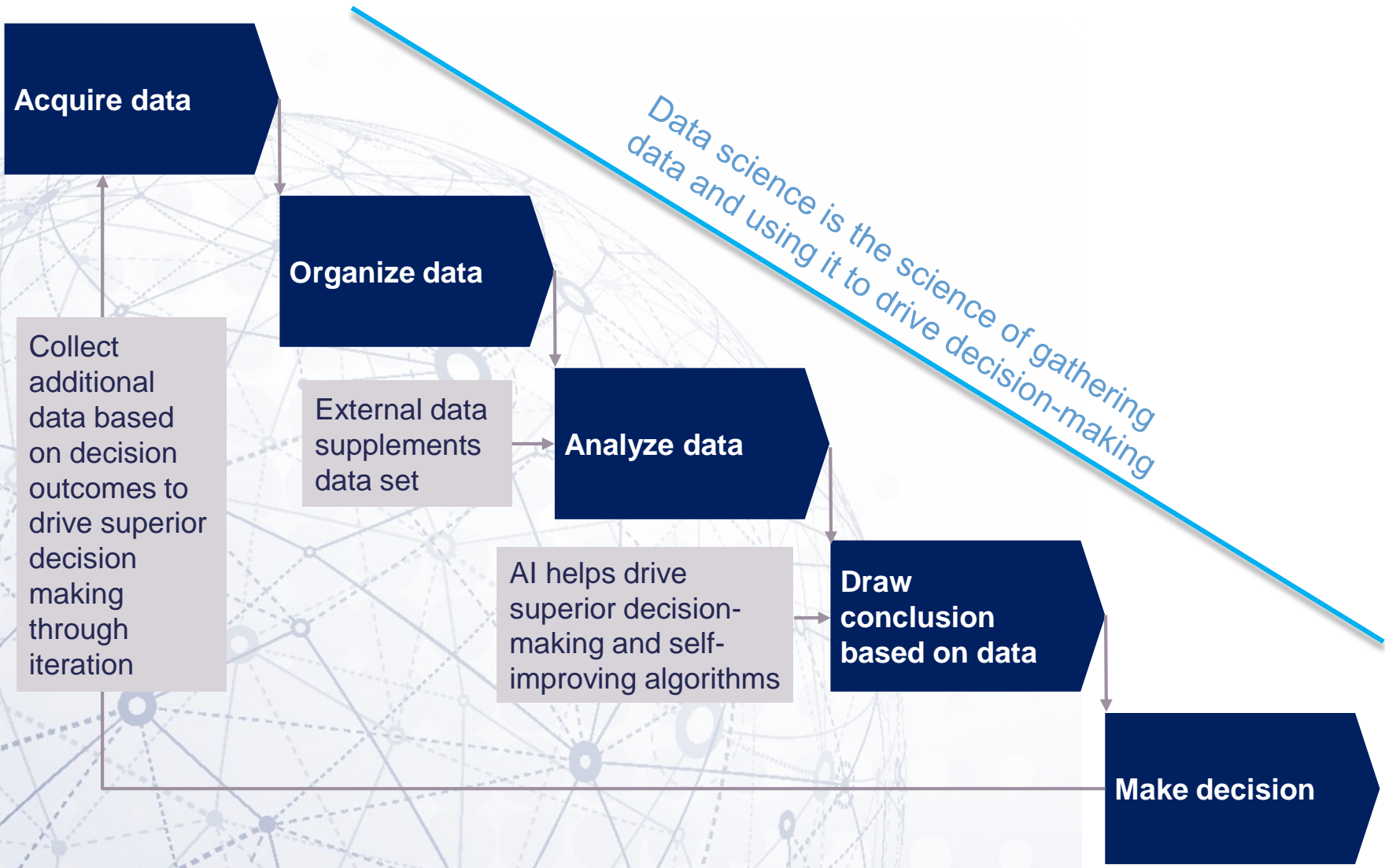




Canada's impending AI revolution and the opportunity for Canadian business

February 2017

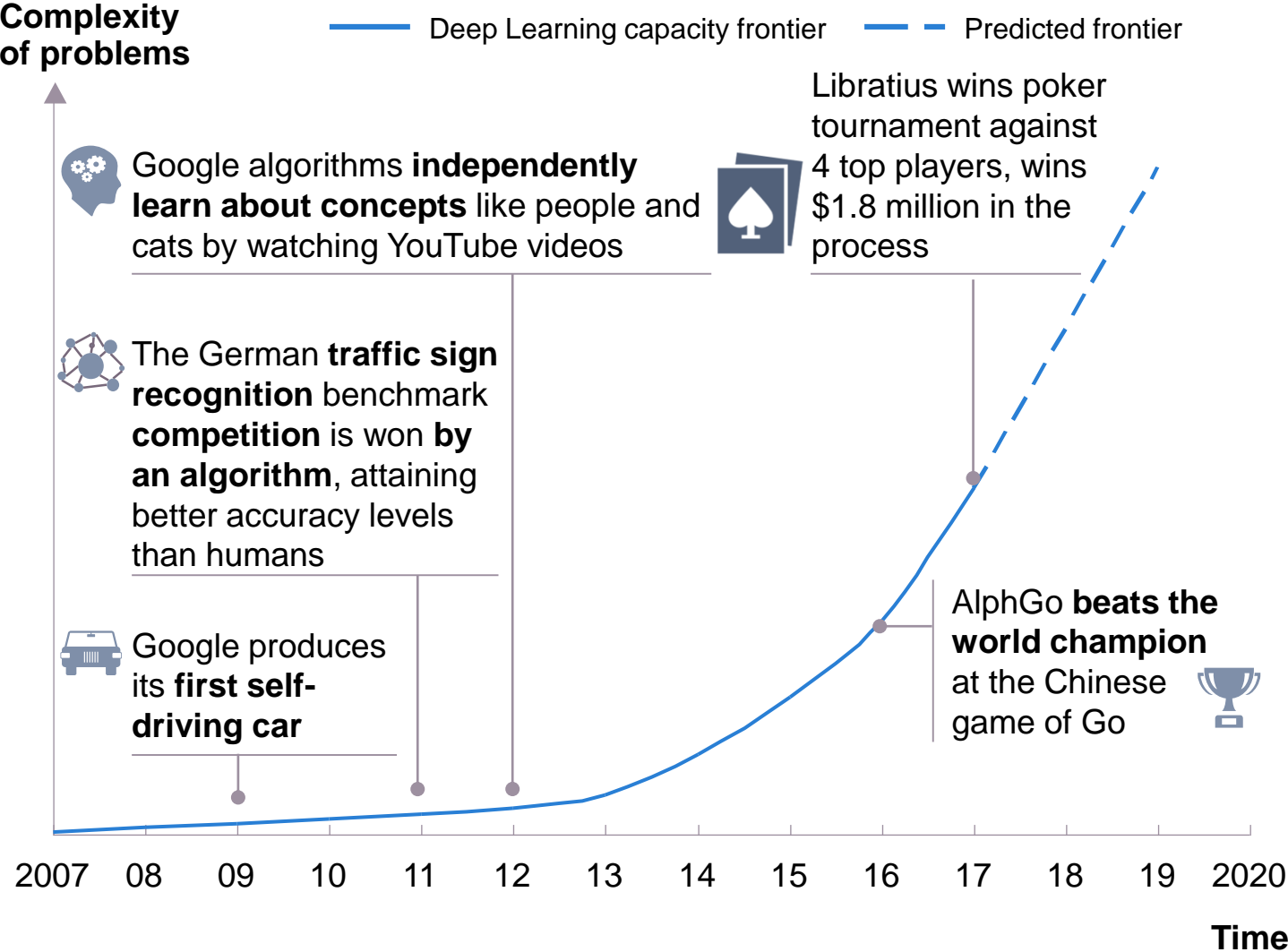
The ability to acquire, organize, and draw conclusions from data with the help of Artificial intelligence will play a transformational role in business



SOURCE: Team analysis; Taylor B. et. al. (2007). The War Against Spam:A report from the front line, Neural Information Processing Systems; Somanchi, S. H. (2015). "The mail you want, not the spam you don't"

Recent advances in deep learning, a subset of AI, have led to an exponential increase in its ability to predict outcomes and make decisions

Deep Learning's ability to tackle problems over time Drivers



Better hardware 

More data 

Better algorithms and training methods 

SOURCE: Press Search

Many technologies are developing and commercializing simultaneously giving rise to significant disruptive forces and a generation of new companies



Mobile Internet



Next-generation genomics



Automation of knowledge work



Energy storage



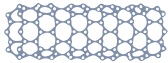
The Internet of Things



3D printing



Cloud technology



Advanced materials



Advanced robotics



Advanced oil and gas exploration and recovery








Autonomous and near-autonomous vehicles



Renewable energy

Artificial intelligence will underpin the next industrial revolution


Artificial intelligence will create new markets and opportunities in industries ranging from healthcare to financial services

Industries	Example of opportunities
<p>Automotive & Transport</p> 	<ul style="list-style-type: none"> Autonomous vehicles to create a \$87bn solutions market
<p>Aerospace & Defense</p> 	<ul style="list-style-type: none"> Drone systems integration to create \$82bn in positive economic impact and generate more than 100,000 jobs
<p>Financial Services</p> 	<ul style="list-style-type: none"> Robo-advisors expected to have ~\$2.2tn in AUM by 2025 Personalized / dynamic financial advice and planning
<p>Healthcare</p> 	<ul style="list-style-type: none"> Global market for telehealth to reach \$34bn Global market for medical robotics to reach \$18bn Possibility of better diagnostics personalized medicine
<p>Agriculture</p> 	<ul style="list-style-type: none"> Global agribot market to reach \$16.3bn Significant improvements in yield management and better environmental management


Artificial intelligence will deliver most of its economic value by **eliminating waste** (e.g. asset underutilization) and **creating surplus opportunities** (e.g. accident avoidance, improved medical outcomes)

To capture this opportunity, nations and corporations have already begun massively investing to build their own capabilities

Nations

 **\$2.3bn** by 2016 in unclassified AI-related R&D


 **\$1.2bn** for the development of AI in the next 5 years

 Made AI development a “national strategy” level priority (investment numbers not public)

Corporations

 Purchased DeepMind, a 75-employee company, for **\$500mn**

 **\$1bn** in “Cognitive Technologies”, which includes Deep Learning as its core technology

 Deep Learning has become the central technology behind a large part of the service-offer of tech giants such as Google, Facebook, Samsung, IBM, and Panasonic

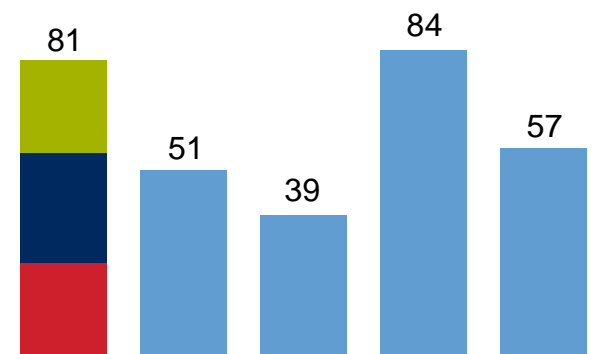
- Talent is a global market being exclusively tapped by a few early leaders;
- The price tag has gotten so high many organizations are essentially shut out from building capabilities from scratch

By working together, Canada has the scale and expertise to win against leading global locations, but no single city is large enough on its own

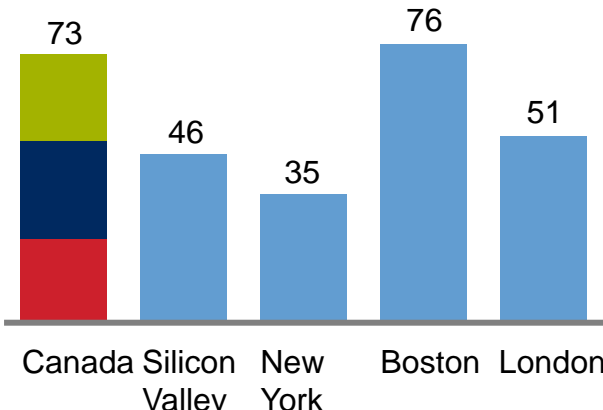
■ Edmonton ■ Toronto ■ Montreal

★ World-class capabilities Ⓞ Strong capabilities Ⓞ Non-distinctive capabilities

PhD students graduating in AI per year
Estimation of yearly graduating AI PhDs



Total AI faculty
of faculty researching AI



AI expertise	Montreal	Toronto	Edmonton	Canada
Deep Learning	★	★	Ⓞ	★
Reinforcement Learning	Ⓞ	Ⓞ	★	★
Natural Language Processing	★	Ⓞ	Ⓞ	★
Automatic Speech Recognition	★	Ⓞ	Ⓞ	★
Computer Vision	Ⓞ	★	Ⓞ	★
Deep commercialization ecosystem	Ⓞ	★	Ⓞ	★

Montreal has been a data science pioneer for the past 40 years

A base of leading research institutes in data science



- Founded in 1993, 9 faculty professors, 40 students, 5 post-docs and 5 researchers conducting cutting-edge research on artificial intelligence



- The Chair's mission is to combine knowledge acquisition through Machine Learning with decision making through Mathematical Optimization in a unified approach.



- Founded in 1971, brings together researchers working in managing logistics, supply chain and transportation networks



- Founded in 1979, brings together 70 experts on quantitative management, operational researchers, theoretical computer scientists, mathematicians and engineers



- Founded in 1968, brings together 1,500 visiting professors every year to work in its thirteen laboratories

Polytechnique – Département de mathématiques et de génie industriel

- A team of 57 researchers working on innovation, operation research, AI, applied mathematics and engineering.

HEC - Département de sciences de la décision

- 32 professors involved in mathematics for management (statistics, operation research, decision analysis, probabilities and financial mathematics).

UdeM – Département de l'information et de recherche opérationnelle

- Created in 1966 following the founding on the Université de Montréal's first computer laboratory.
- Now brings together 40 researchers and 3 Canada Research Chairs.



This culminated in 2016 when UdeM/HEC/Poly were awarded the Canada First Research Excellence grant in data science



Context



Why this matters

Awards

- In September 2016, IVADO received a **\$93.5 million grant** from the Federal Government for deep learning research
- The award is the **largest in the universities' history**
- Andrea Lodi received the **Canada Excellence Research Chair** in “Data Science for Real-Time Decision Making”

Commitment

- Develop fundamental research using **massive data sets** from which to draw **useful information and develop actionable decisions**
- Prioritize **marketplace applications, industry partnerships and spin-offs** in health, transportation, ICT, and energy networks

- UdeM, HEC, and Polytechnique worked together to secure Montreal's leadership position in data science research
- A jury of academic peers selected Montreal, cementing Montreal's global academic reputation
- Montreal has the funding to develop world-leading fundamental research in data science and artificial intelligence
- IVADO reached out to University of Alberta and McGill to collaborate

The CFREF grant consecrated the Montreal ecosystem as a leading hub in data science and artificial intelligence

#1 university hub in Canada



- At 900 researchers and doctoral students, Montreal has the **biggest and most prestigious group of data sciences researchers** in the world
- World-renowned academics, including Yoshua Bengio, one of the **founding fathers of the deep learning** movement
- The Institute for **Data Valorisation (IVADO)** was **created** to make Montréal a leader in data science and AI&OR
- Montreal got **\$93.5 million funding for AI&OR research** funding through IVADO in 2016, on top of **\$140 million from partners**

Leading start-ups & scale-ups



- Presence of **Element AI, a world leading applied AI research company** that launches AI-first solutions in partnership with large corporations
- Up to **2,600 startups** with a pool of skilled talent of approximately 8,000 employees
- **125 technology-focused meet-up groups** connected to startups and 45,000 members
- **Large ecosystem of VC funds** focused on pre-seed to growth equity
- **Grassroots organizations** such as MTL Data, Data Driven MTL, MTL Machine Learning

Strong corporate network



- Significant **investments from Google, Amazon and Microsoft** in the past year with a desire to make Montreal a central talent hub
- A robust data infrastructure system with at least **2,100 data specialists**
- 91,000 ICT professionals and ranked **1st for lowest ICT business operating cost in software development**
- **Leading cloud / datacenter market in Canada**; Amazon recently announced data center investment
- Headquarters to a number of large corporates looking to **invest in data science and integrate it in their business models**

To reach its full potential, the Montreal ecosystem must create opportunities to increase collaboration and promote commercialization

Levers to reach full potential

