



**361CCS: Artificial Intelligence**  
**Prepared by Dr. Aliya Aleryani**

# Class Information

## Book:

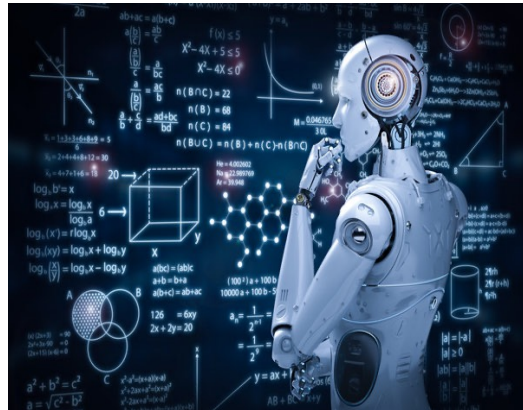
Artificial Intelligence: A Modern Approach  
Stuart Russell & Peter Norvig  
4<sup>th</sup> edition



# Why AI?



Labor



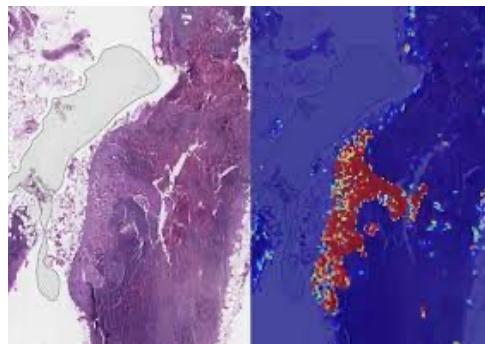
Science/Research



Search engines



Appliances



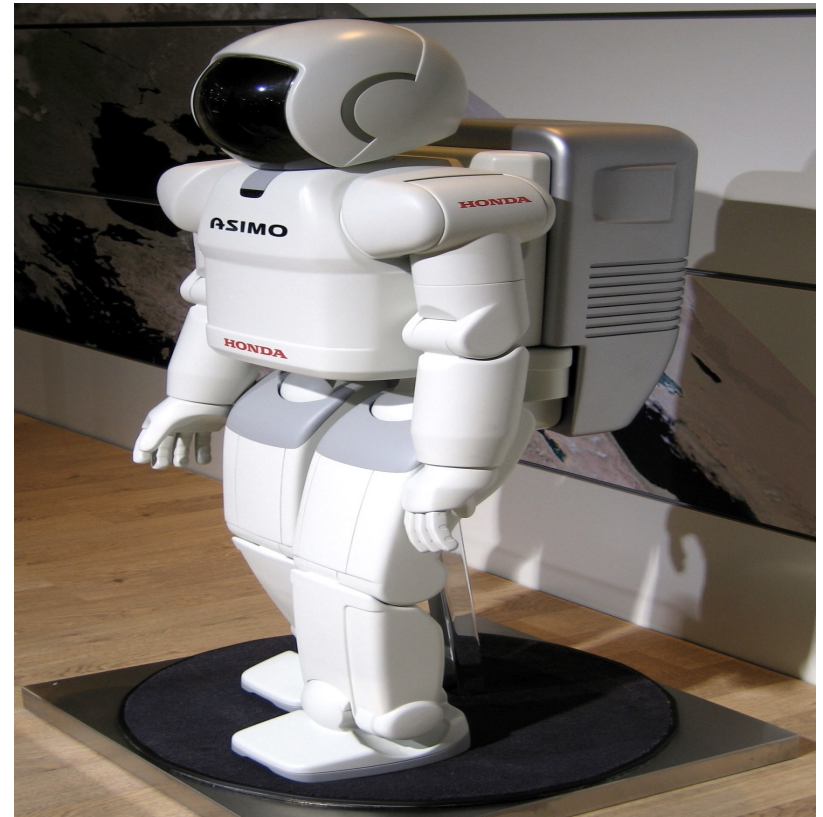
Medicine/Diagnosis



Recommendation

# Why AI?

- Honda ASIMO
  - Advanced Step in Innovation Mobility
- Humanoid Robot
- Capable of recognizing:
  - Moving objects
  - Postures
  - Gestures
  - Handshake
  - Sounds
- Capable of walking and running



<http://en.wikipedia.org/wiki/ASIMO>

# **Introduction – Chapter 1**



The background of the slide is a dark blue-purple gradient with a faint grid pattern. Overlaid on this is a white ECG (heart rate) line. The ECG line has several leads labeled: 'I', 'II', 'III' on the left; 'aVR', 'aVL', 'aVF' in the center; and 'V1', 'V2', 'V3' on the right. In the top left corner, there is a small white dot, a plus sign, and a zero.

# Chapter-1

# Topics

- AI Definition (Section 1.1)
- AI Foundation (Section 1.2)
- AI History (Section 1.3)
- State of Art (Section 1.4)
- AI Risks and Benefits (Section 1.5)

# AI Definition

- **The exciting new effort to make computers thinks ... *machine with minds*, in the full and literal sense” (Haugeland 1985)**
- **The automation of activities that we associate with human thinking, activities such as decision-making, problem solving, learning,...(Bellman, 1978)**

**Think Like Humans**

# AI Definition

- **“The art of creating machines that perform functions that require intelligence when performed by people” (Kurzweil, 1990)**
- **“The study of how to make computers do things at which, at the moment, people do better”, (Rich and Knight, 1991)**

**Act Like Humans**



# AI Definition

- **“The study of mental faculties through the use of computational models”,(Charniak et al. 1985)**
- **“The study of the computations that make it possible to perceive, reason and act”,(Winston, 1992)**

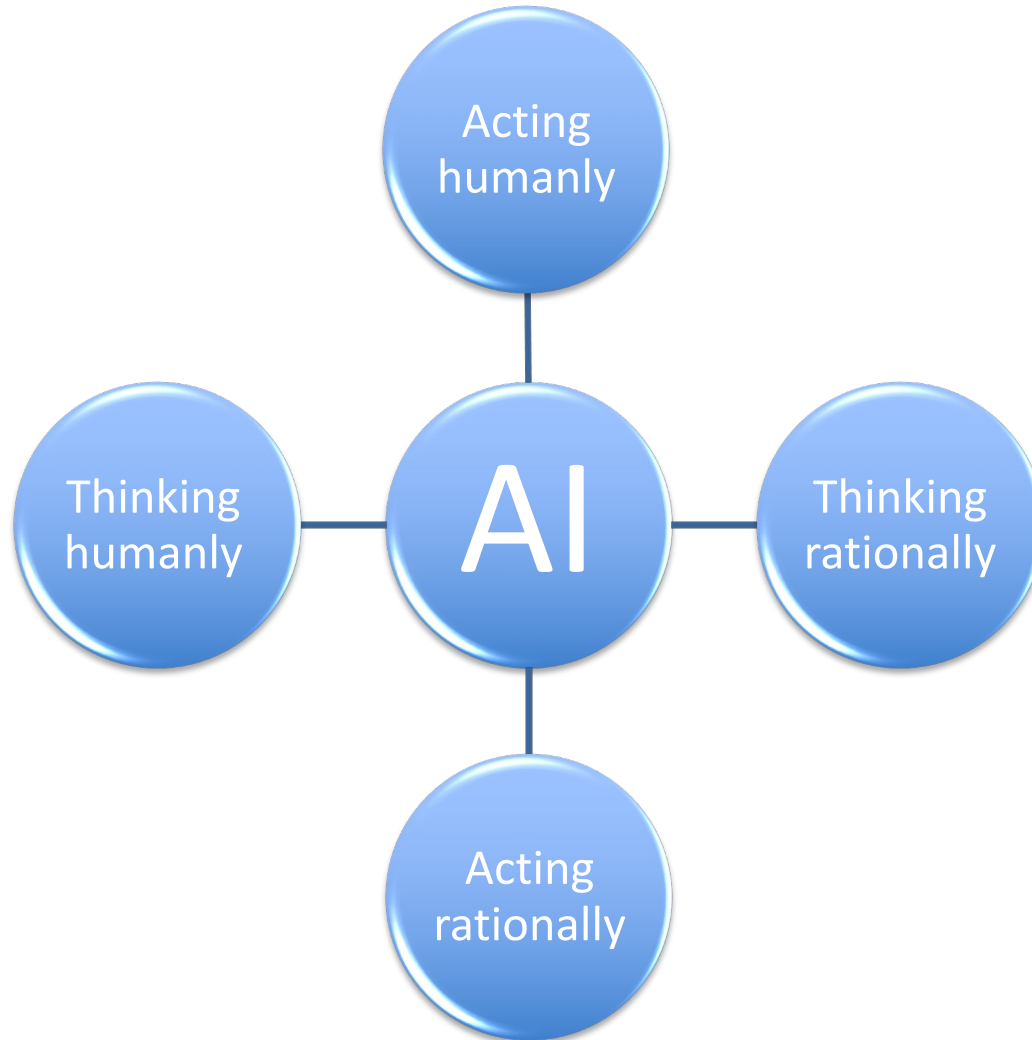
**Think Rationally**

# AI Definition

- **“Computational Intelligence is the study of the design of intelligent agents” (Poole et al, 1998)**
- **“AI....is concerned with intelligent behavior in artifact”, (Nilsson, 1998)**

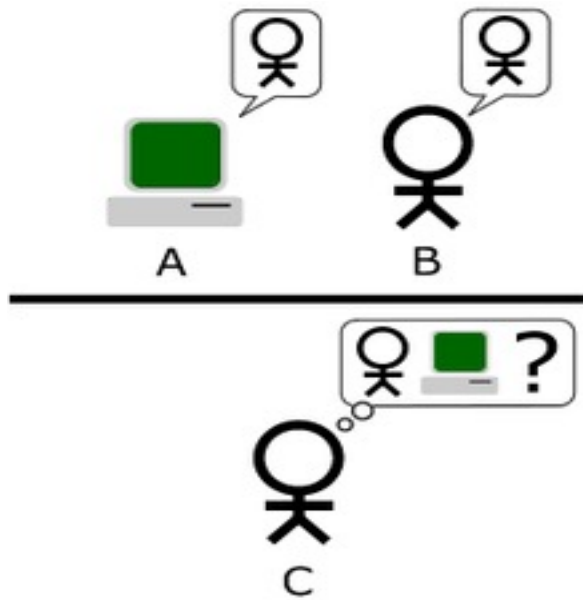
**Act Rationally**

# How to Achieve AI?



# Acting Humanly: The Turing Test

[http://en.wikipedia.org/wiki/Turing\\_test](http://en.wikipedia.org/wiki/Turing_test)



Alan Turing

1912-1954

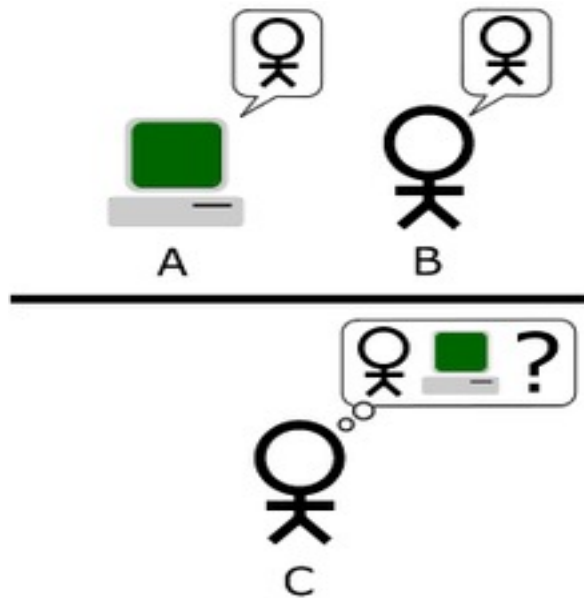
- To be intelligent, a program should simply act like a human

# Acting Humanly

- To pass the Turing test, the computer/robot needs:
  - **Natural language processing** to communicate successfully.
  - **Knowledge representation** to store what it knows or hears.
  - **Automated reasoning** to answer questions and draw conclusions using stored information.
  - **Machine learning** to adapt to new circumstances and to detect and extrapolate patterns.
  - These are the main branches of AI.

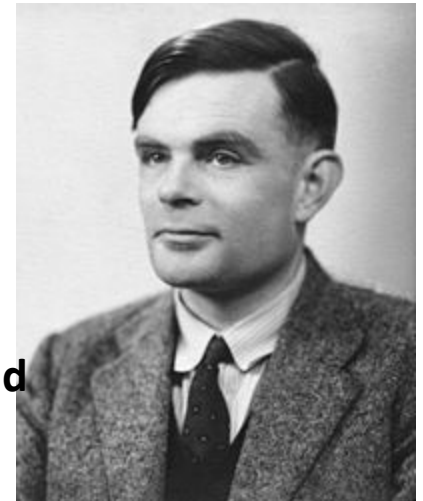
# Acting Humanly: The Turing Test

[http://en.wikipedia.org/wiki/Turing\\_test](http://en.wikipedia.org/wiki/Turing_test)



**+ physical interaction =>  
Total Turing Test**

- **Recognize objects and gestures**
- **Move objects**



Alan Turing  
1912-1954

- To be intelligent, a program should simply act like a human

# Acting Humanly – for Total Turing

- To pass the Turing test, the computer/robot needs:
  - **Natural language processing** to communicate successfully.
  - **Knowledge representation** to store what it knows or hears.
  - **Automated reasoning** to answer questions and draw conclusions using stored information.
  - **Machine learning** to adapt to new circumstances and to detect and extrapolate patterns.
  - **Computer vision** to perceive objects. (Total Turing test)
  - **Robotics** to manipulate objects and move. (Total Turing test)
  - These are the main branches of AI.



# Thinking Humanly

- Real intelligence requires thinking → think like a human !
- First, we should know how a human think
  - Introspect ones thoughts
  - Physiological experiment to understand how someone thinks
  - Brain imaging
- Then, we can build programs and models that think like humans
  - Resulted in the field of cognitive science: a merger between AI and psychology.

# Problems with Imitating Humans

- The human thinking process is difficult to understand: how does the mind raises from the brain ? Think also about unconscious tasks such as vision and speech understanding.
- Humans are not perfect ! We make a lot of systemic mistakes:

# Thinking Rationally

- Instead of thinking like a human : think rationally.
- Find out how correct thinking must proceed: **the laws of thought.**
- Aristotle syllogism: “Socrates is a man; all men are mortal, therefore Socrates is mortal.”
- This initiated logic: a traditional and important branch of mathematics and computer science.
- Problem: it is not always possible to model thought as a set of rules; sometimes there uncertainty.
- Even when a modeling is available, the complexity of the problem may be too large to allow for a solution.

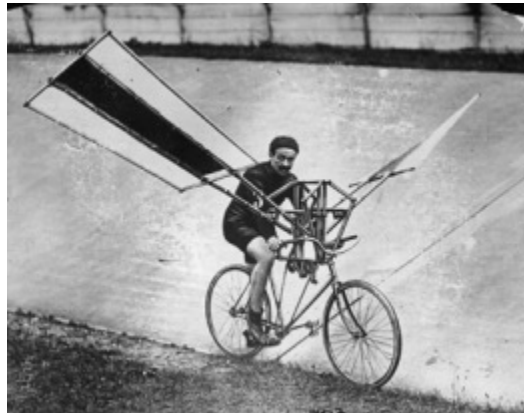
# Acting Rationally

- Rational agent: acts as to achieve the best outcome
- Logical thinking is only one aspect of appropriate behavior: reactions like getting your hand out of a hot place is not the result of a careful deliberation, yet it is clearly rational.
- Sometimes there is no correct way to do, yet something must be done.
- Instead of insisting on how the program should think, we insist on how the program should act: we care only about the final result.
- Advantages:
  - more general than “thinking rationally” and more
  - Mathematically principled; proven to achieve rationality unlike human behavior or thought

# Acting Rationally



This is how birds fly



Humans tried to mimic birds for centuries



This is how we finally achieved “artificial flight”

# The Foundations of AI



Philosophy

Logic, methods of reasoning and rationality.



Mathematics

Formal representation and proof, algorithms, computation, (un)decidability, (in)tractability, probability.



Economics

utility, decision theory (decide under uncertainty)



Neuroscience

neurons as information processing units.



Psychology/Cognitive Science

how do people behave, perceive, process information, represent knowledge.



Computer engineering

building fast computers



Control theory

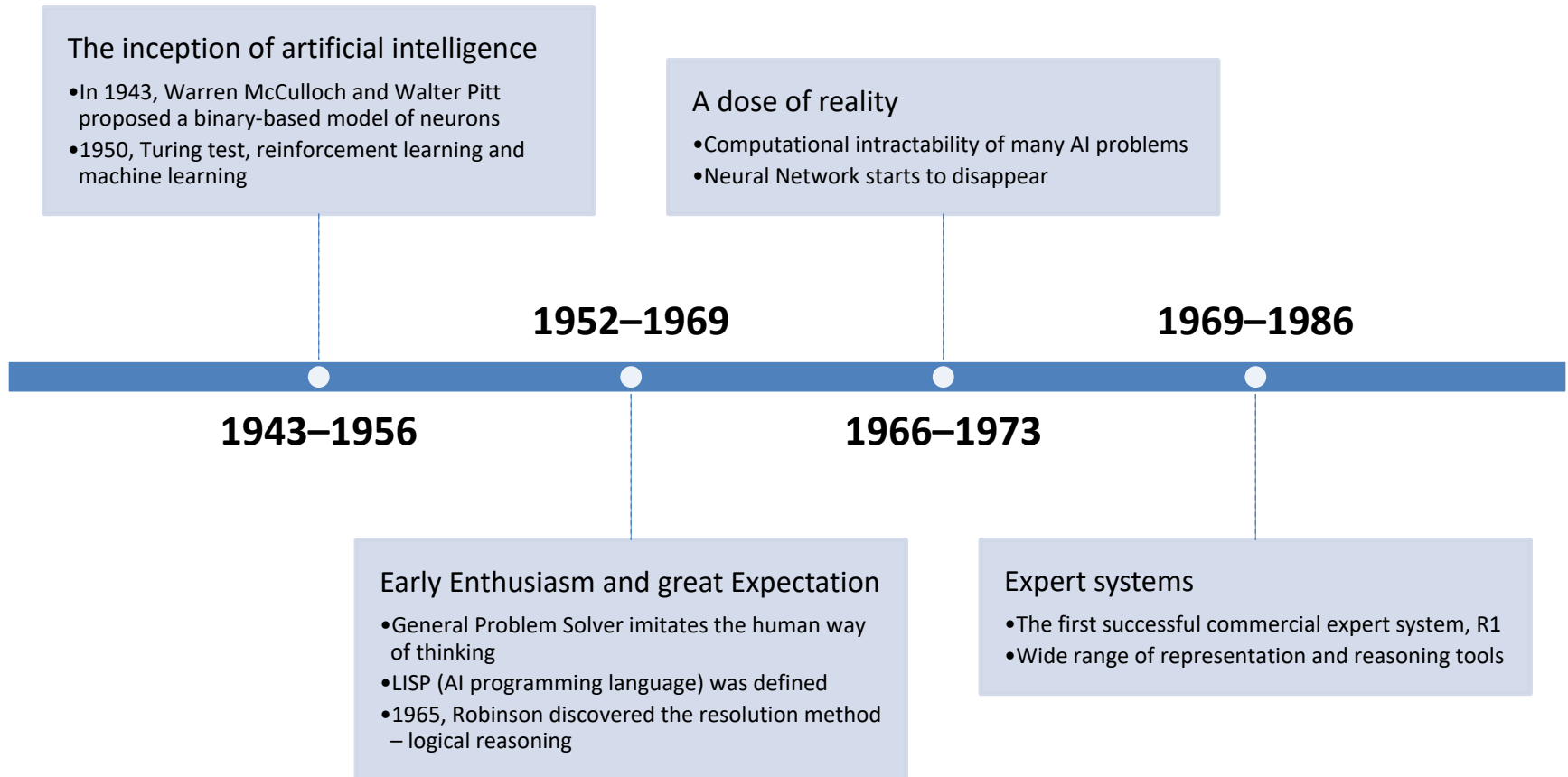
design systems that maximize an objective function over time



Linguistics

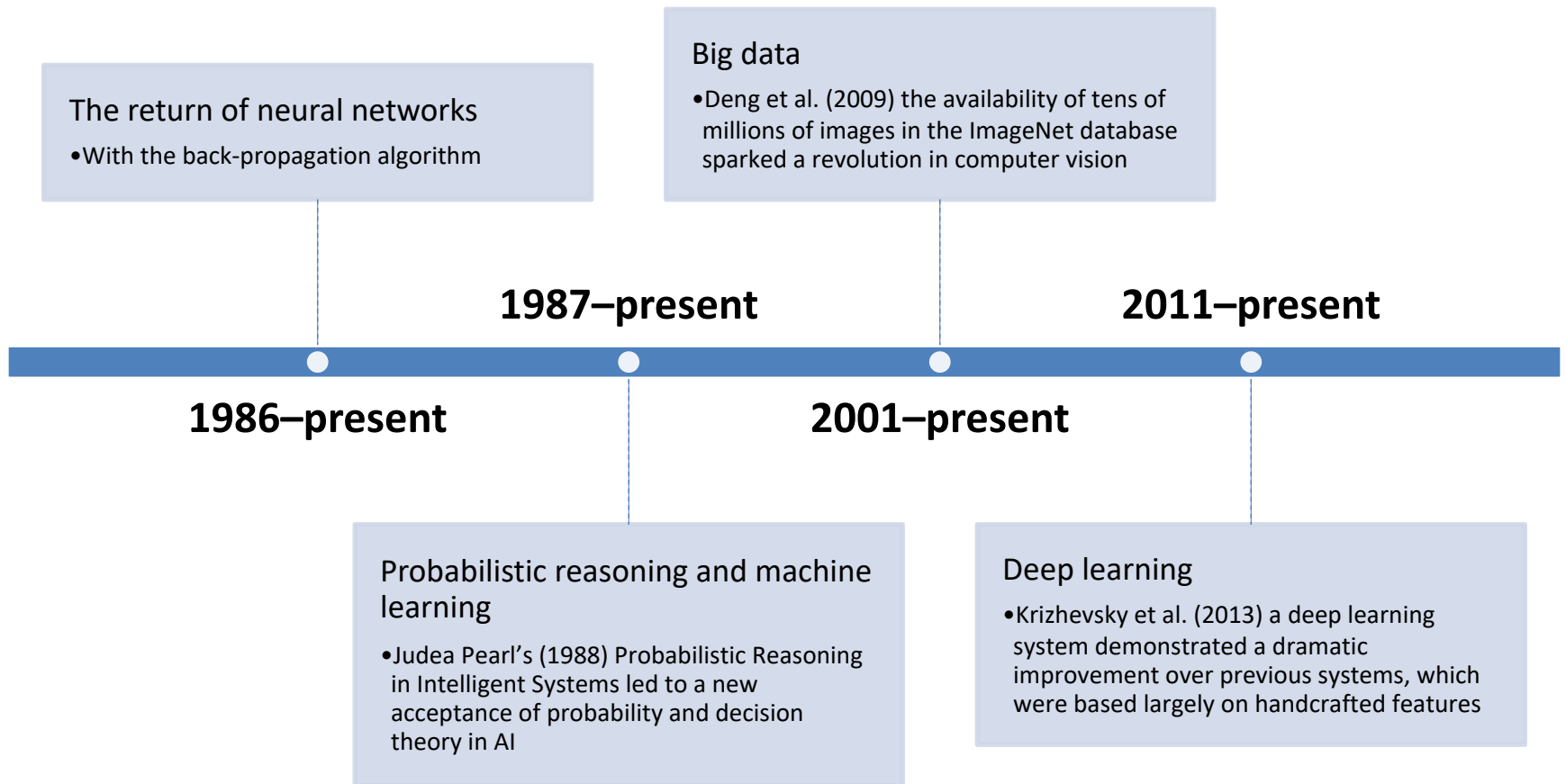
knowledge representation, grammar

# AI History

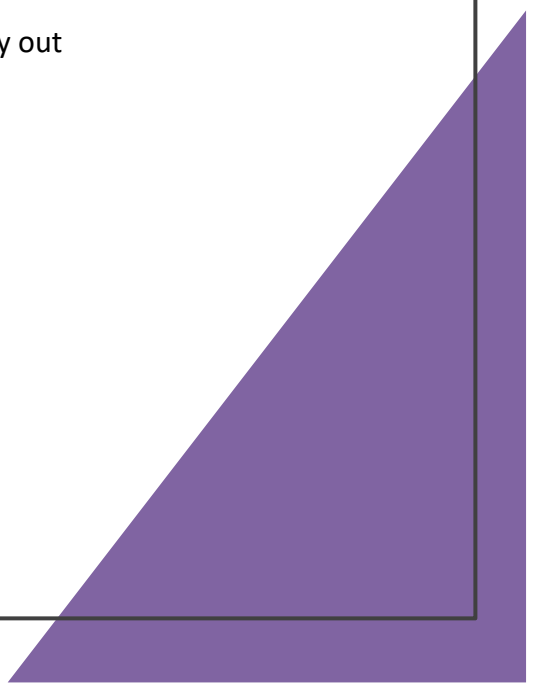




# AI History



# The State of the Art

- Robotics Vehicle
  - Speech Recognition
    - Alexa, Siri, and Google offer assistants that can answer questions and carry out tasks for the user
  - Autonomous Planning and Scheduling
    - Remote Agent: Plan and control spacecraft
    - Google Maps
  - Recommendations
    - Amazon, Facebook, Netflix, Spotify, YouTube and others
  - Image Understanding
  - Medicine
  - Machine Translation
  - Climate Science
- 

# AI Risks and Benefits

## Risks

- Lethal autonomous weapons
- Surveillance and persuasion
- Biased decision making
- Impact on employment
- Safety-critical applications
- Cybersecurity

## Benefits

- Free humanity from menial repetitive work
- Increase the production of goods and services
- Diseases treatments
- Solutions for climate change and resource shortages

