DEVELOPMENTS IN AGRI-FOOD: What's so 'smart' about artificial intelligence?

Agri-food Innovation Council

Dawn Trautman

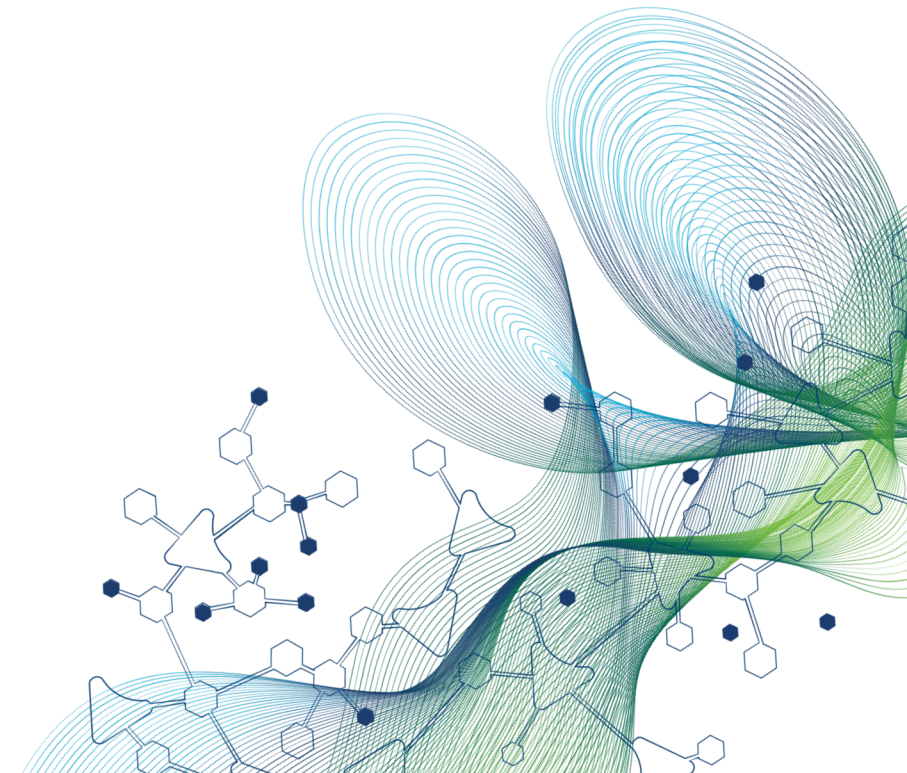**November 5, 2019**

ALBERTA **INNOVATES**

TABLE OF CONTENTS

ALBERTA INNOVATES

Alberta Innovates Priorities

- Embrace the digital future

- Enhance Alberta's knowledge workforce

- Growth and Development of four core emerging technologies:

1 **Data-Enabled Innovation**

Transforming data into actionable information enables digital transformation.

2 **Digital Technology for Business Transformation**

How we leverage technology to sense and measure information across enterprise is changing the way we live and conduct business.

3 **Clean Technology**

The sustainability of our planet necessitates innovation for a low carbon future.

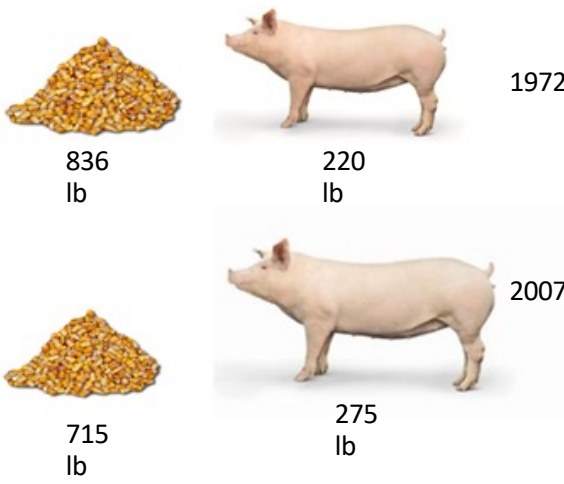4 **Innovative Production and Distribution**

In a globalized economy, product innovation and access to market is critical to competitiveness and continued prosperity.

Bio Sector Priorities

- **(climate) Smart agriculture knowledge and technologies**
- Addition of value to agriculture and forestry commodities
- Connections between food, health, & the environment
- Sustainable land and water management systems and resilience to climate change

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Smart Agriculture and Food Innovation

836 lb

220 lb

1972

715 lb

275 lb

2007

Why AI?

Technological forces that brought AI to life

1. Computing power
2. Digital data boom
3. Better algorithms

We are here
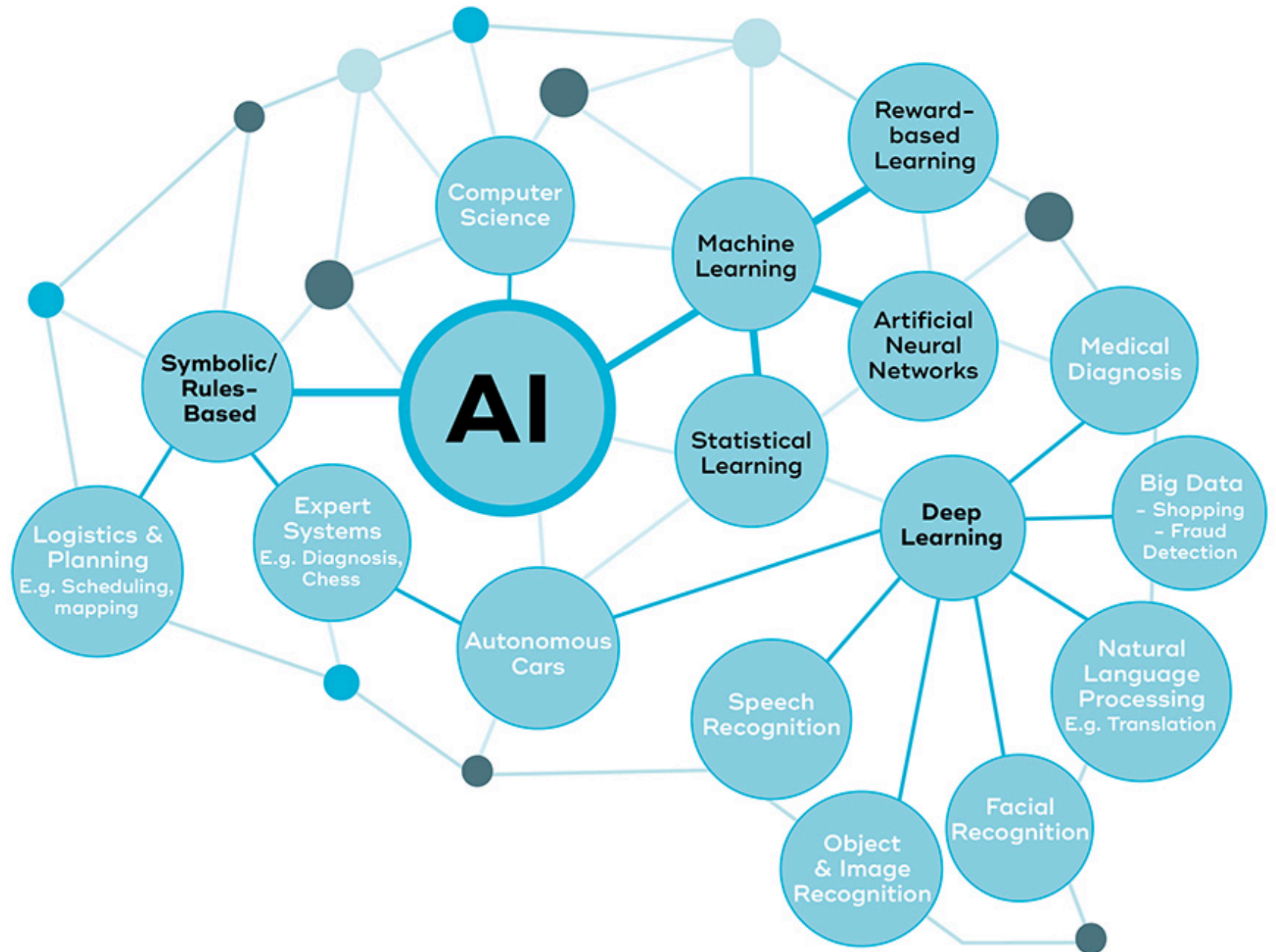
COMPUTING POWER

1900   2000

nature

Article | Published: 23 October 2019

Quantum supremacy using a programmable superconducting processor

Frank Arute, Kunal Arya, [...] John M. Martinis ✉

Nature **574**, 505–510(2019) | Cite this article

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AI

Computer Science

Symbolic/Rules-Based

Machine Learning

Reward-based Learning

Artificial Neural Networks

Medical Diagnosis

Statistical Learning

Deep Learning

Big Data
- Shopping
- Fraud Detection

Logistics & Planning
E.g. Scheduling, mapping

Expert Systems
E.g. Diagnosis, Chess

Autonomous Cars

Speech Recognition

Natural Language Processing
E.g. Translation

Object & Image Recognition

Facial Recognition

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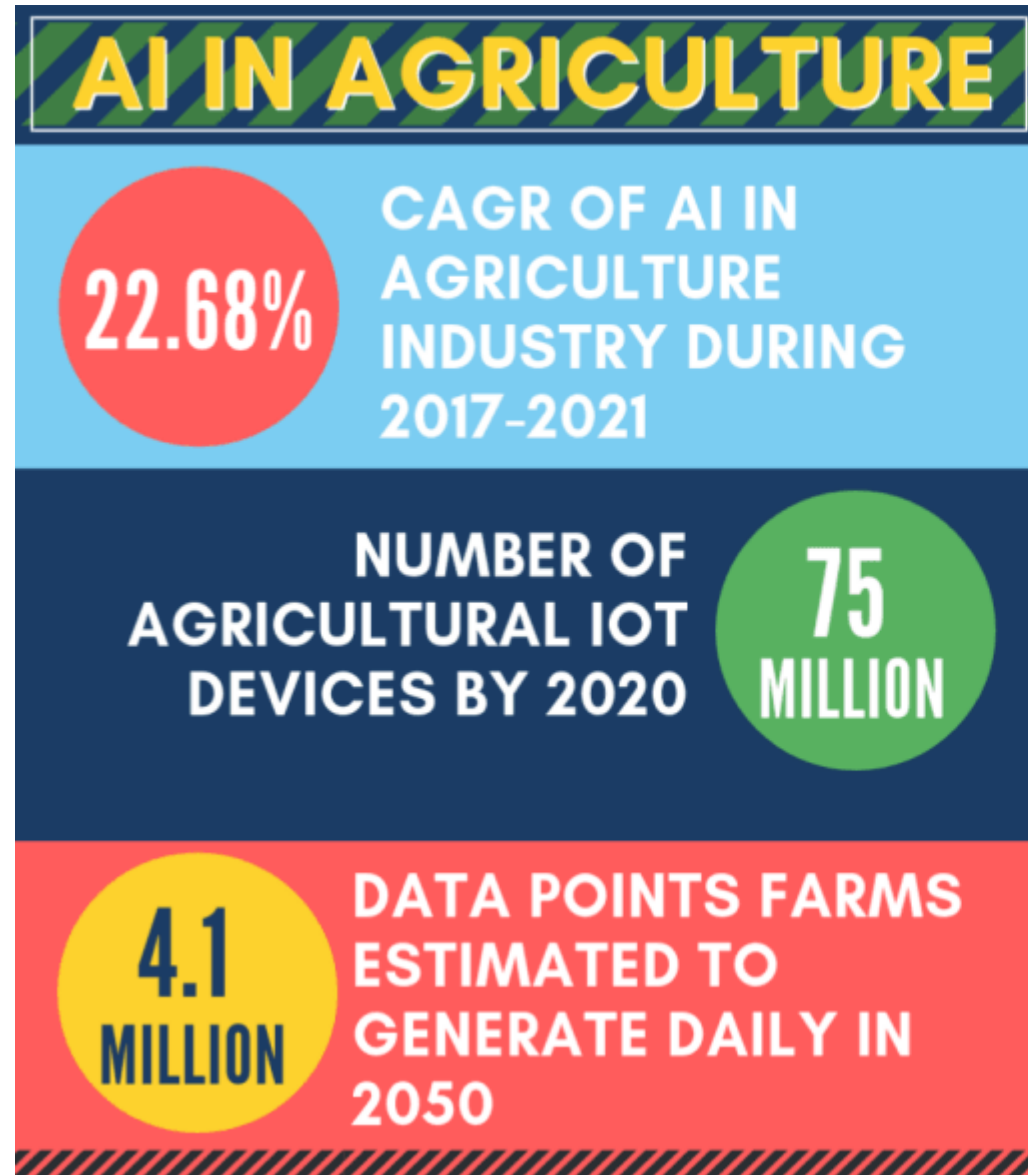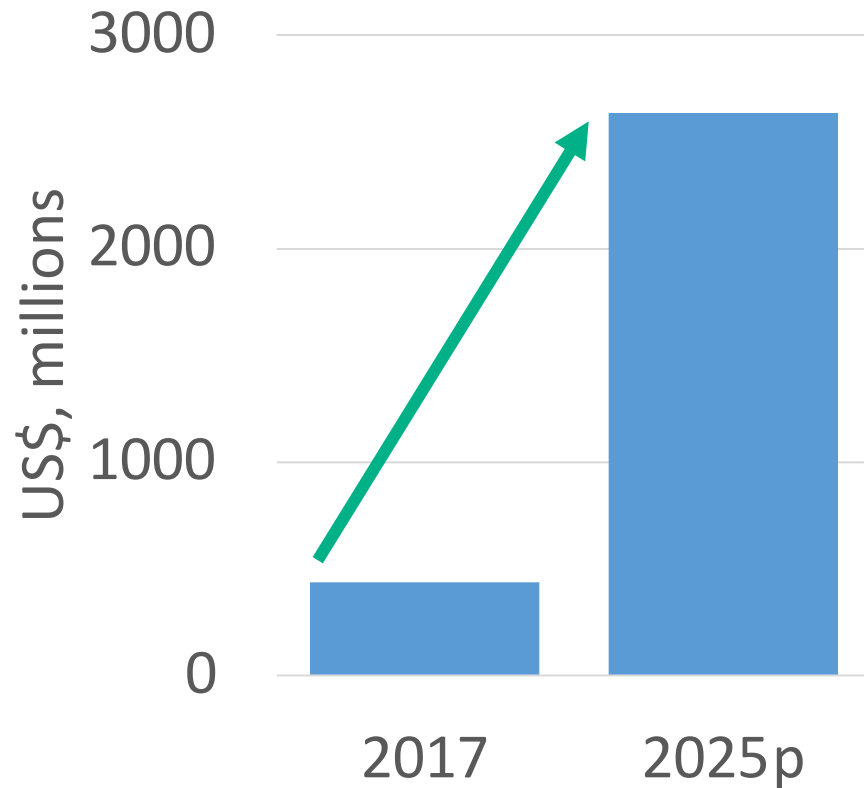
Why AI in Agri-Food?

Projected food demand vs. supply

- Population growth
- Fewer resources
- Climate change
- Globalization & trade
- Consumer preferences
- Sustainability

How do we feed 10 billion people...

WE WILL NEED 56% more food

2010 2050

TO FEED NEARLY

2050
2010

10B people in 2050

...without using more land...

WE NEED TO PREVENT AGRICULTURE FROM EXPANDING

we currently use ~50% of the world's vegetated land for agriculture

TO SAVE AN AREA OF FORESTS NEARLY 2X the size of India

...while lowering emissions?

WE CAN LOWER EMISSIONS

12 Gt CO₂e -67%

4 Gt CO₂e

2010 2050

WITH INNOVATIVE TECHNOLOGY LIKE

burp Improved feeds

Plant-based burgers

Resilient crop breeds

Source: wri.org/sustfoodfuture

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WORLD RESOURCES INSTITUTE

Value of AI in the Global Agriculture Industry

US$, millions

3000
2000
1000
0

2017   2025p

AI IN AGRICULTURE

22.68% CAGR OF AI IN AGRICULTURE INDUSTRY DURING 2017-2021

NUMBER OF AGRICULTURAL IOT DEVICES BY 2020 **75 MILLION**

4.1 MILLION DATA POINTS FARMS ESTIMATED TO GENERATE DAILY IN 2050

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What about AI in Agri-Food?

AI provides benefit in 'digital thinking'

- Data in action

- Data have been gathered and processed (AI)

  - 'sense' data + analyze data & optimize + implementation

There is a gap in agricultural potential and reality

- What are the real needs of crops and livestock?

- Identify and act accordingly

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What of AI in Agri-Food?

Process	What - examples	AI enabling:
Selection	e.g., breeding, genetic selection	Identification of traits; analysis of millions of genes
Assessment	e.g., soil nutrients, fertility assessment, SaaS	Decision support
Inputs	e.g., disease prediction, precision inputs and application time	Image recognition
Outputs (i.e., harvest)	e.g., optimize harvest with robotics	Autonomous machinery

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How is AI in Agri-food happening?

Past setbacks and future potential roadblocks

Data availability

Too much (sensors, images, etc.)! → need AI & compatible format

Data quality

Junk in = junk out

Validated algorithms in converting images to data

ROI

Motivation for adoption

Benefits > Costs

Regulatory & Policy

UAVs & other autonomous vehicles

Data ownership & privacy

Social Acceptance

Role of agronomists

Role of workers

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Applications of AI in Agri-Food

Breeding (e.g., linking omics to desired traits, etc.)

Producer (e.g., sensors, SaaS, AV, PA, financials, etc.)

Value-add (e.g., robotics, safety compliance, etc.)

Retail (e.g., demand forecasting, reduce waste, etc.)

Consumer (e.g., apps, chatbots, assurance)

SCM (blockchain enabled AI for traceability)

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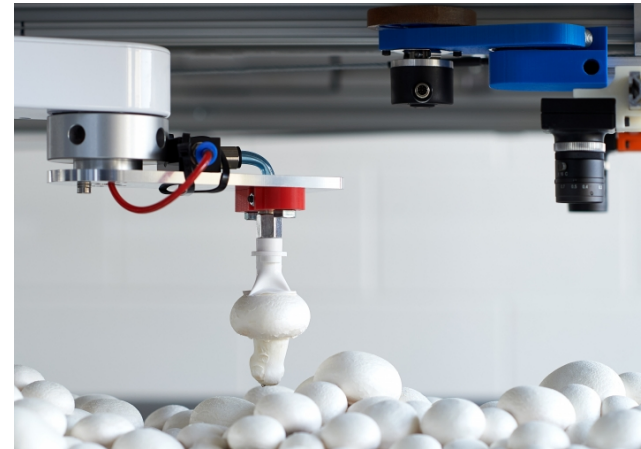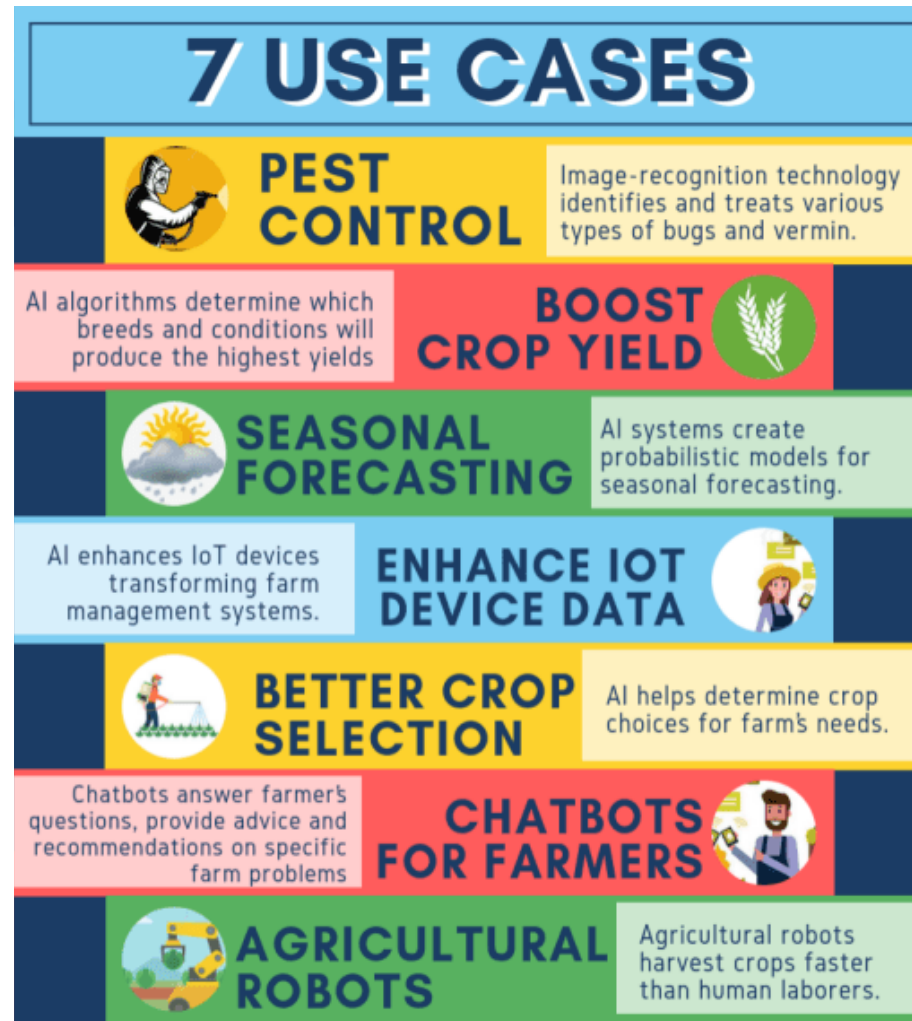# Applications of AI in Agri-Food

STRATEGIC INNOVATION FUND

"… Canada is a top destination for *businesses to invest, grow and create jobs and prosperity for Canadians* …. The Strategic Innovation Fund's (SIF) objective is to spur innovation for a better Canada …"

Stream 4 : Automation & Digital Technologies in the Agri-food Sector
- Canadian Food Innovators (CFI) – Canadian Food Innovators Network (CFIN)
- Canadian Agri-Food Automation and Intelligence Network (CAAIN)

CAAIN
Canadian Agri-Food Automation and Intelligence Network

connect. create. cultivate.

CAAIN Overview

WHO?

- 8 core partners, 61 companies

WHAT? BUILDING A NETWORK

- Automated Technologies Ecosystem
- Data driven Decision Frameworks
- Smart Farm Platform

WHY? ADVANCING THE AGRI-FOOD AND TECHNOLOGY SECTORS

- Productivity and Cost Efficiency
- Premiums and Value addition

CAAIN
Canadian Agri-Food Automation
and Intelligence Network

connect. create. cultivate.

Total value of CAAIN= $108.5M → $57M industry + $49.5 ISED

CAAIN Impact

New businesses created

67

as a direct result of CAAIN

Employment as a result of CAAIN

275

jobs created as a direct result of CAAIN investment

Direct investment, 5 years

$57m

investment a result of project investment from core partner team and open competitions

Estimated 10-year impact

$1.5b

from digital ag-based revenues as a result of ISED SIF investment

CAAIN
Canadian Agri-Food Automation and Intelligence Network

connect. create. cultivate.

Benefits to Canadians

Transformative change through opportunities for collaboration across the value chain and between sectors, creating healthy food for healthy people in Canada and globally

CAAIN
Canadian Agri-Food Automation and Intelligence Network

connect. create. cultivate.

Nuffield ✦ Canada
AGRICULTURAL SCHOLARSHIPS

Jodi Souter - Saskatoon, Saskatchewan

An accomplished and motivated scientist, Jodi Souter is an independent plant breeder who believes that the future opportunities for Canada's crop sector is limitless. Jodi plans to learn more about the progress and limitations surrounding crop development in varying political environments. She will gain insight into opportunities enabled by the Plant Breeders Rights Act and hopes to promote innovations in the development of cutting-edge varieties to enable farmers to be more competitive in the global market.

Amy Cronin - Bluevale, Ontario

A passionate leader, advocate and mother of six, Amy Cronin has already created waves within the agricultural landscape. She and her husband, Mike, farm in Ontario, Iowa, and Missouri as hog and cash crop producers. Amy works in many capacities, being active in agriculture and food at the local, provincial and national levels. Amy plans to take a comprehensive look at the risk management strategies implemented by successful farm businesses, agricultural industries and governments around the world.

CANADIAN CANOLA GROWERS ASSOCIATION

GRAIN FARMERS OF ONTARIO

Dawn Trautman - Edmonton, Alberta

A futurist in technology, Dawn Trautman is a manager of Smart Agriculture and Food Innovation with Alberta Innovates. As an agricultural economist with a BSc in Biological Sciences and a MSc in Agricultural and Resource Economics, Dawn plans to study the barriers for Smart Agriculture adoption for producers while also expanding on opportunities for technology companies to develop and integrate made-in-Canada solutions for sustainable production.

Andrew Rosychuk - Edmonton, Alberta

A city slicker turned visionary farmer, Andrew Rosychuk is the owner of Rosy Farms, a haskap orchard in the prairies. After graduating from Olds College with a Diploma in Production Horticulture, he became unstoppable in achieving his goals. He founded the Haskap Alberta Association and co-founded North 49 Fruit Corporation. His topic of study will focus on the value in developing on-farm, medium scale processing units giving the primary producer an advantage in capitalizing a value added ingredient or product.

Alberta Wheat COMMISSION

Nuffield ✦ Canada AGRICULTURAL SCHOLARSHIPS

AI Tried To Create Inspirational Quotes, And It Went Hilariously Wrong

SEEK SUCCESS, BUT PREPARE FOR VEGETABLES.

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So what?

AI in agri-food is a fast-moving, competitive industry. In Canada, we have technical expertise and government investment. If it's going to be enough to maintain our position we must continue financial and training investments, and work together to capitalize on future network effects.

THANK YOU

Contact information

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Twitter: @dawn_trautman

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