

Artificial Intelligence

CS202 Lecture 20a

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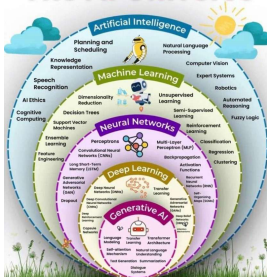
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What is Artificial Intelligence?

Definition: Systems or machines that simulate human intelligence to perform tasks, improve upon experiences, and adapt as they learn

- Intelligence exhibited by machines, particularly computer systems
- Computers thinking like humans do

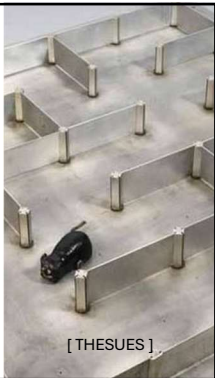
“Humans use available information as well as reason in order to solve problems and make decisions, so why can't machines do the same thing?”

Computing Machinery and Intelligence, Alan Turing, 1950

History of AI

Evolution from concept to reality:

- i-robot novel published by Isaac Asimov in 1950
- **Theseus built in 1950**
 - The first machine by Claude Shannon
 - A maze solving mouse
- **Perceptron Mark I, 1957**
 - The first Neural Network
 - Could distinguish between cards marked on left and right
- High growth in recent decades due to advances in compute power / data availability



[THESEUS]

TIMELINE OF ARTIFICIAL INTELLIGENCE

HAL 9000 FROM "2001: A SPACE ODYSSEY" (CREDIT: WARNER BROS. STUDIOS)

Advances in artificial intelligence (AI) have given the world computers that can beat people at chess and "Jeopardy!" as well as drive cars and manage calendars. But despite the progress, engineers are still years away from developing machines that are self-aware. Some believe the resulting **technological singularity** will eradicate poverty and disease, while others warn it could endanger human survival.



1950: Isaac Asimov publishes the influential sci-fi story collection **"I, Robot."** (Left: 2004 film version of "I, Robot")

1950s

Summer of 1956: Dartmouth conference launches the field of AI and **coins the term "artificial intelligence."** (Right: room-filling IBM-702 computer, as used by first AI researchers)

1960s

1968: "2001: A Space Odyssey," the book by Arthur C. Clarke and film by Stanley Kubrick, features the sentient and deadly computer **HAL 9000.**

1970s



1984: The first **"Terminator"** film depicts a near-future world overtaken by killing machines run by the artificial intelligence Skynet.

1950: Alan Turing introduces the **Turing test** in his paper "Computing Machinery and Intelligence." (Credit: National Portrait Gallery, London)



1974-early 1980s: The first **Winter of AI**, a period of reduced funding and lowered interest in the field as hype turned to disappointment.

1978: The original **"Battlestar Galactica"** science fiction TV series introduces warrior robots called **Cylons.**



June 26, 2001: Steven Spielberg releases his version of a film – originally developed by Stanley Kubrick – about a robot boy: **"A.I.: Artificial Intelligence."**



2000s

2011: **IBM's Watson wins "Jeopardy!"** beating former champions Brad Rutter and Ken Jennings. (Credit: "Jeopardy!" screenshot from Wikimedia)



2010s



December 18, 2013: The movie **"Her"** (left), stars Joaquin Phoenix as a man who **falls in love with his artificially intelligent computer operating system**, voiced by Scarlett Johansson.

April 10, 2014: The film **"Transcendence"** (below) stars Johnny Depp as an AI researcher whose **mind is uploaded to a computer** and develops into a super-intelligence.

June 7, 2014: Chatbot Eugene Goostman is said to have **passed the Turing test** in University of Reading competition, launching controversy.

August, 2014: Researchers call for creation of a **new Turing test**, to be decided at 2015 workshop.



2005: A Stanford vehicle wins the **DARPA grand challenge**, driving autonomously across the desert for 131 miles (211 kilometers).

2005: Inventor and futurist Ray Kurzweil predicts an event he calls **the Singularity** will occur around 2045, when the intelligence of artificial minds exceeds that of the human brain.



October 14, 2011: Apple introduces intelligent personal assistant **Siri** on the iPhone 4S.

June 2012: A Google Brain computer cluster **trains itself to recognize a cat** from millions of images in YouTube videos. (Credit: Shutterstock)



Types of AI

1. Narrow AI (ANI): Specialized AI

- Designed to perform specific tasks, such as facial recognition or language translation

2. General AI (AGI): Hypothetical, human-like intelligence

- Theorized to understand and reason like a human across various tasks
- Does not exist yet

3. Superintelligent AI: Speculative future AI

- Speculative level of AI that would surpass human intelligence

What is Machine Learning?

Definition: Computers learning from data without being explicitly programmed

Learning from data rather than explicit programming:

- Instead of following set instructions, ML algorithms analyze patterns in data and make predictions or decisions

Example:

- For instance, an ML model can predict customer preferences based on past buying behavior

Types of Machine Learning

1. Supervised Learning:

- Uses labelled data to teach models
- Much like a teacher guiding a student

2. Unsupervised Learning:

- Works with unlabelled data to find patterns or groupings independently

3. Reinforcement Learning:

- Involves an agent that learns by interacting with its environment and receiving rewards or penalties

1. Supervised Learning

- **Image recognition in healthcare:**

- Helps with image recognition tasks
- For instance, identifying tumors in MRI scans



IMAGE RECOGNITION

Identifying objects within images

- **Predictive analytics in business:**

- Forecast sales or customer behavior



FINANCIAL ANALYSIS

Predicting stock prices

- **Language translation:**

- Foundational in language translation tools

2. Unsupervised Learning

- **Customer segmentation in marketing:**

- Segment customers in marketing, finding groups with similar behaviors or preferences

- **Anomaly detection in finance:**

- Identify unusual transactions that may indicate fraud

- **Clustering in genomics:**

- Clustering and uncovering hidden patterns in unlabeled data

3. Reinforcement Learning

- **Autonomous driving:**

- AI learns from road interactions

- **Robotics:**

- Allows machines to optimize tasks like picking and placing items

- **Game AI (e.g., AlphaGo):**

- Masters the game of Go through millions of interactions and feedback loops

Neural Networks

Definition: A series of algorithms that attempt to recognize relationships in data by mimicking the human brain

Types:

- Perceptrons
- Multi-Layer Perceptrons (MLP)
- Convolutional Neural Networks (CNNs)
- Recurrent Neural Networks (RNNs)
- Long Short-Term Memory (LSTM)
- Self-Organizing Maps (SOMs)

Neural Networks Structure

Structure: Input, Hidden, and Output layers

- A neural network consists of three main types of layers: the input layer, hidden layers, and the output layer.

Role of each layer in learning:

- The hidden layers process the input data, transforming it through multiple stages.

Backpropagation in training:

- The model learns through backpropagation
- Adjusts the weights between layers based on errors
- Allows the model to become increasingly accurate

Thank You !