



**Wolkite University**  
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**Chapter One : Introduction to Artificial intelligence**

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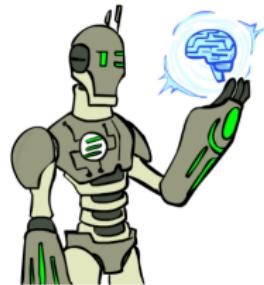
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# Outline

- 1 Introduction
- 2 Goals of Artificial Intelligence
- 3 History of Artificial Intelligence
- 4 The Foundations of AI
- 5 Types of Artificial Intelligence
- 6 The State of the Art
- 7 Summary

# Introduction to AI

- What is artificial intelligence?
- Where are we and how did we get here?
- How do we think about the design of AI systems?



Cont..



- **With artificial intelligence we are summoning the demon – Elon Musk**

Cont..

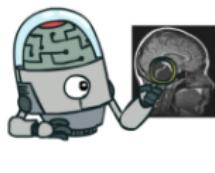


- We're really closer to a smart washing machine than Terminator – Fei-Fei Li, Director of Stanford AI Lab.

Cont..

- **Artificial intelligence** is the science of making machines or programs that:

*Think like people*



*Think rationally*



*Act like people*

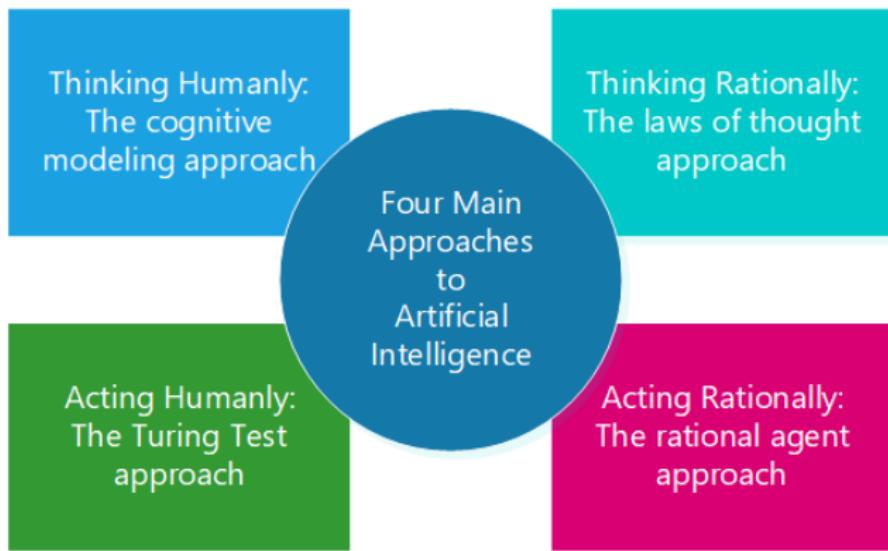


*Act rationally*



Cont..

- Views of AI fall into four categories



Cont..

- What is AI?

	Like humans	Not necessarily like humans
Think	Systems that think like humans	Systems that think rationally
Act	Systems that act like humans	Systems that act rationally

Cont..

- The four approaches of AI

- **Acting humanly**

- The Turing test approach.

- **Thinking humanly**

- The cognitive modeling approach.

- **Thinking rationally**

- The laws of thought approach.

- **Acting rationally**

- The rational agent approach.

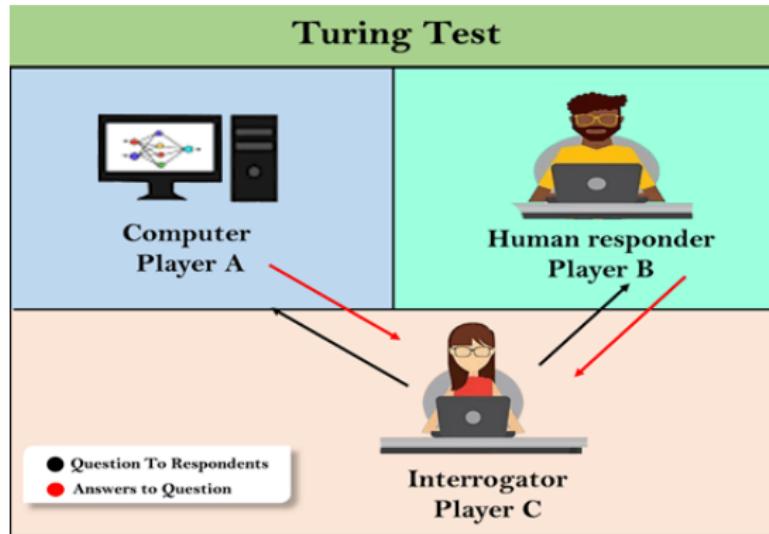
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## The Turing test approach

- Computing machinery and intelligence
  - A human questioner cannot tell if there is a computer or
  - a human answering his question, via teletype (remote communication)
  - The computer must behave intelligently
- 
- Intelligent behavior
    - to achieve human-level performance in all cognitive tasks

Cont..

- Operational test for intelligent behavior: the Imitation Game

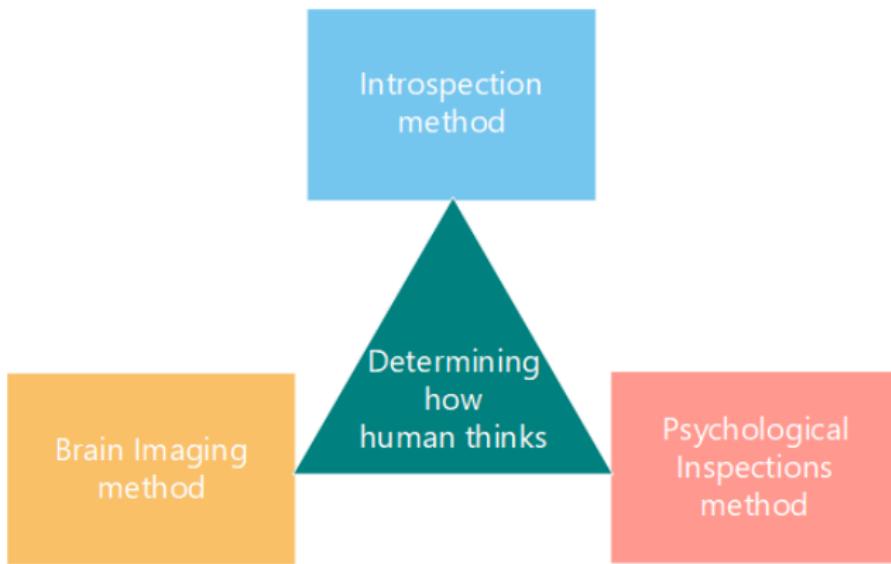


- These cognitive tasks include:

- Natural language processing
  - for communication with human
- Knowledge representation
  - to store information effectively and efficiently
- Automated reasoning
  - to retrieve and answer questions using the stored information
- Machine learning
  - to adapt to new circumstances

Cont..

- **Thinking humanly:** cognitive modeling



Cont..

- **Thinking humanly:** cognitive modeling

- Introspection method
  - Catch our thoughts and see how it flows.
- Psychological Inspections method
  - Observe a person on the action.
- Brain Imaging method (MRI (Magnetic resonance imaging))
  - Observe a person's brain in action.

## Thinking rationally: "laws of thought"

- Aristotle: what are correct arguments/thought processes?
- Several Greek schools developed various forms of logic: notation and
- rules of derivation for thoughts; may or may not have proceeded to the idea of mechanization
- Direct line through mathematics and philosophy to modern AI

### Problems:

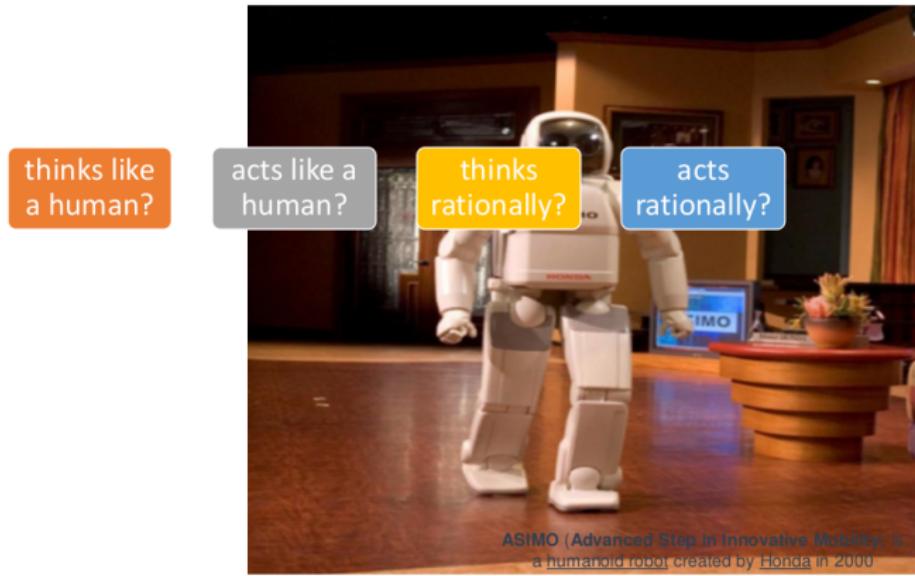
- Not all intelligent behavior is mediated by logical deliberation
- What is the purpose of thinking? What thoughts should I have?

## • Acting rationally: "rational agent"

- Act to achieve goals, given set of beliefs
- Rational behavior is doing the “right thing”
- Thing which expects to maximize goal achievement
- Rational agents
  - An agent is an entity that perceives and
  - acts in the world (i.e. an “autonomous system” (e.g. self-driving cars) / physical robot or software robot (e.g. an electronic trading system))

# Goals of Artificial Intelligence

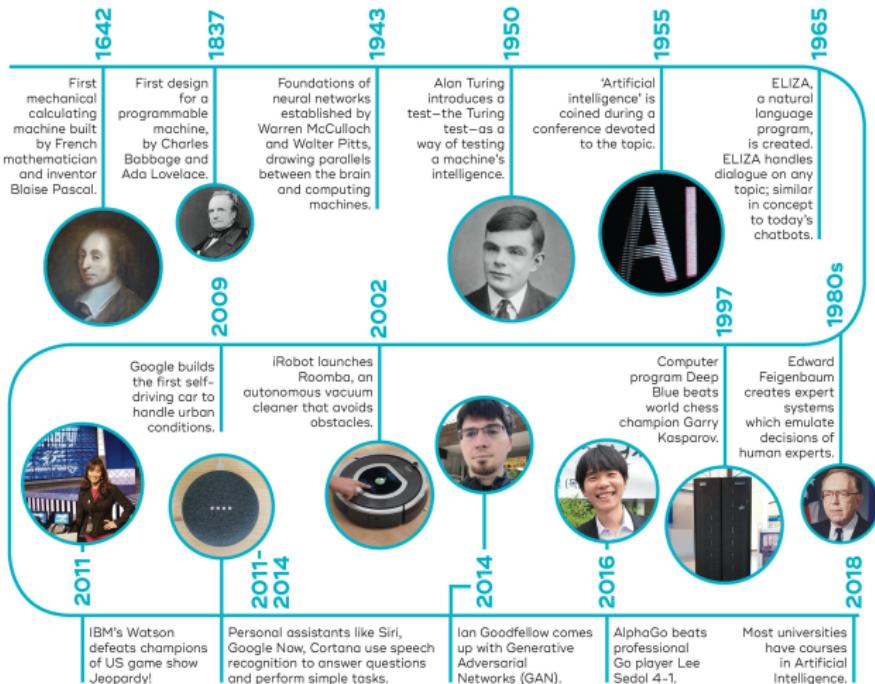
Create an agent that



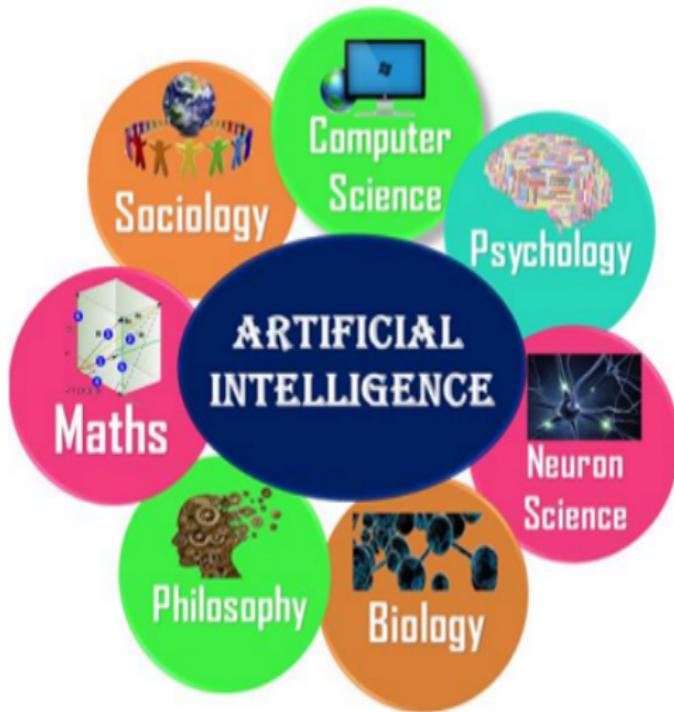
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- Replicate human intelligence
- Solve Knowledge-intensive tasks
- An intelligent connection of perception and action
- Building a machine which can perform tasks that requires human intelligence
- Creating some system which can exhibit intelligent behavior,

# History of Artificial Intelligence



# The Foundations of AI



Cont..

- **Philosophy**
  - Logic, methods of reasoning, mind as physical
  - system foundations of learning, language, rationality
- **Mathematics**
  - Formal representation and proof algorithms,
  - computation, (un)decidability, (in)tractability, probability
- **Economics**
  - utility, decision theory, game theory
- **Neuroscience** physical substrate for mental activity
- **Psychology** phenomena of perception and motor control, experimental techniques
- **Computer engineering** building fast computers
- **Control theory** design systems that maximize an objective function over time
- **Linguistics** knowledge representation, natural language

# Types of Artificial Intelligence

- Artificial Intelligence can be divided into various types based on
  - **capabilities** and **functionality of AI**
- **Based on capabilities** AI can be divided into :
  - Weak AI or Narrow AI
  - General AI
  - Super AI
- **Based on the functionality**
  - Reactive Machines
  - Limited Memory
  - Theory of Mind
  - Self-Awareness

Cont..

- **Weak AI or Narrow AI**

- A type of AI which is able to perform a dedicated task with intelligence.
- The most common and currently available AI is Narrow AI in the world of Artificial Intelligence.
- It Cannot perform beyond its field or limitations, as it is only trained for one specific task.
- It Can fail in unpredictable ways if it goes beyond its limits.

- **General AI**

- A type of intelligence that could perform any intellectual task with efficiency like a human.
- The idea behind the general AI to make such a system that could be smarter and think like a human on its own.
- Currently, there is no such system exists which could come under general AI.

Cont..

- **Super AI**

- A level of Intelligence of Systems at which machines could surpass human intelligence, and
- can perform any task better than a human with cognitive properties.
- This refers to aspects like general wisdom, problem solving and creativity.
- It is an outcome of general AI.
- Super AI is still a hypothetical concept of Artificial Intelligence.
- The development of such systems in real is still a world-changing task.

Cont..

- **Reactive Machines**

- Purely reactive machines are the most basic types of Artificial Intelligence.
- Such AI systems do not store memories or past experiences for future actions.
- These machines only focus on current scenarios and react on it as per possible best action.
- IBM's Deep Blue system is an example of reactive machines.
- Google's AlphaGo is also an example of reactive machines.

- **Self-Awareness**

- Self-awareness AI is the future of Artificial Intelligence.
- These machines will be super intelligent and will have their own consciousness, sentiments, and self-awareness.
- These machines will be smarter than the human mind. Self-Awareness AI does not exist in reality still and it is a hypothetical concept.

Cont..

- **Limited Memory**

- Limited memory machines can store past experiences or some data for a short period of time.
- These machines can use stored data for a limited time period only.
- Self-driving cars are one of the best examples of Limited Memory systems.
- These cars can store the recent speed of nearby cars, the distance of other cars, speed limits, and other information to navigate the road.

- **Theory of Mind**

- Theory of Mind AI should understand human emotions, people, beliefs, and
- be able to interact socially like humans.
- This type of AI machines is still not developed, but researchers are making lots of efforts and
- improvement for developing such AI machines

# The State of the Art

- **Machine learning**
- **Speech recognition:** banking agent, travel agent
- **Autonomous planning and scheduling:** NASA's autonomous planning programs
- **Game playing:** IBM's Deep Blue, Google's AlphaGo
- **Spam fighting**
- **Logistic planning:** to do automated logistics planning and scheduling for transportation.
- **Robotics:** Roomba that helps cleaning, PackBots that handle hazardous materials, clear explosives and identify location of snipers
- **Machine translation**

# Cont..

## Computer Vision



Semantic  
Segmentation

102 benchmarks

1874 papers with code



Image  
Classification

240 benchmarks

1652 papers with code



Object  
Detection

209 benchmarks

1410 papers with code



Image  
Generation

155 benchmarks

632 papers with code



Denoising

100 benchmarks

612 papers with code

## Natural Language Processing



Language  
Modelling

21 benchmarks

1182 papers with code



Machine  
Translation

69 benchmarks

1135 papers with code



Question  
Answering

90 benchmarks

1066 papers with code



Sentiment  
Analysis

57 benchmarks

687 papers with code



Text  
Generation

62 benchmarks

515 papers with code

# Cont..

## Speech



### Speech Recognition

116 benchmarks

472 papers with code



### Speech Synthesis

2 benchmarks

106 papers with code



### Dialogue Generation

9 benchmarks

86 papers with code



### Speech Enhancement

11 benchmarks

80 papers with code



### Voice Conversion

1 benchmark

62 papers with code

## Medical



### Medical Image Segmentation

81 benchmarks

177 papers with code



### Drug Discovery

14 benchmarks

125 papers with code



### Lesion Segmentation

6 benchmarks

86 papers with code



### Medical Diagnosis

3 benchmarks

53 papers with code



### Brain Tumor Segmentation

8 benchmarks

53 papers with code

Cont..

## Latest AI projects across industries

Robotics



Self- Driving



Voice Assistant



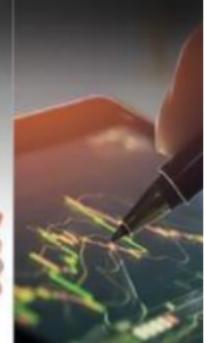
Healthcare



Consumer Electronics



Financial Advisor

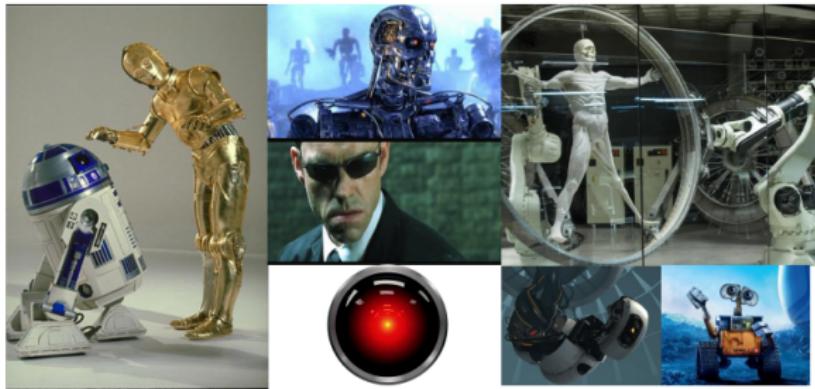


# What can an AI do today?

- Translate spoken Chinese to spoken English, live?
- Answer multi choice questions, as good as an 8th grader?
- Converse with a person for an hour?
- Play decently at Chess? Go? Poker? Soccer?
- Buy groceries on the web? in a supermarket?
- Prove mathematical theorems?
- Drive a car safely on a parking lot? in New York?
- Perform a surgery?
- Identify skin cancer better than a dermatologist?

Cont..

- Movie AI



Cont..

- Real world AI



Cont..

- News of AI

TECH + ARTIFICIAL INTELLIGENCE

## United Kingdom Plans \$1.3 Billion Intelligence Push

France to spend \$1.8 billion on compete with U.S., China

EU wants to invest €18b development

## China's Got a Huge Artificial Intelligence Plan

"Whoever leads in AI will rule the world": Putin to Russian children on Knowledge Day

Published time: 1 Sep, 2017 14:08  
Updated time: 1 Sep, 2017 14:45



# Cont..

- ► Speech translation and synthesis (2012)
- ► Speech synthesis and question answering (Google 2018)
- ► Playing soccer (2018)
- ► although some robots might now do better (2021)
- ► Learning to walk (2017)
- ► NVIDIA Autonomous Car
- ► Write computer code (OpenAI, 2021)

# AI Ethics

- **Unemployment**

- We need money for food, rent, medical care and We work to earn money.
- What if AI takes over our jobs?

- **Technology addiction**

- AI is used to trigger our behavior
- Interaction with technology can be highly addictive
- Social media, email, ... How long can you be without your cellphone and feel perfectly comfortable?
- Are AI's better company than humans?

- **Human safety**

- How can we be sure that the AI/machine does not make mistakes?

- **Cyber security**

- Very powerful AI systems should not fall into the wrong hands, e.g. weapons

Cont...

- **Robot rights**

- The AI will be conscious. Is that a ground for treating it the same as a human?
- Will AI in the future be sentient? Would that be ground to treating it as a human?
- When AI is smarter and more capable as humans and animals what protective rights do they need?

- ► Stuart Russel talks about AI and ethics

# Summary

- Different people approach AI with different goals in mind.
- According to what we have called the standard model, AI is concerned mainly with rational action.
- An ideal intelligent agent takes the best possible action in a situation.
- Mathematicians provided the tools to manipulate statements of logical certainty as well as uncertain, probabilistic statements.
- AI has matured considerably compared to its early decades, both theoretically and methodologically.
- As AI systems find application in the real world,
- it has become necessary to consider a wide range of risks and ethical consequences.