# ARTIFICIAL INTELLIGENCE

# LAB 10



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**Define the following terms:**

1. **Supervised machine learning**
2. **Unsupervised machine learning**
3. **Classification problem**
4. **Regression problem**

# 1.Supervised machine learning

- Supervised learning is the types of machine learning in which machines are trained using well labelled training data, and on basis of that data, machines predict the output. The labelled data means some input data is already tagged with the correct output.
- In supervised learning, the training data provided to the machines work as the supervisor that teaches the machines to predict the output correctly. It applies the same concept as a student learns in the supervision of the teacher.
- Supervised learning is a process of providing input data as well as correct output data to the machine learning model. The aim of a supervised learning algorithm is to find a mapping function **to map the input variable(x) with the output variable(y**).
- In the real-world, supervised learning can be used for **Risk Assessment, Image classification, Fraud Detection, spam filtering, etc.**

**How Supervised Learning Works?**

In supervised learning, models are trained using labelled dataset, where the model learns about each type of data. Once the training process is completed, the model is tested on the basis of test data (a subset of the training set), and then it predicts the output.

**Steps Involved in Supervised Learning**

- First Determine the type of training dataset
- Collect the labelled training data.
- Split the training dataset into training dataset, test dataset, and validation dataset.
- Determine the input features of the training dataset, which should have enough knowledge so that the model can accurately predict the output.
- Determine the suitable algorithm for the model, such as support vector machine, decision tree, etc.
- Execute the algorithm on the training dataset. Sometimes we need validation sets as the control parameters, which are the subset of training datasets.
- Evaluate the accuracy of the model by providing the test set. If the model predicts the correct output, which means our model is accurate.

**Types of supervised Machine learning**

- Regression
- Classification

**Advantages of Supervised learning**

o With the help of supervised learning, the model can predict the output on the basis of prior experiences.
o In supervised learning, we can have an exact idea about the classes of objects.
o Supervised learning model helps us to solve various real-world problems such as fraud detection, spam filtering, etc.

**Disadvantages of supervised learning**

o Supervised learning models are not suitable for handling the complex tasks.
o Supervised learning cannot predict the correct output if the test data is different from the training dataset.
o Training required lots of computation times.
o In supervised learning, we need enough knowledge about the classes of object.

# 2.Unsupervised Machine Learning

- Unsupervised learning is a machine learning technique in which models are not supervised using training dataset. Instead, models itself find the hidden patterns and insights from the given data. It can be compared to learning which takes place in the human brain while learning new things.
- It can be defined as*: Unsupervised learning is a type of machine learning in which models are trained using unlabeled dataset and are allowed to act on that data without any supervision*
- Unsupervised learning cannot be directly applied to a regression or classification problem because unlike supervised learning, we have the input data but no corresponding output data.
- The goal of unsupervised learning is to find the underlying structure of dataset, group that data according to similarities, and represent that dataset in a compressed format.
- **Example:** Suppose the unsupervised learning algorithm is given an input dataset containing images of different types of cats and dogs. The algorithm is never trained upon the given dataset, which means it does not have any idea about the features of the dataset. The task of the unsupervised learning algorithm is to identify the image features on their own. Unsupervised learning algorithm will

perform this task by clustering the image dataset into the groups according to similarities between images.

**Why use Unsupervised Learning**

- ❖ Unsupervised learning is helpful for finding useful insights from the data.
- ❖ Unsupervised learning is much similar as a human learns to think by their own experiences, which makes it closer to the real AI.
- ❖ Unsupervised learning works on unlabeled and uncategorized data which make unsupervised learning more important.
- ❖ In real-world, we do not always have input data with the corresponding output so to solve such cases, we need unsupervised learning.

**Types of Unsupervised Learning**

- o Clustering
- o Association

**Advantages of Unsupervised Learning**

- ❖ Unsupervised learning is used for more complex tasks as compared to supervised learning because, in unsupervised learning, we don't have labeled input data.
- ❖ Unsupervised learning is preferable as it is easy to get unlabeled data in comparison to labeled data.

**Disadvantages of Unsupervised Learning**

- ❖ Unsupervised learning is intrinsically more difficult than supervised learning as it does not have corresponding output.
- ❖ The result of the unsupervised learning algorithm might be less accurate as input data is not labeled, and algorithms do not know the exact output in advance.
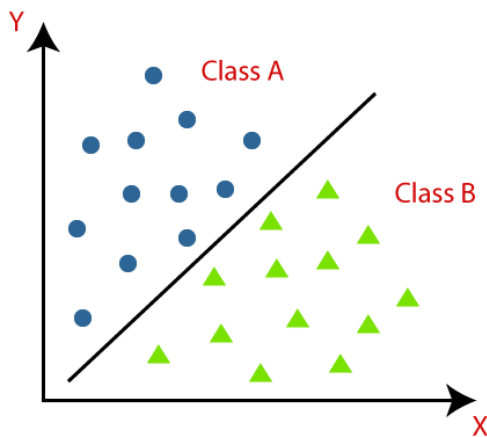
# Classification

- The Classification algorithm is a Supervised Learning technique that is used to identify the category of new observations on the basis of training data.
- In Classification, a program learns from the given dataset or observations and then classifies new observation into a number of classes or groups. Such as, **Yes or No, 0 or 1, Spam or Not Spam, cat or dog,** etc. Classes can be called as targets/labels or categories
- Unlike regression, the output variable of Classification is a category, not a value, such as "Green or Blue", "fruit or animal", etc. Since the Classification algorithm is a Supervised learning technique, hence it takes labeled input data, which means it contains input with the corresponding output.
- The main goal of the Classification algorithm is to identify the category of a given dataset, and these algorithms are mainly used to predict the output for the categorical data.

In classification algorithm, a discrete output function(y) is mapped to input variable(x).

$$y=f(x), \text{ where } y = \text{categorical output}$$

The best example of an ML classification algorithm is **Email Spam Detector**.



Classification algorithms can be better understood using the below diagram. In the below diagram, there are two classes, class A and Class B. These classes have features that are similar to each other and dissimilar to other classes.

**Types of Classifications:**

**Binary Classifier**

If the classification problem has only two possible outcomes, then it is called as Binary Classifier.

**Examples**: YES or NO, MALE or FEMALE, SPAM or NOT SPAM, CAT or DOG, etc.

**Multi-class Classifier**

If a classification problem has more than two outcomes, then it is called as Multi-class Classifier.

**Example:** Classifications of types of crops, Classification of types of music.

## Classification Problems

1. **Lazy Learners:** Lazy Learner firstly stores the training dataset and wait until it receives the test dataset. In Lazy learner case, classification is done on the basis of the most related data stored in the training dataset. It takes less time in training but more time for predictions.
   **Example:** K-NN algorithm, Case-based reasoning

2. **Eager Learners:** Eager Learners develop a classification model based on a training dataset before receiving a test dataset. Opposite to Lazy learners, Eager learners take less time in training and more time in prediction.

     **Example:** Decision Trees, Naïve Bayes, ANN.

**Use cases of Classification**

Classification algorithms can be used in different places. Below are some popular use cases of Classification Algorithms:

- o   Email Spam Detection
- o   Speech Recognition
- o   Identifications of Cancer tumor cells.
- o   Drugs Classification

# Regression problem

Regression analysis consists of a set of machine learning methods that allow us to predict a continuous outcome variable (y) based on the value of one or multiple predictor variables (x). Briefly, the goal of regression model is to build a mathematical equation that defines y as a function of the x variables

**Types of Regression**

- o   Simple Linear Regression
- o   Polynomial Regression
- o   Support Vector Regression
- o   Decision Tree Regression
- o   Random Forest Regression

**For viewing code and output , please  open the link below**

**https://github.com/Enggadil/-AI-LAB-_BSSE-5-M-**