Artificial Neural Network
Lecture 1

Dina El-Manakhly, Ph. D.

dina_almnakhly@science.suez.edu.eg

Introduction to the machine learning and artificial intelligence

What is artificial intelligence (AI)?

❑ It is the science of making intelligent machines, especially intelligent computer programs. The goal of AI is to develop machines that behave as though they were intelligent.

❑ AI is the ability of machines to observe, think and react like human beings.

❑ AI is an umbrella term that encompasses a wide range of concepts and technologies, including machine learning (ML).
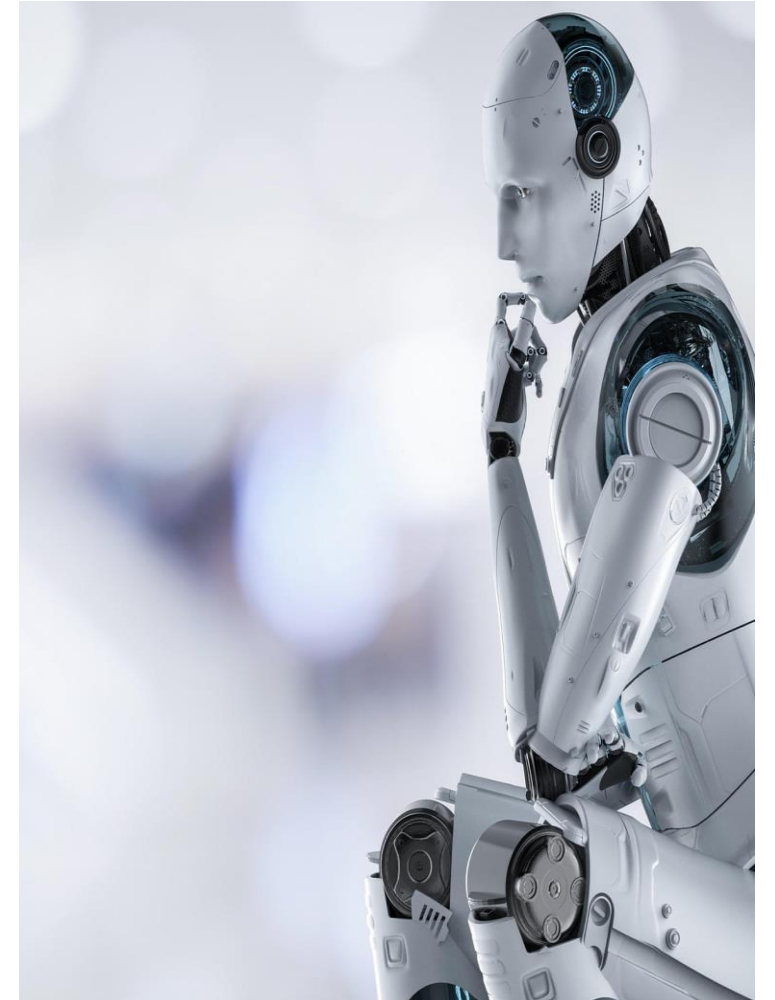
Introduction to the machine learning and artificial intelligence

❑ AI consists of many subfields that use techniques to mimic specific behaviors we associate with natural human intelligence.

❑ For example:

  ✓ Humans can speak, hear, read and write language and glean meaning from it. The fields of speech recognition and natural language processing (NLP) mimic these abilities by converting audio signals into text and processing that text to extract meaning from it.

  ✓ Building artificial systems that replicate human behaviors like our ability to move through our physical environment (robotics),

  ✓ See and process visual information (computer vision),

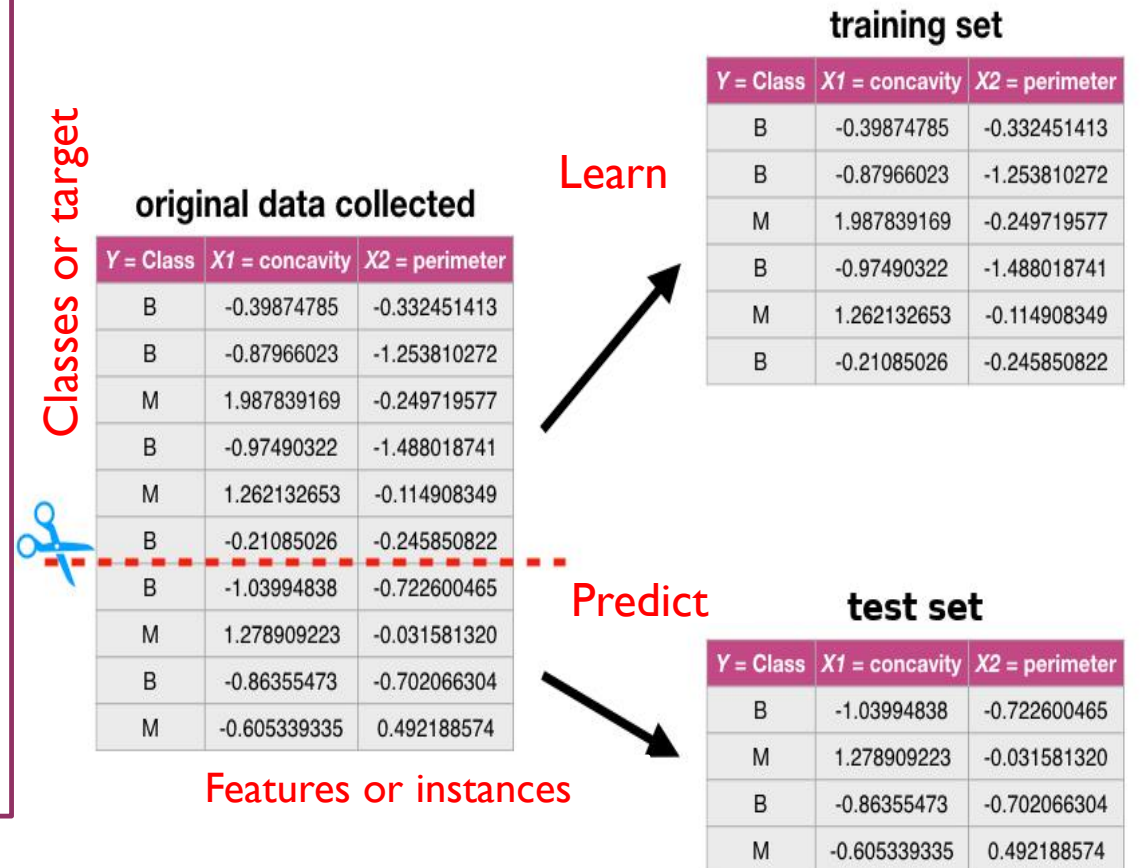 ✓ Identify and categorize objects (pattern recognition).

What is Machine Learning?

❑ Machine learning is the field of study that gives computers the ability to learn without being explicitly programmed.

   ✓ Programming = input + equation = output

   ✓ Machine learning = input + output = equation

❑ Machine learning is the field of computer science working to develop computer systems that can autonomously learn from experience, specifically, by processing the data they receive and improve the performance of specific tasks. The term "machine learning" is often used interchangeably with the term "artificial intelligence," but machine learning is a subfield of AI.
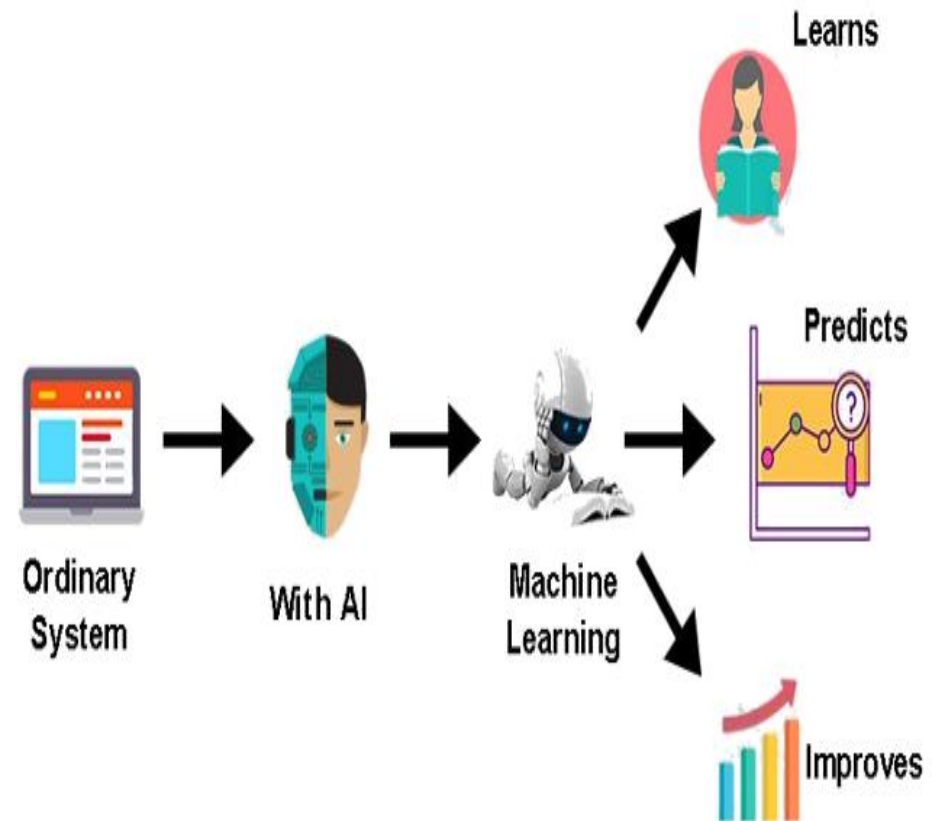
What is Machine Learning?

- ❑ Machine Learning is the most popular technique of **predicting** the **future** or **classifying information** to help people in making necessary decisions.

- ❑ Therefore, as it trains over the examples, again and again, it is able to identify patterns in order to make predictions about the future.

- ❑ These algorithms learn from the past instances of data through **statistical analysis** and **pattern matching**. Then, based on the learned data, it provides us with the **predicted results**.

- ❑ **Data** is the core **backbone** of machine learning algorithms. With the help of the historical data, we are able to **create more data** by training these machine learning algorithms.

Creating the training and test sets

Classes or target

original data collected

Y = Class	X1 = concavity	X2 = perimeter
B	-0.39874785	-0.332451413
B	-0.87966023	-1.253810272
M	1.987839169	-0.249719577
B	-0.97490322	-1.488018741
M	1.262132653	-0.114908349
B	-0.21085026	-0.245850822
B	-1.03994838	-0.722600465
M	1.278909223	-0.031581320
B	-0.86355473	-0.702066304
M	-0.605339335	0.492188574

Features or instances

Learn

training set

Y = Class	X1 = concavity	X2 = perimeter
B	-0.39874785	-0.332451413
B	-0.87966023	-1.253810272
M	1.987839169	-0.249719577
B	-0.97490322	-1.488018741
M	1.262132653	-0.114908349
B	-0.21085026	-0.245850822

Predict

test set

Y = Class	X1 = concavity	X2 = perimeter
B	-1.03994838	-0.722600465
M	1.278909223	-0.031581320
B	-0.86355473	-0.702066304
M	-0.605339335	0.492188574

Types of Machine Learning

❑ Based on the methods and way of learning, machine learning is divided into mainly two types, which are:

➢ Supervised Machine Learning

➢ Unsupervised Machine Learning

Supervised Machine Learning

❑ Supervised Machine Learning (Input and output are given):

Supervised machine learning is a type of machine learning where the algorithm is trained on a labeled dataset. In supervised learning, the input data is labeled with the correct output, and the algorithm learns to map the input to the correct output. The objective of supervised learning is to use the labeled dataset to train the algorithm, so that it can generalize to new, unseen data and make accurate predictions.

Training
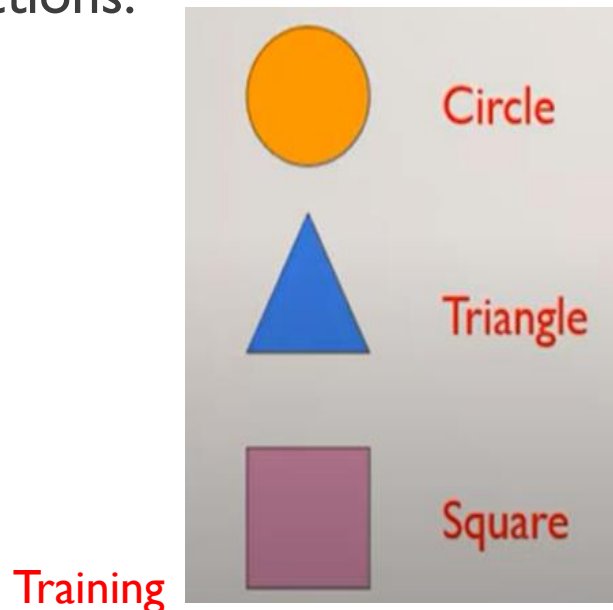
Testing

Supervised Machine Learning

❑ Supervised machine learning can be classified into two types of problems, which are given below:

Classification

Regression

Classification problem

❑ Classification algorithms are used to solve the classification problems in which the output variable is categorical, such as **"Yes" or No, Male or Female, Red or Blue, etc**. The classification algorithms predict the categories present in the dataset. Some real-world examples of classification algorithms are **Spam Detection, Email filtering, etc.**
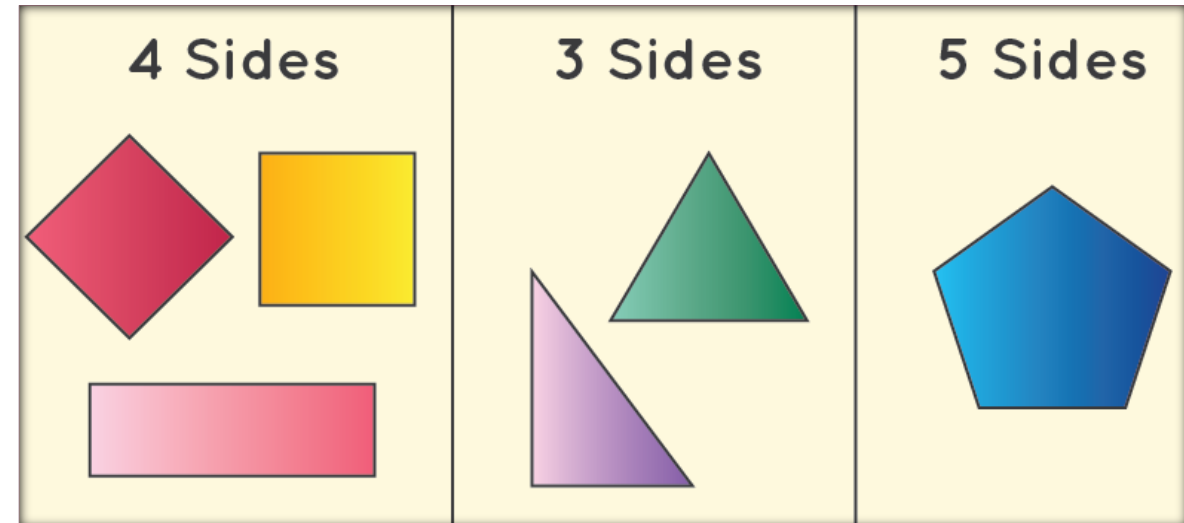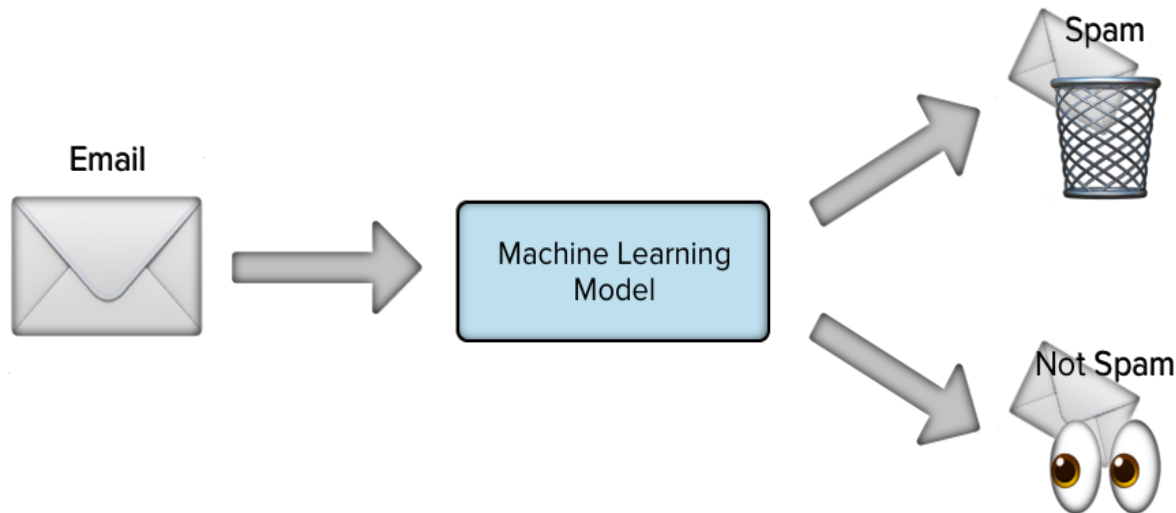
Examples of Classification Algorithms

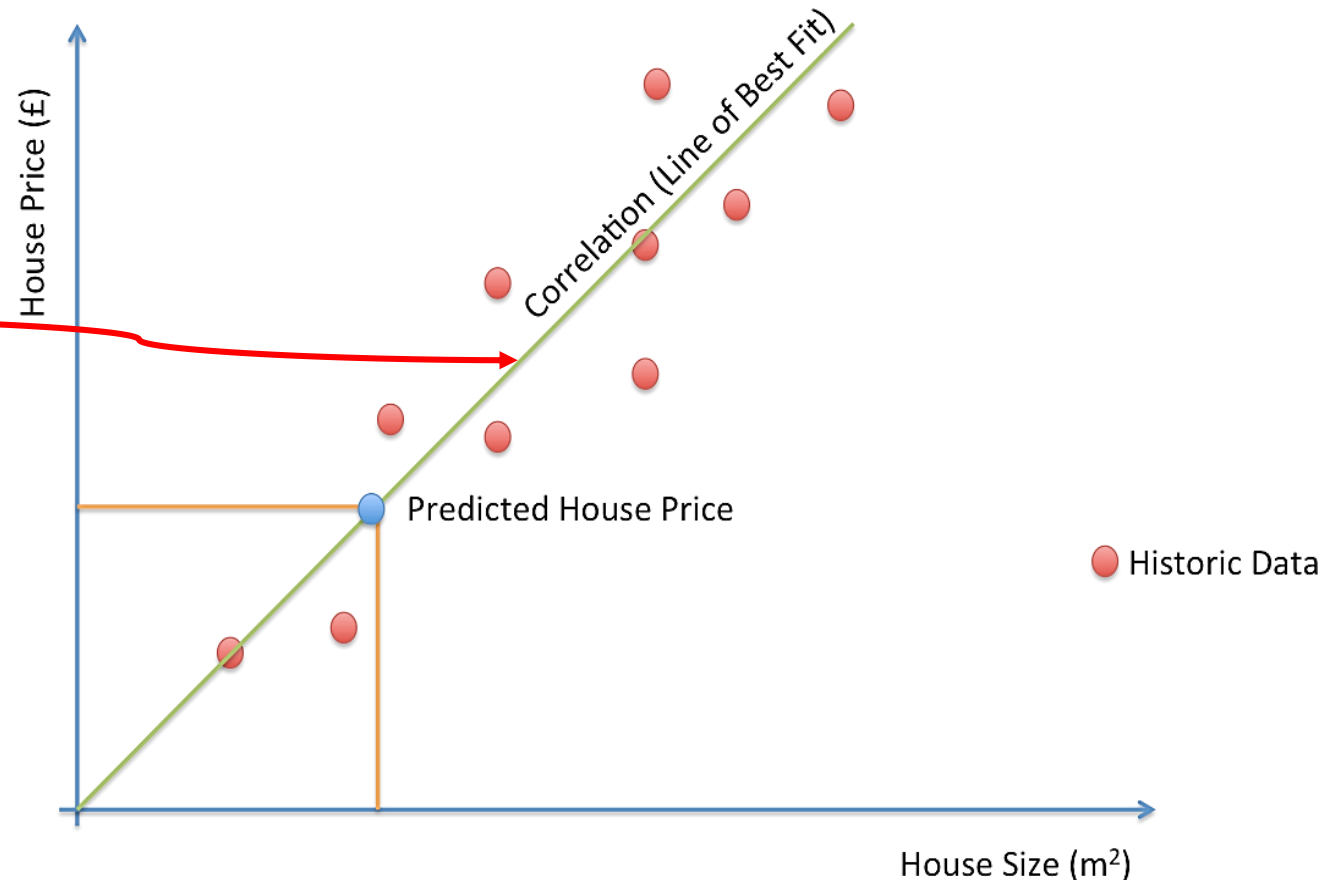❑ Some popular classification algorithms are given below:

- ✓ **Random Forest Algorithm**

- ✓ **Decision Tree Algorithm**

- ✓ **Logistic Regression Algorithm**

- ✓ **Support Vector Machine Algorithm**

Regression problem

- Regression is a type of supervised learning problem where the goal is to predict a continuous output variable based on one or more input variables. In other words, regression is used when the output variable is a numerical value, such as a price, a temperature, or a stock price, and the algorithm needs to learn the relationship between the input variables and the output variable.

Regression (Ex: **Predict the price of a house**)

The main objective of a regression problem is to find the best-fitting line or curve that can predict the output variable based on the input variables. The line or curve is determined by a set of parameters, which are estimated from the training data. Once the parameters are learned, the algorithm can use them to make predictions on new, unseen data.

Examples of Regression Algorithms

❑ Some popular Regression algorithms are given below:

✓ **Simple Linear Regression Algorithm**

✓ **Multivariate Regression Algorithm**

✓ **Lasso Regression**

Unsupervised machine learning

❑ Unsupervised learning (unlabeled data) is different from the Supervised learning technique; as its name suggests, there is no need for supervision. It means, in unsupervised machine learning, the machine is trained using the unlabeled dataset, and the machine predicts the output without any supervision.

❑ In unsupervised learning, the models are trained with the data that is neither classified nor labelled, and the model acts on that data without any supervision.

❑ The main aim of the unsupervised learning algorithm is to group or categories the unsorted dataset (clustering) according to the similarities, patterns, and differences. Machines are instructed to find the hidden patterns from the input dataset.

Artificial intelligence vs Machine learning vs Deep learning