Artificial Intelligence
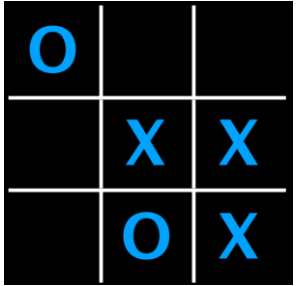## Lecture-0 :Introduction

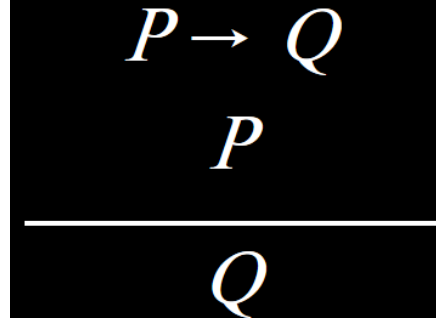Dr. Bayan Omar Mohammed

2024-2025

Syllabus

- Introduction to Artificial Intelligence
- Artificial Intelligence Problems
  - Knowledge representation
  - Search
  - Uncertainty
  - Optimization
  - Learning
  - Neural Network
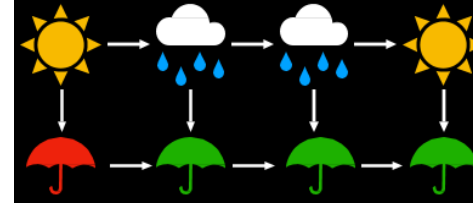 - Natural Language Processing

Artificial Intelligence

Search

Knowledge

$$P \rightarrow Q$$
$$P$$
$$Q$$

Uncertainty

Optimization

Learning

Inbox

Spam

Neural Networks

Languages
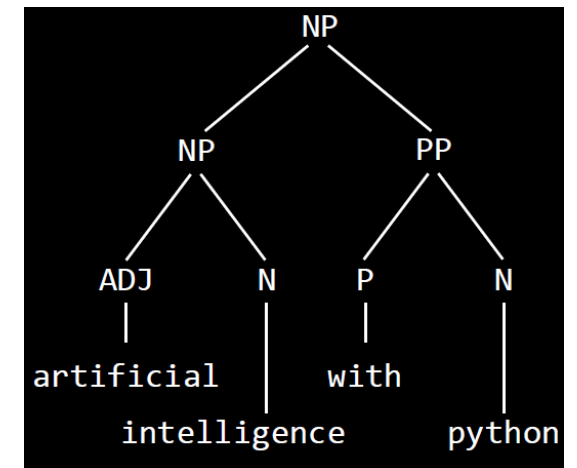
Goals of AI

1 • To make computers more useful by letting them take over dangerous or tedious tasks from human

2 • Understand principles of human intelligence
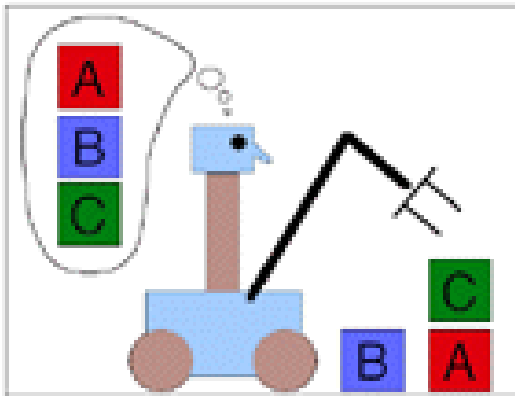
AI

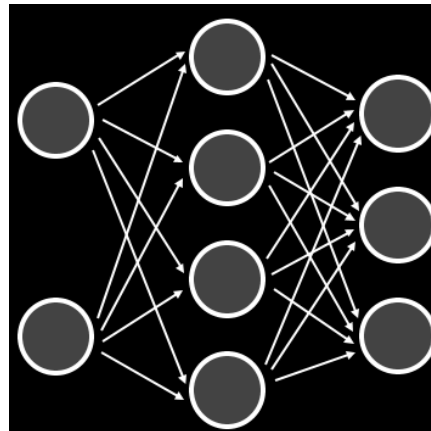- **AI** is the part of computer science concerned with design of computer systems that exhibit human intelligence.

- AI has two major roles:
  - Study the intelligent part concerned with humans.
  - Represent those actions using computers.

Study the human intelegent

represent those actions by using computers.

The main topics in AI

Artificial intelligence can be considered under a number of headings:

- Search (includes Game Playing).
- Representing Knowledge and Reasoning with it.
- Planning.
- Learning.
- Natural language processing.
- Expert Systems.
- Interacting with the Environment
                (e.g. Vision, Speech recognition, Robotics)

Search
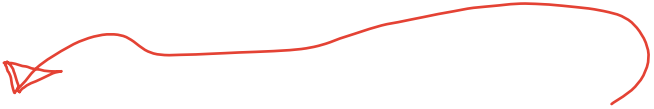
- *Search* is the fundamental technique of AI.
  - Possible answers, decisions or courses of action are structured into an abstract space, which we then search.

- Search is either "blind" or "uninformed" and informed :
  - blind
    - we move through the space without worrying about what is coming next, but recognising the answer if we see it
  - informed
    - we guess what is ahead, and use that information to decide where to look next.

- We may want to search for the first answer that satisfies our goal, or we may want to keep searching until we find the best answer.

Knowledge Representation & Reasoning

- <u>The most important concept in AI</u>

- If we are going to act rationally in our environment, then we must have some way of describing that environment and drawing inferences from that representation.

  - how do we describe what we know about the world ?

  - how do we describe it so that we can get hold of the right piece of knowledge when we need it ?

  - how do we generate new pieces of knowledge ?

  - how do we deal with *uncertain* knowledge ?

Planning

Given a set of goals, construct a sequence of actions that achieves those goals:

- often very large search space
- but most parts of the world are independent of most other parts
- often start with goals and connect them to actions
- no necessary connection between order of planning and order of execution
- what happens if the world changes as we execute the plan and/or our actions don't produce the expected results?

Learning

- If a system is going to act truly appropriately, then it must be able to change its actions in the light of experience:
  - how do we generate new facts from old ?
  - how do we generate new concepts ?
  - how do we learn to distinguish different situations in new environments ?

History of AI

| Year	Advances in AI
1923	Karel Čapek play named "Rossum's Universal Robots" (RUR) opens in London, first use of the word "robot" in English.
1943	Foundations for neural networks laid.
1945	Isaac Asimov, a Columbia University alumni, coined the term *Robotics*.
1950	Alan Turing introduced Turing Test for evaluation of intelligence and published *Computing Machinery and Intelligence.* Claude Shannon published *Detailed Analysis of Chess Playing* as a search.
1956	John McCarthy coined the term *Artificial Intelligence*. Demonstration of the first running AI program at Carnegie Mellon University.
1958	John McCarthy invents LISP programming language for AI.
1964	Danny Bobrow's dissertation at MIT showed that computers can understand natural language well enough to solve algebra word problems correctly.
1965	Joseph Weizenbaum at MIT built *ELIZA*, an interactive problem that carries on a dialogue in English.
1969	Scientists at Stanford Research Institute Developed *Shakey*, a robot, equipped with locomotion, perception, and problem solving.
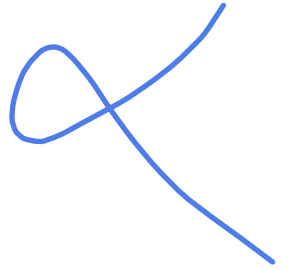
History of AI Cont….

Year	Advances in AI
1973	The Assembly Robotics group at Edinburgh University built *Freddy*, the Famous Scottish Robot, capable of using vision to locate and assemble models.
1979	The first computer-controlled autonomous vehicle, Stanford Cart, was built.
1985	Harold Cohen created and demonstrated the drawing program, *Aaron*.
1990	Major advances in all areas of AI – •Significant demonstrations in machine learning •Case-based reasoning •Multi-agent planning •Data mining, Web Crawler •natural language understanding and translation •Vision, Virtual Reality •Games
1997	The Deep Blue Chess Program beats the world chess champion, Garry Kasparov.
2000	Interactive robot pets become commercially available. MIT displays *Kismet*, a robot with a face that expresses emotions. The robot *Nomad* explores remote regions of Antarctica and locates meteorites.
After	The era of Artificial Neural Network

Artificial Intelligence disciplines

- Artificial Intelligence is a multi-discipline area, the major areas participated in AI :-
  - Computer Science
  - Mathematics
  - Neuron Science
  - Biology
  - Sociology
  - Psychology
  - Philosophy
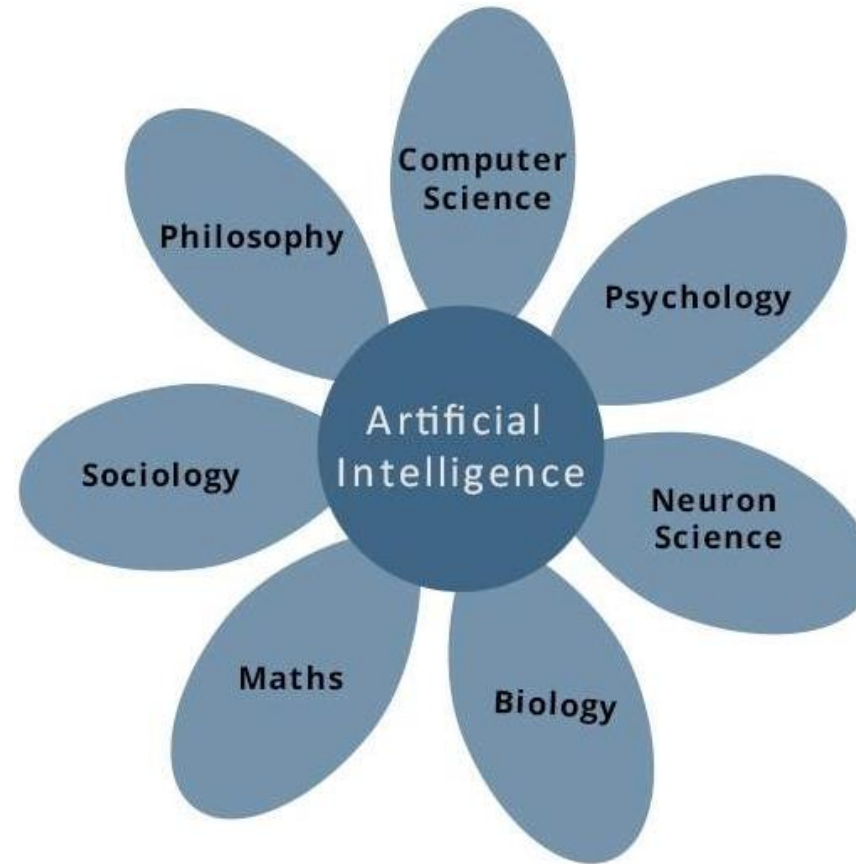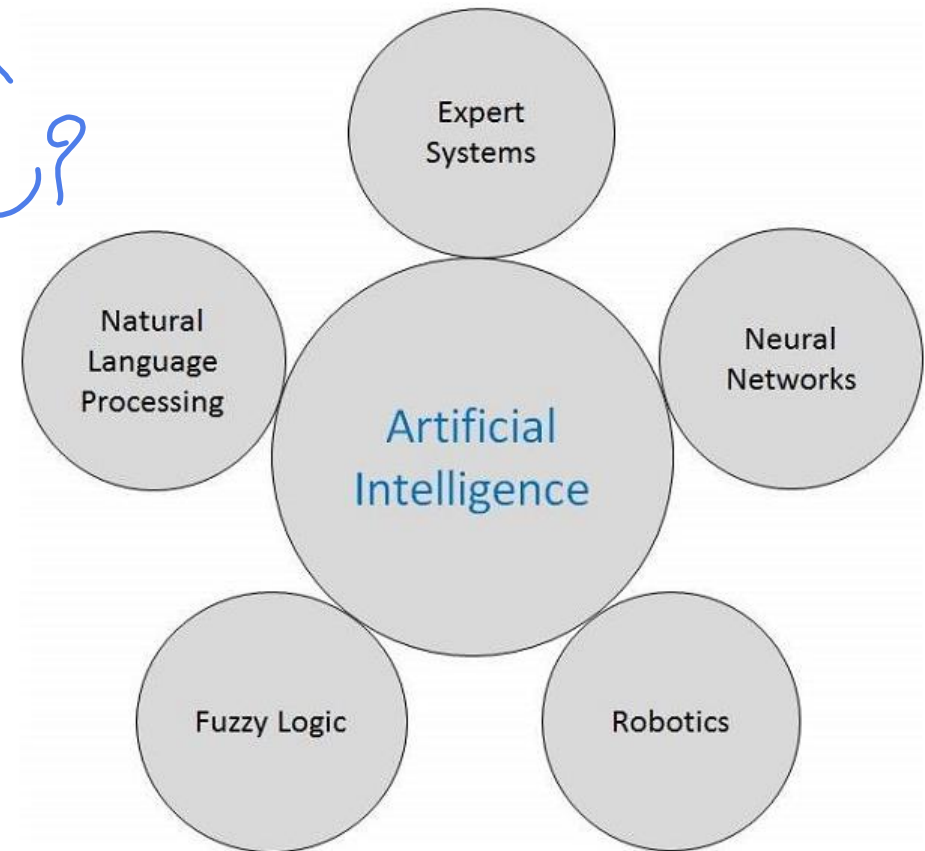
Artificial Intelligence - Research Areas

- AI has many applications, the most important ones are:
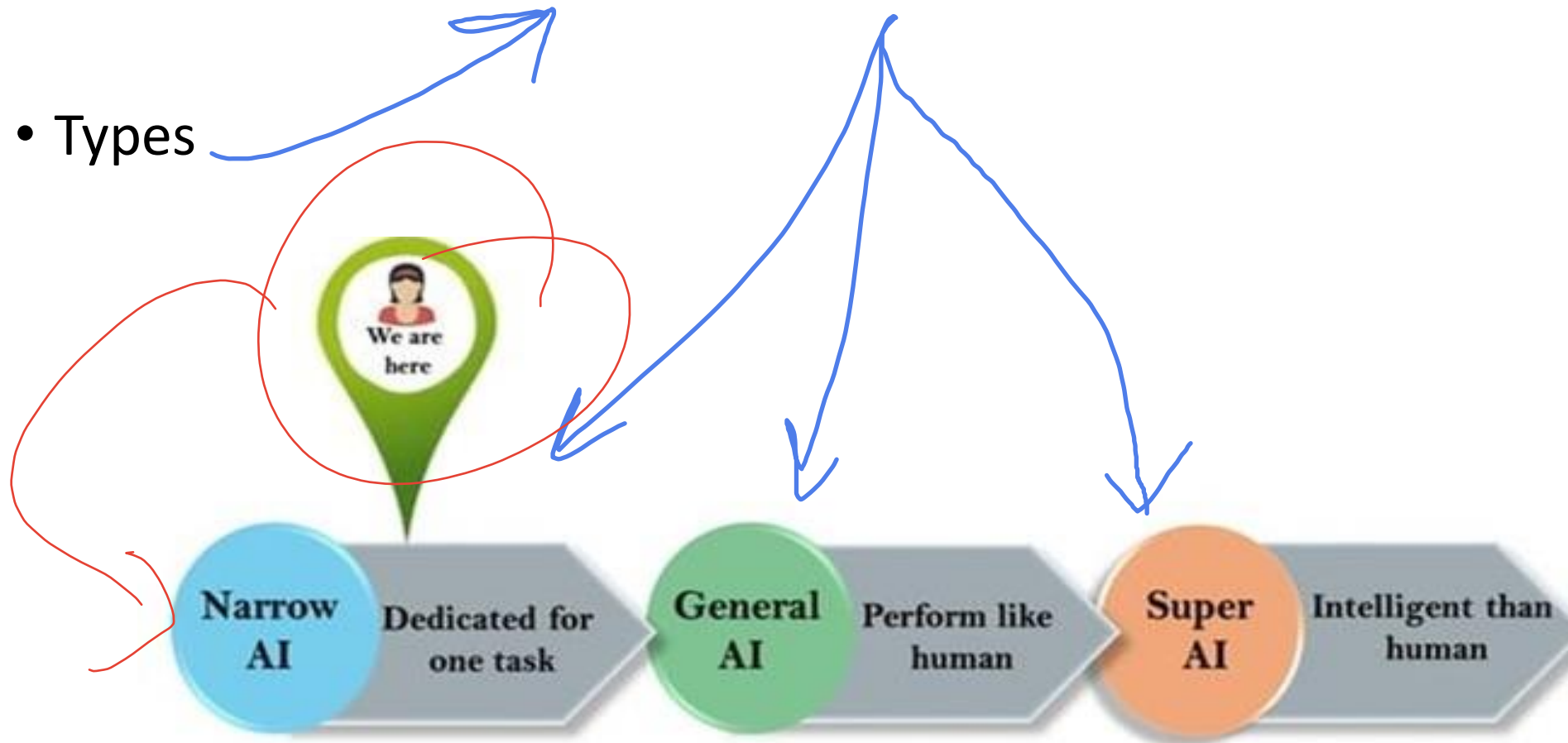 1 • Expert Systems
  2 • Robotics
  3 • Neural Network
  4 • Fuzzy Logic
  5 • Natural Language Processing
  • And many more ….

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Artificial Intelligence

- Types

We are here

| Narrow AI | Dedicated for one task | General AI | Perform like human | Super AI | Intelligent than human |

Artificial Narrow Intelligence

- Also known as Weak AI, ANI is the stage of Artificial Intelligence involving machines that can perform only a narrowly defined set of specific tasks.

- At this stage, the machine does not possess any thinking ability, it just performs a set of predefined functions.

Artificial General Intelligence (AGI)

- Also known as Strong AI, AGI is the stage in the evolution of Artificial Intelligence wherein machines will possess the ability to think and make decisions just like us humans.

Artificial Super Intelligence (ASI)

- Artificial Super Intelligence is the stage of Artificial Intelligence when the capability of computers will surpass human beings.

What is Artificial Intelligence ?

	HUMAN	RATIONAL
THOUGHT	Systems that think like humans	Systems that think rationally
BEHAVIOUR	Systems that act like humans	Systems that act rationally

Some Disadvantages Of Artificial Intelligence

- increased costs
- difficulty with software development - slow and expensive
- few experienced programmers
- few practical products have reached the market as yet. *the products are little*

Some Advantages of Artificial Intelligence

- more powerful and more useful computers
- new and improved interfaces
- solving new problems
- better handling of information
- relieves information overload
- conversion of information into knowledge

Applications of Artificial intelligence

Intelligent systems are poised to fill a growing number of roles in today's society, including:

- Factory automation
- Field and service robotics
- Assistive robotics
- Military applications
- Medical care
- Education
- Entertainment
- Visual inspection
- Character recognition
- Human identification using various biometric modalities (e.g. face, fingerprint, iris, hand)
- Visual surveillance
- Intelligent transportation

What are intelligent systems?

- Intelligent systems are technologically advanced machines that perceive and respond to the world around them.

- two main areas within intelligent systems:
  1. how machines perceive their environment
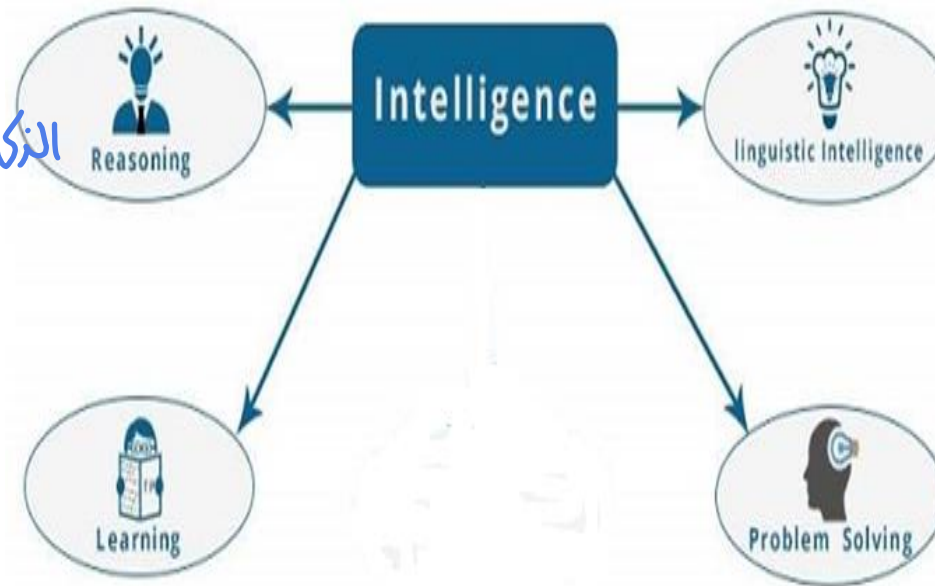 2. how those machines interact with that environment.

Intelligence Components

- The major ==component==s of intelligence can be:
  - ==Reasoning== (logical)
  - ==Learning==
  - ==Problem solving==
  - ==Linguistic Intelligence== الذكاء اللغوي

/lɪŋ'gwɪstɪk/

CHALLENGES IN ARTIFICIAL INTELLIGENCE

Research in intelligent systems faces numerous challenges, many of which relate to representing a dynamic physical world computationally.

1. **Uncertainty**: Physical sensors/effectors provide limited, noisy and inaccurate information/action. Therefore, any actions the system takes may be incorrect both due to noise in the sensors and due to the limitations in executing those actions.

2. **Dynamic world**: The physical world changes continuously, requiring that decisions be made at fast time scales to accommodate for the changes in the environment.

3. **Time-consuming computation**: Searching for the optimal path to a goal requires extensive search through a very large state space, which is computationally expensive. The drawback of spending too much time on computation is that the world may change in the meantime, thus rendering the computed plan obsolete.

4. **Mapping**: A lot of information is lost in the transformation from the 3D world to the 2D world. Computer vision must deal with challenges including changes in perspective, lighting and scale; background clutter or motion; and grouping items with intra/inter-class variation.

References

❑ Wolfgang, Ertel. "Introduction to artificial intelligence." *Translated by Nathanael Black With illustrations by Florian Mast, Springer-Verlag London Limited* (2011).

❑ Guido, Andreas Müller C. Sarah. *Introduction to machine learning with python*. O'Reilly Media, Incorporated, 2016.

❑ *Adrian A. Hopgood, Intelligent Systems for Engineers and Scientists, 2nd Edition, CRC Publication (2000).*

❑ *Michael Negnevitsky, Artificial Intelligence: A Guide to Intelligent Systems, 2nd Edition, Addison Wesley (2004).*

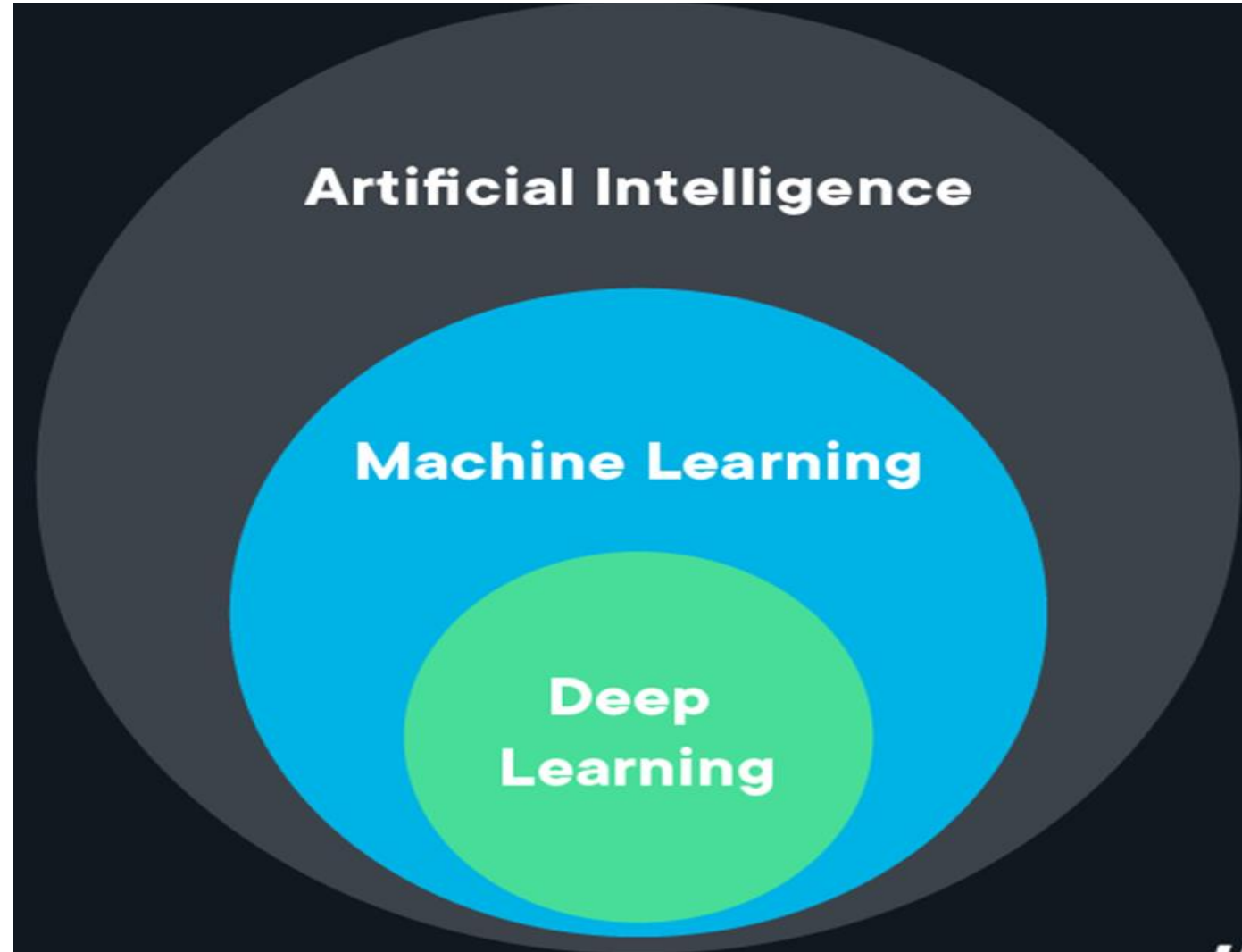❑ *Selected papers and journal articles used for assignment, analysis, classroom discussion and case study purposes.*

Assignment 1:

Q) Explain with example the three different types of Artificial Intelligence:
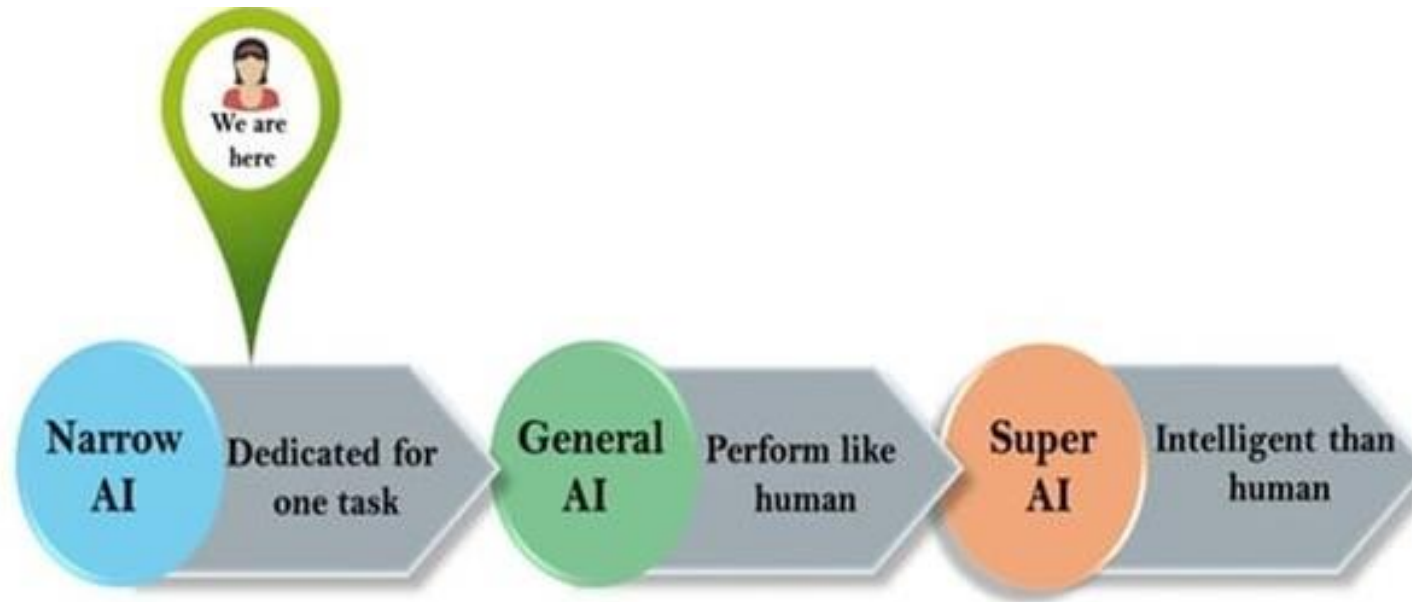
Assignment 2:   AI Vs. ML Vs. DL

Thank You