

Thoughts about how AI could support research activities in the future

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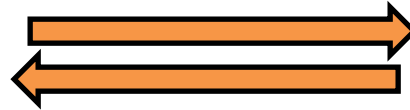
Artificial intelligence (AI) is capable of:

- **Perception:** collecting satellite-generated data, such as elevation, slope, temperature, humidity, etc. from Earth's surface including catastrophic dynamics (storms, floods, droughts, fires, volcanic eruptions, etc.)
- **Learning:** improving knowledge or skills from experience, e.g., by perceiving patterns and insights not evident by traditional methods
- **Reasoning:** drawing conclusions from collected information, devising strategies to achieve pre-set goals resulting recommendation of actions based on predictions
- **Communication:** ability to understand and generate human language, such as chatbots (ChatGPT and other similar software)

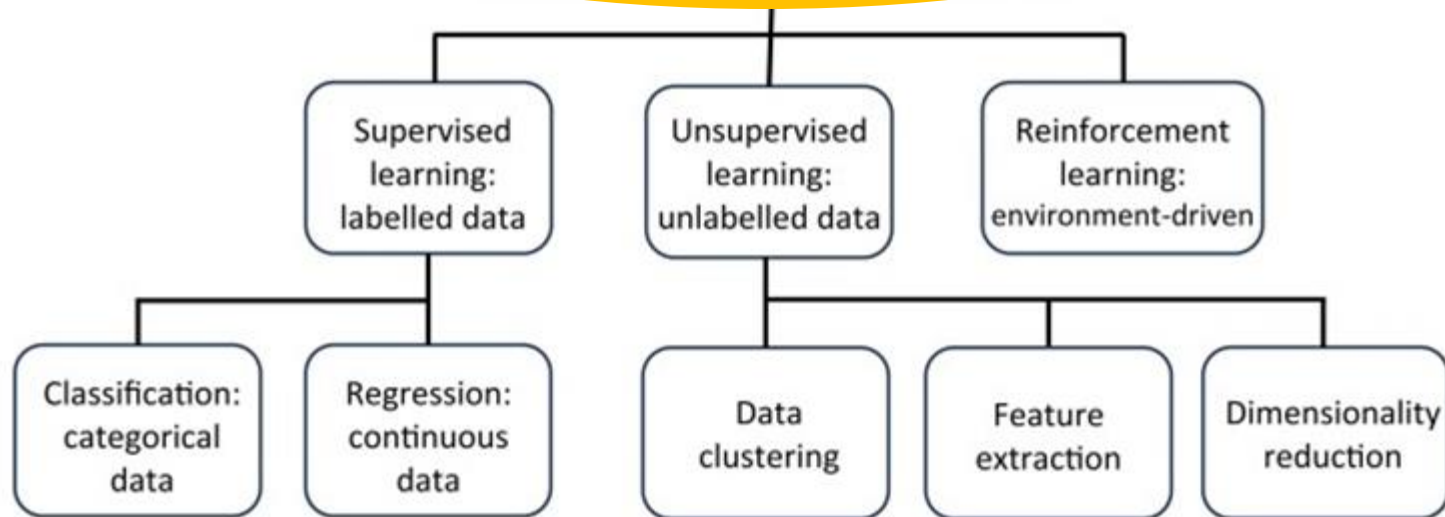
Generative artificial intelligence (AI): a schematic overview

Machine-Learning

Generative pre-trained
transformation (GPT)



Deep Learning (DL)

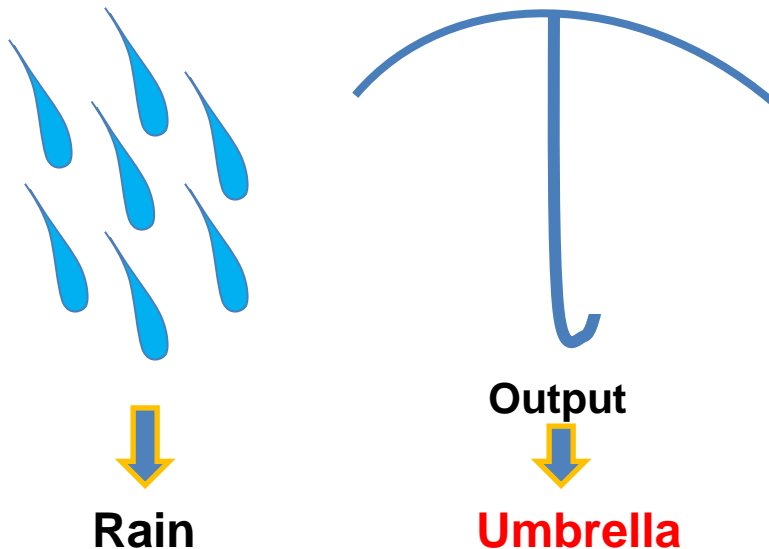


Although GPT and DL are sorted in as part of Machine Learning, they also show activities that extends outside this 'box'

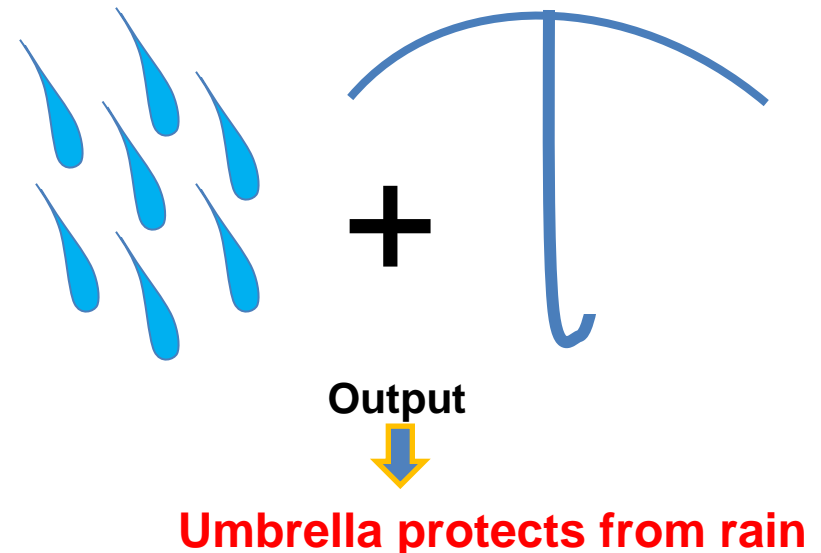
General machine learning (ML)

1. Focused on the development of statistical models that enable computers to perform specific tasks without explicit instructions
2. Learns from data with the aim of identifying patterns
3. Based on Data, Algorithms, Model training and Evaluation
4. Applied in image recognition, spam filtering and epidemiological research

Internet browser

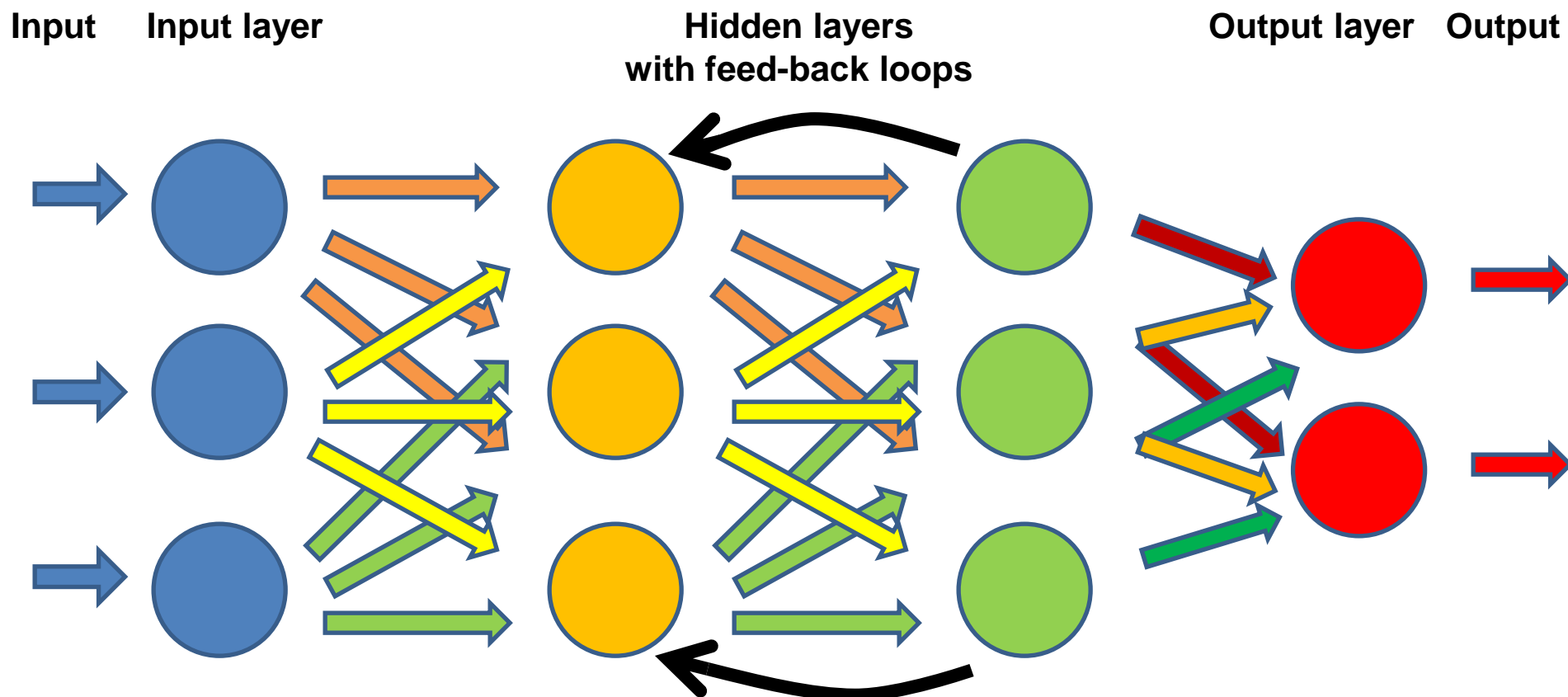


Machine learning



Deep learning (DL) relies on neural networks

Focuses on complex tasks that involve large volumes of unstructured data such as images (art production), audio (speech recognition) and text

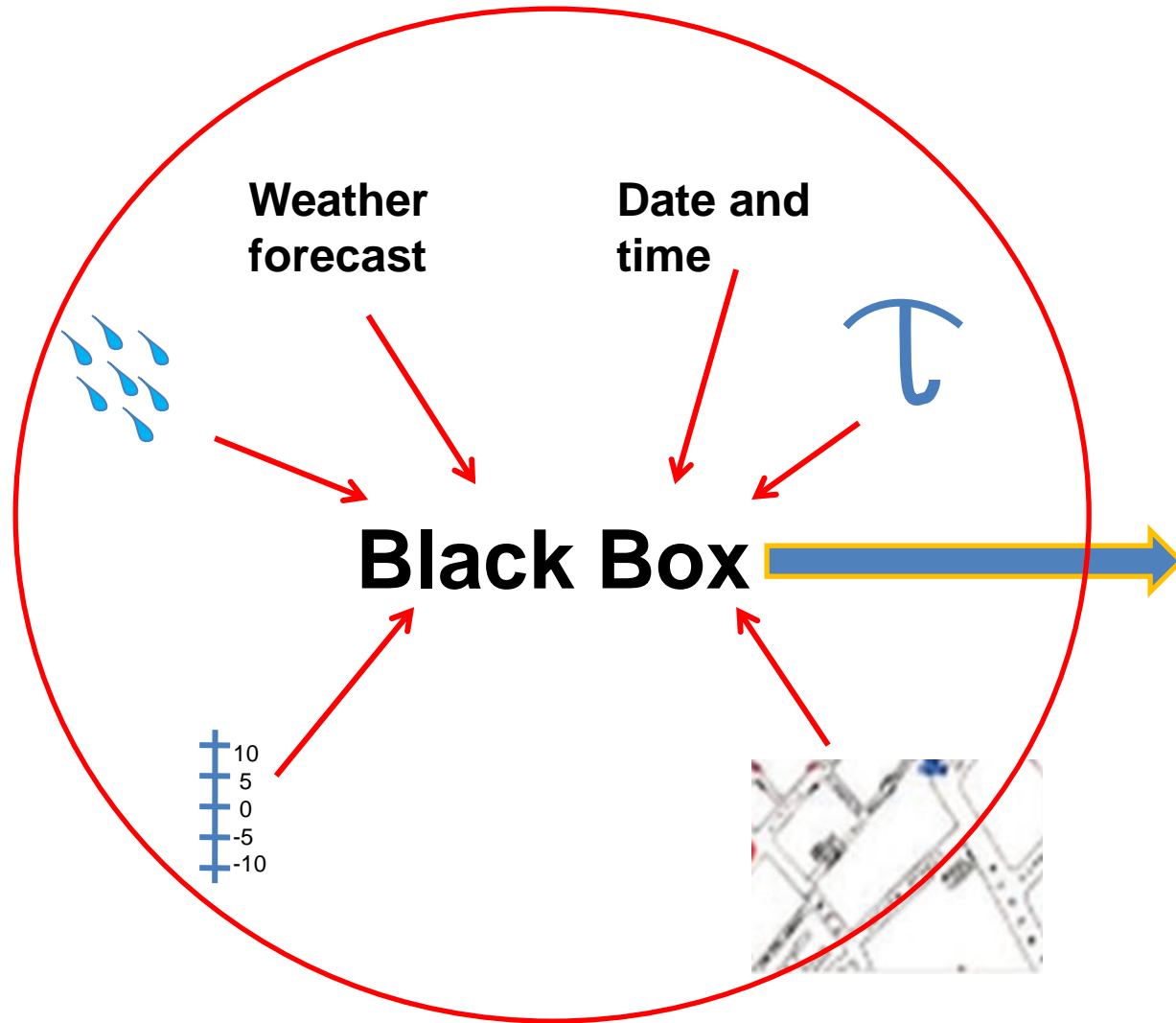


 Pixel layer that can be an image or a range of time series data

 Weights learnt during training of the network reformatting the original pixel

 Final layer produces a prediction based on input and weights

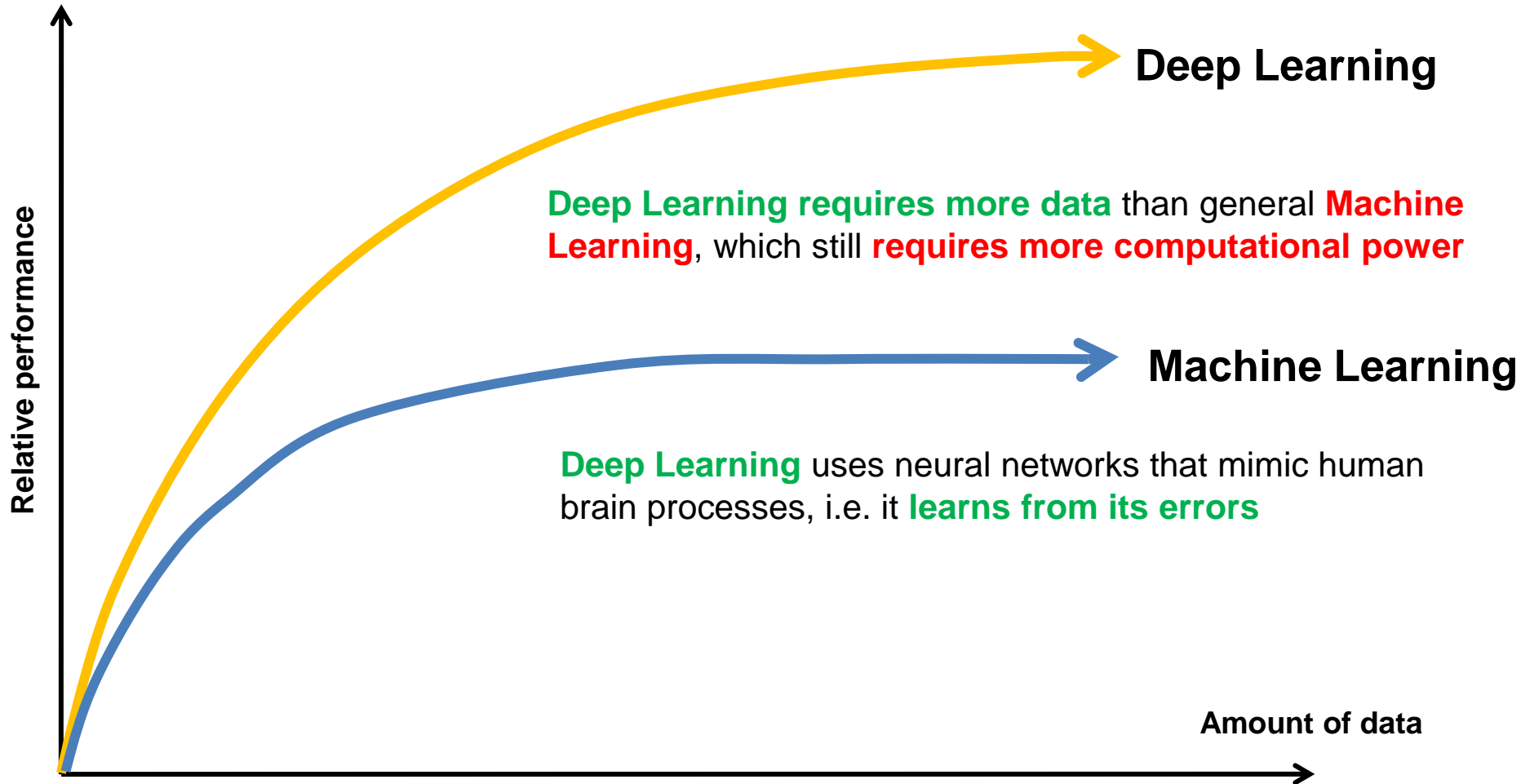
Deep learning (DL)



Output
↓

If you are planning to shop this morning, please take an umbrella as it is a long way to walk and it will rain. Please consider also the risk of slippery roads since temperatures might dip below freezing

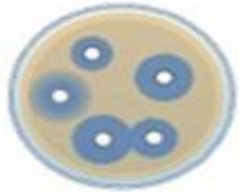
General ML and DL: a comparison



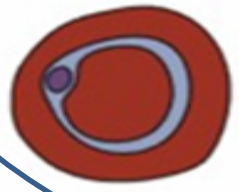
Laboratory diagnostics



Digital culture plates

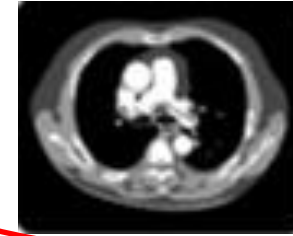


Anti-microbiological resistance



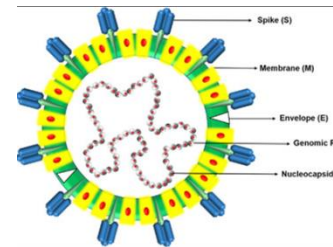
Microscopic diagnosis

Clinical imaging

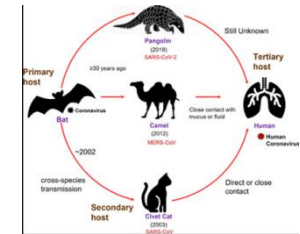


Research applications

Virus modulation



Epidemiology



Drug development



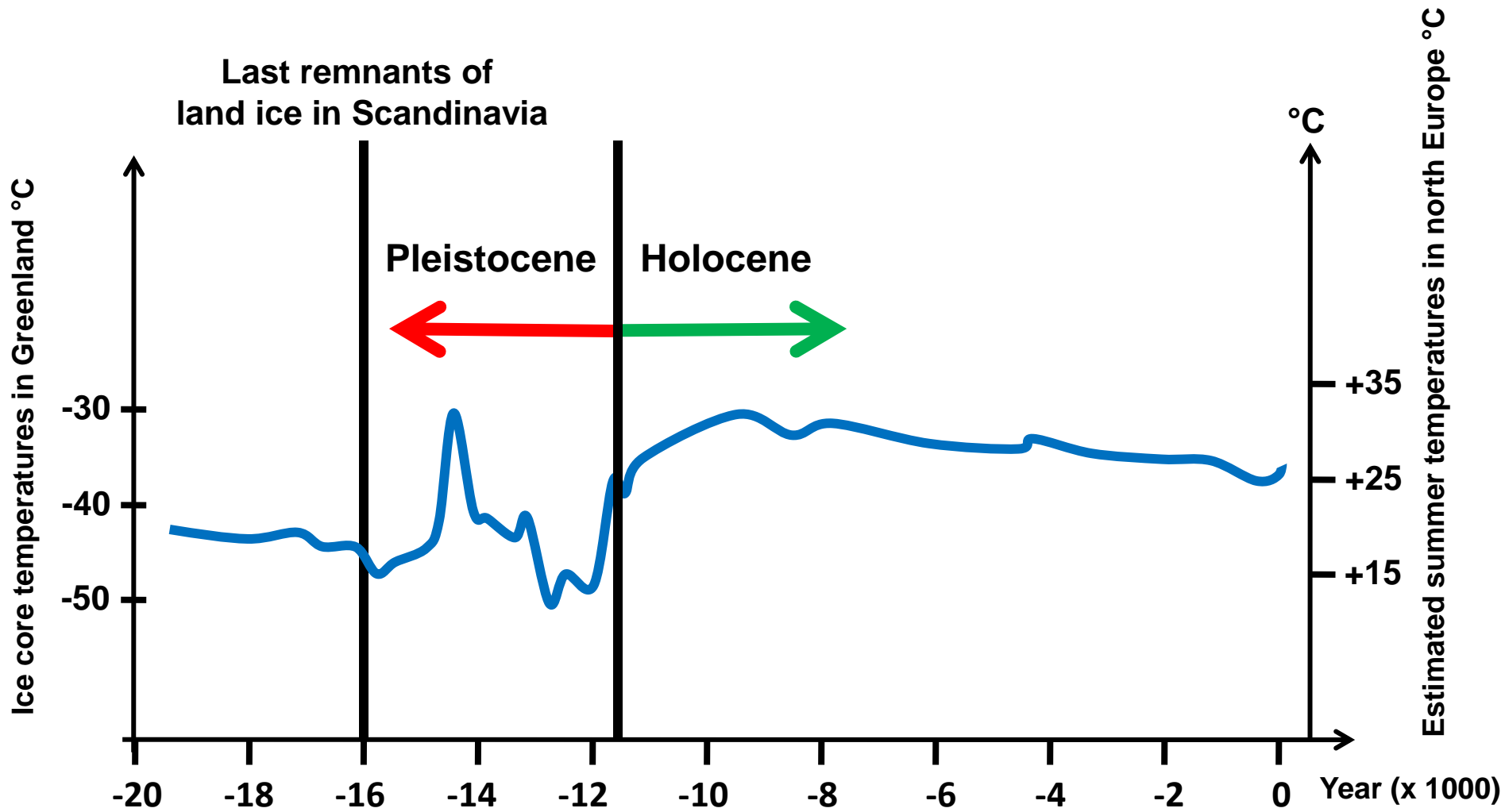
Modelling



Public Health and surveillance



Temperature fluctuations after the Ice Age



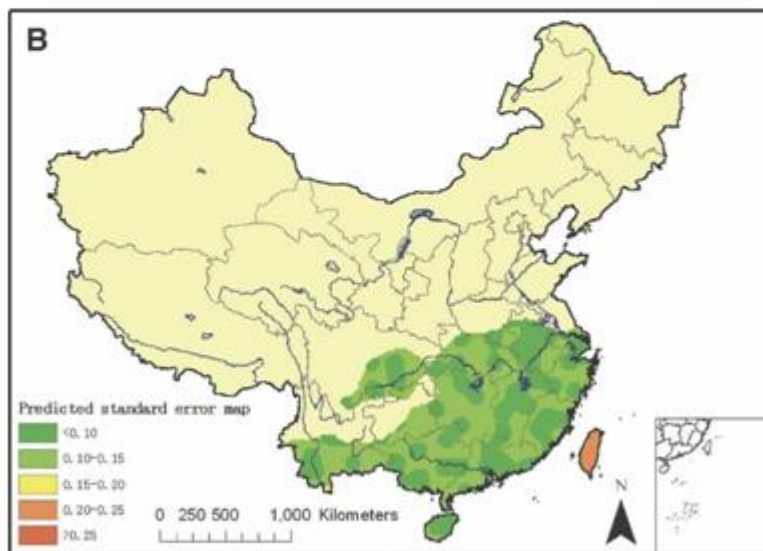
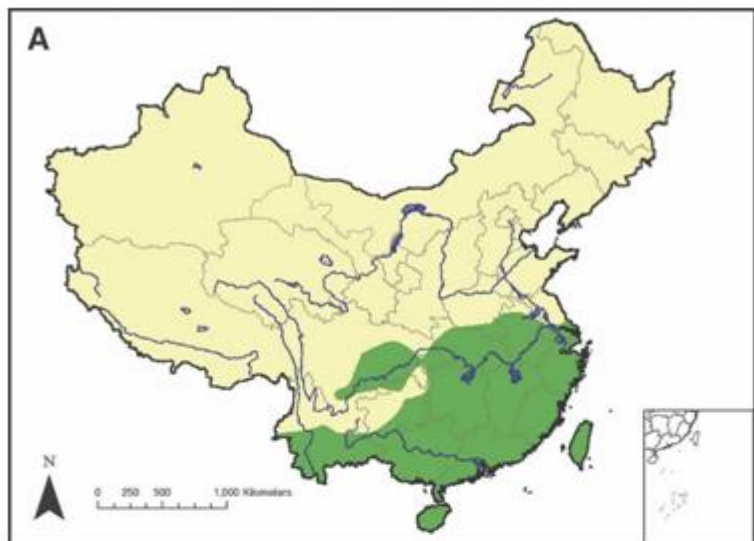


FIGURE 2. Risk map of schistosomiasis transmission in China in 2000 (A) (green color denotes potential risk areas for schistosomiasis transmission), and corresponding prediction error distribution map (B).

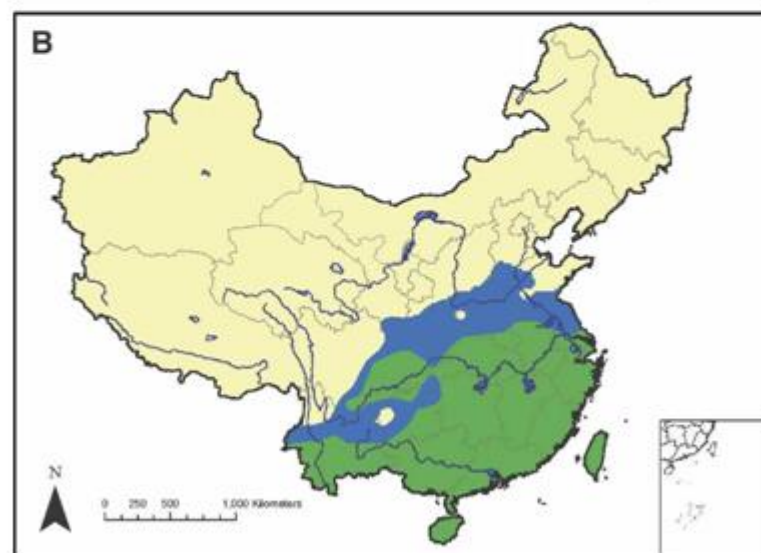
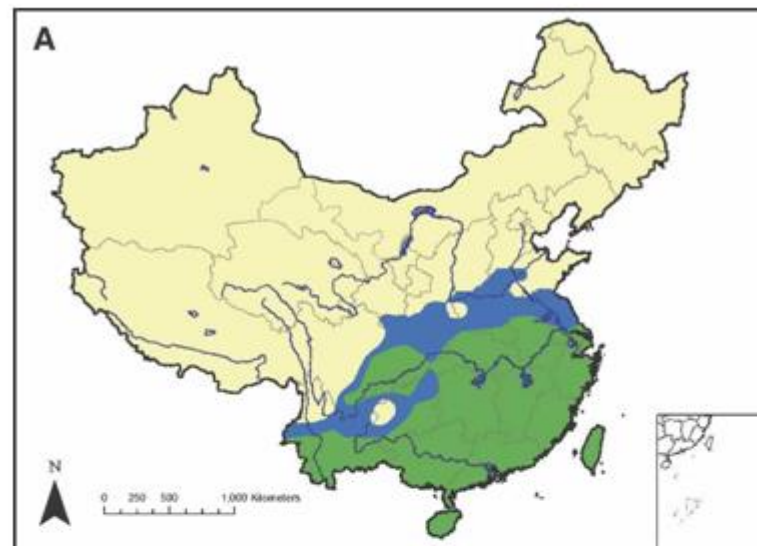


FIGURE 3. Predicted risk map of schistosomiasis transmission in China in 2030 (A) and 2050 (B) (green color denotes potential risk areas for schistosomiasis transmission in 2000, and blue color denotes predicted additional risk areas).

Rise of AI and related applications

