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Artificial Intelligence and/or Machine Learning (AI &| ML)

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AI &| ML

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Understanding Artificial Intelligence

- AI aims to create machines performing tasks requiring human intelligence.
- Encompasses understanding language, recognizing patterns, making decisions, learning from experience.
- AI augments human capabilities and improves efficiency.
- Applications range from healthcare to entertainment.
- AI is a blend of computer science, mathematics/statistics, cognitive science, and engineering.

Things I work on. How I use AI.

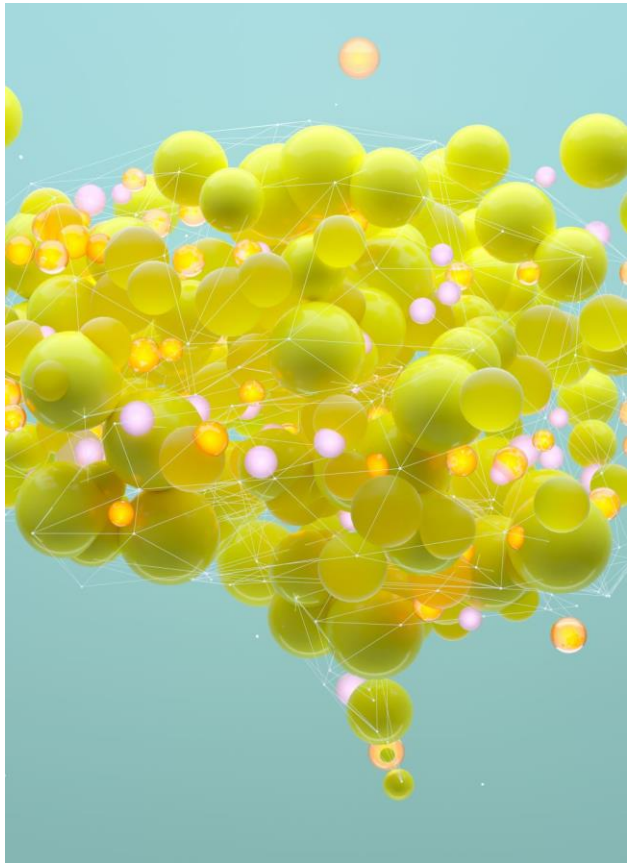
- Making computer vision work on embedded/mobile devices.
- Empirical software engineering: Understanding reuse and adaptation patterns in pre-trained model ecosystems (e.g. Hugging Face).
- Neuroscience (Carbon) focused on the shape and texture play in computer vision vs. human perception.
- History of Computing (COMP 111, former core, now writing-intensive) and Platform Studies.
- Curricular mapping and analysis; learning outcomes.
- Automating administrative work: reports, course scheduling, etc. ☺
- Using AI to reduce tedious coding and writing. Tedious everything, actually.

Machine Learning and Artificial Intelligence

- Machine Learning is a *subset* of AI focused on data-driven learning.
- AI includes rule-based (logic) systems, ML, and more.
- ML is data hungry and improves with experience, using algorithms to find patterns in data (ML=rocket, data=fuel*, Andrew Ng*).
- Key ML types: supervised, unsupervised, and reinforcement learning.
- ML powers applications such as speech recognition and predictive analytics, text classification, vision, robotics
- GPT4 and other generative methods are not the only interesting applications of machine learning.

Challenges

- AI requires tremendous computational power (supercomputer class systems).
- Generalized reasoning and common sense remain challenges.
- AI struggles with creativity and emotional intelligence (affective reasoning). The fake, “I’m sorry.” or “I apologize.”
- Ethical reasoning and moral judgment are complex for AI.
- Long-term planning and strategic thinking are underdeveloped in AI.
- Bridging these gaps could lead to more human-like AI but will likely require different (non-ML) methods.



Potential Benefits of AI and ML

- Revolutionizing healthcare with diagnostics and personalized treatment.
- Enhancing environmental conservation and sustainability.
- Transforming education through personalized learning.
- Improving disaster response and public safety.
- Advancing agriculture with optimized production and sustainability.
- Integration into robotics. Great example: Psyonic Ability Hand (startup by Aadeel Akhtar, CS + Biology @ LUC; featured on Shark Tank) for those who have lost limbs (focused on arms/hand).

Star Trek makes you wonder: How did it take this long to get here?

- The Universal Translator - Introduced in the original Star Trek series, first appearing in "Metamorphosis" (1967).
- The Holodeck - First introduced in Star Trek: The Next Generation, in the episode "Encounter at Farpoint" (1987).
- The Computer - Featured in various Star Trek series, with notable appearances in numerous episodes, starting from the original series.
- **Data - Introduced in Star Trek: The Next Generation, first appearing in the episode "Encounter at Farpoint" (1987).**
- The Borg - First introduced in Star Trek: The Next Generation, in the episode "Q Who" (1989).
- The Doctor - Introduced in Star Trek: Voyager, first appearing in the episode "Caretaker" (1995).
- The EMH (Emergency Medical Hologram) - Also introduced in Star Trek: Voyager, in the same episode "Caretaker" (1995).

The Cyclical Nature of AI: Winters and Summers

AI winters: periods of reduced funding and interest due to unmet expectations.

AI summers: times of optimism, breakthroughs, and increased investments.

First AI Winter (1974-1980) caused by limitations of early algorithms. Computational power a major challenge.

Second AI Winter (1987-1993) due to the failure of pure logic-based expert systems.

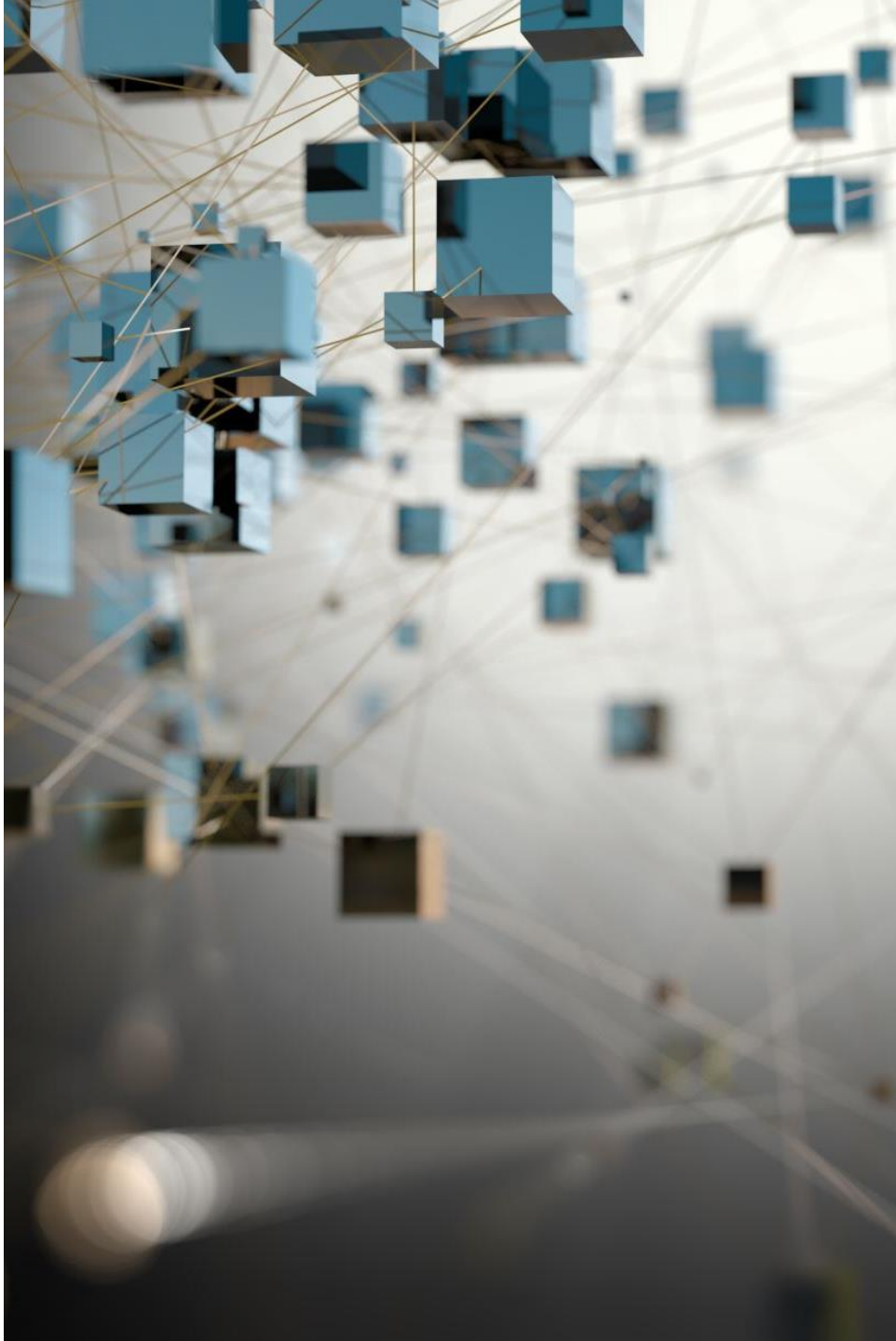
Ongoing AI summer since the early 2000s, fueled by ML and big data. **Is the next winter coming?**

Pioneers and Landmarks in AI Development

- **Alan Turing: Turing Test and conceptual foundations of AI.**
- John McCarthy: Coined the term "Artificial Intelligence" in 1956. Inventor of Lisp programming.
- Frank Rosenblatt: Developed the perceptron, an early neural network model.
- Geoffrey Hinton: Key figure in the resurgence of neural networks and deep learning.
- Yann LeCun, Yoshua Bengio, and Hinton: Deep learning pioneers.

Evolution from Basic Neural Networks to Advanced Models

- From single-layer perceptrons to multi-layered neural networks.
- Introduction of backpropagation enabled learning in deep networks.
- CNNs for spatial data processing, RNNs for sequential data.
- Transformers revolutionized NLP with attention mechanisms.
- AI's evolution reflects growing complexity and capability in modeling intelligence.



The Ethical and Social Implications of AI

Job displacement and economic impacts due to automation.

Privacy concerns with widespread data collection and surveillance.

Ethical dilemmas in decision-making processes.

The need for transparency and accountability in AI systems.

The importance of ethical AI development and use.