ARTIFICIAL INTELLIGENCE AND DEEP LEARNING

WEEK 1
2021 SPRING

CHAPTER 1: Introduction to Artificial Intelligence
Chapter Goals

At the end of this chapter you will be able to;

- Explain the notions of intelligence and artificial intelligence
- Tell the main properties of intelligent behavior,
- Tell the disciplines related to artificial intelligence,
- Obtain a brief knowledge of artificial intelligence's history
- Explain the advantages and disadvantages of working with artificial intelligence
- Compare artificial intelligence to natural intelligence

CHAPTER 1: Introduction to Artificial Intelligence
1.1 Definition of Artificial Intelligence

- Artificial intelligence is the act of behaviors by machines that are named as intelligence when carried out by humans.
- According to Websters dictionary, the most important property of humans than other living beings is their ability to learn and solve problems.
- Rational thought is a property of human intelligence. Rational action is the action that provides maximum benefit in reaching to a goal with known data.
- Artificial intelligence generally consists of approaches that aim to model the thinking ability of human and the mechanism of brain.
- The aim of artificial intelligence is to mimic the human intelligence via computer and by this way, give some learning capability to computers.

CHAPTER 1: Introduction to Artificial Intelligence
1.1 Definition of Artificial Intelligence

- The term «Artificial Intelligence» was first used by Minsky and McCarthy in 1956 at a machine intelligence conference in America.

- Since that day, thousands of academical publications, research projects and doctoral theses about artificial intelligence were carried out in the fields of computer software and hardware, machine vision, recognition, pattern and speech recognition, learning, mental modelling, Access to information, search queries, game theory and so on.

- Although many important developments were witnessed in the field of artificial intelligence to this day, the level of Research is still at incubation phase. AI researchers continue to propose new findings and improvements to develop AI.

- Minsky defines AI as follows: The search of having machines to do things that require intelligence when done by humans.

- Chris Riesbeck defines AI as follows: It’s the search for an answer to this basic question: Why are the computers so stupid?

CHAPTER 1: Introduction to Artificial Intelligence
1.2 Some Opinions about Artificial Intelligence

- Robots will invade Earth (Kevin Warwick)
- Computers will never be intelligent (Roger Penrose)
- People will choose to be computers. (Ray Kurzweil)
- Computers will develop to become humans. (Mark Jeffery)

1.3 Main Goals of Artificial Intelligence

The following are the two main goals of AI:

- To improve the machines to be more intelligent and useful
- Generate programs that simulate the intelligence of human to understand it better.

CHAPTER 1: Introduction to Artificial Intelligence
1.4 Properties of Intelligent Actions

- Learn from experience
- Quick and successful adaptation to a new situation
- Solve problems
- Find and use information
- Reasoning
- Benefit from random occurances
- Ability to detect similarities among differents
- Ability to detect differences among similars
- Produce new ideas/notions
- Use multi-meaning and contradicting information

CHAPTER 1: Introduction to Artificial Intelligence
1.5 Disciplines Related To Artificial Intelligence

- Computer Sciences
- Psychology
- Philosophy
- Language Studies
- Neurology

CHAPTER 1: Introduction to Artificial Intelligence
1.6 Some Examples of Artificial Intelligence

- ELIZA, developed by Joseph Weizenbaum in 1965 simulates a psychological therapist. It's the first example of computer chat bots that are in use now.
- It usually rephases and outputs the user input (a Rogerian psychotherapy technique)
- The working principles of ELIZA are as follows:

1. If an appropriate template exists, perform paraphrasing and answer.
2. Else, provide one of the general purpose answers .

- Following slide demonstrates a samples dialog with ELIZA

CHAPTER 1: Introduction to Artificial Intelligence
1.6 Some Examples of Artificial Intelligence

- Men are all alike.

IN WHAT WAY?

- They're always bugging us about something or other.

CAN YOU THINK OF A SPECIFIC EXAMPLE?

- Well, my boyfriend made me come here.

YOUR BOYFRIEND MADE YOU COME HERE?

- He says I'm depressed much of the time.

I AM SORRY TO HEAR THAT YOU ARE DEPRESSED.

- It's true that I am unhappy.

DO YOU THINK COMING HERE WILL HELP YOU NOT TO BE UNHAPPY?

- I need some help, that much seems certain.

TELL ME MORE ABOUT YOUR FAMILY.

- My mother takes care of me.

WHO ELSE IN YOUR FAMILY TAKES CARE OF YOU?

- My father.

YOUR FATHER

Rudolf Arnheim- Problem of Approach

- We can't claim that every problem that can be solved by intelligence can only be solved by intelligence.
- The method used by computers cannot be defined as intelligent unless the mental processes are defined by their outputs or our vision of mechanism of intelligence take a mechanist form.
- The method used by computers is running around many possible responses until bumping into a successful response.
- It's embarassing to see that this approach is the same as the method used by psychologist Thorndike in 1890's ascribed to animals to prove that they could not reason. Computers are just faster, that's all.

CHAPTER 1: Introduction to Artificial Intelligence
1.7 Some Opinions and Approaches related to Artificial Intelligence

- John Searle: Syntax alone, regardless of how much it is, cannot reveal the symantic. Computers have no grasp of meanings of the symbols they process. If there is no meaning, then there is no intelligence.
- Gödel Theorem: There are facts that are known to be true by humans, but machines cannot prove that.
- John Lucas: Since there are such facts, the human brain is above the capacity of machines.

CHAPTER 1: Introduction to Artificial Intelligence
1.7 Some Opinions and Approaches related to Artificial Intelligence

Supporters of AI can be grouped into two main communities:

- Bottom to Toppers: Physical structure of brain has an important role in our mental structure.
  - Artificial neural networks (It is possible to act intelligently without having a theory of this world)
- Top to Bottomers: It is necessary to focus on symbolic representation schemes and thought rules. There is no need to consider the physical structure of brain.
  - Searching
  - Micro Worlds
  - Marvin Minksy frames, Roger Shank scenarios
  - Information of common sense.

CHAPTER 1: Introduction to Artificial Intelligence
1.8 Brief History of Artificial Intelligence

- **First Period Studies**

1943: McCulloch & Pitts, first artificial neuron design

1949: Hebbian learning rule (If two neurons are simultaneously active, their relation will improve)

1950: Turing's article

1951: First artificial neural network (ANN) computer(Minsky & Edmonds)

- **Era of High Expectations**

- 1950: (Turing) In 50 years, at least %30 of ordinary querists will fail to make the correct decision after a 5 minutes dialog

Newell & Simon: In 10 years, World chess champion will be a computer.

1950-60 : Automatic language translation is imminent .

The Reasons of Expectations not Met in the High Expectations Era

Large effect of information of World / Common

The exponential complexity of Problems

Microworlds' unability to be models to real World.

- **1966-1973: Some Facts Era**

1969: Minsky & Papert's proof of AI's failure in many problem types resulted in ceasation of funds reserved for ANN studies.

1969: Bryson & Ho's discovery of multilayer neural networks did not attract attention until 1980's.

Disappointment in automatic translation systems

"the spirit is willing, but the flesh is weak"

Translation from English to Russian

"the vodka is good, but the meat is rotten"

CHAPTER 1: Introduction to Artificial Intelligence
1.8 Brief History of Artificial Intelligence

- **1979-1990: Nice Times**

Expert systems emerged (Rule based, providing understandable results that act as experts in limited fields (ex: MYCIN, analysis of blood infections)).

1981 - 1991: Japan announced its Project named 'Fifth Generation' to produce intelligent machines working on Prolog basis.

America and Europe spared large funds to AI projects to not lag behind.

New cliche in software: 'now with AI!'

A large increase in number of AI companies is observed

- **1991-1995: Artificial Intelligence Experiences its Winter**

Fifth Generation Project was halted

New focus in AI industry: Instead of trying to produce programs that could entirely replace humans; started to develop in the form of applying AI techniques to relevant problems and producing programs that supports humans.

CHAPTER 1: Introduction to Artificial Intelligence
1.8 Brief History of Artificial Intelligence

- **Nowadays**

Deep Blue beatGarry Kasparov in 1997.

Driverless cars began to be used (Darpa rally, 132 mil)

America employed AI based software to carry out its whole logistical planning in 1991 Coast War.

An autonomous robot is used in Mars.

Programs that understand speech in a limited field are developed (Pegasus Travel Aid)

Programs to transform speech to text are developed (Google Speech to text).

Automatic theorem provers are developed. Otomatik Teorem ispatlayıcılar geliştirildi.

Surgery robots are developed (HipNav)

SKICAT: Program that identifies interesting objects in terabytes worth of image data sent by space telescopes achieved %94 classification accuracy.

CHAPTER 1: Introduction to Artificial Intelligence
1.8 Brief History of Artificial Intelligence

- **Nowadays**

Meteorology systems now predict later dates and work with smaller time intervals.

Google news: Established the system to form live newspaper

Automatic adress recognition and letter clustering systems are set up in post offices.

AI applications such as signature verification systems, automatic crediting decisions, automatic Detection of credit card frauds are started to be used in banks.

Age and sex prediction based on browsing history in Web is realized.

Digital Cameras: Features such as automatic face detection and focusing are added. Intelligent characters appeared in computer games

IBM's Watson (2011) is introduced.

CHAPTER 1: Introduction to Artificial Intelligence
1.8 Brief History of Artificial Intelligence

- **Suprises encountered in artificial intelligence studies**

1. Tasks that are difficult for humans but easy for machines:
   - Chess
   - Trip Planning
   - Flight scheduling in airports
   - Fraud detection (of credit cards)
   - Theorem proving
   - Square Crossword

2. Tasks that are easy for humans but difficult for machines :
   - Speech recognition
   - Facial Recognition
   - Composing/Painting
   - Motor activities (walking)
   - Language understanding
   - World Knowledge (Example: How many feet do fish have)

CHAPTER 1: Introduction to Artificial Intelligence
1.8 Brief History of Artificial Intelligence

- **Comparison of Artificial and Natural Intelligence**

1. Artificial Intelligence

- More Permanent
- Can be copied
- Can be published to the masses
- Cheaper
- Mostly Consistent
- Its operation can be documented

2. Natural Intelligence:

- Creative
- Can transfer its experience from one topic to another
- Has the property of adaptation
- Can learn models without conscious effort

CHAPTER 1: Introduction to Artificial Intelligence Questions

1. Explain 3 properties of intelligent actions

2. To what did the focus on AI studies shift starting from mid 90’s?

3. What are the 5 disciplines Related To Artificial Intelligence?

4. Provide 3 examples of tasks that are difficult for humans but easy for machines

5. Why didn’t John Searle consider computers as intelligent?

CHAPTER 1: Introduction to Artificial Intelligence Solutions

1-Learn from experience.Quick and successful adaptation to a new situation. Solve problems

2- Instead of trying to produce programs that could entirely replace humans; started to develop in the form of applying AI techniques to relevant problems and producing programs that supports humans.

3-Computer Sciences, Psychology, Philosophy, Language Studies, Neurology

4-Tasks that are difficult for humans but easy for machines: Chess, Trip Planning, Flight scheduling in airports, Fraud detection (of credit cards), Theorem proving, Square Crossword

5- Computers have no grasp of meanings of the symbols they process. If there is no meaning, then there is no intelligence