1204307 Artificial Intelligence
1210211 Artificial Intelligence and Intelligent Software

Asst.Prof.Rapeeporn Chamchong

Department of Computer Science, Faculty of Informatics

Course Description

- Fundamental of artificial intelligence (AI), state space, search, problem solving, knowledge representation, reasoning, inference under uncertainty, probabilistic methods, and machine learning, research topics in AI such as natural language understanding, expert system, and machine learning

Teaching Plan

Week	Topic
1	Fundamental of AI
2-3	Problem solving,
4-5	State space & Search
6-7	Knowledge Representation & Reasoning
8	Midterm
9-10	Machine learning
11-12	Deep Learning (CNN) and applications
13-14	Deep Learning (RNN) and applications
15	Project assignment
16	Final

Grading Policy

Assessment Method	Week	%
Attend class & Practice in class	1-7,9-14	30 %
Project & Demo	10	10 %
Midterm	8	30 %
Final	16	30 %

References

- Russell and Norvig. Artificial Intelligence: A Modern Approach.
- Haroon Sheikh, Corien Prins, Erik Schrijvers. Mission AI The New System Technology, Springer, 2023
- บุญเสริม กิจศิริกุล. ปัญญาประดิษฐ์ ภาควิชาวิศวกรรมคอมพิวเตอร์ จุฬาลงกรณ์มหาวิทยาลัย 2548
- https://www.tutorialspoint.com/artificial_intelligence_with_python/index.htm
- https://aima.cs.berkeley.edu/
- https://ocw.mit.edu/courses/6-034-artificial-intelligence-fall-2010/video_galleries/lecture-videos/
- https://github.com/aimacode
- https://scikit-learn.org/stable/index.html
- https://www.tensorflow.org/tutorials

Assignment1

- https://www.mycourseville.com/?q=onlinecourse/store/12/course/51607
  - Get the certificate, score 10 points
  - Cannot get the certificate but study all topics, score 5 points
  - Will have some questions in the examination.
- https://www.tutorialspoint.com/artificial_intelligence_with_python/index.htm
- https://scikit-learn.org/stable/index.html

Chapter 1
Fundamental of AI

Asst.Prof.Rapeeporn Chamchong

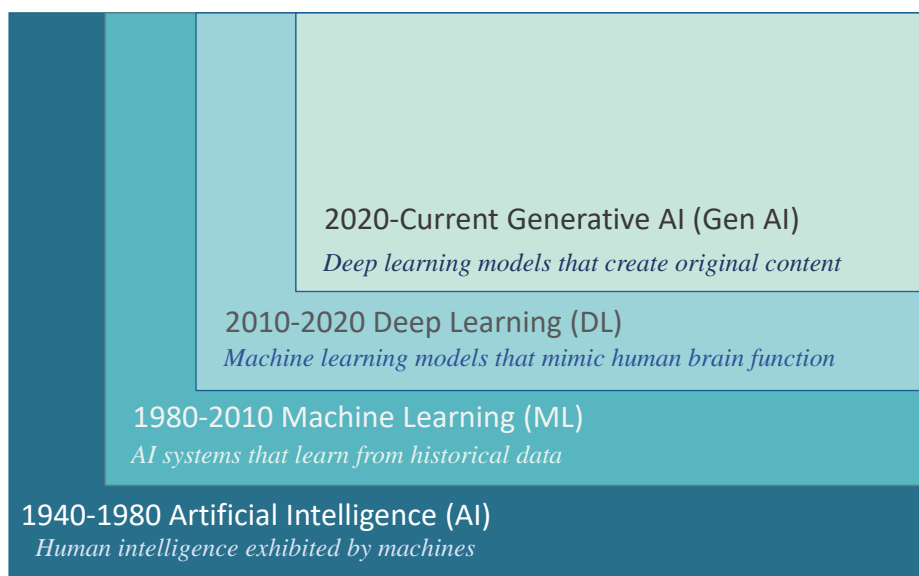Department of Computer Science, Faculty of Informatics

Content

- Introduction to Artificial Intelligence

- Advantages & Disadvantages of Artificial Intelligence
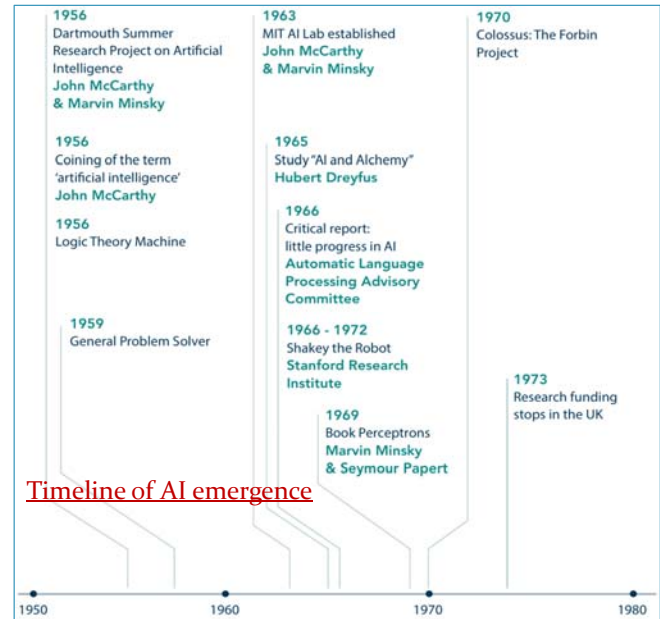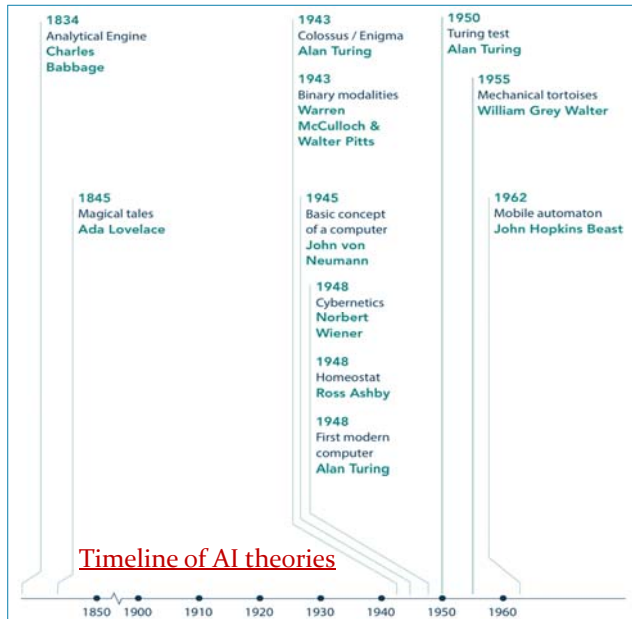
- Domains of AI

- Applications of AI
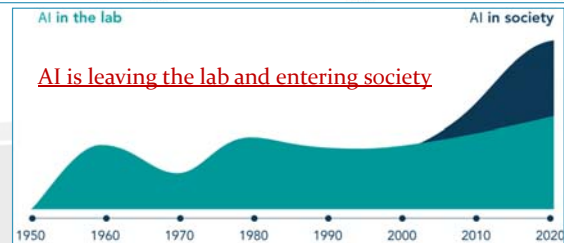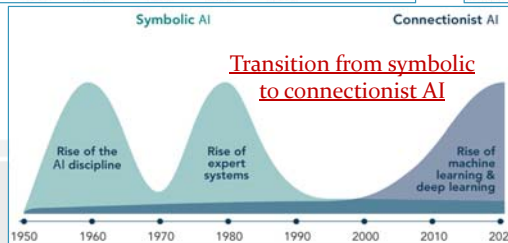
What is AI?

- Intelligence can be considered as:
  - Problem Understanding
  - Problem solving skills
  - Ability to learn
  - Decision making abilities etc.
- Intelligence is an intangible part of our brain which is a combination of Reasoning, learning, problem-solving perception, language understanding, etc.

Overview and History of AI

2020-Current Generative AI (Gen AI)
Deep learning models that create original content

2010-2020 Deep Learning (DL)
Machine learning models that mimic human brain function

1980-2010 Machine Learning (ML)
AI systems that learn from historical data

1940-1980 Artificial Intelligence (AI)
Human intelligence exhibited by machines

Timeline of AI

Timeline of AI theories

1834	1943	1950
Analytical Engine Charles Babbage	Colossus / Enigma Alan Turing	Turing test Alan Turing
	1943 Binary modalities Warren McCulloch & Walter Pitts	1955 Mechanical tortoises William Grey Walter
1845 Magical tales Ada Lovelace	1945 Basic concept of a computer John von Neumann	1962 Mobile automaton John Hopkins Beast
	1948 Cybernetics Norbert Wiener	
	1948 Homeostat Ross Ashby	
	1948 First modern computer Alan Turing	

1850 1900 1910 1920 1930 1940 1950 1960

Timeline of AI emergence

1956	1963	1970
Dartmouth Summer Research Project on Artificial Intelligence John McCarthy & Marvin Minsky	MIT AI Lab established John McCarthy & Marvin Minsky	Colossus: The Forbin Project
1956 Coining of the term 'artificial intelligence' John McCarthy	1965 Study "AI and Alchemy" Hubert Dreyfus	
1956 Logic Theory Machine	1966 Critical report: little progress in AI Automatic Language Processing Advisory Committee	
1959 General Problem Solver	1966 - 1972 Shakey the Robot Stanford Research Institute	1973 Research funding stops in the UK
	1969 Book Perceptrons Marvin Minsky & Seymour Papert	

1950 1960 1970 1980

Transition from symbolic to connectionist AI

Symbolic AI — Connectionist AI

Rise of the AI discipline · Rise of expert systems · Rise of machine learning & deep learning

1950 1960 1970 1980 1990 2000 2010 2020

AI is leaving the lab and entering society

AI in the lab — AI in society

1950 1960 1970 1980 1990 2000 2010 2020

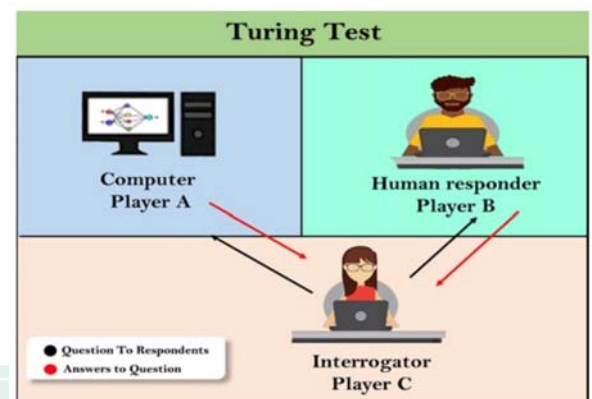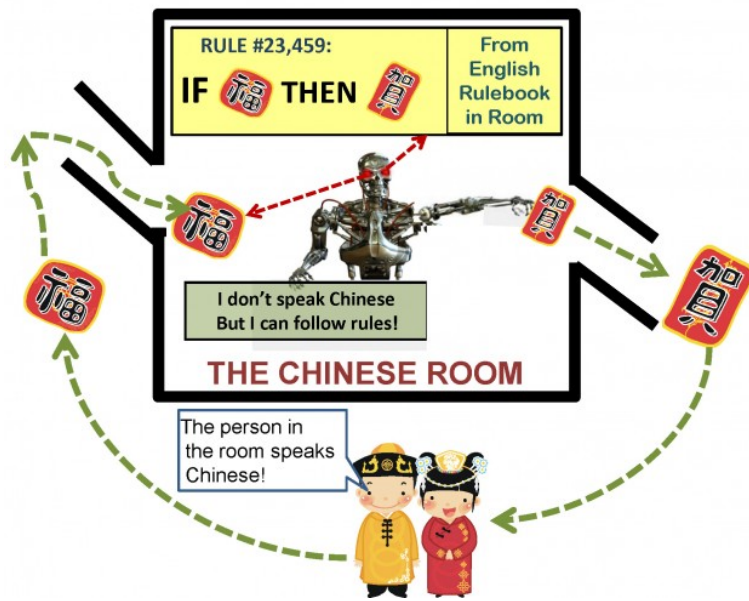## Turing Test

- It was proposed by Alan Turing in 2493.
- The experiment is in the form of an 'imitation game' of a computer pretending to be a human being.
- This test is to identify between computer and human.
- If we cannot identify the difference between computers and humans, it means that the system is artificial intelligence.
- Most researchers count that AI starts from this era.

Turing Test

Computer Player A — Human responder Player B

● Question To Respondents
● Answers to Question

Interrogator Player C

Chinese Room

2016
- Google's AlphaGo program defeated reigning Go champion Lee Sedol. When IBM's Deep Blue beat chess champion Garry Kasparov in the 1990s, it was believed it would take a century for a computer to win at the more complex game of Go.
  Microsoft introduced Tay, an AI bot that learns from social media. Within hours, it started making hateful comments about women and posting fascist tweets.

2017
- Rumors spread that Facebook's AI had created its own unintelligible language, fueling fears of uncontrollable AI and prompting a quick shutdown of the programs.

2018
- Saudi Arabia grants citizenship, while CEO Sundar Pichai showcases Google Duplex, an AI assistant with a human-like voice for tasks like making reservations. A deep-fake video features President Obama, with comedian Jordan Peele reading the speech.

2019
- IBM's Project Debater faced off against top debater Harish Natarajan on subsidizing nursery schools, but the judges declared Natarajan the winner.

2020
- The Guardian publishes an essay by GPT-3, created by OpenAI, claiming that humans need not fear AI. Meanwhile, Boston Dynamics shares a video of its robots dancing to "Do You Love Me?" by The Contours.

AI Definitions

- AI is composed of two words **Artificial** and **Intelligence**, where Artificial defines *"man-made,"* and Intelligence defines *"thinking power"*, hence AI means *"a man-made thinking power."*
- "The branch of computer science that is concerned with the automation of intelligent behavior" (Luger+Stubblefiled, 1993)
- "[The automation of] activities that we associate with human thinking, activities such as decision-making, problem-solving, learning …" (Bellman, 1978)
- "The study of mental faculties through the use of computational models" (Charniak+McDermott, 1985)
- "The imitation of all human intellectual abilities by computers or various complex human skills by machines."
- "Technology that can function appropriately and with foresight in its environment."

AI Definitions (Cont.)

Systems that think like humans	Systems that think rationally
Systems that act like humans	Systems that act rationally

AI Definitions (Cont...)

- The study of how to make computers do things at which, at the moment, people are better (Rich+Knight, 1991)
- The intelligence is intangible. It is composed of –
  - Reasoning
  - Learning
  - Problem Solving
  - Perception
  - Linguistic Intelligence

AI Definitions (Cont...)

- **Learning** – It is the activity of gaining knowledge or skill by studying, practicing, being taught, or experiencing something. Learning enhances the awareness of the subjects of the study.
- **Problem Solving** – It is the process in which one perceives and tries to arrive at a desired solution from a present situation by taking some path, which is blocked by known or unknown hurdles.
- Problem solving also includes **decision making**, which is the process of selecting the best suitable alternative out of multiple alternatives to reach the desired goal are available.
- **Perception** – It is the process of acquiring, interpreting, selecting, and organizing sensory information.
- Perception presumes **sensing**. In humans, perception is aided by sensory organs. In the domain of AI, perception mechanism puts the data acquired by the sensors together in a meaningful manner.
- **Linguistic Intelligence** – It is one's ability to use, comprehend, speak, and write the verbal and written language. It is important in interpersonal communication.

AI in Disciplines

- To achieve the above factors for a machine or software Artificial Intelligence requires the following discipline:
  - Mathematics
  - Biology
  - Psychology
  - Sociology
  - Computer Science
  - Neurons Study
  - Statistics

Why Artificial Intelligence?

- Following are some main reasons to learn about AI:
  - Creating such software or devices which can solve real-world problems very easily and with accuracy such as health issues, marketing, traffic issues, etc.
  - Creating your personal virtual Assistant, such as Cortana, Google Assistant, Siri, etc.
  - Building such Robots that can work in an environment where the survival of humans can be at risk.
  - Opening a path for other new technologies, new devices, and new Opportunities.

Advantages of Artificial Intelligence

- **High Accuracy with fewer errors:** AI machines or systems are prone to fewer errors and high accuracy as they make decisions based on pre-experience or information.
- **High-Speed:** AI systems can be of very high speed and fast-decision making
- **High reliability:** AI machines are highly reliable and can perform the same action multiple times with high accuracy.
- **Useful for risky areas:** AI machines can be helpful in situations such as defusing a bomb or exploring the ocean floor, where employing a human can be risky.
- **Digital Assistant:** AI can be very useful in providing digital assistance to users. For example, AI technology is currently used by various e-commerce websites to show products as per customer requirements.
- **Useful as a public utility:** AI can be very useful for public utilities such as a self-driving car, which can make our journey safer and hassle-free, facial recognition for security purposes, Natural language processing to communicate with humans in human language, etc.

Disadvantages of Artificial Intelligence

- **High Cost:** The hardware and software requirements of AI are very costly as they require lots of maintenance to meet current world requirements.
- **No feelings and emotions:** AI machines can be outstanding performers but still do not have feelings, so they cannot make any kind of emotional attachment to humans, and may sometimes be harmful to users if the proper care is not taken.
- **Increase dependency on machines:** With the increase of technology, people are becoming more dependent on devices, and hence, they are losing their mental capabilities.
- **No Original Creativity:** Humans are so creative and can imagine some new ideas but still AI machines cannot beat this power of human intelligence and cannot be creative and imaginative

Domains of AI

- Perception (Computer vision, NLP, Touch sensation)
- Robotics
- Planning
- Expert System
- Theorem Proving
- Gaming
- Drones
- Machine Learning
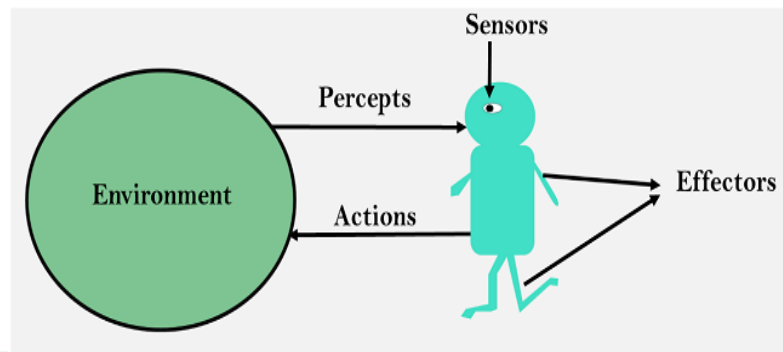- Deep Learning
- Data Sciences

ARTIFICIAL INTELLIGENCE EXAMPLES

- Manufacturing robots
- Biometric
- Proactive healthcare management
- Smart Car
- Automated financial investing
- Virtual travel booking agent
- Social media monitoring
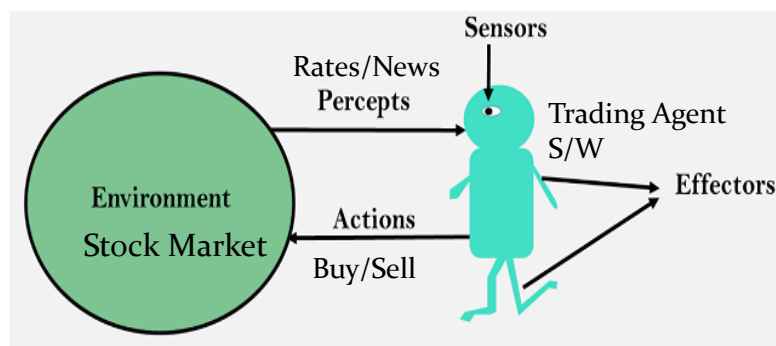- Inter-team chat tool
- Conversational marketing bot
- Natural Language Processing (NLP) tools

AI Action-Perception Cycle

- AI system is composed of an agent and its environment
- An **agent** is anything (system/robot) that can perceive its environment through **sensors** and acts upon that environment through its **effectors.**
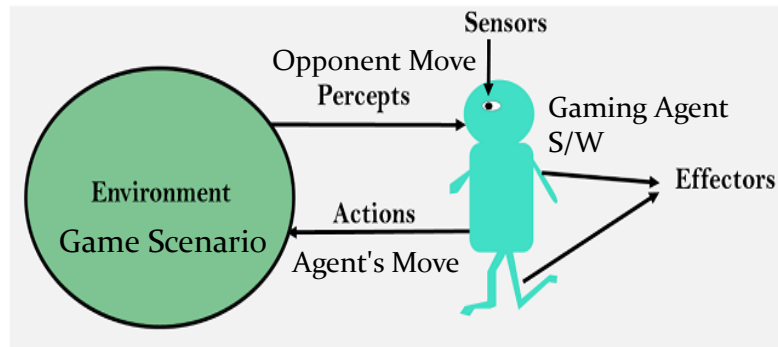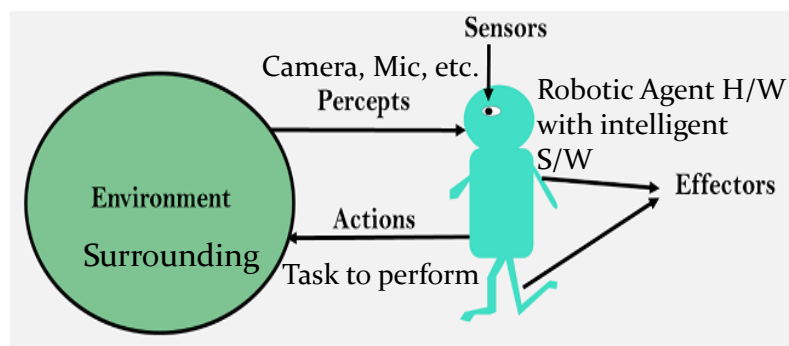
Action-Perception Cycle – In Finance

Action-Perception Cycle – In Games

Action-Perception Cycle – In Robotics