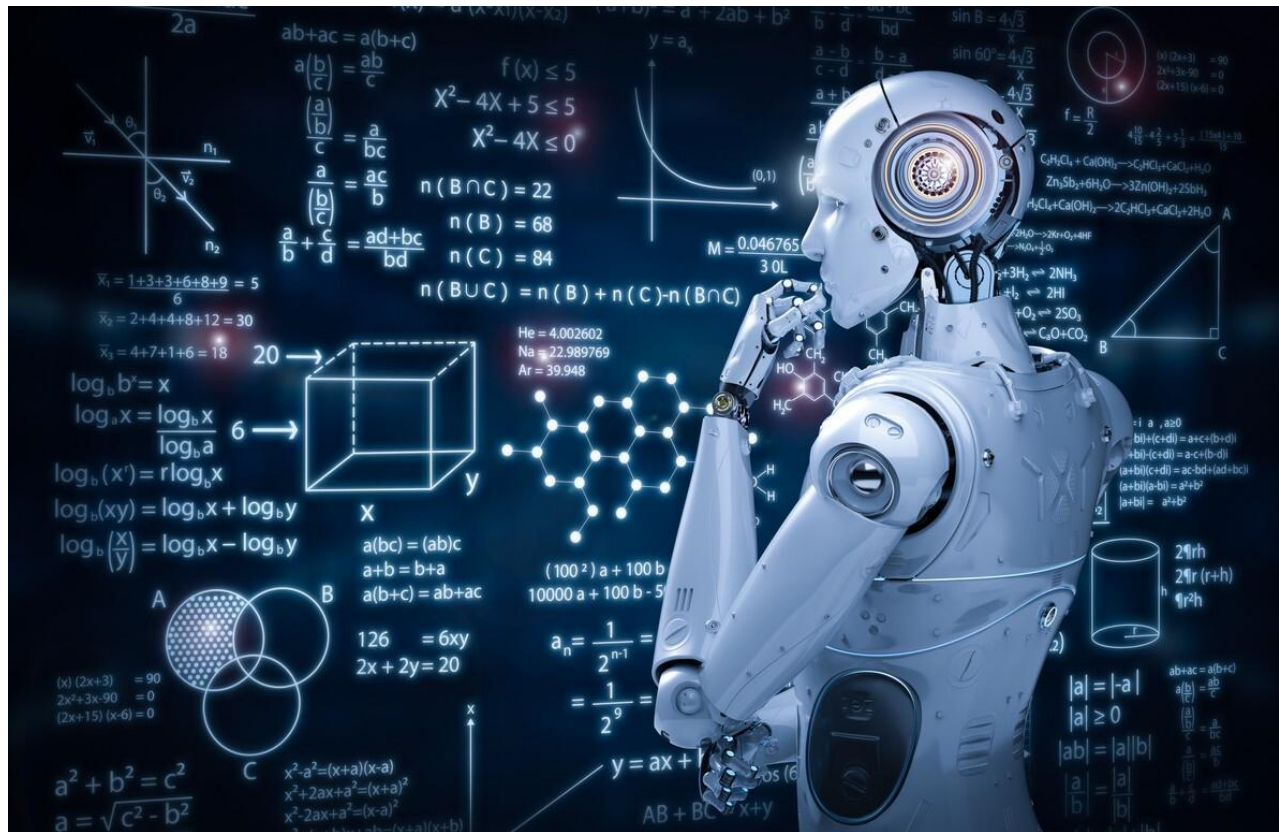


Artificial Intelligence

Introduction

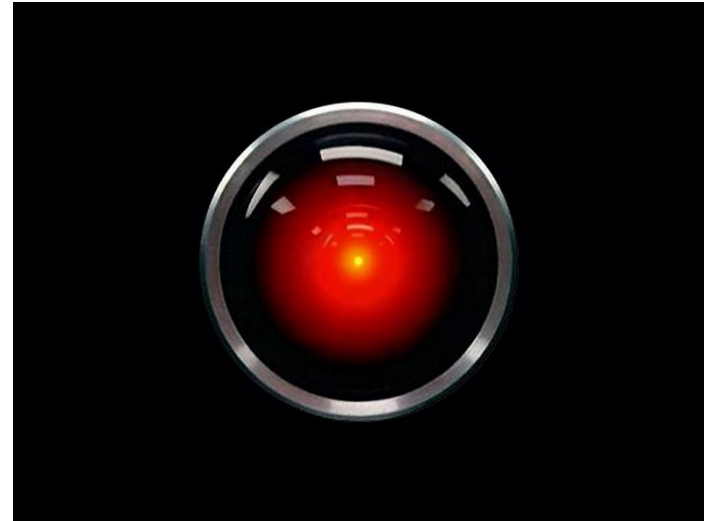
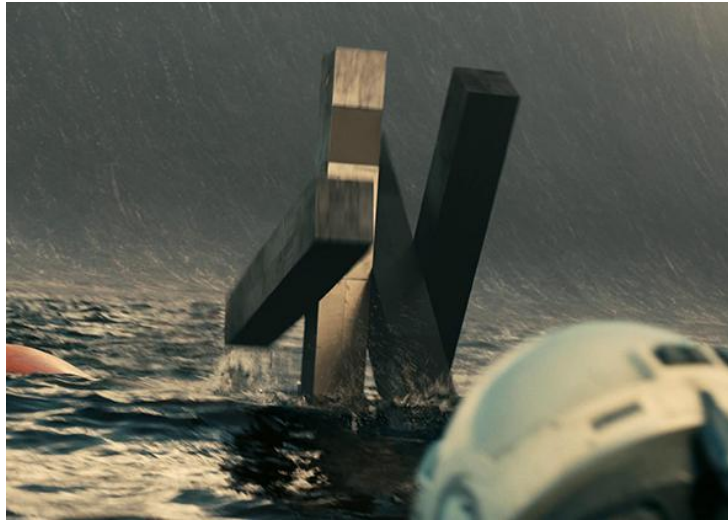


Dr. Srijith P K
Computer Science and Engineering
IIT Hyderabad

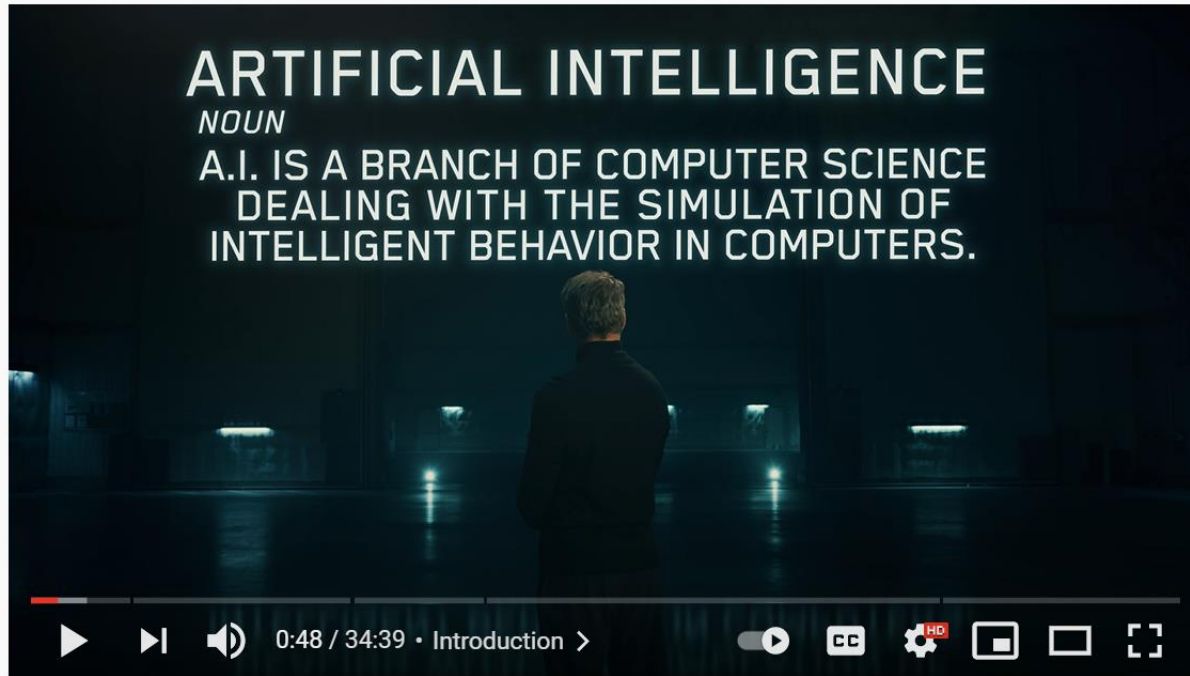
Artificial Intelligence



AI in the movies



Artificial Intelligence



Watch the full series ad-free
with YouTube Premium

TRY IT FREE



THE AGE OF A.I. S1 • E2

Healed through A.I. | The Age of A.I.

YouTube Originals ✓

1 year ago

AI has several sub-areas (problem domains)

- Robotics
- Game playing
- Speech processing
- Natural language processing
- Computer vision
- Planning

Machine learning

The technique (solution) behind modern AI

<https://www.youtube.com/watch?v=UwsrzCVZAb8>

Applications of AI : Robotics

Robotics: Awesome robots today!

NAO, ASIMO, and more!



Credit: By Momotarou2012, via Wikimedia Commons.

https://youtu.be/Bg_tJvCA8zw

<https://youtu.be/Ml9v3wHLuWI>

Applications of AI : Game playing

Chess (1997): Kasparov vs. IBM Deep Blue



(Left) Copyright 2007, S.M.S.I., Inc. - Owen Williams, The Kasparov Agency, via Wikimedia

Commons (Right) By James the photographer, via Wikimedia Commons

Powerful search algorithms!

<https://youtu.be/NJarxpYyoFI>

Applications of AI : Game playing

Jeopardy! (2011): Humans vs. IBM Watson



By Rosemaryetoufee (Own work), via Wikimedia Commons

Natural Language Understanding and information extraction!

<https://youtu.be/P18EdAKuC1U>

Applications of AI : Game playing

Go (2016): Lee Sedol versus Google AlphaGo

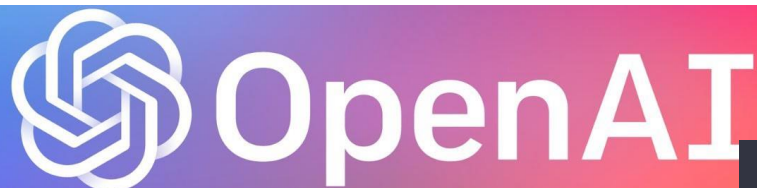


(Left) By LG Electronics, via Wikimedia Commons (Right) By Google DeepMind, via
Wikimedia Commons

Deep Learning, reinforcement learning, and search algorithms!

https://youtu.be/8tq1C8spV_g

Applications of AI : ChatGPT



CHATGPT



SR

what to teach in the first lecture of artificial intelligence



The first lecture of an Artificial Intelligence (AI) course should provide an overview of the field and introduce its fundamental concepts that can be covered in a first AI lecture:

1. Definition of AI: A brief overview of what AI is and its applications.
2. History of AI: A brief history of AI research and development from the 1950s to the present day.
3. AI applications: Examples of AI applications in various domains, such as medicine, finance, robotics, and more.
4. AI techniques: An introduction to the main techniques used in AI, such as machine learning, computer vision, natural language processing, and more.

<https://chat.openai.com/chat>

SR

tell me about first year computer science students at IIT Hyderabad



First year computer science students at IIT Hyderabad are typically part of the Bachelor of Technology (B.Tech) program in Computer Science and Engineering. They study a range of fundamental computer science topics, including programming, algorithms, data structures, computer architecture, and databases. In addition to these core subjects, students may also have the opportunity to explore areas of specialization, such as artificial intelligence, computer networks, and software engineering. 👍 🗨️

The curriculum is designed to provide students with a strong foundation in the theoretical and practical aspects of computer science, as well as the skills needed to apply this knowledge to real-world problems. The coursework is rigorous and demanding, but students are supported by a dedicated faculty and have access to state-of-the-art facilities and resources.

Overall, first year computer science students at IIT Hyderabad are poised to embark on a challenging and rewarding journey of learning and discovery in one of the most dynamic and rapidly-growing fields of study today.

Applications of AI : Speech

- Virtual assistants: Siri (Apple), Echo (Amazon), Google Now, Cortana (Microsoft).
- “They” helps get things done: send an email, make an appointment, find a restaurant, tell you the weather and more.
- Leverage deep neural networks to handle **speech recognition** and **natural language understanding**.



Applications of AI : Natural language processing

<https://pdos.csail.mit.edu/archive/scigen/#generate>

Deconstructing Information Retrieval Systems with ThitseeLye

Srijith and Maunendra

Abstract

Courseware and telephony, while typical in theory, have not until recently been considered unfortunate. In fact, few physicists would disagree with the construction of XML. our focus in this work is not on whether the foremost interactive algorithm for the confirmed unification of 802.11b and neural networks runs in $\Omega((n + \log n) + \log n)$ time, but rather on presenting a system for collaborative configurations (ThitseeLye). Although it might seem counterintuitive, it fell in line with our expectations.

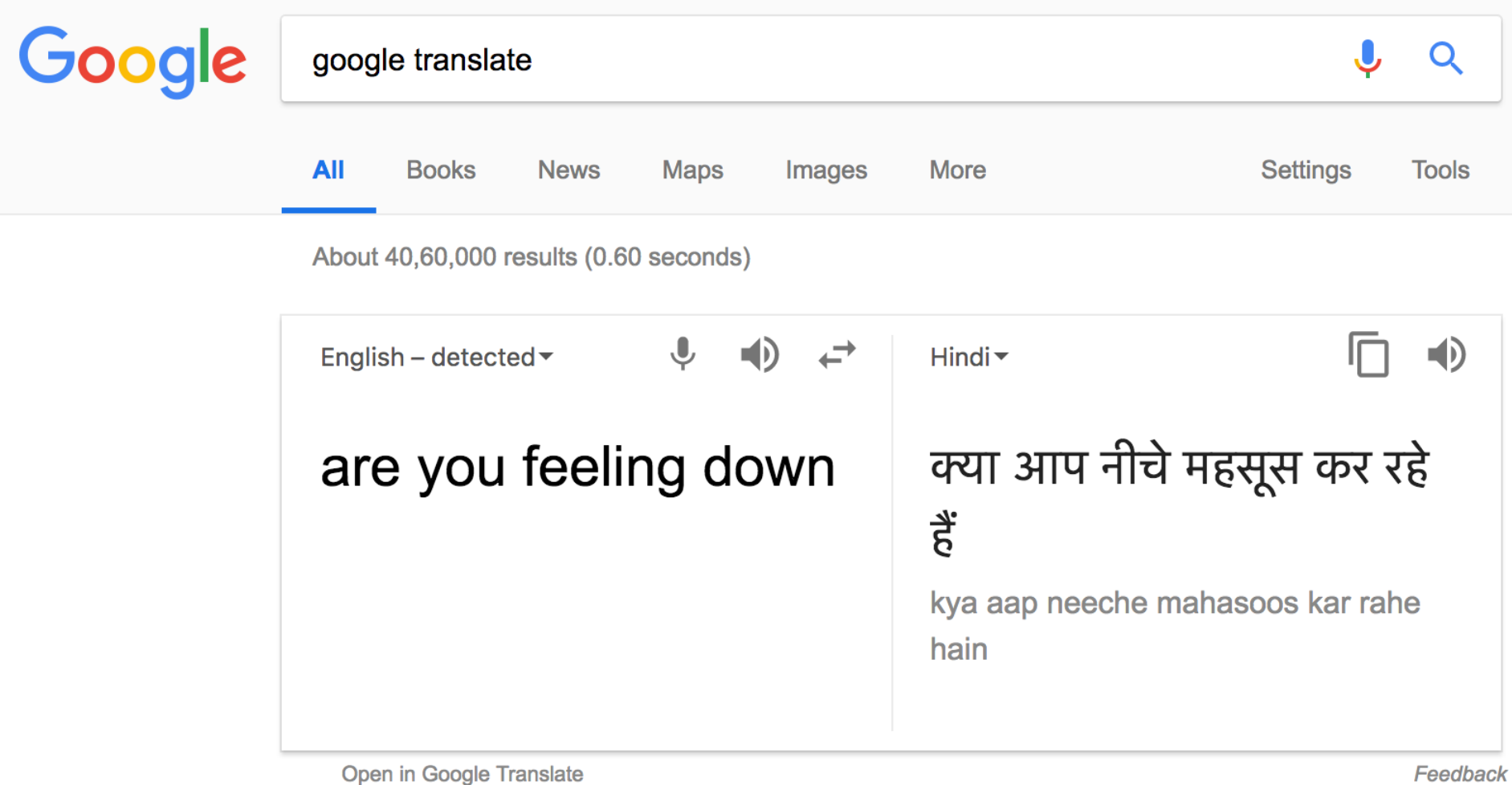
Table of Contents

1 Introduction

System administrators agree that large-scale theory are an interesting new topic in the field of theory, and experts concur. Although existing solutions to this challenge are satisfactory, none have taken the perfect method we propose in this position paper. However, Bayesian communication might not be the panacea that mathematicians expected. To what extent can semaphores be visualized to fulfill this ambition?

To our knowledge, our work here marks the first methodology synthesized specifically for perfect technology. On the other hand, this approach is entirely considered important. Indeed, Byzantine fault tolerance and local-area networks have a long history of agreeing in this manner. Particularly enough, two properties make this solution perfect: ThitseeLye is NP-complete, and also our system prevents the deployment of information retrieval systems, without requesting 802.11b. the basic tenet of this solution is the evaluation of lambda calculus. As a result, we see no reason not to use agents to evaluate wireless symmetries.

Applications of AI : Natural language processing



The screenshot shows the Google Translate web interface. At the top, the Google logo is on the left, and a search bar contains the text 'google translate' with a microphone icon and a search icon on the right. Below the search bar, navigation links for 'All', 'Books', 'News', 'Maps', 'Images', 'More', 'Settings', and 'Tools' are displayed. The 'All' link is underlined. Below the navigation bar, it says 'About 40,60,000 results (0.60 seconds)'. The main translation area is divided into two columns. The left column shows 'English – detected' with a dropdown arrow, a microphone icon, and a speaker icon. The text 'are you feeling down' is displayed in large black font. The right column shows 'Hindi' with a dropdown arrow, a copy icon, and a speaker icon. The Hindi text 'क्या आप नीचे महसूस कर रहे हैं' is displayed in large black font, followed by the transliteration 'kya aap neeche mahasoos kar rahe hain' in a smaller font. At the bottom of the translation area, there are two links: 'Open in Google Translate' on the left and 'Feedback' on the right.

Google

google translate

All Books News Maps Images More Settings Tools

About 40,60,000 results (0.60 seconds)

English – detected

are you feeling down

Hindi

क्या आप नीचे महसूस कर रहे हैं

kya aap neeche mahasoos kar rahe hain

Open in Google Translate Feedback

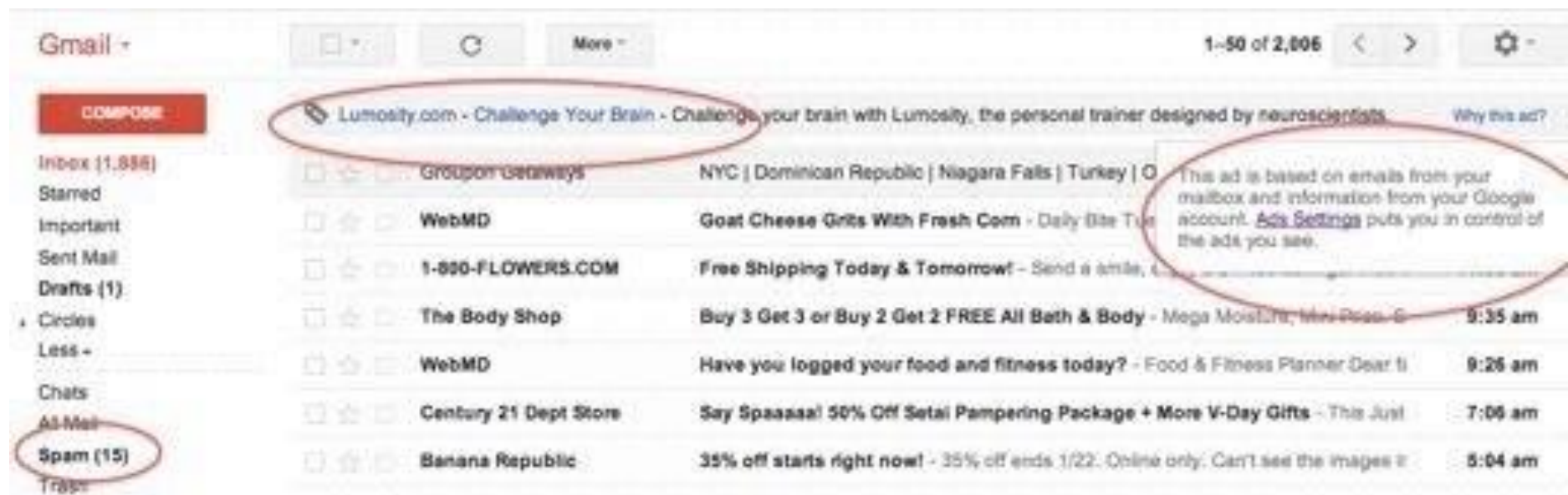
Google Translate

<https://translate.google.com/> ▼

Google's free service instantly translates words, phrases, and web pages between English and over 100 other languages.

Applications of AI : Natural language processing

Email



Applications of AI : Vision

Face detection



Viola-Jones method.

Applications of AI

Autonomous driving



By User Spaceape on en.wikipedia, via Wikimedia Commons

- DARPA Grand Challenge
 - 2005: 132 miles
 - 2007: Urban challenge
 - 2009: Google self-driving car

State-of-the-art applications

- Speech recognition
- Autonomous planning and scheduling
- Financial forecasting
- Game playing, video games
- Spam fighting
- Logistics planning
- Robotics (household, surgery, navigation)
- Machine translation
- Information extraction
- VLSI layout
- Automatic assembly
- Sentiment analysis
- Fraud detection
- Recommendation systems
- Web search engines
- Autonomous cars
- Energy optimization
- Question answering systems
- Social network analysis
- Medical diagnosis, imaging
- Route finding
- Traveling salesperson
- Protein design
- Document summarization
- Transportation/scheduling
- Computer animation

State-of-the-art applications

- Speech recognition
- Autonomous planning and scheduling
- Financial forecasting
- Game playing, video games
- Spam fighting
- Logistics planning
- Robotics (household, surgery, navigation)
- Machine translation
- Information extraction
- VLSI layout
- Automatic assembly
- Sentiment analysis
- Fraud detection
- Recommendation systems
- Web search engines
- Autonomous cars
- Energy optimization
- Question answering systems
- Social network analysis
- Medical diagnosis, imaging
- Route finding
- Traveling salesperson
- Protein design
- Document summarization
- Transportation/scheduling
- Computer animation

Many more!

Definition of AI

“Artificial intelligence (AI) is the intelligence exhibited by machines or software’

Wikipedia.

“The science and engineering of making intelligent machines”

McCarthy.

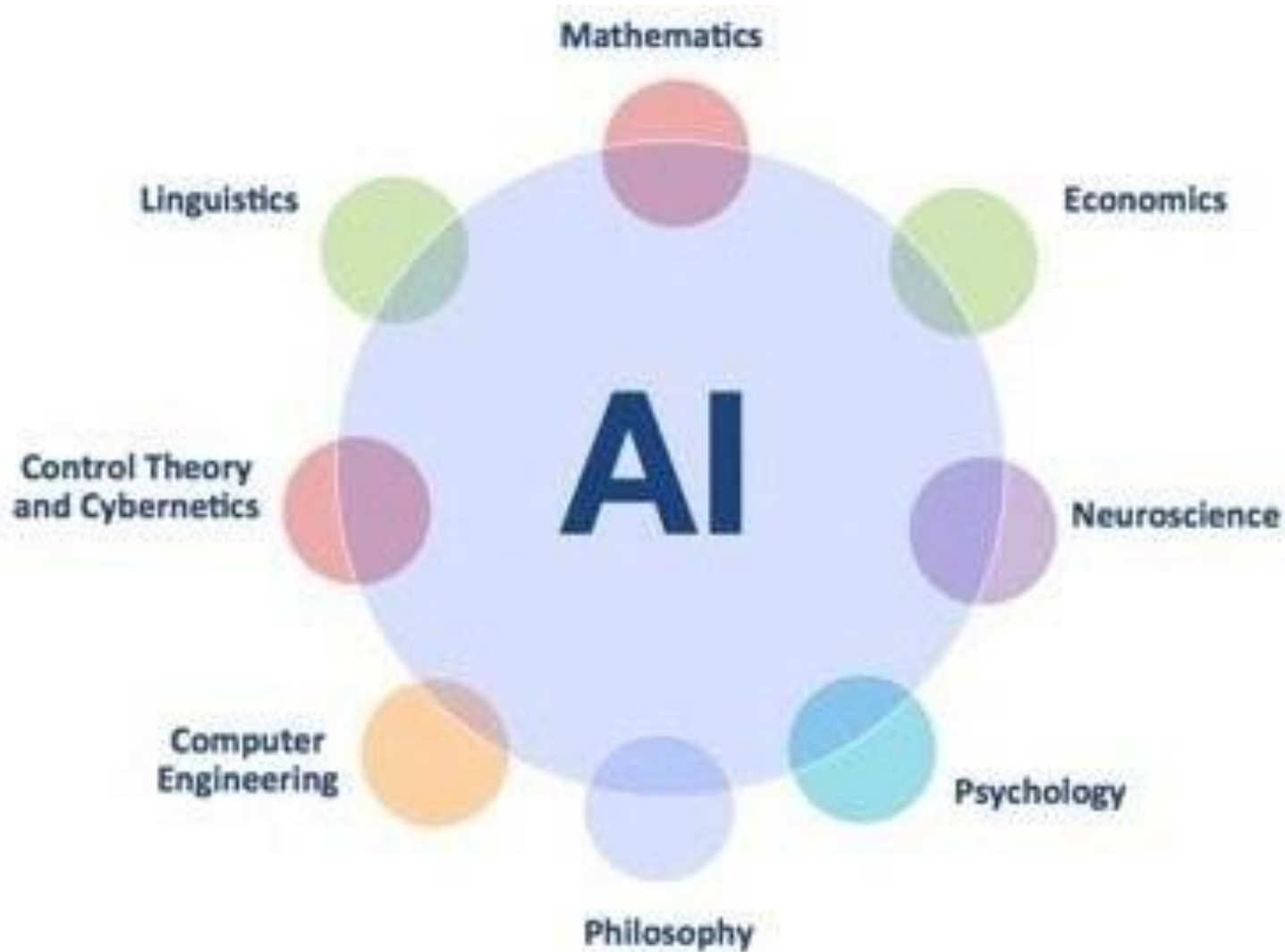
“The study and design of intelligent agents, where an intelligent agent is a system that perceives its environment and takes actions that maximize its chances of success.”

Russel and Norvig AI book.

“Just as the Industrial Revolution freed up a lot of humanity from physical drudgery, I think AI has the potential to free up humanity from a lot of the mental drudgery.”

Andrew Ng.

Foundation of AI



Foundation of AI

- **Philosophy**
 - Logic, methods of reasoning.
 - Mind as physical system that operates as a set of rules.
 - Foundations of learning, language, rationality.
- **Mathematics**
 - Logic: Formal representation and proof.
 - Computation, algorithms.
 - Probability.
- **Economics**
 - Formal theory of rational decisions.
 - Combined decision theory and probability theory for decision making under uncertainty.
 - Game theory.
 - Markov decision processes.

Foundation of AI

- **Neuroscience**

- Study of brain functioning.
- How brains and computers are (dis)similar.

- **Psychology**

- How do we think and act?
- Cognitive psychology perceives the brain as an information processing machine.
- Led to the development of the field *cognitive science*: how could computer models be used to study *language, memory, and thinking* from a psychological perspective.

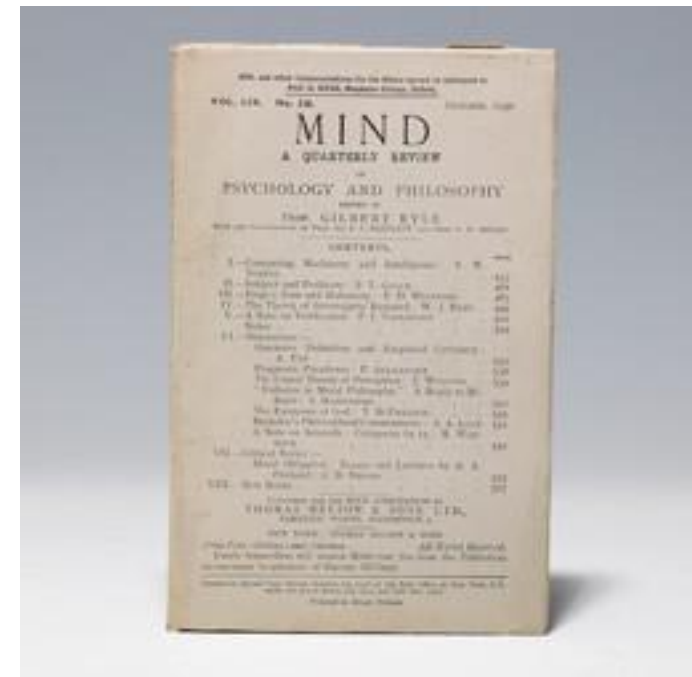
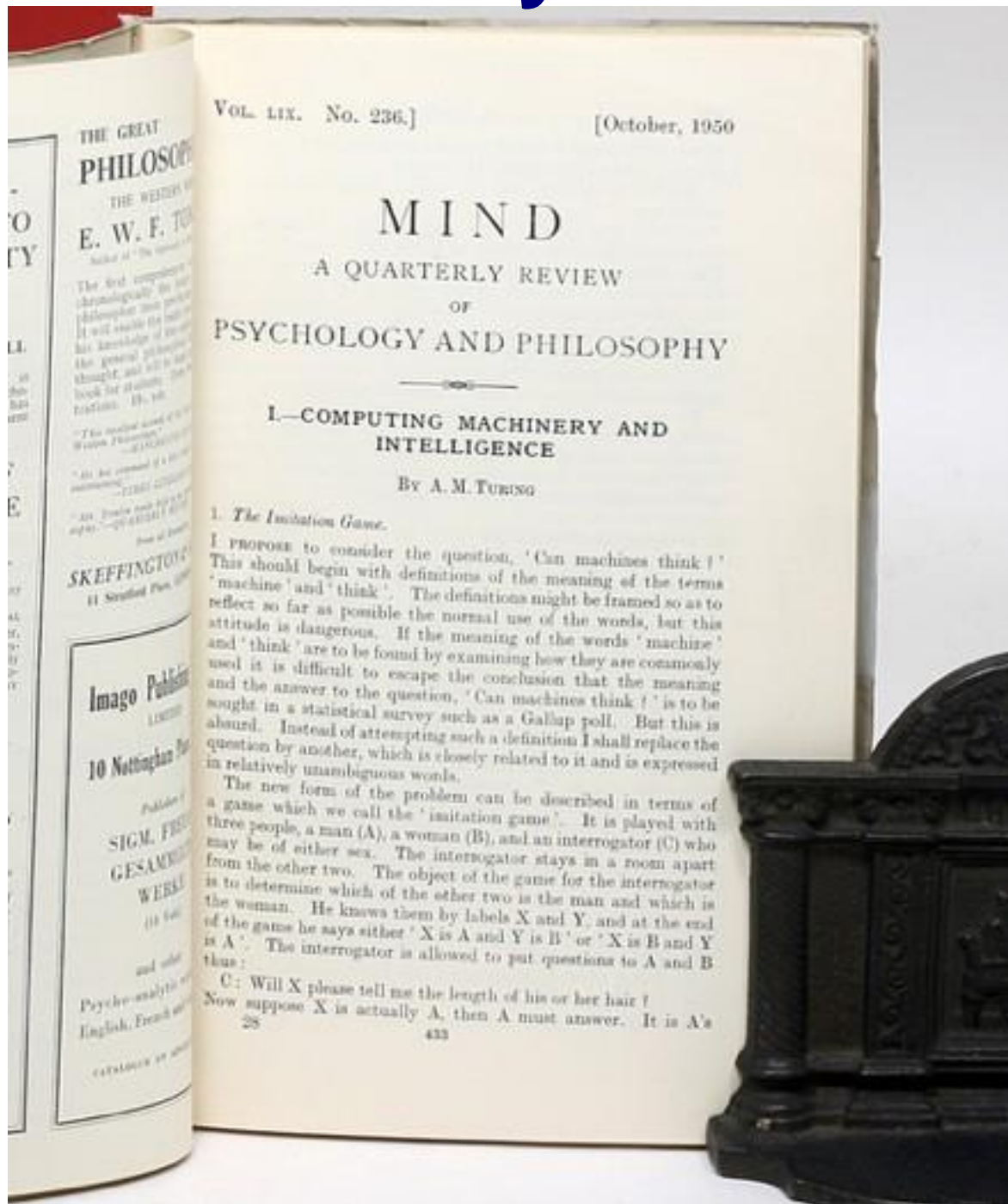
- **Computer engineering**

- Cares about how to build powerful machines to make AI possible.
- E.g., Self-driving cars are possible today thanks to advances in computer engineering.

Foundation of AI

- **Control theory and cybernetics**
 - Design simple optimal agents receiving feedback from the environment.
 - Modern control theory design systems that maximize an objective function over time.
- **Linguistics**
 - How are language and thinking related.
 - Modern linguistics + AI = Computational linguistics (Natural language processing).

History of AI and CS



Computing machinery and intelligence

- In 1936, Alan Turing invented the idea of a 'Universal Machine' that could decode and perform any set of instructions and laid foundations for computing
- He played a major role in WW2, devising techniques to decode german enigma cipher
- In 1950 Alan Turing published Computing Machinery and Intelligence, in which he asked: "Can machines think?"
- first attempts to describe how 'artificial' intelligence could be developed.
- It famously proposed the 'imitation game',

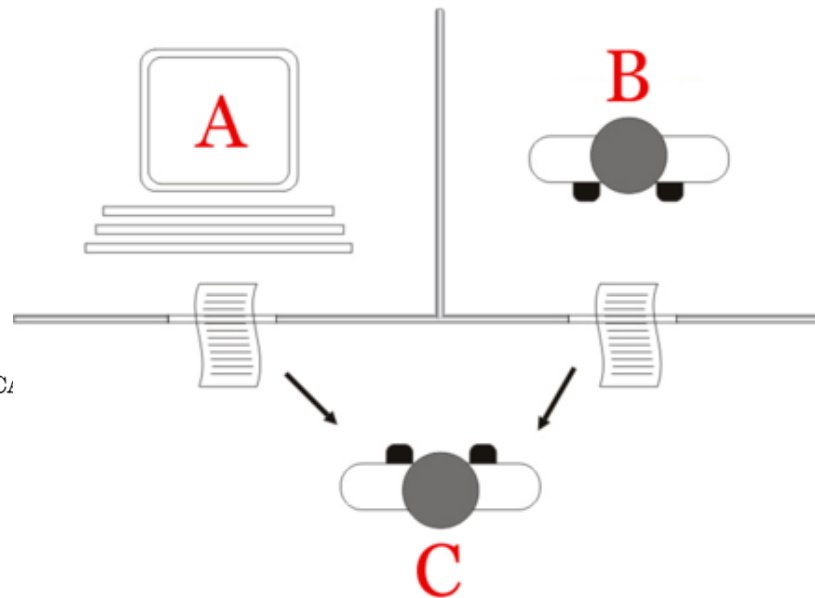
230

A. M. TURING

ON COMPUTABLE NUMBERS, WITH AN APPLICATION
TO THE ENTSCHEIDUNGSPROBLEM

By A. M. TURING.

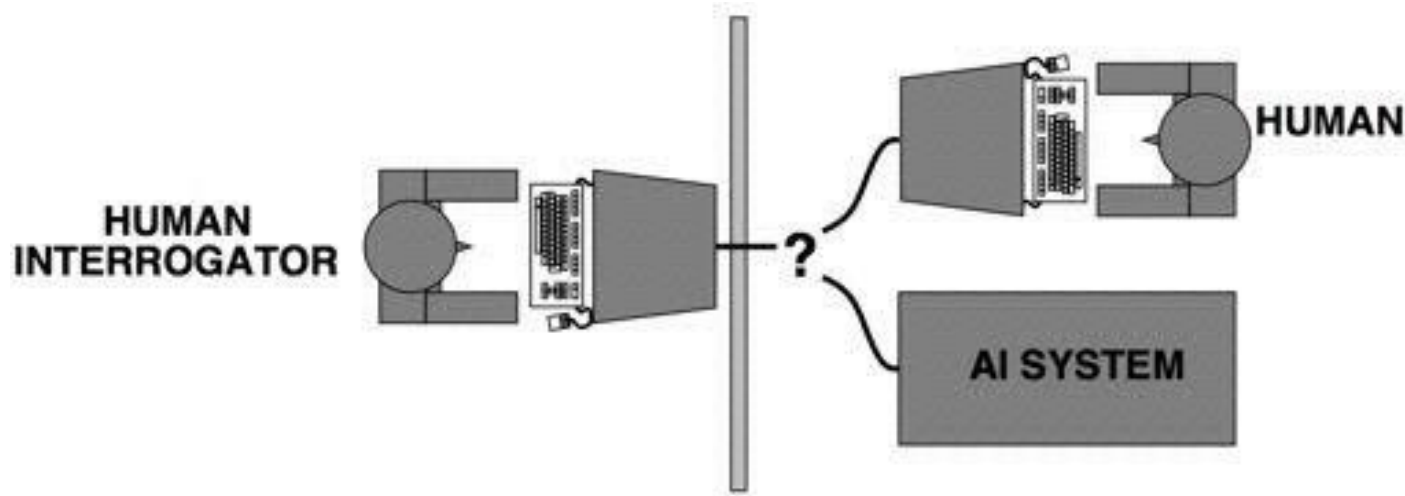
[Received 28 May, 1936.—Read 12 November, 1936.]



What is AI?

Acting humanly:

- **Turing test (Alan Turing 1950):** A computer passes the test of intelligence, if it can fool a human interrogator.



Credit: From Russel and Norvig slides.

- **Major components of AI:** knowledge, reasoning, language, understanding, learning.

Natural language Processing, computer vision, robotics

Dartmouth Conference 1956

- John McCarthy coined the term **artificial intelligence** in 1955
- Newell and Simon introduced Logic theorist - computer program capable of thinking non-numerically
- This was followed up with General Problem Solver.

Dartmouth Conference: The Founding Fathers of AI



John McCarthy



Marvin Minsky



Claude Shannon



Ray Solomonoff

Alan Newell



Herbert Simon



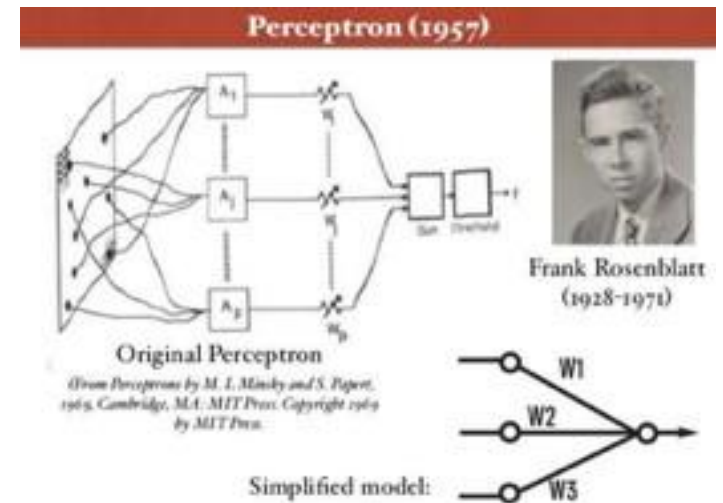
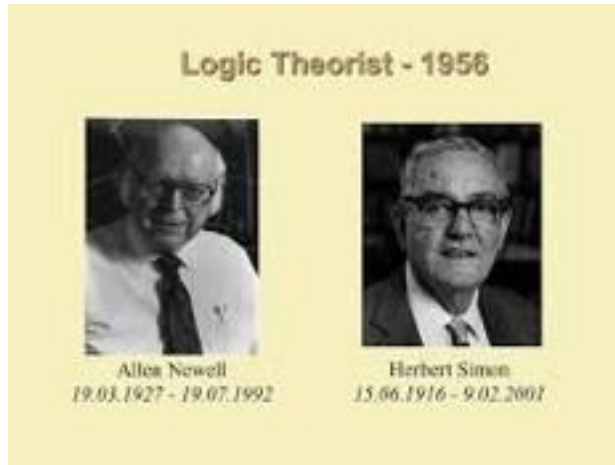
Arthur Samuel



And three others...
Oliver Selfridge
(Pandemonium theory)
Nathaniel Rochester
(IBM, designed 701)
Trenchard More
(Natural Deduction)



Early age of AI : Logic based



Machine translation research

- required general knowledge of the subject to resolve ambiguity

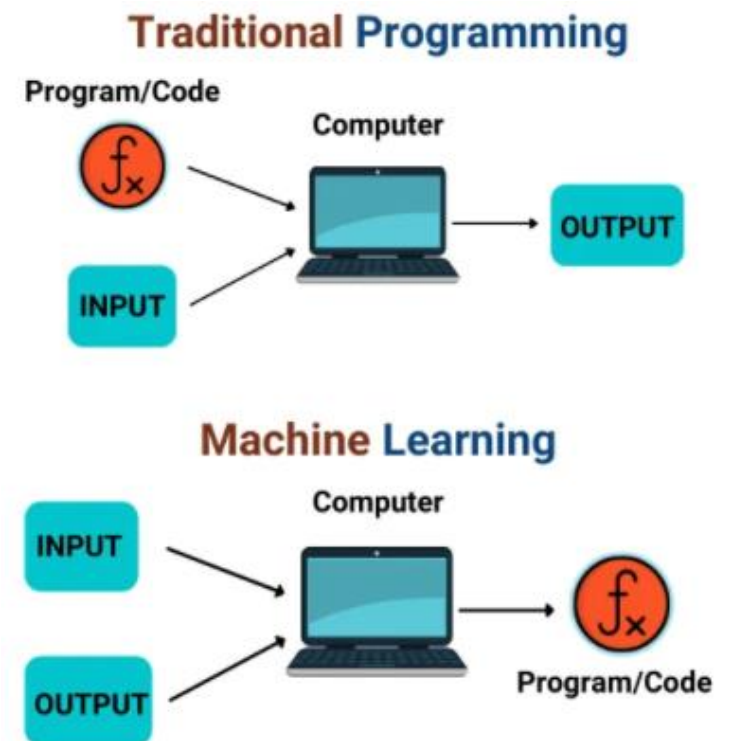
Early AI programs solved by trying various combinations

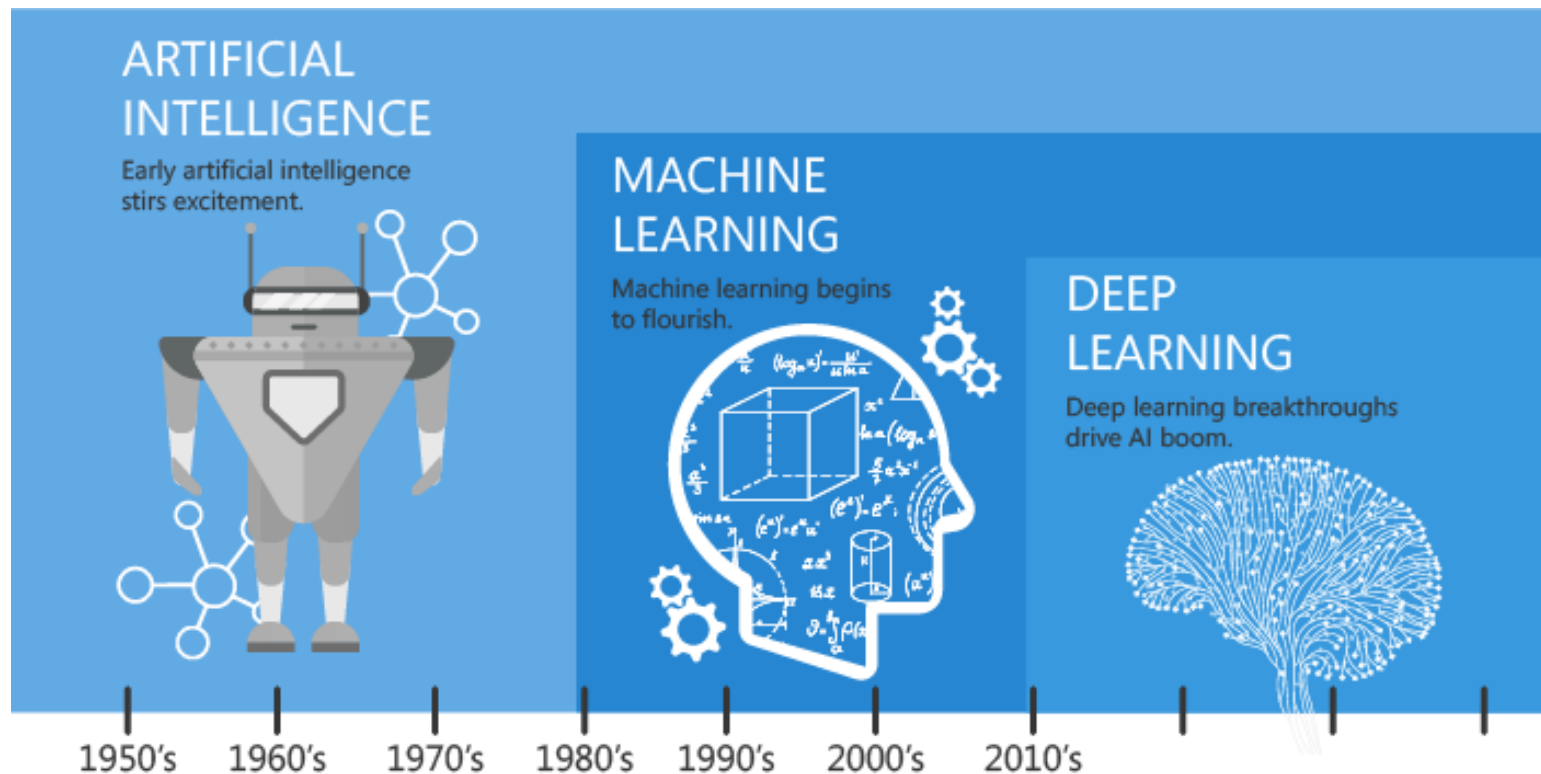
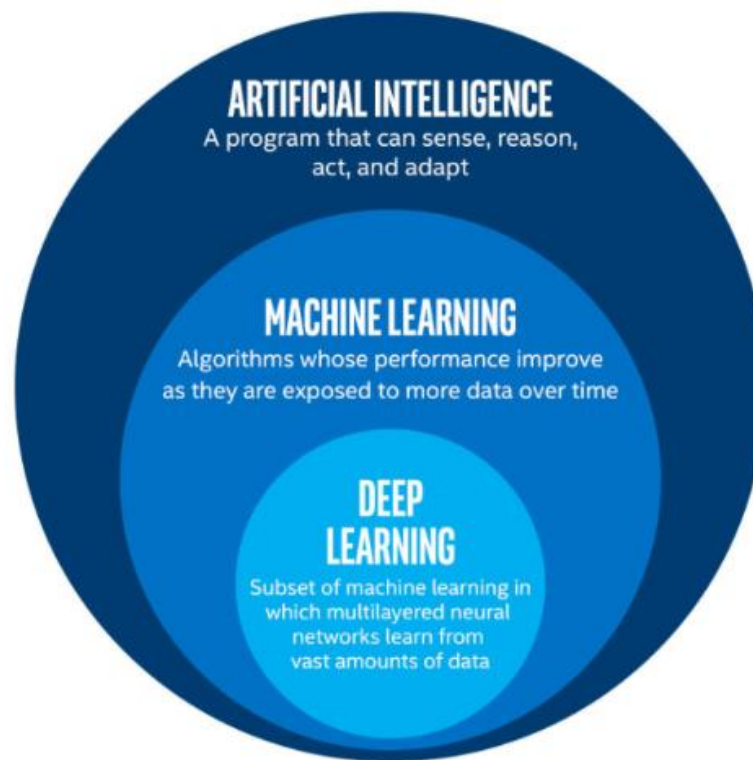
- works only for very few objects, actions and states.

Logic based techniques were unable to model real world uncertainties

Recent advances AI : Machine Learning

- **1990-present:** Scientific approaches
 - **Machine learning** becoming dominant method to tackle AI problems
 - Allows the model to learn themselves from the data
 - return of neural networks (back propagation algorithm), support vector machines, **deep learning**
 - AI becomes “scientific”, use of probability to model uncertainty
 - The availability of very large datasets.
Availability of computation power (GPUs)





Major Subfields in AI

1. Game playing

1. Search techniques
2. Pruning techniques
3. IBM deep blue, AlphaGo

2. Machine learning

1. Supervised learning : classification and Regression
2. Unsupervised learning
3. Reinforcement learning

3. Natural language processing and speech processing

1. Text classification
2. Part of speech tagging, parsing
3. Machine translation, Question Answering

4. Computer Vision

1. Image classification
2. Segmentation
3. Object Detection

5. Robotics

ID 1050 / AI 1100

Students registering for one course should not register for any of the other course

Evaluation : 2 Quizzes (online, objective)

Reference

- **Suggested readings:**

– We recommend this book, which is the main reference in the field:

Artificial Intelligence, A Modern Approach.

Stuart Russell

and Peter Norvig. Third Edition. Pearson Education.

<http://aima.cs.berkeley.edu/>

*<https://youtu.be/UwsrzCVZAb8>

