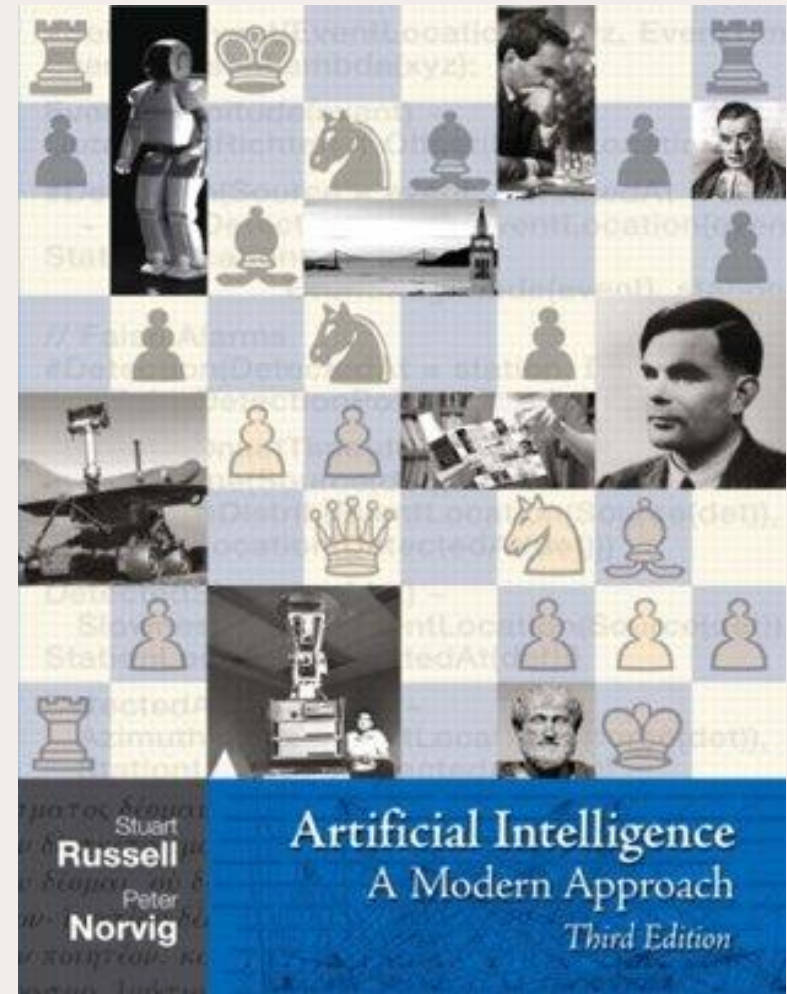# Artificial Intelligence

- Module 1
- Topic: 1.1
- Introduction to AI
- VBDS1402

Basic Info

- **Textbook:** S. Russell and P. Norvig, *Artificial Intelligence: A Modern Approach,* Prentice Hall, 2nd or 3rd ed.

WHAT IS AI?

SOME DEFINITIONS OF ARTIFICIAL INTELLIGENCE

FOUNDATIONS OF AI

HISTORY OF AI
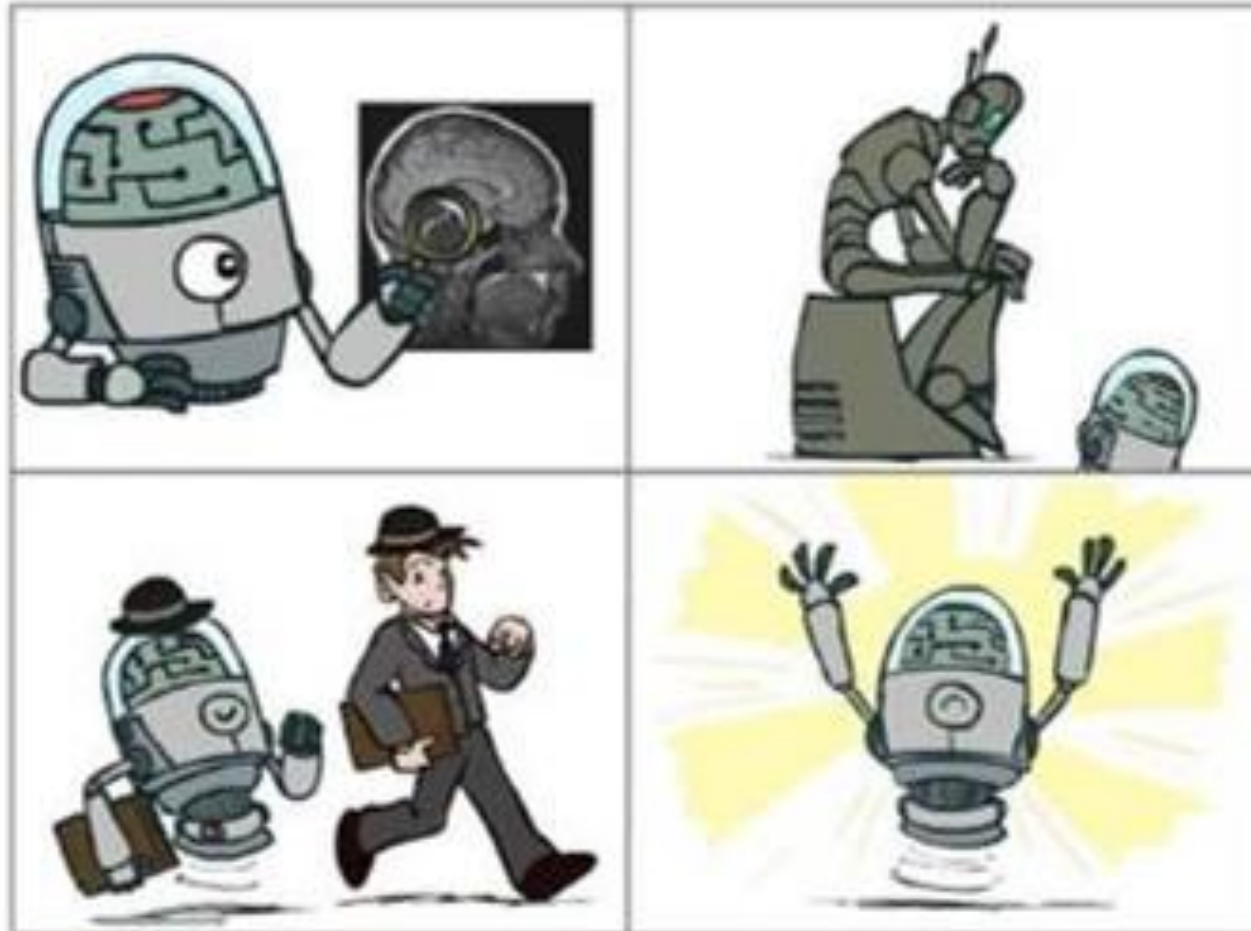
Topics you will learn

- According to the father of Artificial Intelligence, John McCarthy, it is *"The science and engineering of making intelligent machines, especially intelligent computer programs"*.

- Artificial Intelligence is a way of **making a computer, a computer-controlled robot, or a software think intelligently**, in the similar manner the intelligent humans think.

AI

What is AI?

- 1. Thinking Humanly

- 2. Acting Humanly

- 3. Thinking Rationally

- 4. Acting Rationally
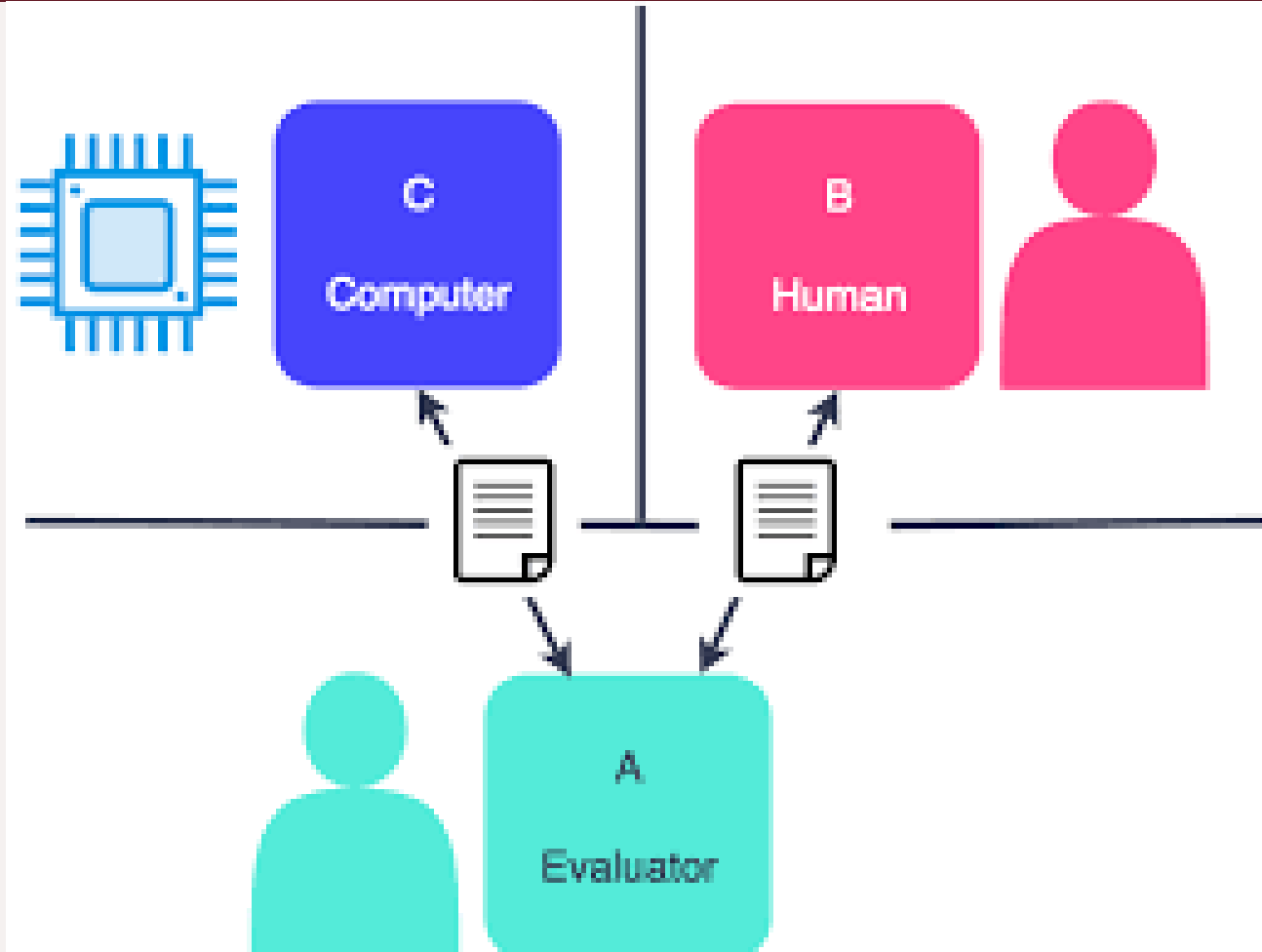
1. Thinking humanly

- The cognitive modeling approach Here, we must have some way of determining how humans think. We need to get inside the actual workings of human minds.

- There are three ways to do this: through introspection–trying to catch our own thoughts as they go by; through psychological experiments–observing a person in action; and through brain imaging– observing the brain in action. mechanisms could also be operating in humans.
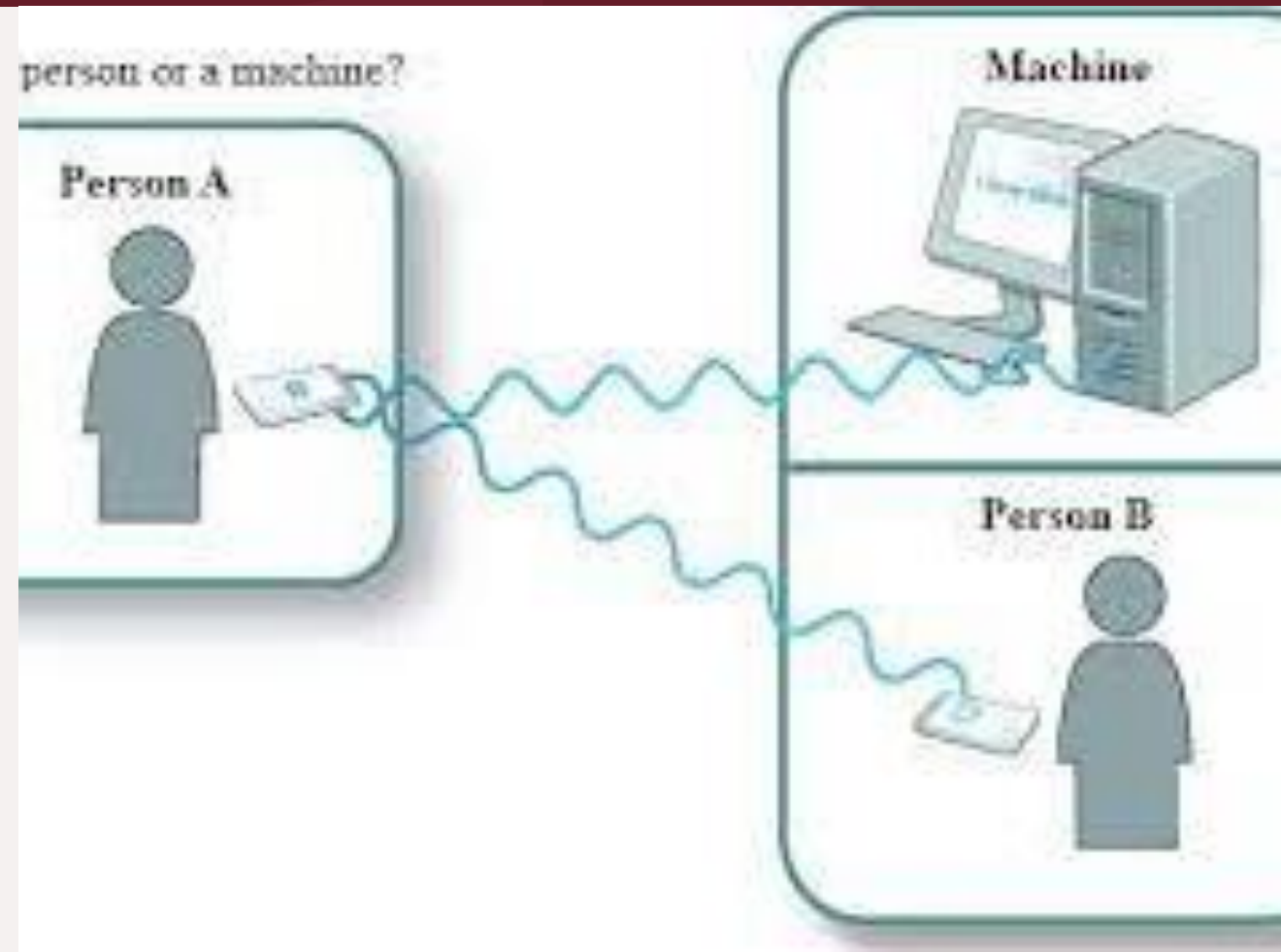
2. Acting humanly

The Turing Test approach

- The computer would need to possess the following capabilities:

- Natural language processing to enable it to communicate successfully in English

- Knowledge representation to store what it knows or hears

- Automated reasoning to use the stored information to answer questions and to draw new conclusions

- Machine learning to adapt to new circumstances and to detect and extrapolate patterns

- Computer vision to perceive objects

- Robotics to manipulate objects and move about.

Turing Test

Suggested major components of AI/ Capabilities computer would need to possess to pass Turing test:

- knowledge representation
- Automated reasoning,
- Natural language processing /image understanding,
- machine learning

3. Thinking rationally

The "laws of thought" approach:

- "Socrates is a man; all men are mortal; therefore, Socrates is mortal."
- These laws of thought were supposed to govern the operation of the mind; their study initiated the field called logic.

1. If Socrates is a human, then he is mortal
2. Socrates is a mortal
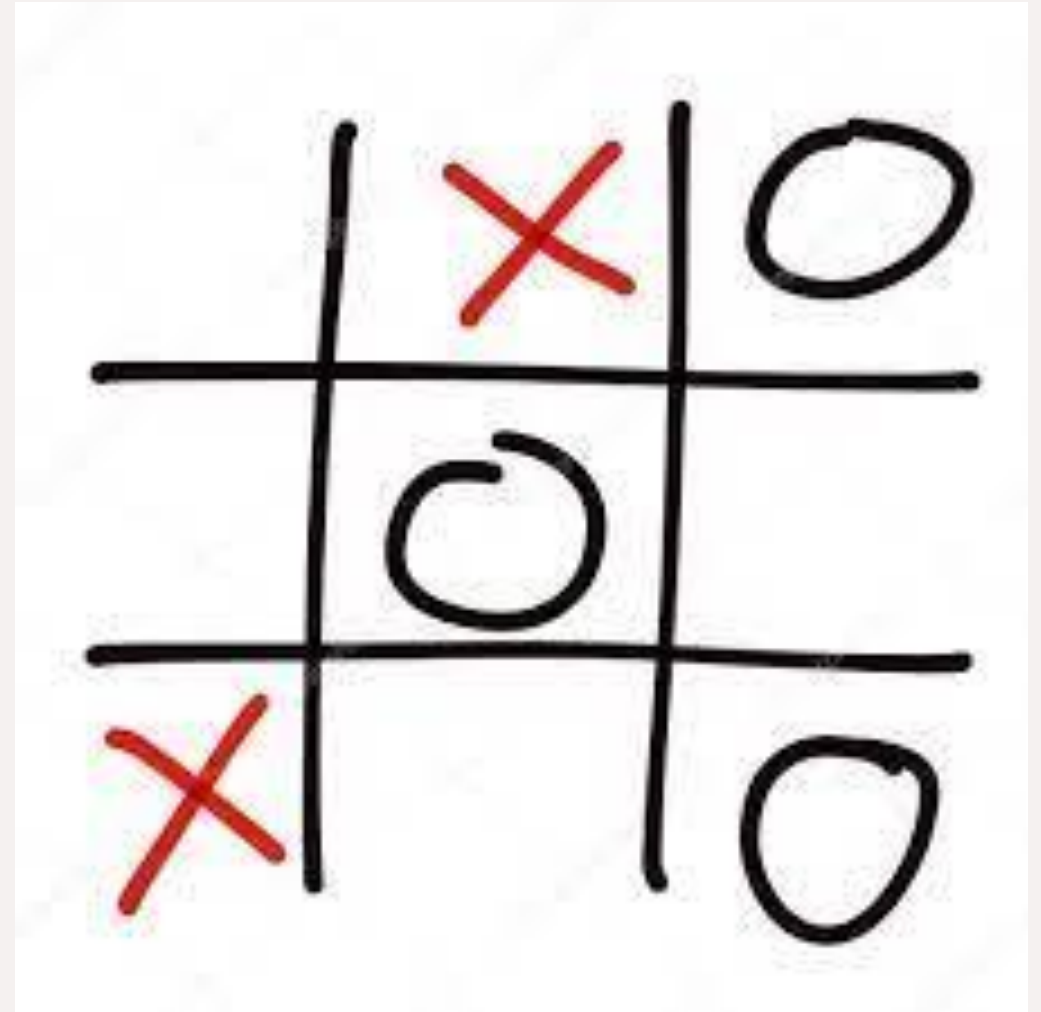3. Therefore, Socrates is human.

This argument is | invalid |. It has

the form of | Modus Ponens |

4. Acting rationally

The rational agent approach:

- An agent is just something that acts.

- A rational agent is one that acts so as to achieve the best outcome or, when there is uncertainty, the best expected outcome.

Introduction to AI

https://www.youtube.com/watch?v=mJeNghZXtMo&t=202s

Foundations of AI

Philosophy

- Can formal rules be used to draw valid conclusion?
- How does the mind arise from a physical brain?
- Where does knowledge come from?
- How does knowledge lead to action?

Mathematics

- What are the formal rules to draw valid conclusions?
- What can be computed?
- How do we reason with uncertain information?

Economics

- How should we make decisions so as to maximize payoff?
- How should we do this when others may not go along?
- How should we do this when the payoff may be far in the future.

Foundations of AI

Neuroscience	Psychology	Computer engineering	Control theory and cybernetics	Linguistics
• How do brain Process Information?	• How do humans and animals think and act? • Cognitive psychology which views the brain as an information-processing unit	• How can we build an effective computer? • For AI to succeed we have two things: intelligence and artifacts.	• How can artifacts operate under own control?	• How does language relate to thought?

History of AI

- The concept of intelligent machines is found in Greek mythology.

- There is a story in the 8th century A.D about Pygmalion Olio, the legendary king of Cyprus.
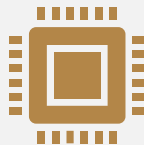
History of AI

Aristotle (384-322 BC) developed an informal system of syllogistic logic, which is the basis of the first formal deductive reasoning system.
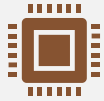
Early in the 17th century, Descartes proposed that bodies of animals are nothing more than complex machines.

Pascal in 1642 made the first mechanical digital calculating machine.

In the 19th century, George Boole developed a binary algebra representing (some) "laws of thought."

Charles Babbage & Ada Byron worked on programmable mechanical calculating machines.

In the late 19th century and early 20th century, mathematical philosophers like Gottlob Frege, Bertram Russell, Alfred North Whitehead, and Kurt Gödel built on Boole's initial logic concepts to develop mathematical representations of logic problems.
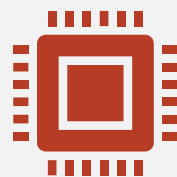
In 1943 McCulloch & Pitts developed a Boolean circuit model of brain. They wrote the paper "A Logical Calculus of Ideas Immanent in Nervous Activity", which explained how it is possible for neural networks to compute.

History of AI

History of AI

Marvin Minsky and Dean Edmonds built the SNARC in 1951, which is the first randomly wired neural network learning machine (SNARC stands for Stochastic Neural-Analog Reinforcement Computer).It was a neural network computer that used 3000 vacuum tubes and a network with 40 neurons.

In 1950 Turing wrote an article on "Computing Machinery and Intelligence" which articulated a complete vision of AI.

Turing's paper talked of many things, of solving problems by searching through the space of possible solutions, guided by heuristics. He illustrated his ideas on machine intelligence by reference to chess. He even propounded the possibility of letting the machine alter its own instructions so that machines can learn from experience.
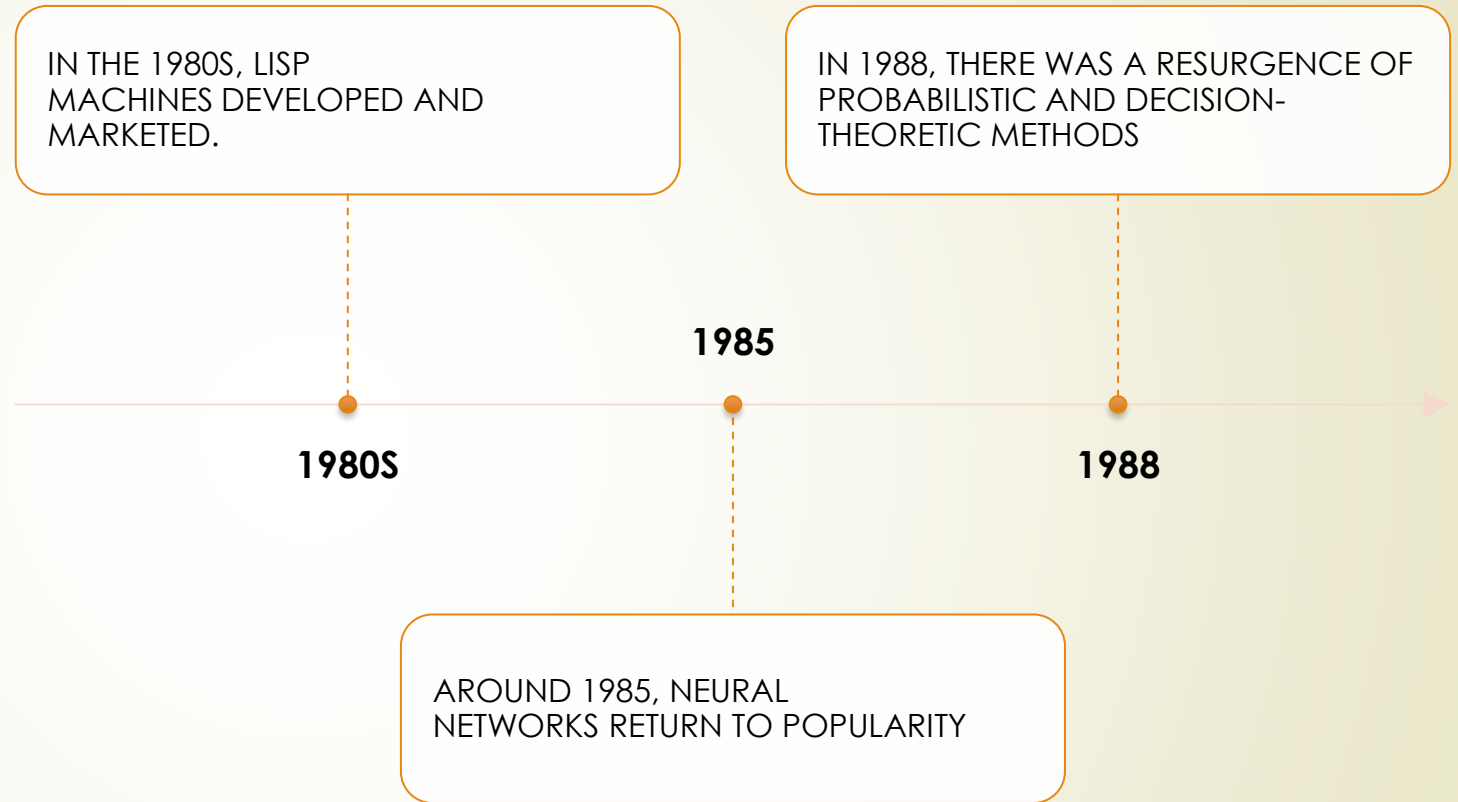
History of AI

- In 1956 a famous conference took place in Dartmouth. The conference brought together the founding fathers of artificial intelligence for the first time. In this meeting the term "Artificial Intelligence" was adopted.

- Between 1952 and 1956, Samuel had developed several programs for playing checkers. In 1956, Newell & Simon's Logic Theorist was published. It is considered by many to be the first AI program. In 1959, Gelernter developed a Geometry Engine. In 1961 James Slagle (PhD dissertation, MIT) wrote a symbolic integration program, SAINT. It was written in LISP and solved calculus problems at the college freshman level. In 1963, Thomas Evan's program Analogy was developed which could solve IQ test type analogy problems.

- In 1963, Edward A. Feigenbaum & Julian Feldman published Computers and Thought, the first collection of articles about artificial intelligence.

History of AI

- In 1965, J. Allen Robinson invented a mechanical proof procedure, the Resolution Method, which allowed programs to work efficiently with formal logic as a representation language. In 1967, the Dendral program (Feigenbaum, Lederberg, Buchanan, Sutherland at Stanford) was demonstrated which could interpret mass spectra on organic chemical compounds. This was the first successful knowledge-based program for scientific reasoning. In 1969 the SRI robot, Shakey, demonstrated combining locomotion, perception and problem solving.

- The years from 1969 to 1979 marked the early development of knowledge-based systems. In 1974: MYCIN demonstrated the power of rule-based systems for knowledge representation and inference in medical diagnosis and therapy. Knowledge representation schemes were developed. These included frames developed by Minski. Logic based languages like Prolog and Planner were developed.

History of AI

IN THE 1980S, LISP MACHINES DEVELOPED AND MARKETED.

IN 1988, THERE WAS A RESURGENCE OF PROBABILISTIC AND DECISION-THEORETIC METHODS

1985

1980S

1988

AROUND 1985, NEURAL NETWORKS RETURN TO POPULARITY

History of AI (The 1990's saw major advances in all areas of AI including the following:)

MACHINE LEARNING, DATA MINING

INTELLIGENT TUTORING

CASE-BASED REASONING

MULTI-AGENT PLANNING, SCHEDULING

UNCERTAIN REASONING

NATURAL LANGUAGE UNDERSTANDING AND TRANSLATION

VISION, VIRTUAL REALITY, GAMES, AND OTHER TOPICS

History of AI

- Rod Brooks' COG Project at MIT, with numerous collaborators, made significant progress in building a humanoid robot

- The first official Robo-Cup soccer match featuring table-top matches with 40 teams of interacting robots was held in 1997.

- In the late 90s, Web crawlers and other AI-based information extraction programs become essential in widespread use of the world-wide-web.

- Interactive robot pets ("smart toys") become commercially available, realizing the vision of the 18th century novelty toy makers.

- In 2000, the Nomad robot explores remote regions of Antarctica looking for meteorite samples.

Summary

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