiently, and even uncover information that could have been missed by sifting through over a billion text documents per second.

ROSS's advanced NLP technology has been trained to understand legal jargon and encompasses all American case law. Lawyers can enter queries such as, "When is secondary liability with respect to copyright infringement established?" and receive an overview of relevant key points drawn from a database of published and unpublished case law, substantive law, procedural law, and legal analysis.

ROSS is also able to track relevant developments in the law related to a specific legal issue and notify lawyers of relevant legal updates. Additionally, lawyers are able to upload a range of legal documents, such as memos, motions, or briefs, for ROSS to analyze and flag cases cited in the document that have received negative treatments in court.

Built on IBM Watson's cognitive computing platform, ROSS learns from past interactions and improves its accuracy the more its system is used. ROSS is currently used by law firms such as Baker Hostetler and Latham & Watkins LLP.

APPENDIX D: *NESTOR*

Nestor, developed by LCA Learning, is an artificial intelligence class assistant that uses machine learning algorithms and advanced facial recognition to analyze student attention while listening to online lectures. The software is currently being used for two online courses offered through the ESG business school in Paris, France.

Nestor aims to enhance the performance of both the student and the teacher. Using students' webcams, Nestor's facial recognition software tracks 20 key landmarks on the students face - including the eyes, brows, mouth, and jaw - and can even detect when a student has pulled out their phone. Facial expressions are measured using three variables. The first is engagement, which measures facial muscle activation that detects expressiveness and responsiveness. The second is valence, which measures the positive and negative facial expressions. The third is attention, which measures focus according to head orientation.

Once the system detects the student has lost focus, it can send a message alerting them to pay attention. Nestor can also predict when a student may start to drive away again, sending them a signal to stay focused before attention is lost. Nestor also quizzes students on content that was covered while they appeared to be distracted. Student performance and attention analysis, particularly when focus decreases, is then relayed to the teacher who can adjust future lessons appropriately.

Nestor's software can also integrate with students' social network profiles and calendars to suggest study times and foster more effective study habits. For example, if a student has a tendency to watch YouTube videos at 11:00am on Sundays, Nestor can suggest that as a time for a study session instead.

Nestor encrypts, anonymizes and stores analysis data, but does not currently keep video footage or sell it to advertisers.

APPENDIX E: *INNEREYE*

Project InnerEye, a research initiative led by Microsoft, applies state-of-the-art computer vision and machine learning algorithms to automatically analyze three-dimensional medical CT (Computer Tomography) and MR (Magnetic Resonance) images to identify tumours and organs at risk.

The current processes of marking up radiology images is time consuming and expensive, with images often only marked up once before radiotherapy begins, and once again at the end of the treatment cycle. InnerEye serves to enhance the workflow of healthcare professionals, such as radiologists, surgeons, and medical physicists by analyzing images pixel-by-pixel to identify the exact position and size of the tumour, as well as the healthy organs that surround it. This enables healthcare professionals to more effectively plan a patient's radiotherapy strategy or surgery navigation.

By making this process more effective and cost efficient, InnerEye patients can potentially receive "adaptive radiotherapy", with scanning, image markup, and therapy planning being done after every treatment session. In doing so, InnerEye can help identify which type of treatment works best by monitoring changes in tumour size.

InnerEye has been trained on scores of images from past patients that have been marked up by experienced health professionals, meaning its system should perform as well as a leading expert every time. Nevertheless, doctors retain full control of InnerEye's system, and can make adjustments to the software at any time until they are completely satisfied with the results they receive.

InnerEye is currently being used by the UK's National Health Service for prostate cancer diagnosis and treatment, but could potentially benefit any health processes that use 3D imaging.

APPENDIX F: *THE AI THING FROM THE FUTURE KEY*

ARC outlines the type of future that the "thing" comes from, and how far away it is from today. There are four types of Arc cards, each an umbrella for countless possible scenarios:

1. *Growth:* a future in which "progress" has continued
2. *Collapse:* a future in which society as we know it has come apart
3. *Discipline:* a future in which order is deliberately coordinated or imposed
4. *Transformation:* a future in which a profound historical evolution has occurred

TERRAIN is the thematic context or location where this object could be found in that future. *OBJECT* is the focus of your imagination - a specific cultural artifact that reveals something about how this future is different from today. *AI* indicates the technological capability or application that needs to be integrated in the artifact you create.

As an example, imagine you are presented with the five cards below:

These cards point towards a future in which progress has continued, in the domain of shopping, with the focus being a song, accompanied by a feeling of amusement, and the use of predictive analytics. In imagining a thing associated with the prompts on these cards, you may think that a century from now, there will be fitting rooms that predict which songs you like to hear while you are shopping.

THE AI THING FROM THE FUTURE

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1) YOUR CARDS

ARC	TERRAIN	OBJECT	AI
_____			
_____			

2) DESCRIPTION

_____

_____

_____

_____

_____

_____

_____

_____

_____

3) SKETCH

Adapted from Situation Lab (Stuart Candy and Jeff Watson)

APPENDIX H: *CANVAS 1*

Case Study.

Canvas #1: 2018

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Step 1 How are different groups experiencing both positive and negative effects?

? Stakeholders	+ Positive	- Negative

Step 2 What are the potential impacts of this technology?

	Local	*National*	*Global*
Social			
Technological			
Environmental			
Economic			
Political			
Values			

Step 3 What existing policies and programs are affected?

APPENDIX I: *CANVAS 2*

Case Study.

Canvas #2: Responding Today

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Step 1	Step 2	Step 3
What are the most important positive and negative implications of this technology today?	What are the most important and negative implications of the scenario in 2028?	What stakeholder groups experience the strongest gains and the most significant losses.
+	+	+
-	-	-

Step 4 What policy responses today could help to improve outcomes today and prepare for potential futures?

Option

Benefits

Concerns

Step 5 What are your final policy recommendations?

1 2 3

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1. Describe the case study/context in ~3 sentences:

2. What are the main opportunities and challenges?

3. What are your top 3 policy recommendations to address these opportunities and/or challenges?