

Faculty of Economics Commerce and Management Sciences

Finance and Accounting Department

Introduction to Artificial Intelligence

Chapter 04

Comparison Between Artificial Intelligence, Machine Learning, and Deep Learning

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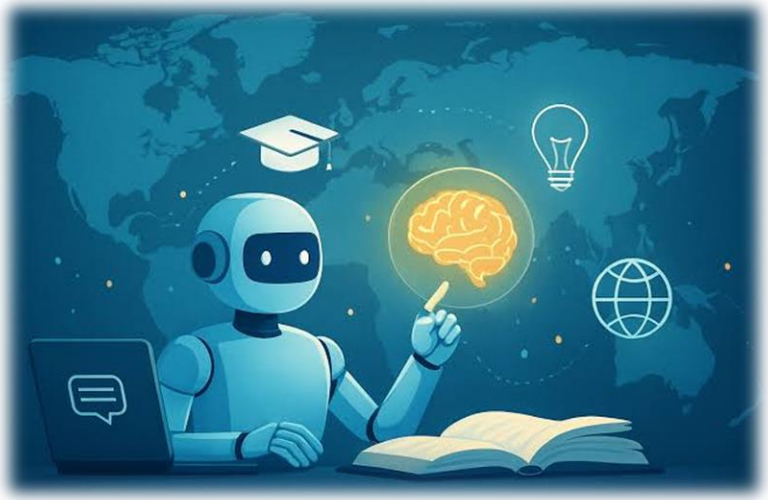
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01 – Definition of Artificial Intelligence, Machine Learning, and Deep Learning

Definition of Artificial Intelligence:

Scientific development involving the creation of a machine capable of performing tasks that fall within the scope of human intelligence, such as learning, logic, self-correction, or dealing with data that exceeds the capacity of humans to analyze in size and scope.

The main goal of artificial intelligence is to enable computers to perform tasks that humans do.



Definition of Machine Learning:

It’s a subfield of artificial intelligence, where technology systems learn patterns and relationships from data and improve or acquire knowledge autonomously without the need for explicit programming.

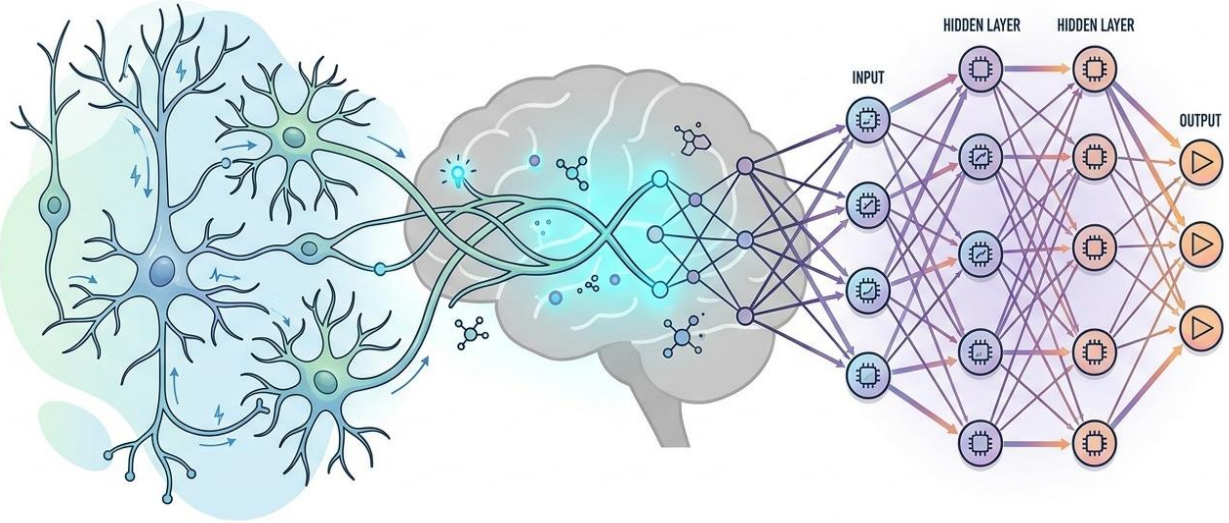
Machine Learning has many types, the most important of these include:

- Supervised Learning: This type include all the machine problems that rely on the use of classified training examples.
- Unsupervised Learning: This process discovers hidden patterns and groups in unclassified data without human guidance or specific answers.

In addition to other types like Reinforcement Learning.

Definition of Deep Learning:

Deep Learning is a branch of machine learning that aims to develop a model that mimics the human brain's ability to solve complex real-world problems using artificial neural networks. Since the human brain is composed of a network of neurons, deep learning seeks to emulate this level of neural connectivity using artificial neural networks techniques, which form the core of deep learning.



A deep learning model consists of an input layer, an output layer, and one or more hidden layers, each containing a set of weighted nodes or neurons connected to each other.

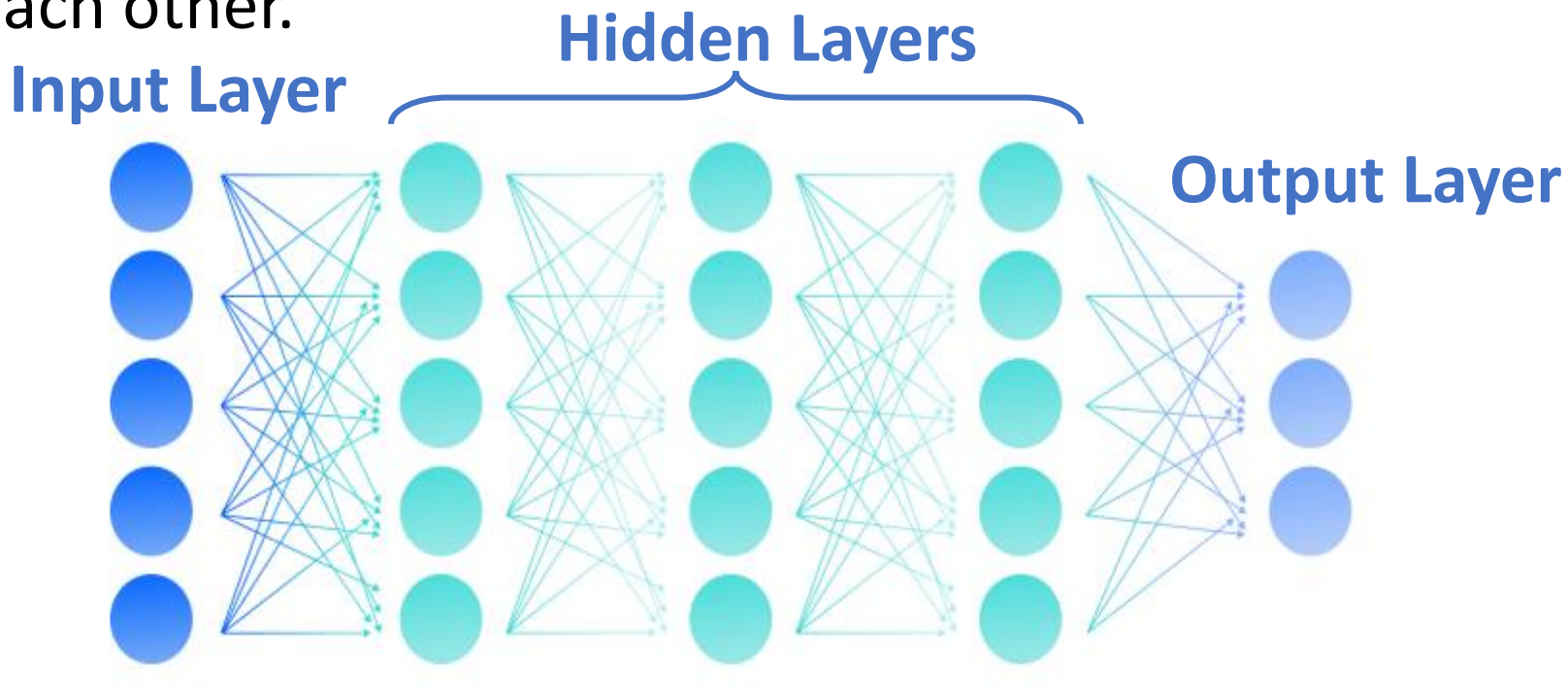


Figure 01: Deep learning model architecture.

02 – The Relation Between Artificial Intelligence, Machine Learning, and Deep Learning

The relation between artificial intelligence, machine learning, and deep learning is one of inclusion. AI is the broader field, including both machine learning and deep learning, while machine learning is a subfield of AI. Deep learning, on the other hand, is a specialized branch of machine learning.

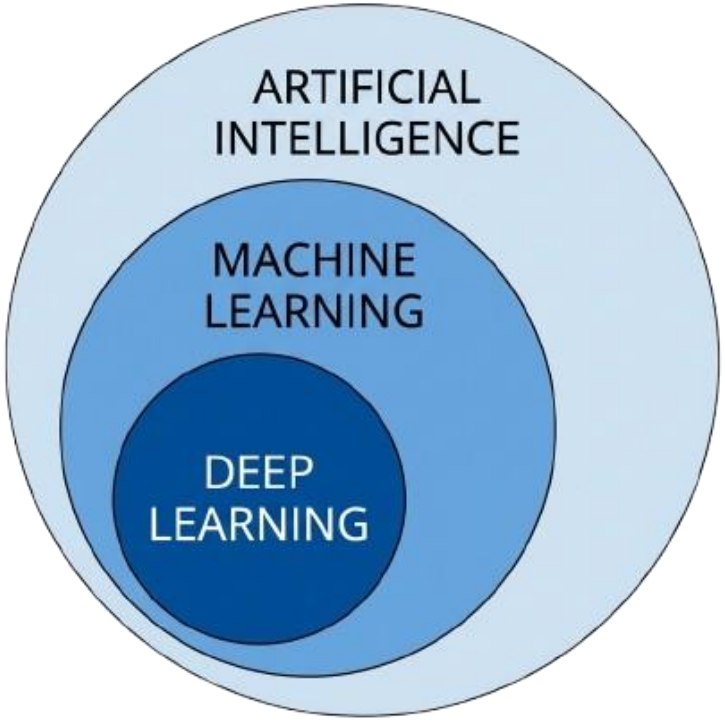


Figure 02: The relation between artificial intelligence, machine learning, and deep learning.

03 – Comparison Regarding the Scope of Application and the Nature of the Data

03.Comparison Regarding the Scope of Application and the Nature of the Data

Side	Artificial Intelligence	Machine Learning	Deep Learning
Scope of Application	Field dedicated to creating systems or machines that can perform tasks typically requiring human intelligence (Example: reasoning, problem-solving, learning, perception).	A subset of artificial intelligence. It focuses on developing systems that can learn from data and make decisions based on it, without being explicitly programmed for every scenario.	A subset of machine learning. Artificial neural networks are used to learn complex patterns directly from large amounts of raw data.
Nature of Data	Rule-based AI may need little data, while AI based on machine learning/deep learning needs a lot of data.	It takes large amounts of structured, organized, or categorized data to train algorithms effectively. Performance generally improves as the amount of data increases.	Requires extremely large datasets. Performance is highly dependent on data size. The data is unstructured and diverse, such as images and videos in computer vision, audio files, and text and natural language processing.

Table 01: Comparison between artificial intelligence, machine learning, and deep learning.

The table below shows how a structured organized data looks, where the goal is to predict:Will the house be sold or not?.

House ID	Area in m^2	Bedrooms	Age in Years	Price in USD	Decision
1	139.5	3	10	250000	Buy
2	185.8	4	5	320000	Not Buy
3	83.6	1	20	150000	Buy
4	222.9	4	2	410000	Not Buy
5	111.4836	2	15	195000	Buy

Table 02: Structured, tabular data for training a machine learning model to predict: Will the house be sold or not?

04 – Practical Examples Illustrating the Differences

Example	Artificial Intelligence	Machine Learning	Deep Learning
Detecting spam messages	We create a system based on rules written by humans: - If the message contains "earn money quickly" or comes from a suspicious sender, classify it as a spam message.	We feed the model classified messages into: - Regular message. - Spam message. In addition to some properties: - Number of words. - Number of links (URLs). - Presence of certain words. - Message length. Then we use a machine learning algorithm that learns the relation between the properties and the categorization, and then predicts the classification of a new message.	In addition to using classified messages and properties, deep learning uses message content to analyze sentence context, tone, language, and intonation to extract more complex patterns and characteristics.

Table 03: Practical examples illustrating the differences.

04. Practical Examples Illustrating the Differences

Example	Artificial Intelligence	Machine Learning	Deep Learning
Determine if the image contains a cat	We create a system based on rules written by humans: - If the ears are small, the whiskers are long, and the tail is like this, then it's a cat. The system here doesn't learn, it simply applies handwritten rules. Regarding examples of artificial intelligence, we selected the rule-based type to illustrate the differences; however, examples involving machine learning and deep learning also qualify as artificial intelligence.	We give the classified data as: - Cat. - Not a cat. In addition to some characteristics: - Ear length. - Fur color. - Nose size. Then we use a machine learning algorithm that learns the relationship between the characteristics and the categorization, and then predicts the classification of a new message.	Deep learning utilizes classified images directly, autonomously learning to extract the features and patterns that enable it to detect images of cats.

Table 03: Practical examples illustrating the differences.

References:

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- Google Cloud. What is the difference between deep learning, machine learning, and artificial intelligence?