جامـــــعة المـــــستـقبـل
AL MUSTAQBAL UNIVERSITY

كلية العـــــــلوم
قـســـــــم علوم الذكاء الاصطناعي

LECTURE: (1)

Subject: AI definition, history, concept, and applications
Level: First
Lecturer: Dr. Ahmed Adnan Hadi

Introduction to Artificial Intelligence

What is Intelligence?

Intelligence is the ability to learn about, to learn from, to understand about, and interact with one's environment.

What is Artificial Intelligence (AI)?

A.I: - Is a simply way of making a computer think.

A.I: - Is the part of computer science concerned with designing intelligent computer system that exhibit the characteristic associated with intelligent in human behavior.

This requires many processes:

1- Learning: The acquisition of information and the rules needed to use that information.
2- Reasoning: Using the information rules to reach definite or approximate conclusions.
3- Self-Correction: The process of continually fine-tuning AI algorithms and ensure that they offer the most accurate results they can.

Accordingly, a simple **definition** might be as follows:

Artificial Intelligence involves using methods based on the intelligent behavior of humans to solve complex problems.

Advantages of using AI

Many advantages of using AI in different fields. Some of these are:

- ✓ It reduces human error.
- ✓ It never gets bored, so it easily handles repetitive tasks.
- ✓ It's fast.

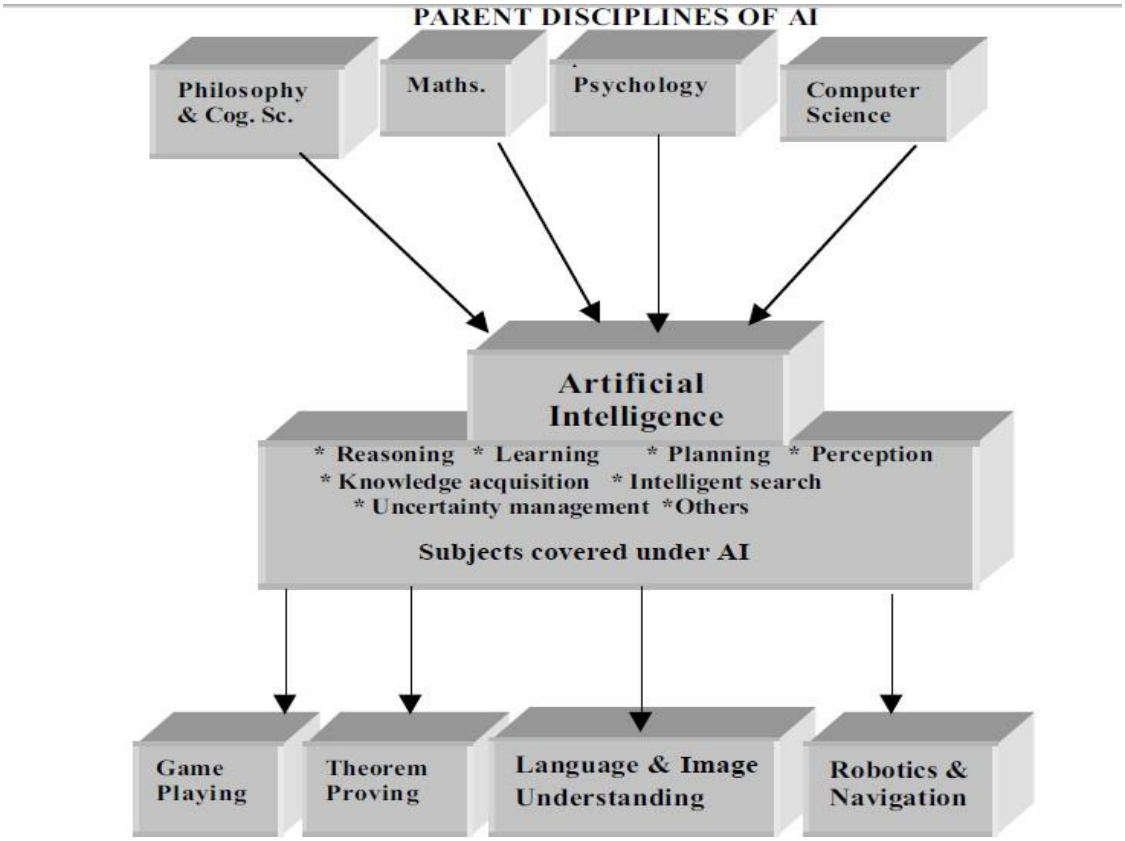
A.I Principles

1- The data structures used in knowledge representation.

2- The algorithms needed to apply that knowledge.

3- The language and programming techniques used their implementation.

The subject of AI spans a wide horizon. It deals with the various kinds of knowledge representation schemes, different techniques of intelligent search, various methods for resolving uncertainty of data and knowledge, different schemes for automated machine learning and many others. Among the application areas of AI, we have Expert systems, Game-playing, and Theorem-proving, Natural language processing, Image recognition, Robotics and many others. The subject of AI has been enriched with a wide discipline of knowledge from Philosophy, Psychology, Cognitive Science, Computer Science, Mathematics and Engineering.



Artificial Intelligence History

The idea of 'a machine that thinks' dates back to ancient Greece. But since the advent of electronic computing (and relative to some of the topics discussed in this article)

important events and milestones in the evolution of artificial intelligence include the following:

1950: Alan Turing publishes Computing Machinery and Intelligence. In the paper, Turing—famous for breaking the Nazi's ENIGMA code during WWII—proposes to answer the question 'can machines think?' and introduces the Turing Test to determine if a computer can demonstrate the same intelligence (or the results of the same intelligence) as a human. The value of the Turing test has been debated ever since.

1956: John McCarthy coins the term 'artificial intelligence' at the first-ever AI conference at Dartmouth College. (McCarthy would go on to invent the Lisp language.) Later that year, Allen Newell, J.C. Shaw, and Herbert Simon create the Logic Theorist, the first-ever running AI software program.

1967: Frank Rosenblatt builds the Mark 1 Perceptron, the first computer based on a neural network that 'learned' though trial and error. Just a year later, Marvin Minsky and Seymour Paper publish a book titled Perceptrons, which becomes both the landmark work on neural networks and, at least for a while, an argument against future neural network research projects.

1980s: Neural networks which use a backpropagation algorithm to train itself become widely used in AI applications.

1997: IBM's Deep Blue beats then world chess champion Garry Kasparov, in a chess match (and rematch).

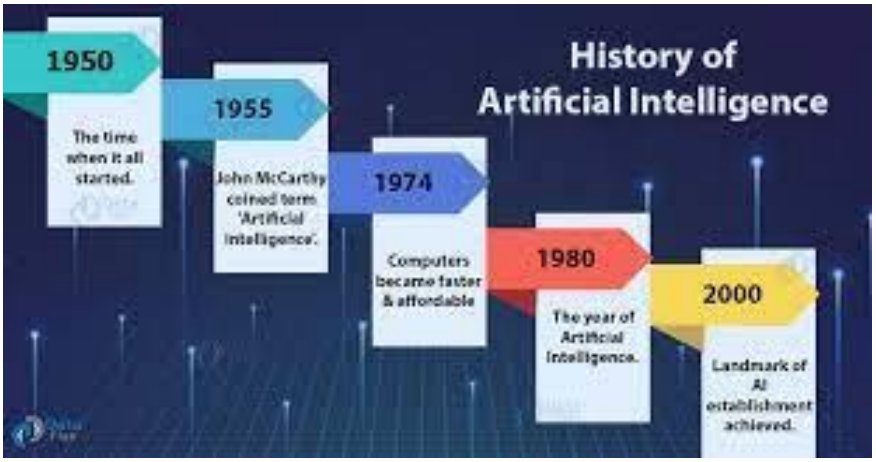
2011: IBM Watson beats champions Ken Jennings and Brad Rutter at Jeopardy!

2015: Baidu's Minwa supercomputer uses a special kind of deep neural network called a convolutional neural network to identify and categorize images with a higher rate of accuracy than the average human.

2016: DeepMind's AlphaGo program, powered by a deep neural network, beats Lee Sodol, the world champion Go player, in a five-game match. The victory is significant given the huge number of possible moves as the game progresses (over 14.5 trillion after just four moves!). Later, Google purchased DeepMind for a reported USD 400 million.

2023: A rise in large language models, or LLMs, such as ChatGPT, create an enormous change in performance of AI and its potential to drive enterprise value.

With these new generative AI practices, deep-learning models can be pre-trained on vast amounts of raw, unlabeled data.



In the most recent decades, the study of Artificial Intelligence has flourished. Areas of particular importance include the following:

(machine learning, multi-agent systems, artificial life, computer vision, planning, and playing games).

Modern Ways of Implementing AI

Let's explore the following ways that explain how we can implement AI:

1. MACHINE LEARNING

Machine learning is the most common form of AI in the world today and how most use cases for ANI are realized. The reason we have been able to develop AI solutions at a rapid rate in the last few years is due to vast volumes of data being generated in the world. Machine learning is the process where computer systems become capable of gaining intelligence through data.

Devices and Systems which are built with machine learning algorithms can learn from experience in the form of historical data. When we talk about algorithms, these are programming codes, a bit like how a developer would build a website or some other online functionality.

There are four common types of machine learning which are summarized below.

◈ Supervised Learning

This method takes existing data and trains a model to work out how to classify a new piece of data. For example, it could hold data on the symptoms of diabetes and when it receives blood test results of a new patient, it is able to make a diagnosis prediction. Initially a human would train the machine how to classify symptoms into "Has Diabetes" or "Does Not Have Diabetes." Over time, with enough data, an AI system will be able to take a new set of information and create its own prediction as to which classification the new patient falls into. Therefore, it defines as a method of learning in which a computer is taught data for which it knows what the correct answer is (=Labeled data) to predict outcomes for new incoming data. Examples of this learning types are:

Regression: Linear Regression, Ridge Regression, Lasso Regression

Classification: KNN Classification, Naive Classification, SVM Classification

◈ **Unsupervised Learning**

Unlike, supervised learning, these models will attempt to classify data without any prior knowledge. The algorithms look to find patterns themselves and put data into groups. A common example is something like customer purchasing behaviors. The algorithm won't have existing labels and will decide on its own how to classify the data, often known as clustering. Imagine going to a party where everybody is a stranger. Your mind will probably classify people based on age, gender or clothing. You don't know them but have still worked out the classifications. Accordingly, it can be defined as a learning method that makes predictions without telling you the right answer, looking for patterns or shapes in unlabeled data and clustering similar data together such as:

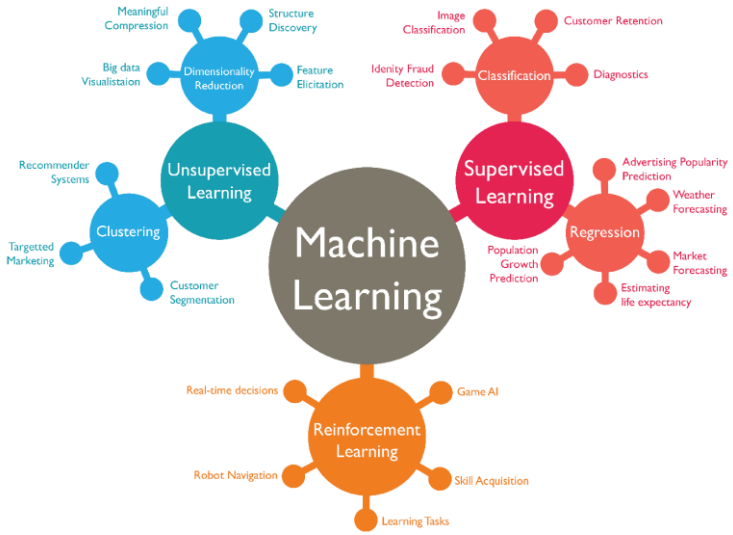
Clustering: K-means, PCA, Density Estimation, Association analysis

◈ **Semi-Supervised Learning**

Semi-Supervised Learning is a mix between supervised and unsupervised learning. In a large volume of data, it is common that some items are labelled, and some are not. A semi-supervised model would have some labelled data to know that classification does exist. It is then trained on unsupervised data to define the boundaries of what it is looking at and potentially specify new classifications that the human did not specify when labelling. For example, machine learning is being used to detect fraud in banking by identifying patterns in the data. However, initially you can only classify the fraudulent activity that you know about.

◈ **Reinforcement Learning**

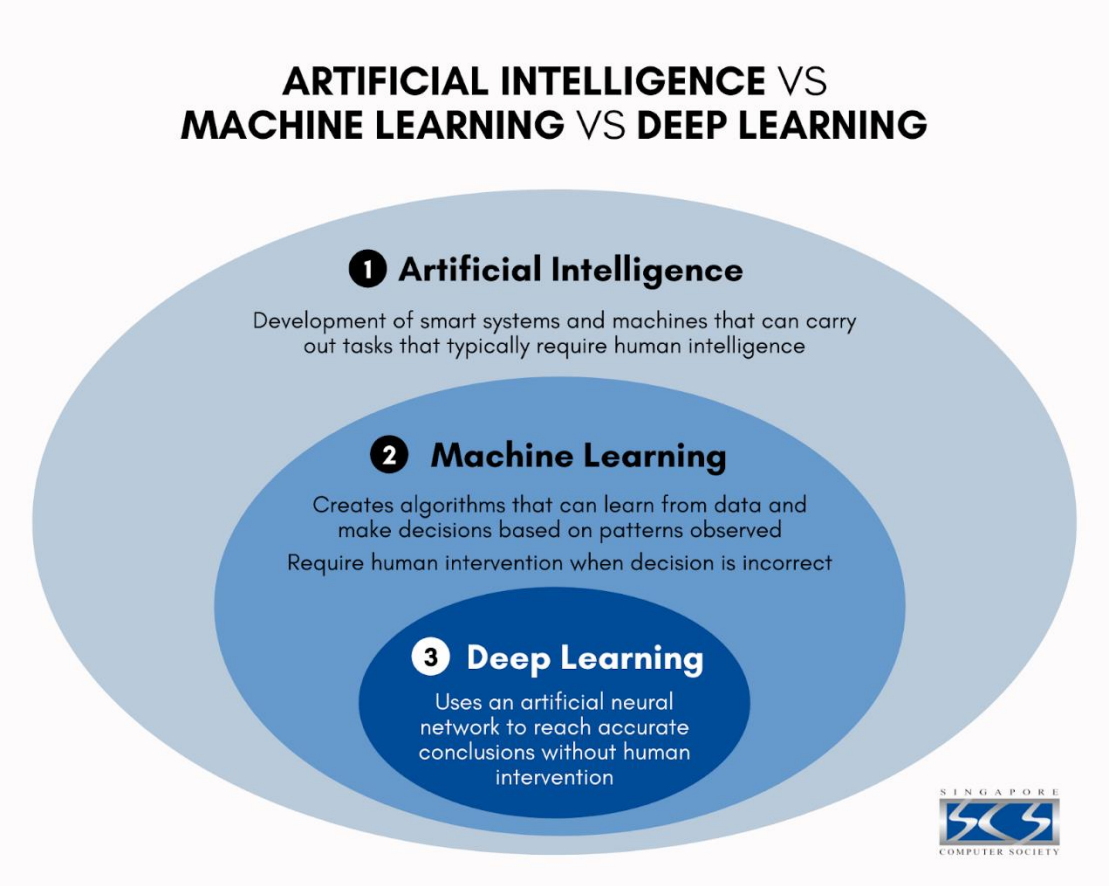
This application is about positive and negative rewards for certain behaviors and is a common method in robotics.



2. DEEP LEARNING

Deep learning is another subset of AI and the term is often used interchangeably with machine learning, but the two applications are different. In the simplest form, deep learning algorithms have numerous layers, each providing a separate interpretation of the data it is based on. This multi-layer approach is often referred to as an artificial neural network as their function is designed to (at least attempt) replicate that of a human brain.

Simply, deep learning is a subcategory of machine learning, provides AI with the ability to mimic a human brain's neural network. It can make sense of patterns, noise, and sources of confusion in the data.



Deep Learning vs. Machine Learning

To summarize in one sentence, deep learning is a specialized subset of machine learning, which is in turn a subset of artificial intelligence. In other words, deep learning is a concept within machine learning. If you look at the definitions of the two technologies, you can see the differences.

Differences in structure

- Machine learning is the term for when a computer learns from data.
- Deep learning is the analysis of data in a logical structure similar to how humans draw conclusions.

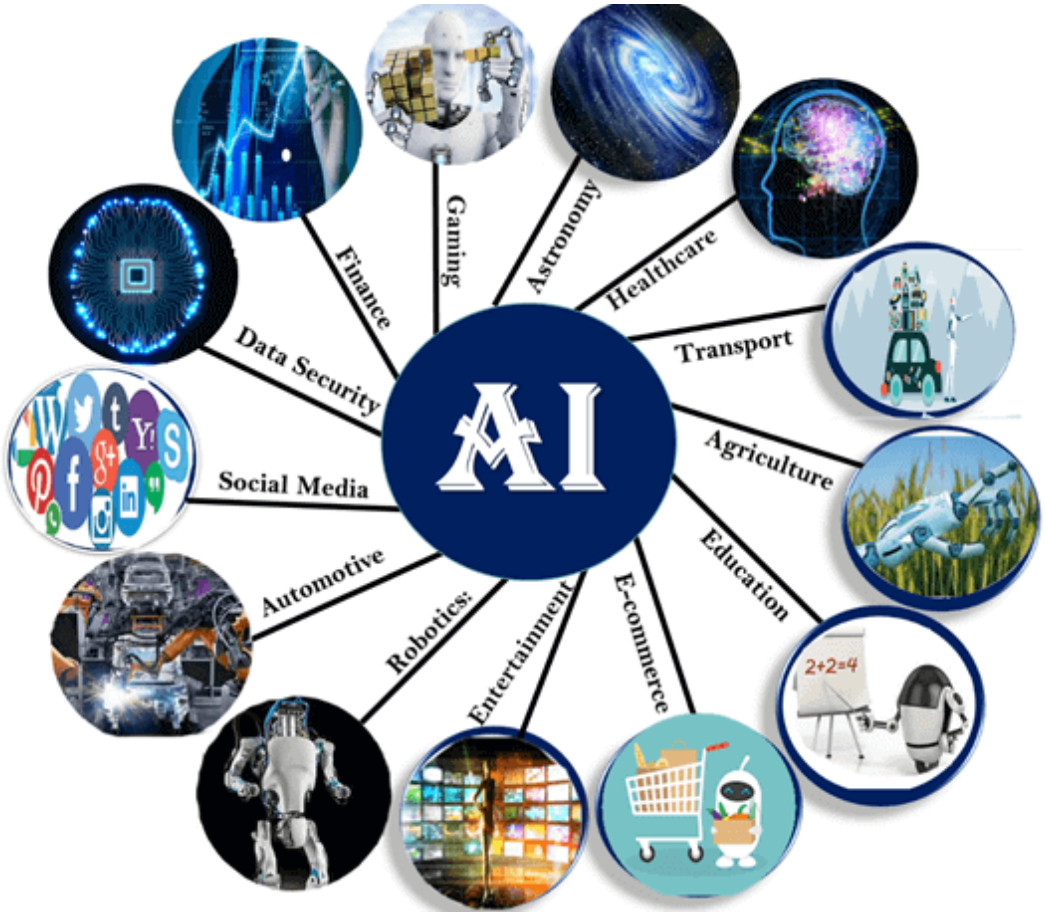
Differences in forecasting methods

- Machine learning algorithms use methods to make predictions based on patterns and inferences.
- Deep learning uses a layered algorithmic structure called an artificial neural network (ANN).

Applications of AI

Here is the list of the top used applications of AI:

- ☒ E-Commerce
- ☒ Education
- ☒ Lifestyle
- ☒ Navigation
- ☒ Robotics
- ☒ Healthcare
- ☒ Agriculture
- ☒ Gaming
- ☒ Social Media
- ☒ Finance
- ☒ Astronomy
- ☒ Data Security
- ☒ Travel and Transport
- ☒ Industry



How Does Artificial Intelligence Work?

Put simply, AI systems work by merging large with intelligent, iterative processing algorithms. This combination allows AI to learn from patterns and features in the analyzed data. Each time an Artificial Intelligence system performs a round of data processing, it tests and measures its performance and uses the results to develop additional expertise.