Health Canada Santé Canada

Harnessing technology innovation: Health Canada Experiences with AI

Developing an Implementation Programme for the Global Framework on Chemicals on Strengthening National Chemicals Legislation and Institutional Capacities

IOMC multi-stakeholder expert meeting and workshop

Punta del Este, Uruguay, 22–23 June 2025

CANADA'S EXPERIENCE WITH AI

- **AI is not new to the Government of Canada**
- **Canada's AI and innovation industries are growing with Government being no exception.**
  - Work and education opportunities are expanding: https://www.educanada.ca/start-commencez/ai-ia.aspx?lang=eng
  - A new Minister of Artificial Intelligence and Digital Innovation, and the Government has been called upon to "become much more productive by deploying AI at scale".
- A new **AI Strategy for the Federal Public Service – 2025-2027**
  - "…to deliver world-class services, protect our people and interests, achieve a more innovative and efficient workplace, and accelerate scientific discovery for the benefit of all."
  - https://www.canada.ca/en/government/system/digital-government/digital-government-innovations/responsible-use-ai/gc-ai-strategy-overview.html

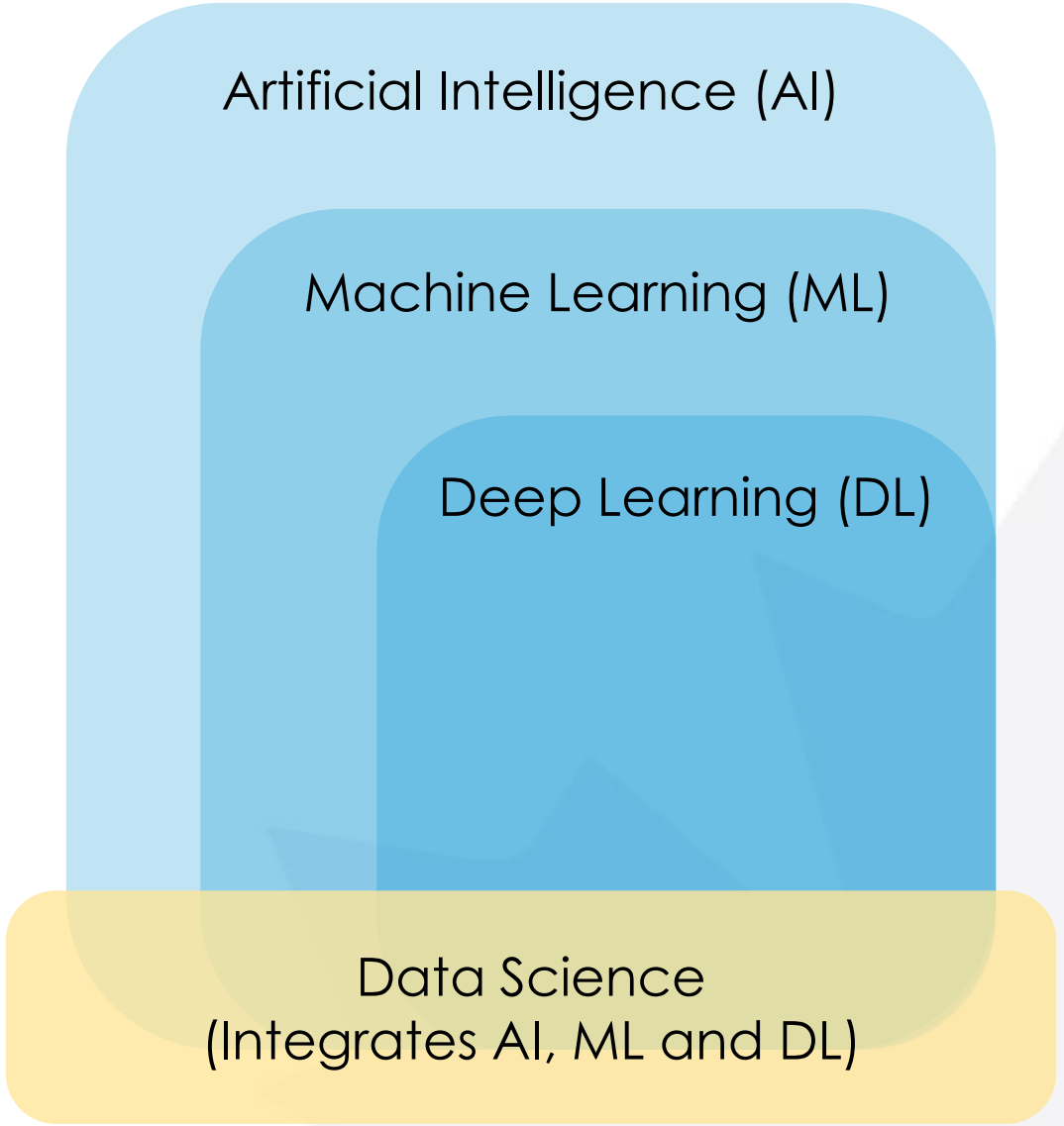
Artificial Intelligence and Machine learning

- Artificial intelligence (AI) and machine learning (ML) are very closely related and connected
- AI is the capability of a computer system to mimic human cognitive functions such as learning and problem-solving

Generative AI
creates new content

Predictive AI
uses existing data to make decisions

- ML refers to computer systems able to learn and adapt without explicit instructions by humans
  - Deep learning is a specific type of ML that uses neural network models
- Data Science combines statistics, programing skills and domain expertise to gain meaningful insights from data and make predictions



Commonly Used AI Capabilities

Predictive analytics

- This capability helps predict trends and behavioral patterns by discovering cause-and-effect relationships in data.

Speech recognition and natural language processing (NLP)

- Speech recognition enables a computer system to identify words in spoken language, and natural language understanding recognizes meaning in written or spoken language.

Sentiment analysis

- A computer system uses sentiment analysis to identify and categorize positive, neutral, and negative attitudes that are expressed in text.

Recommendation engines

- With recommendation engines, companies use data analysis to recommend products that someone might be interested in.

Image and video processing

- These capabilities make it possible to recognize faces, objects, and actions in images and videos, and implement functionalities such as visual search.

Red denotes AI capabilities that are most relevant for chemical risk assessment and are focus areas in ESRAB

Source: Microsoft: Artificial Intelligence vs. Machine Learning

Current Approaches for AI-Assisted Chemical Assessment

Steps	AI Capability
1 • Information Gathering 	**Natural language processing** and **sentiment analysis** to search and filter thousands of scientific papers for relevance and extract data **[active projects]**
2 • Risk Assessment • Substance identity • Physical and chemical properties • Sources and uses • Human health exposure assessment • Human health effects assessment • Human health risk characterization • Conclusion 	**Predictive analytics** to develop models that predict the health effects or exposure routes of a substance, particularly for data-poor situations **[active projects]**
3 • Public Comments 	**Speech recognition** and **natural language processing** to help generate: groupings and summaries of public feedback; plain language summaries of assessments; and, chat interfaces to query assessments for internal or external stakeholders. **[future area of interest]**
4 • Communication of Risk Assessment Outcomes • Plain language summary • Web page listing 	

Current active projects include:

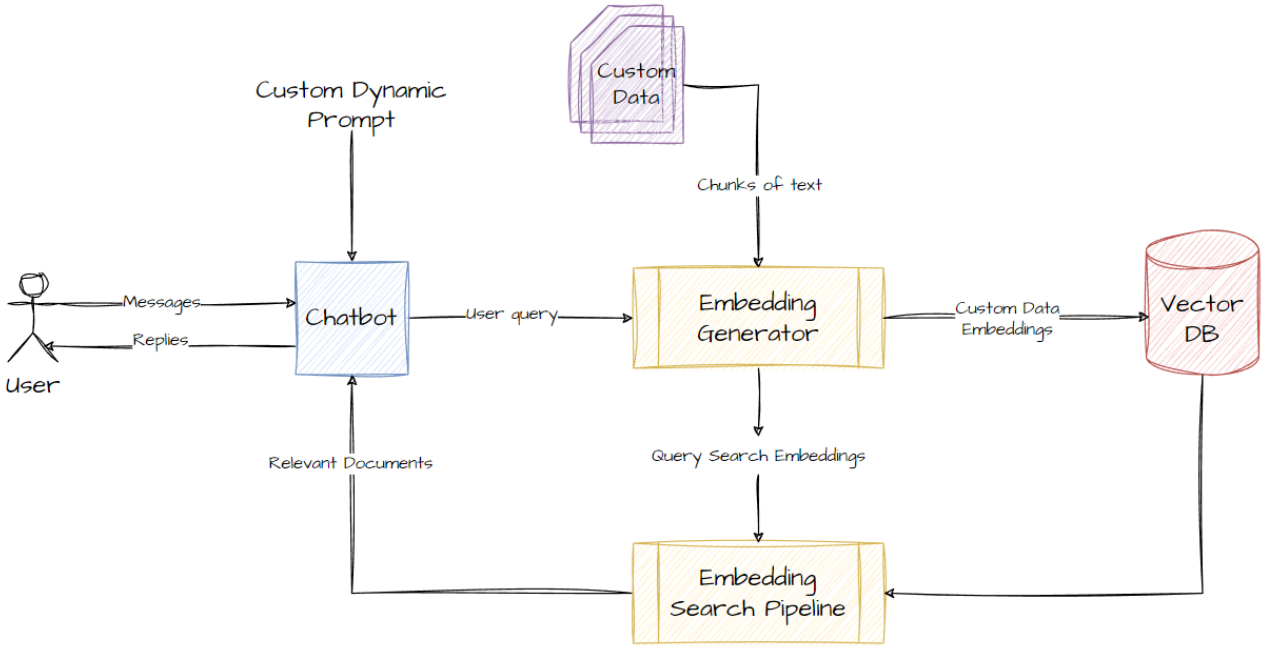
1. For information gathering, using predictive AI and unstructured data:
   - Automated literature screening
     - NLP model to classify and rank scientific article relevance to chemical hazard assessment
     - Improves efficiency, consistency, and transparency of literature search and screening
   - Automated Data Extraction
     - Extracts relevant study data from scientific article titles and abstracts
     - Informs prioritization, risk assessment, further information gathering, or research needs

2. For filling gaps, using predictive AI and structured data:
   - Predictive, machine learning and consensus models
     - combines predictions of multiple models for a toxicity endpoint into a single prediction

Future Areas of Interest

Generative AI

- Speech recognition and natural language processing to build a multimodal large language model (e.g. custom GPT-4):
  - help generate plain language summaries of assessments;
  - build chat-like interface to query assessments for internal or external stakeholders
    - What are the common products that contain a given substance?
    - Does Health Canada consider BPA a health risk?



Source: www.mercity.ai/blog-post/custom-gpt-4-chatbot

Concluding Thoughts

- AI promises to have a prominent role in toxicology and chemical risk assessment
  - Information gathering, filtering, data extraction
  - Handling and integrating large and diverse data
  - Data generation via modelling (enables predictive toxicology)
  - Support NAM development and deployment to reduce animal testing

- Need to remain up to date with State of the Art AI approaches
  - Flexible and nimble
  - Field is developing rapidly; new ideas need to be tested constantly

- Challenges
  - Tremendous competition for staff with relevant domain knowledge and AI skills
  - Accessing tools and services (cloud can help – especially for training)
  - FAIR data – high quality and available
  - Questions around consistency, repeatability, comparability, transparency with trained models and other AI tools (emergence of explainable AI)
  - Generative AI risks (authority, responsibility, reliability/validity, security, privacy, ownership, *etc*.)

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Thank You!