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AI: An Expansive Field

Artificial Intelligence (AI) is a loaded term. It exists firmly in the public zeitgeist, and we can be forgiven for having pigeon-holed what it is (or isn't) in our minds as a result. Most recently, Large Language Models (LLMs) like ChatGPT have staggered us with their abilities to ingest our natural language prompts, and indeed to respond so seemingly-intelligently in kind. Indeed, the nature of language (so viscerally connected in our minds with intelligence/consciousness) has meant that LLMs now occupy first place, and almost all of the space, in our minds when we hear the term "AI".

However, AI is an *expansive* field. It is an umbrella term that refers to computers "doing human stuff". While Natural Language Processing (NLP), such as is achieved by LLMs, is absolutely a key component under this – there are many others.

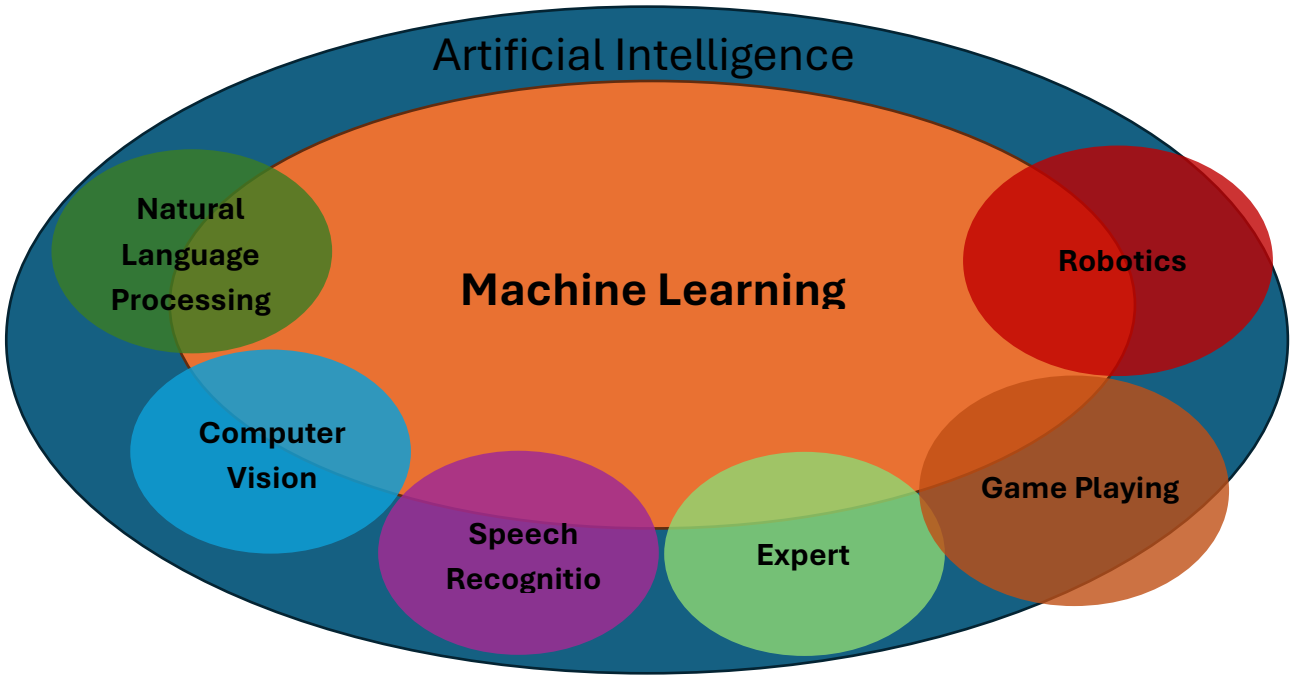

Figure 1: Illustration of the many sub-fields of Artificial Intelligence and their relation to Machine Learning.

Figure 1 illustrates (non-exhaustively) what many of the other sub-fields in AI are.

- **Natural Language Processing (NLP)**: This field focuses on enabling computers to understand, interpret, and generate human language. Applications include text classification, machine translation, speech-to-text, text-to-speech, question answering, text summarization, sentiment analysis, and language modeling.
- **Computer Vision**: This area focuses on enabling machines to interpret and make decisions based on visual data. Applications include image recognition, object detection, and facial recognition. Naturally, this is an area that dominates much of the work done with EO/GIS data.
- **Speech Recognition**: This involves converting spoken language into text. It's used in applications like virtual assistants, transcription services, and voice-controlled devices.
- **Expert Systems**: These are AI systems that emulate the decision-making abilities of a human expert. They are used in fields like medical diagnosis, financial forecasting, and complex problem-solving.
- **Game Playing**: AI in game playing involves creating algorithms that can play games. This includes creating cooperative or adversarial agents that can play video games with people. Some play games at a superhuman level, beating world masters at Chess and Go.
- **Robotics**: AI in robotics involves creating intelligent robots that can perform tasks autonomously. This includes areas like motion planning, manipulation, and human-robot interaction.

Figure 1 also illustrates the relationship between AI and Machine Learning (ML). ML refers to the subset of AI approaches, independent of sub-field, that involves algorithms which are 'trained' (or 'learn') by ingesting large volumes of data. AI solutions are not required to utilize ML. However, as ML models become more sophisticated, and the hardware required for training these models becomes more and more affordable, AI continues to increasingly become synonymous with ML. There are *many* different ML methods. Some of the most common include:

- **Random Forests:** ensembles of decision trees used for classification and regression tasks.
- **Deep Neural Networks (DNNs):** which are inspired by the human brain and utilize linear algebra and non-linear functions to capture subtle, multidimensional relationships between data.
- **Convolutional Neural Networks (CNNs):** DNNs that include 'Convolutional Layers', and excel at Computer Vision tasks.