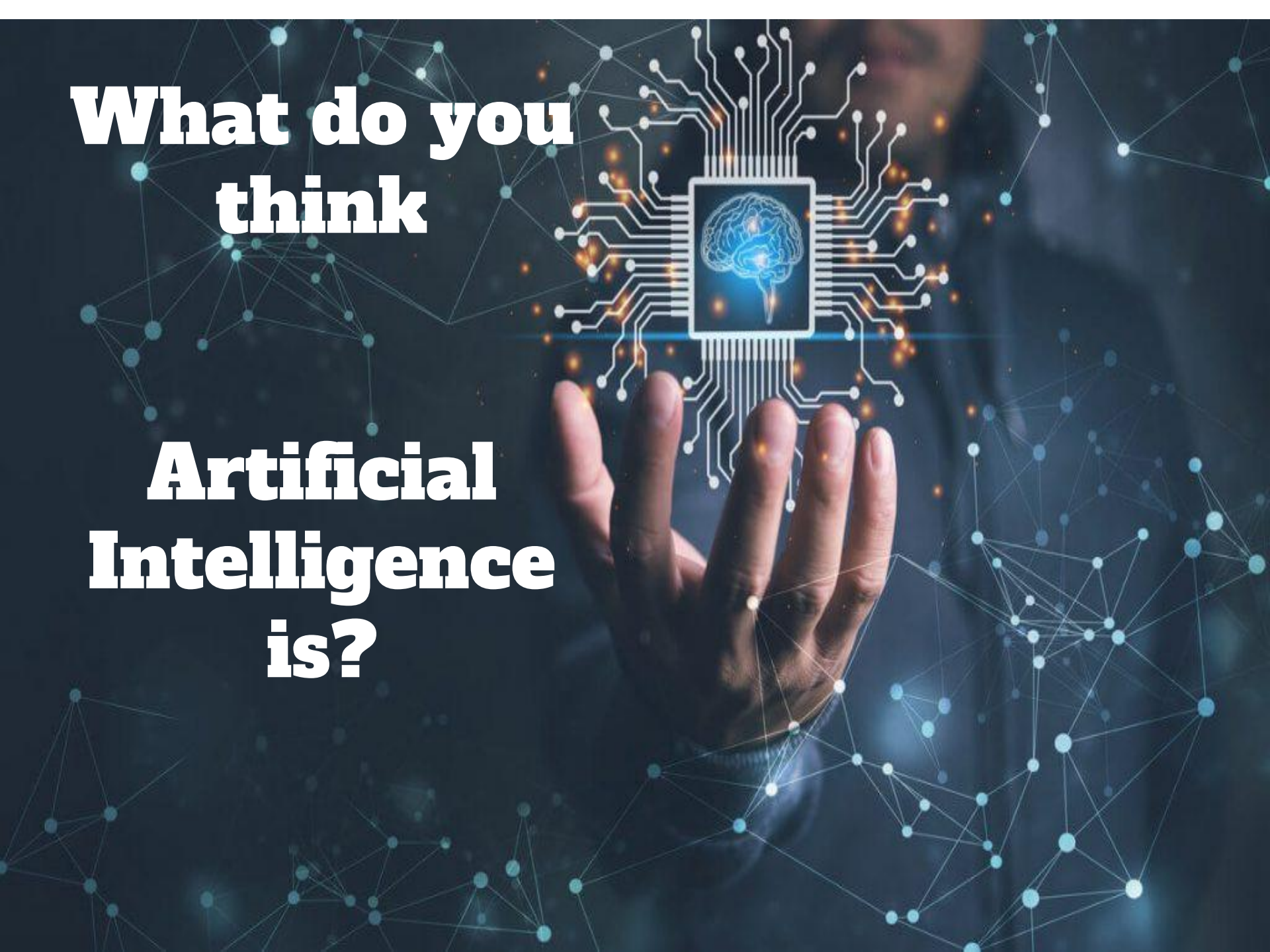
Introduction to Artificial Intelligence

Dr. Partha Pakray
Assistant Professor
Department of CSE
NIT Silchar

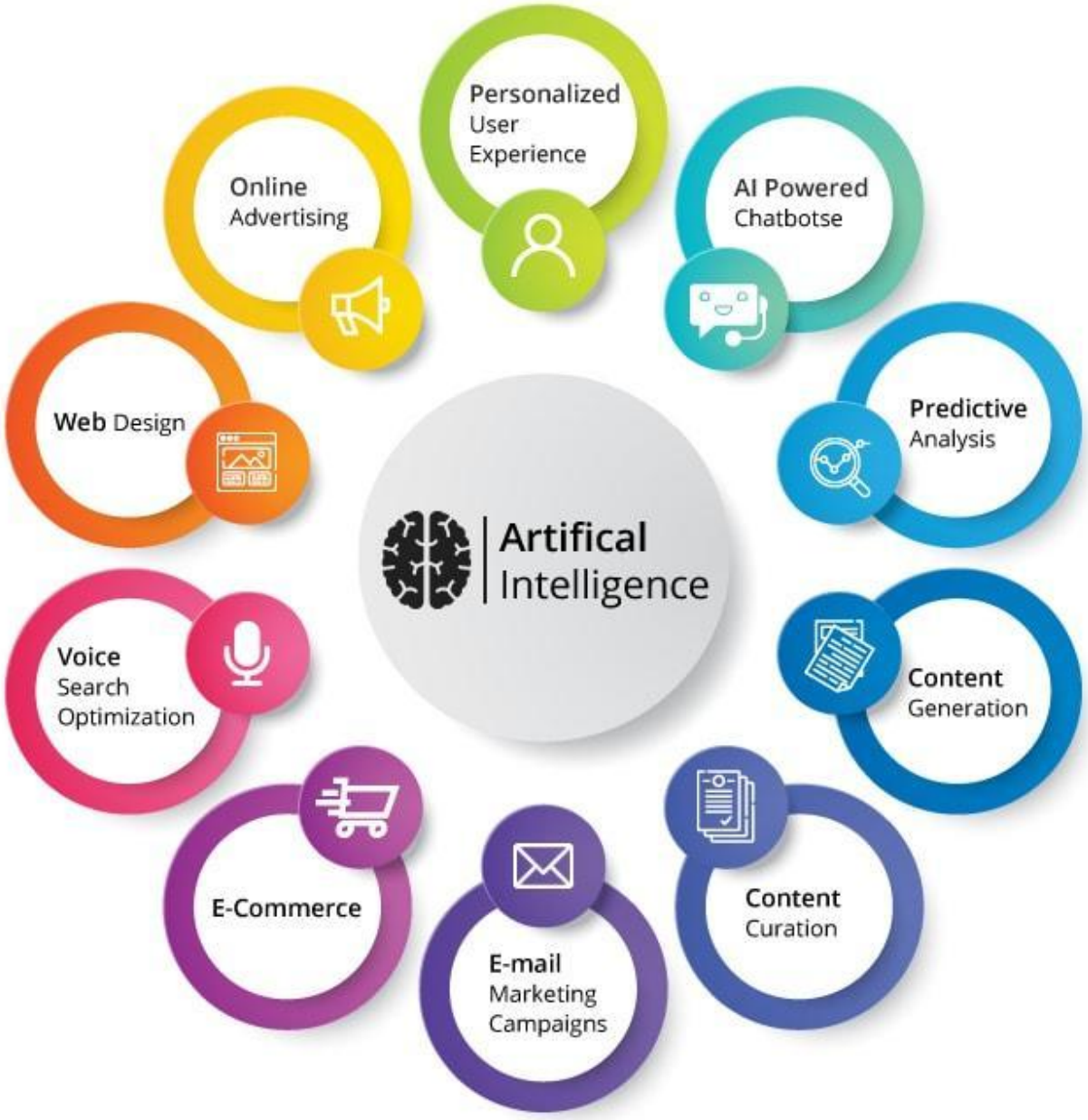
Artificial Intelligence

Introduction to AI

Dr. Partha Pakray

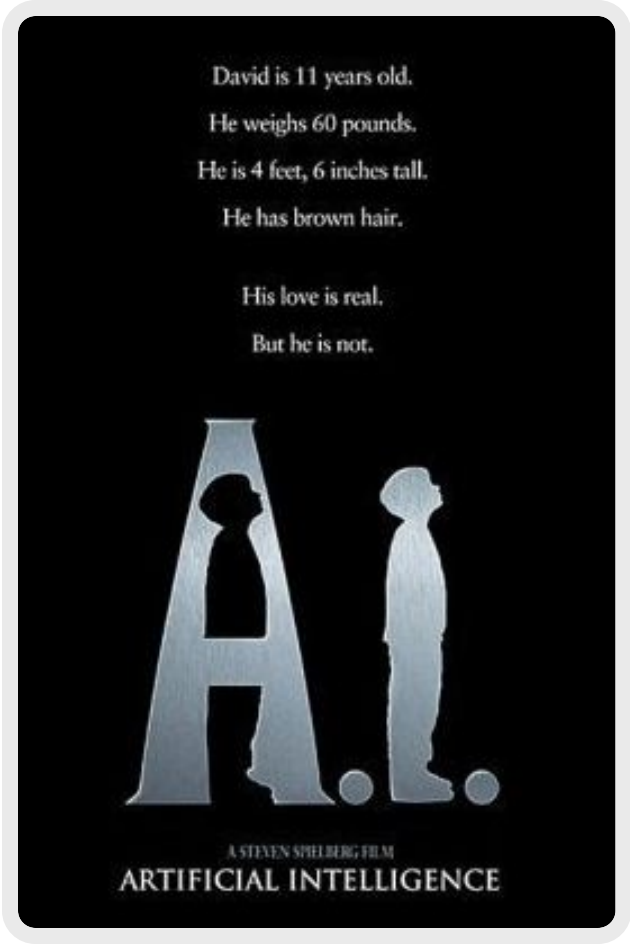

What do you think
Artificial Intelligence is?

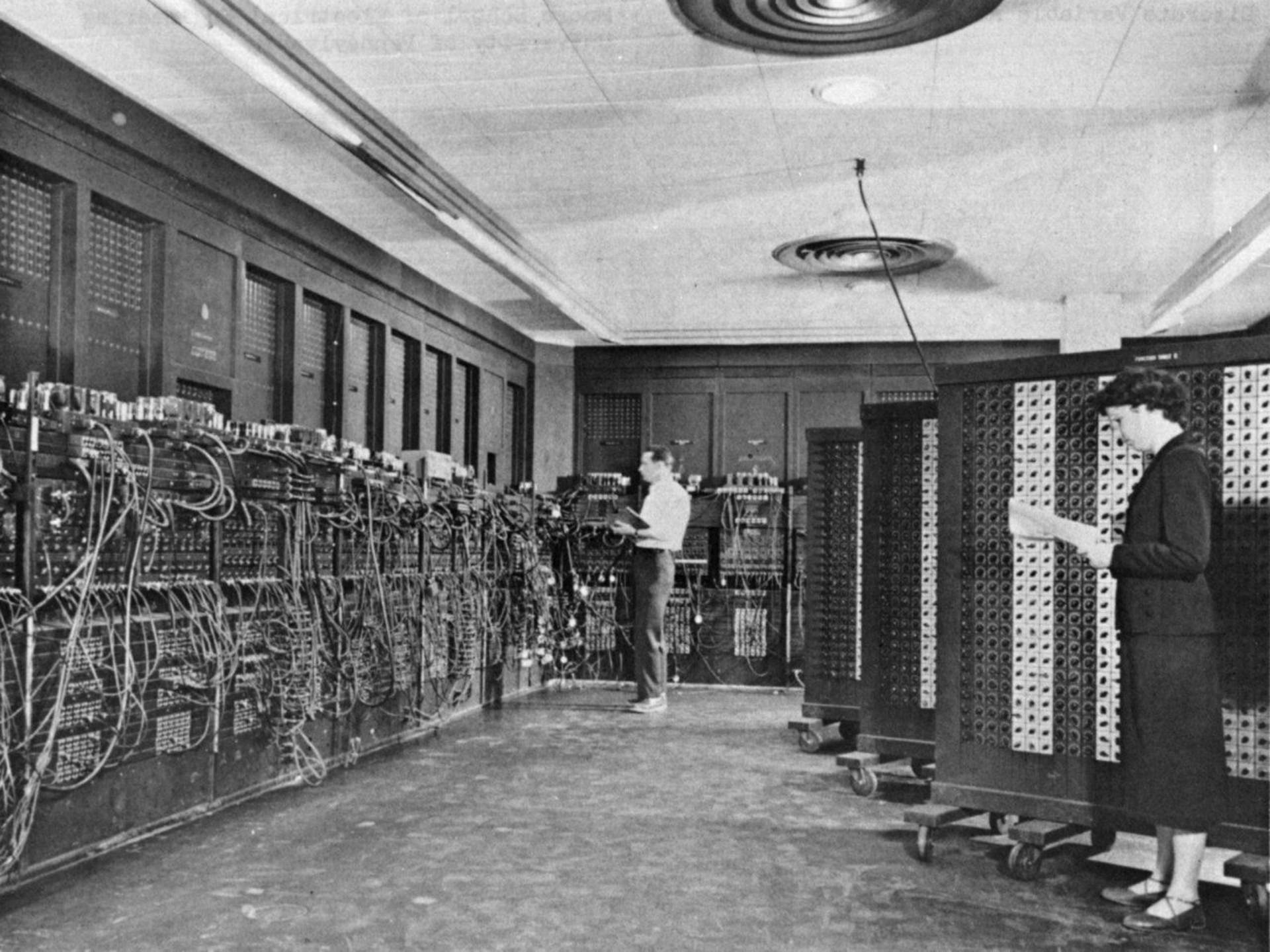
AI in Real Life

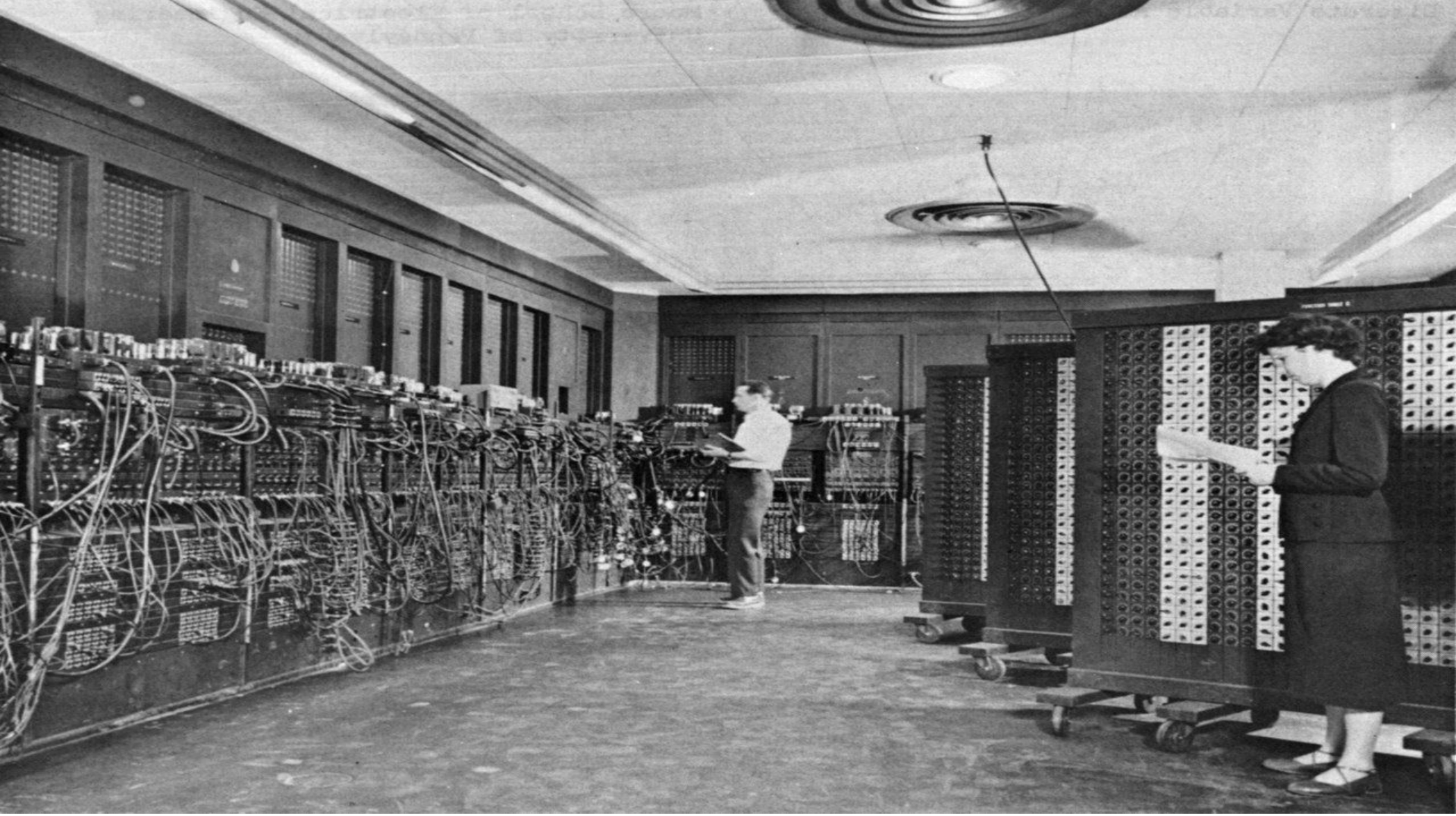


Introduction

- Brief History
- Definition of AI
- Example AI System
- AI Approaches







ENIAC (Electronic Numerical Integrator And Computer) in Philadelphia, Pennsylvania. Glen Beck (background) and Betty Snyder (foreground) program the ENIAC in building 328 at the Ballistic Research Laboratory (BRL).

ENIAC was completed in 1945 and first put to work for practical purposes on December 10, 1945.

https://en.wikipedia.org/wiki/ENIAC

History of AI

1943: McCulloch & Pitts: Boolean circuit model of brain

Article: "*A logical calculus of the ideas immanent in nervous activity*"

- Explaining for the first time how it is possible for neural networks to computer.

1951: Marvin Minsky and Dean Edmonds built SNARC

SNARC

Stochastic Neural Analog Reinforcement Computer

First Neural Network Machine
Marvin Minsky, 1951

One of 40 "neurons"

In the real world, A.I. innovation started in the 1950's.

Source: http://cyberneticzoo.com/mazesolvers/1951-maze-solver-minsky-edmonds-american/

- **1950**: Turing
  - Turing's "Computing Machinery and Intelligence”

- **1956**: birth of AI
  - Dartmouth meeting: “**Artificial Intelligence**” name adopted

Source: https://www.chessprogramming.org/index.php?title=John_McCarthy&mobileaction=toggle_view_mobile

John McCarthy, (September 4, 1927 - October 23, 2011) was an American researcher in computer science and pioneer in the field of artificial intelligence. After short-term appointments at Princeton, Stanford, Dartmouth, and MIT, John McCarthy became a full professor at Stanford in 1962, where he remained until his retirement at the end of 2000. In 1955, McCarthy co-organized the Dartmouth Conference, where he coined the term Artificial intelligence, and introduced the idea of the Alpha-beta algorithm, to become their eponym. Alpha-beta was also approximated by Herbert Simon with Allen Newell and Arthur Samuel and was released to the public by Daniel Edwards and Timothy Hart in 1961 [4] and independently by Alexander Brudno in 1963. In 1958 at MIT, **John McCarthy created the Lisp programming language**.

- **1950**: Turing
  - Turing's "Computing Machinery and Intelligence”
- **1956**: birth of AI
  - Dartmouth meeting: “**Artificial Intelligence**” name adopted
- **1950s**: initial promise
  - Samuel's checkers program
  - Newell & Simon's Logic Theor
- **1955-65**: “great enthusiasm”
  - Newell and Simon: GPS, gener
  - Gelertner: Geometry Theorem
  - McCarthy: invention of LISP

- **1964**: Danny Bobrow shows that computers can understand ***Natural Language Processing*** well enough to solve algebra word problems correctly.
- **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.
- **1966-74:** AI discovers Computational Complexity.
- **1969**: SRI robot, demonstrated combining locomotion, perception and problem solving.

- **1969-85**: Adding domain knowledge
  - Development of knowledge-based systems
  - Success of rule-based expert systems,
    - E.g., DENDRAL, MYCIN

- **1986**: Rise of machine learning
  - Neural networks return to popularity
  - Major advances in machine learning algorithms and applications

- **1990**: Role of uncertainty
  - Bayesian networks as a knowledge representation framework

- **1990**'s: Major advances in all areas of AI

  - Machine Learning, data mining
  - Intelligent tutoring
  - Case based reasoning
  - Multi-agent planning, scheduling
  - Uncertain reasoning
  - Natural Language Understanding and Translation
  - Vision, Virtual Reality, games, etc.

- **1995**: ***AI as Science***
  - Integration of learning, reasoning, knowledge representation
  - AI methods used in vision, language, data mining, etc

Definition of AI

- Artificial Intelligence
  - is concerned with the design of ***intelligence*** in an ***artificial device***.
  - Term coined by McCarthy in 1956

Intelligence:

“the capacity to learn and solve problems”

Artificial Intelligence:

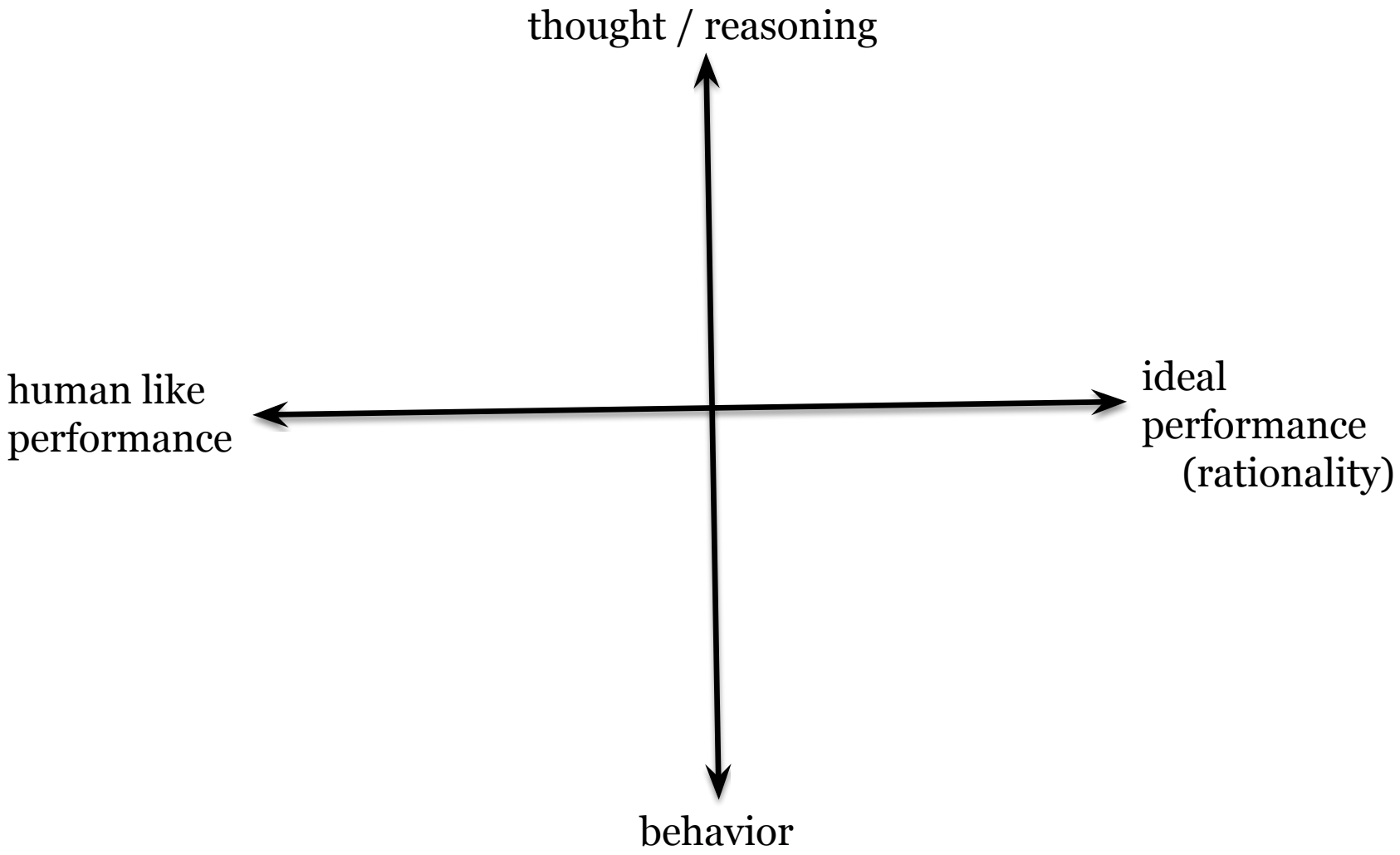
Artificial intelligence (AI) is the intelligence of machines and robots and the branch of computer science that aims to create it

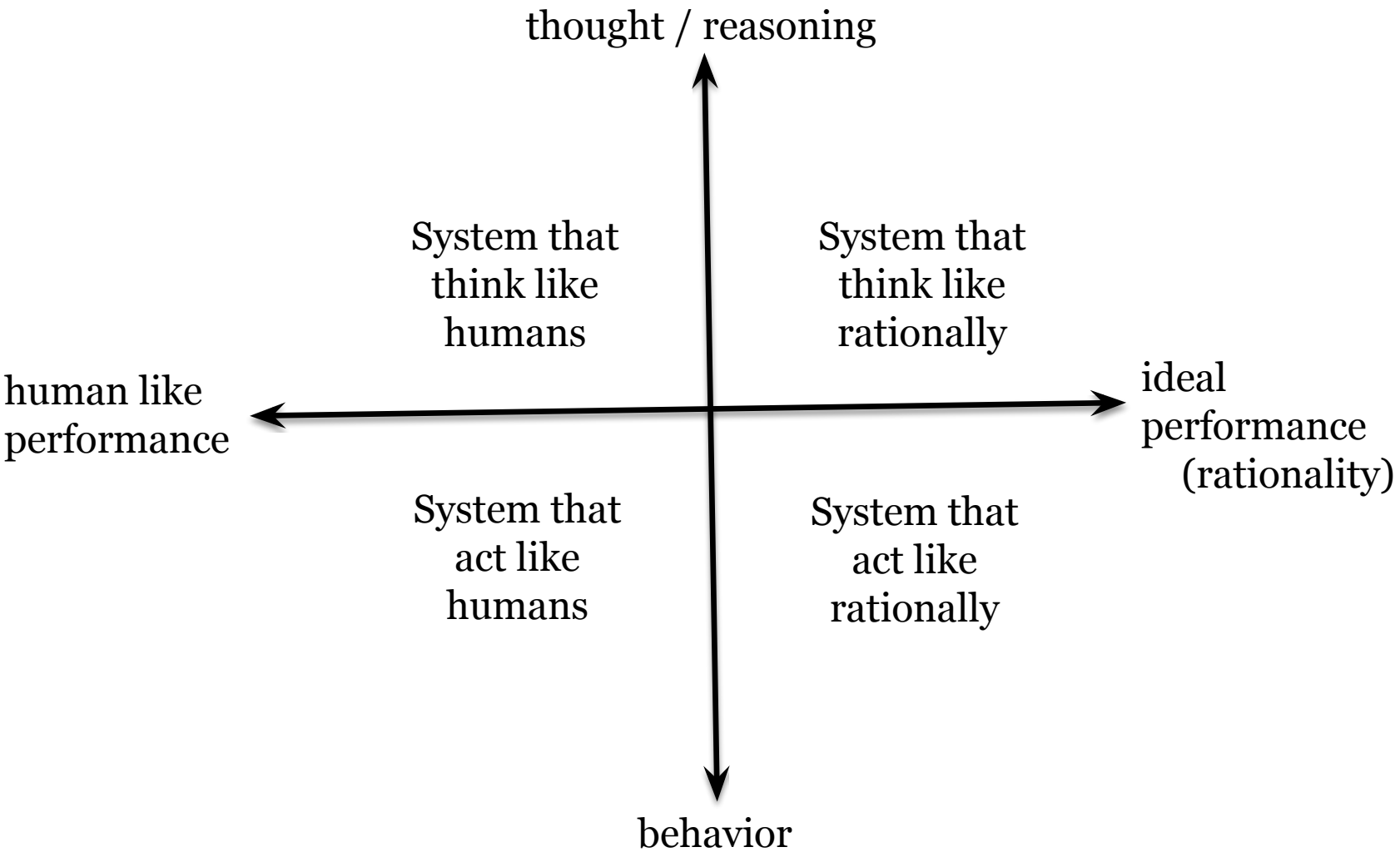
- the ability to solve problems
- the ability to act rationally
- the ability to act like humans

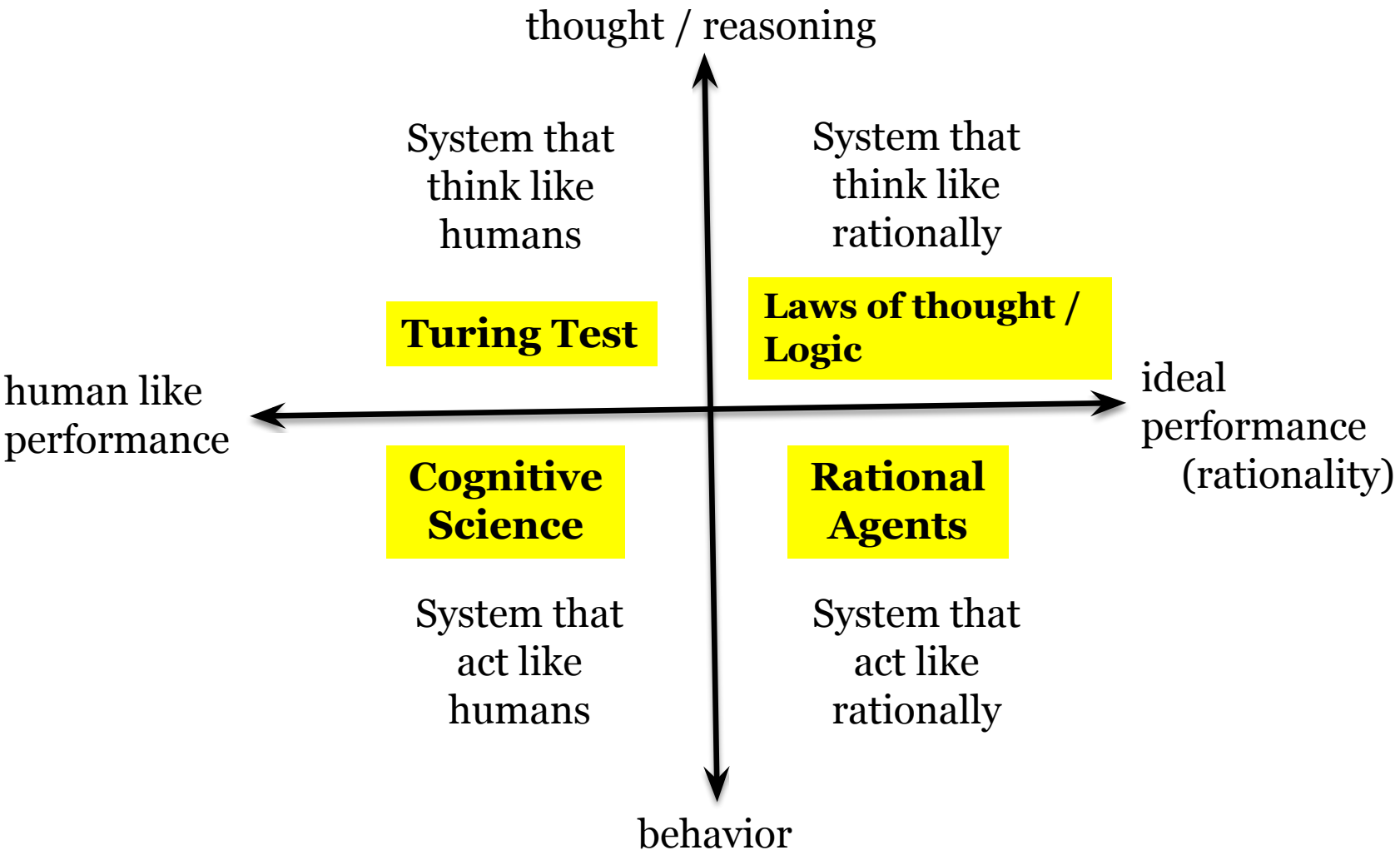
What is intelligence?

- Behave as intelligently as a human
- Behave in the best possible manner
- Thinking
- Acting

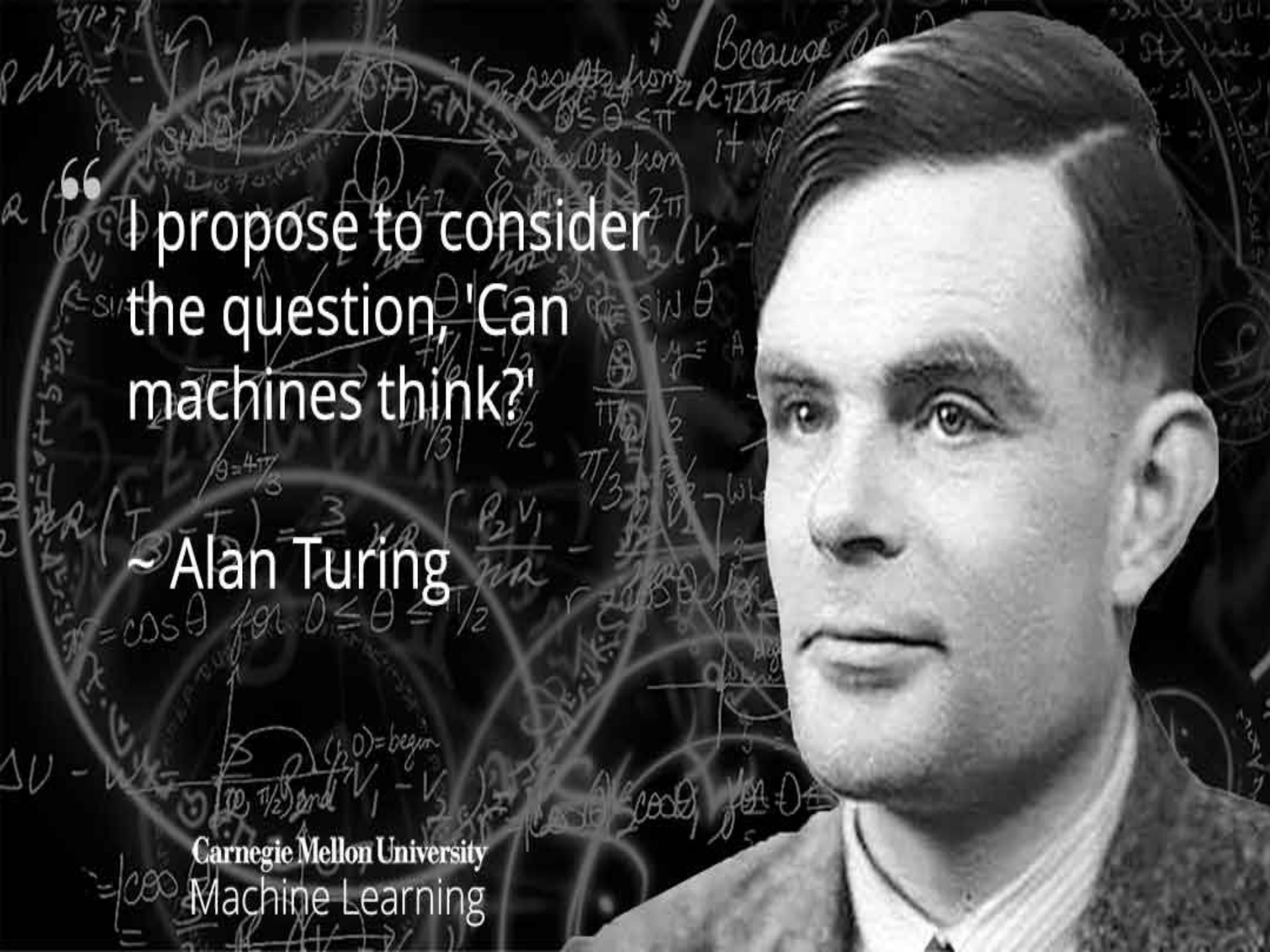
- What to look at
    - *thought processes/reasoning* vs. *behavior*
- How to **measure performance**
    - *Human-like performance* vs. *ideal performance*


thought / reasoning
human like performance
ideal performance (rationality)
behavior

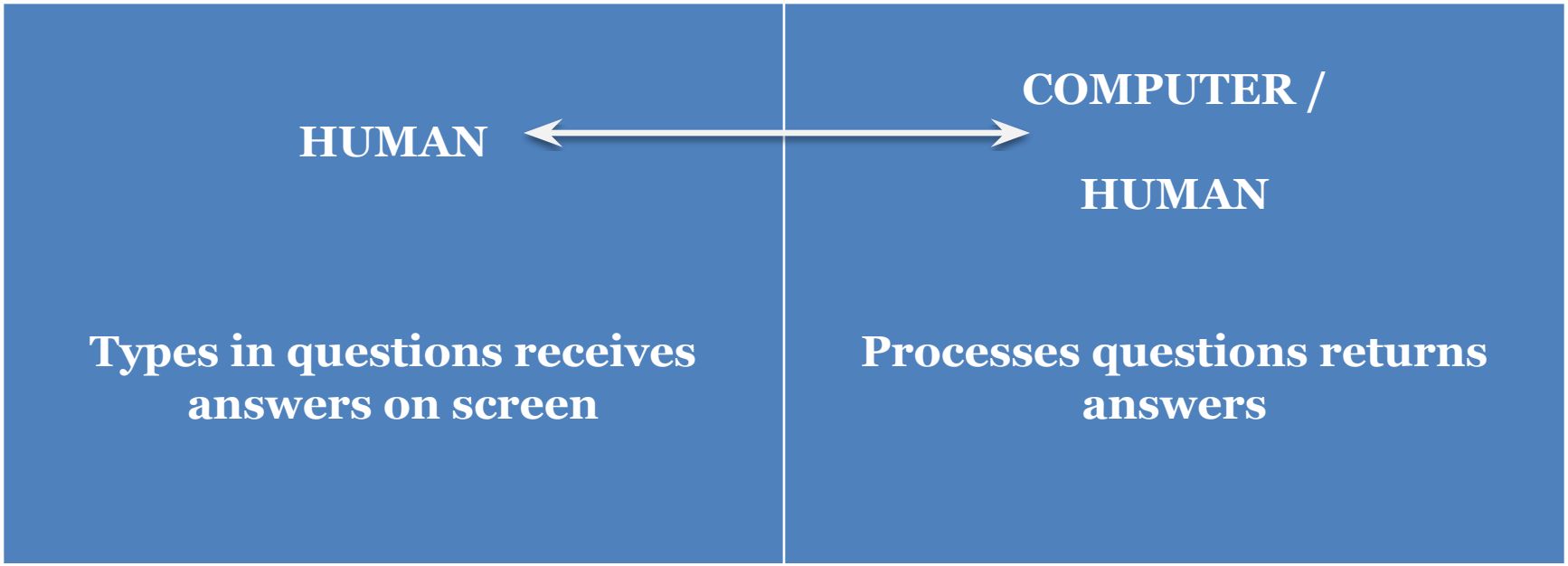

thought / reasoning
System that think like humans
System that think like rationally
human like performance
ideal performance (rationality)
System that act like humans
System that act like rationally
behavior


thought / reasoning
System that think like humans
System that think like rationally
Turing Test
Laws of thought / Logic
human like performance
ideal performance (rationality)
Cognitive Science
Rational Agents
System that act like humans
System that act like rationally
behavior

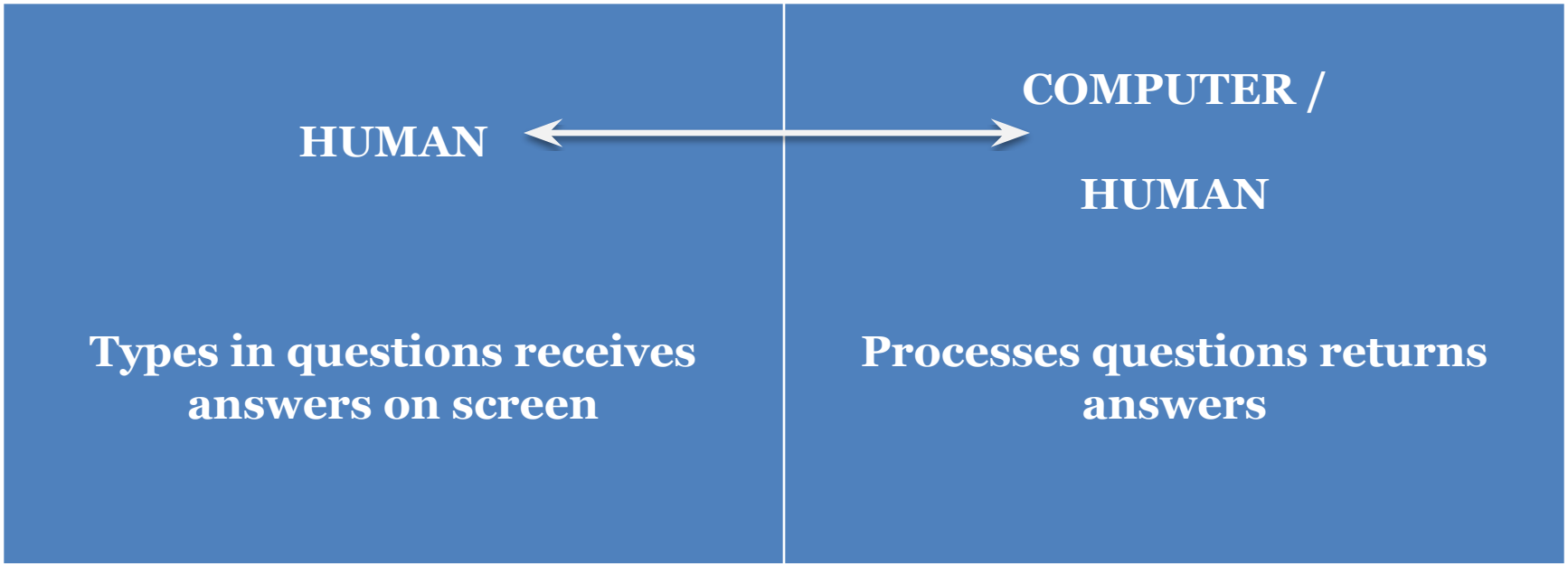
Can Machine Think?


“I propose to consider the question, 'Can machines think?'
~ Alan Turing
Carnegie Mellon University
Machine Learning

The Turing Test



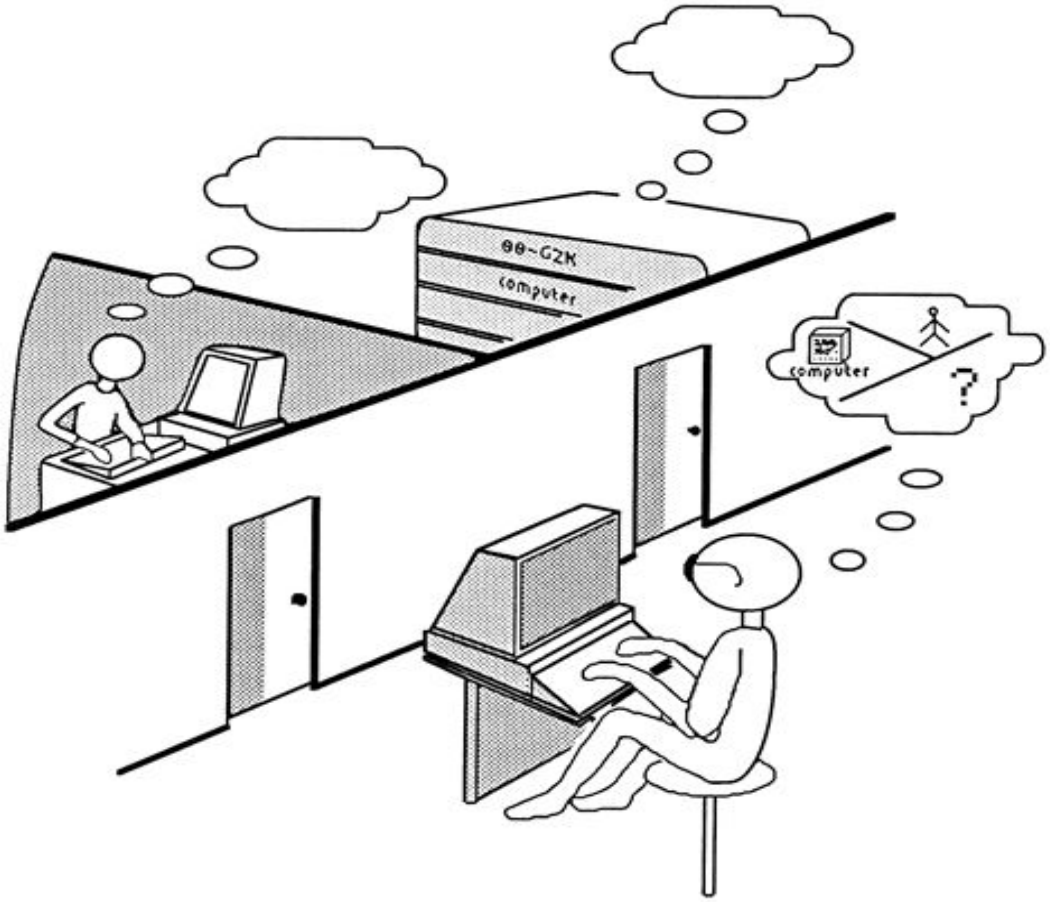
The Turing Test



Both claim to be the (intelligent) human

Interrogator must decide who is human?

The Turing Test



Result: The Turing Test

If the **interrogator** cannot reliably distinguish the human from the computer

Then the computer does possess (artificial) intelligence

Typical AI Problems

- Intelligent entities (or “Agents”) need to be able to do both “mundane” and “expert” tasks:

- “**Mundane**” Tasks:
    - Planning route, activity.
    - Recognizing (through vision) people, objects.
    - Communicating (through Natural Language)
    - Navigating round obstacles on the street
- “**Experts**” Task:
    - Medical Diagnosis
    - Mathematical Problem solving

What's easy and what's hard?

- It has been easier to mechanize many of the high-level tasks we usually associate with "intelligence" in people.

    - Symbolic integration
    - Proving theorems
    - Playing chess
    - Medical diagnosis

- It has been very hard to mechanize tasks that lots of animals can do
    - Walking around without running into things
    - Catching prey and avoiding predators
    - Interpreting complex sensory information
    - Modeling the internal states of other animals from their behavior

Intelligent behavior

- Perception
- Reasoning
- Learning
- Understanding Language
- Solving Problems

Application

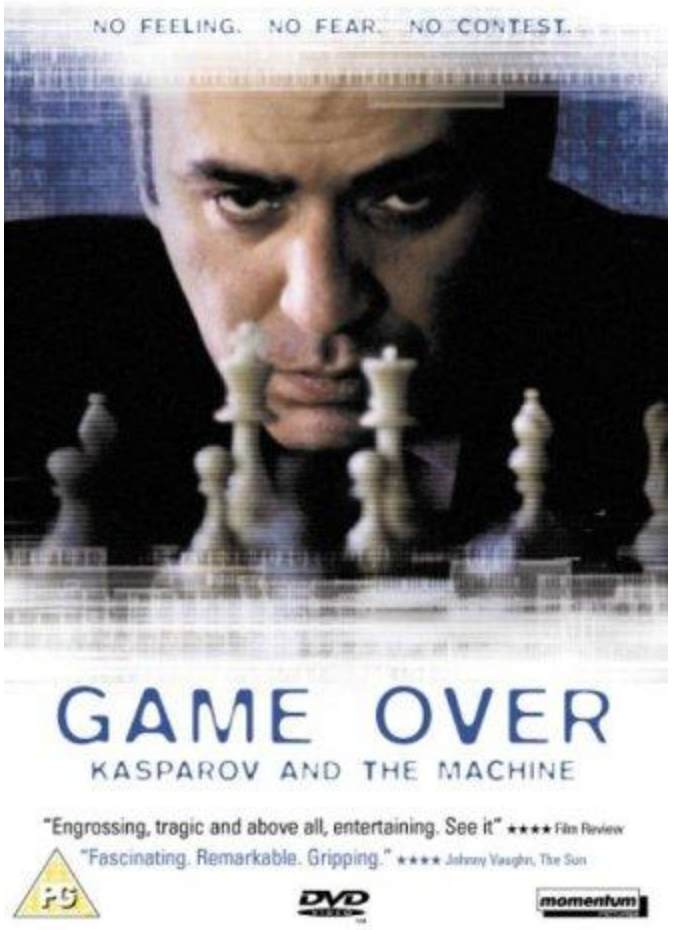
- Computer Vision
- Image Recognition
- Robotics
- Language Processing
- etc.

Practical Impact of AI

- AI Components are embedded in numerous devices e.g. copy machines.
- AI systems are in everyday use
    - Detecting credit card fraud
    - Configuring products
    - Aiding complex planning tasks
    - Advising physicians
- Intelligent tutoring systems provide students with personalized attention

Deep Blue

- 1997: The Deep Blue chess program beats. The current world chess champion, Gary Kasparov, in a widely followed match.



AI Topics

Core areas
- Knowledge representation
- Reasoning
- Machine Learning

Perception
- Vision
- Natural Language
- Robotics

Uncertainty
- Probabilistic approaches

General Algorithm
- Search
- Planning
- Constraint satisfaction

Applications
- Game playing
- AI and education
- Distributed agents

Decision Theory

Reasoning with symbolic data

Thank You!

Any Questions?