



Fusion 2019

The Convergence of Satellite Imagery and Artificial Intelligence – What it Means to Canada

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July 5 2019

Canada's Leadership in Artificial Intelligence



Canada is a world leader in the artificial intelligence space

- “Canada is home to some of the brightest minds in the field of artificial intelligence
- Canada excels in machine learning and deep learning
- Turing Award - Geoffrey Hinton of the University of Toronto and Yoshua Bengio of the University of Montreal.

Why are we there?

- Liberal immigration policy. Recently opened its doors to tech talent willing to relocate to Canada.
- The fast-track visa program offers up permanent residency and is designed to woo talented innovators from around the world.
- The Canadian government has also committed about \$125 million to A.I.

Future outlook

Tough road to maintain AI superiority.

- Canadian start ups receive a fraction of the investment dollars that their counterparts in the U.S. do.
- Current booming outlook looks bright for the future
- <https://dmz.ryerson.ca/artificial-intelligence/>



RADARSAT Constellation Mission:

CANADA'S NEW GENERATION OF EARTH OBSERVATION SATELLITES



MAIN USES:
Monitor the environment, oceans and ice; support emergency teams during natural disasters; detect ships

LAUNCH:
Spring 2019 aboard a SpaceX Falcon 9 rocket

3 IDENTICAL SATELLITES working together

ALTITUDE:
600 km

APPROXIMATELY 250,000 IMAGES PER YEAR will be used

SPEED:
27,200 km/h
One Earth orbit every **96 minutes**

50 times more than the first generation of RADARSAT

1.1 m
3.6 m
6.98 m

MASS:
1,430 kg each
(like a black rhino)

Canadian Space Agency / Agence spatiale canadienne

Launched June 11, 2019



The RADARSAT Constellation is Canada's new generation of Earth observation satellites. (Canadian Space Agency)

The Global Potential of AI and Satellite Big Data

Commercial satellite systems are critical infrastructure - delivering a broad rang of essential services on a global scale.

Earth Observations (EO) now has the potential to provide near-real-time data of the Earth's surface. These data are becoming widely available to public and private actors through platforms like the Global EO System of Systems (GEOSS).

High-quality, timely, accessible data, including remote sensing data, are absent where sustainable development needs are greatest.

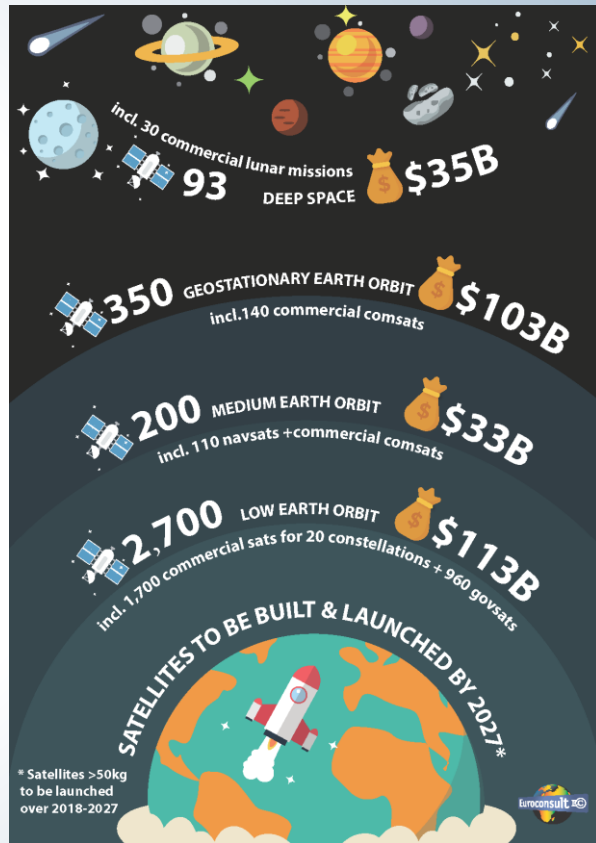
Growing recognition – Remote sensing data can be used to support the 2030 Agenda for Sustainable Development .

The application of remote sensing data to economics through the monitoring of human activity is new.

Feedback loop - Real-time information and timeliness enables evidence-based decision and policy making by continuously monitoring outcomes and adjusting actions to accelerate development.

“What we see now thanks to Big Data processing and analysis, we can train the machines using AI and machine learning to analyze satellite images at a scale never seen before... now we can really take a stab at global data sets for the global good,” Einar Bjørge, Manager of UNOSAT

<https://news.itu.int/ai-satellite-images/>



The Enablers: New Sensing Modalities, Big Data, Fusion, AI



Today's space-based sensors offer a wide variety of sensor frequencies, parameters and modalities.

Hyperspectral and Synthetic Aperture Radar combinations are especially powerful

Big data, fusion and artificial intelligence are key elements in unleashing the potential of space-based data.

Advances in artificial intelligence (AI) we are enabling new uses for satellite imaging through a new range of satellite applications aimed at image interpretation

New approaches are emerging in how data is collected; stored; analyzed

Big data platforms allow for processing real-time information, while machine learning enables pattern recognition across multiple information sources.

Canadian Perspective – Improving the OODA Loop



- **Sovereignty, surveillance and security**
- **Effects of climate change**
 - > Canada's North
- **Economic resilience**
 - > Natural resource monitoring
- **Community resilience**
 - > Marrying remote sensing, data analytics with traditional knowledge
- **Real-time, accurate information can shorten the OODA loop, accelerating the confidence, speed and scale at which decision and policy makers can act.**



Challenges

- **Satellite data still poorly utilized and understood**
- **Ever increasing amounts of data**
- **Tasking and availability of commercial data**
- **Bias**
- **Computing Power**
- **Human Power**
- **Black box complexity**
- **Transferring Learning**
- <https://www.mckinsey.com/featured-insights/artificial-intelligence/the-promise-and-challenge-of-the-age-of-artificial-intelligence>