

LEARNING CLASSIFICATION PATTERNS & RECOGNIZATION AND UNDERSTANDING SPEECH

Content

- Learning classification Patterns
- Learning through clustering
- Speech Recognition And Understanding

Learning Classification Patterns

Learning

- Learning is a phenomena through which a system gets trained and becomes adaptable to give result in an accurate manner.
- It is a process where human trains machines and machine learns from the human on the bases of their past experience.

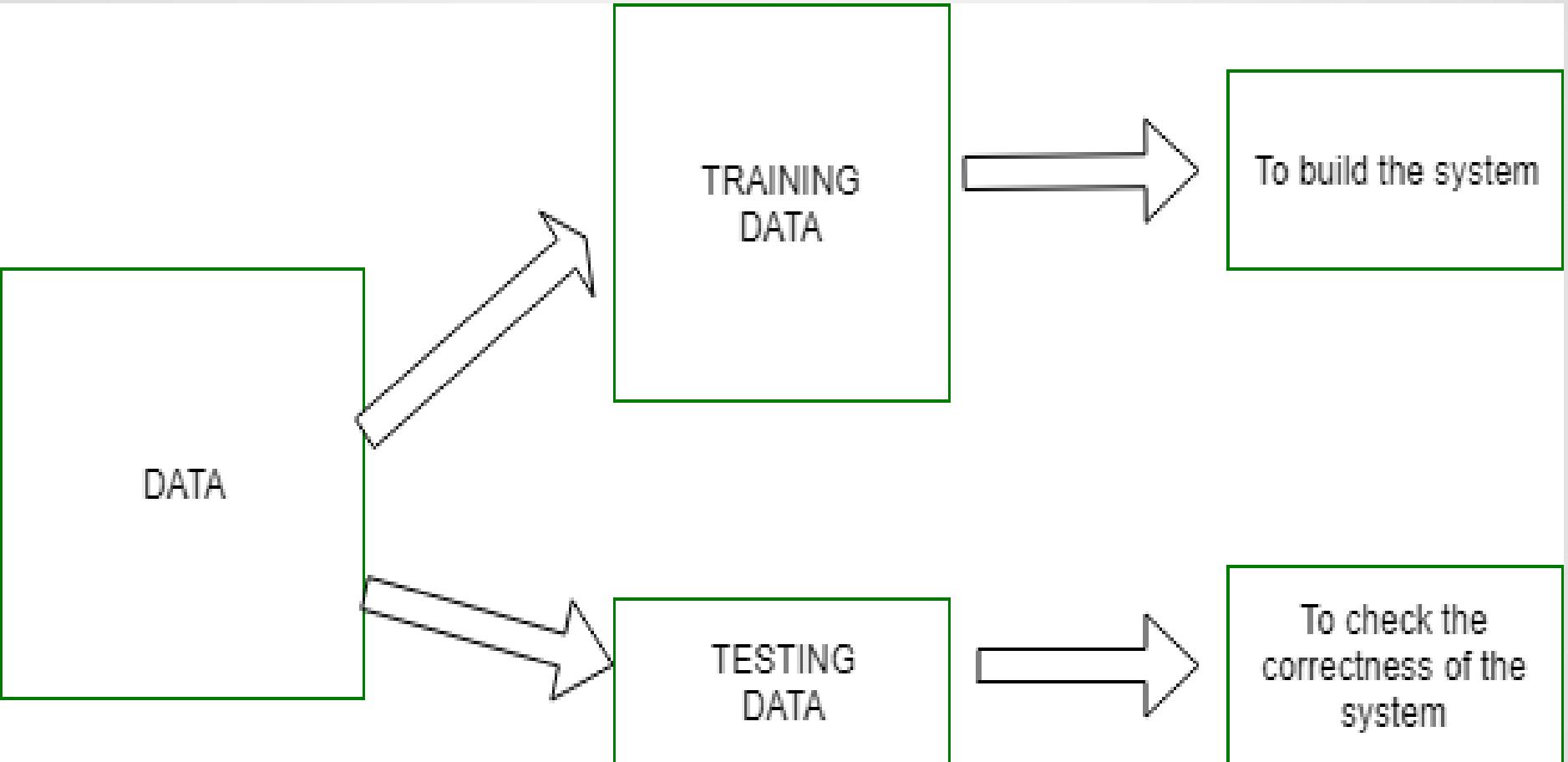
Learning

- A machine is said to be learning from **past Experiences**(data feed in) with respect to some class of **Tasks**, if it's **Performance** in a given Task improves with the Experience.

Learning

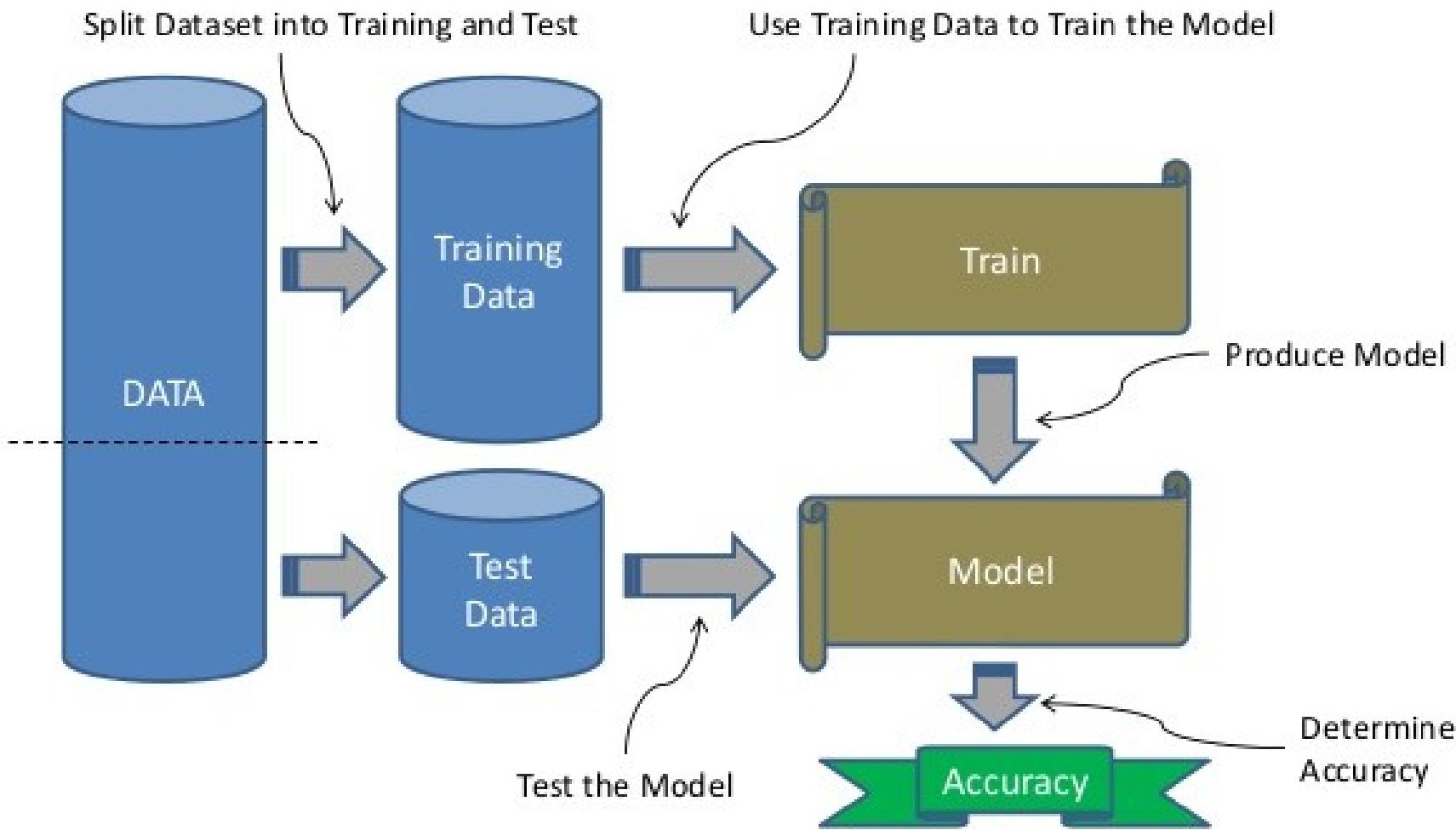
- Learning is the most important phase as how well the system performs on the data provided to the system depends on which algorithms used on the data.
- Entire dataset is divided into two categories:-
- one which is used in training the model i.e. **Training set**
- the other that is used in testing the model after training, i.e. **Testing set.**

Learning



- The ratio of training and testing data should be 7:3
Means 70% for training and 30% for Testing.
-

Training & Testing data



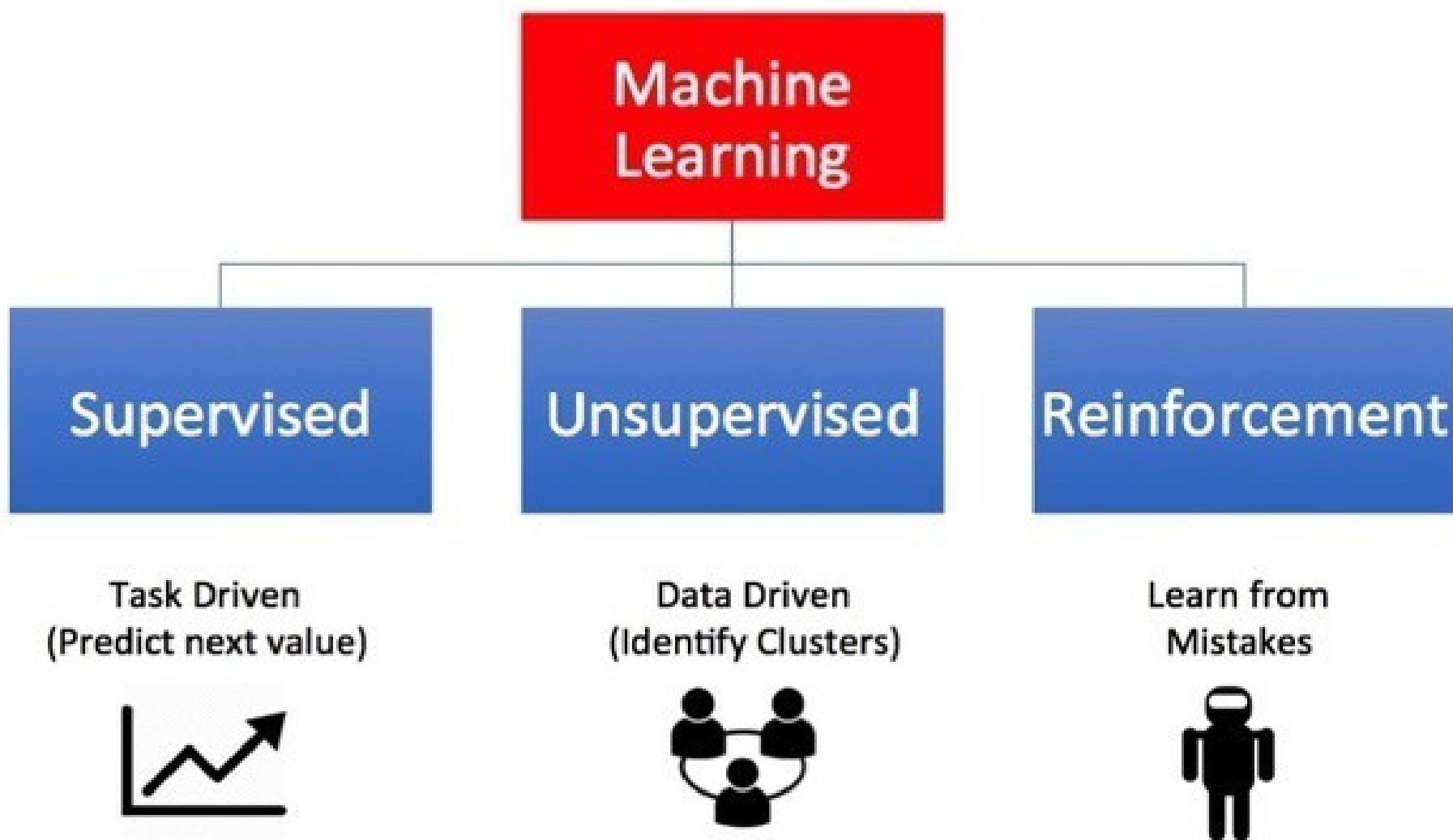
Training Data

- Training set is used to build a model.
- It consists of the set of images which are used to train the system.
- Training rules and algorithms used give relevant information on how to associate input data with output decision.
- The system is trained by applying these algorithms on the dataset, all the relevant information is extracted from the data and results are obtained.
- Generally, 70% of the data of the dataset is taken for training data

Testing Data

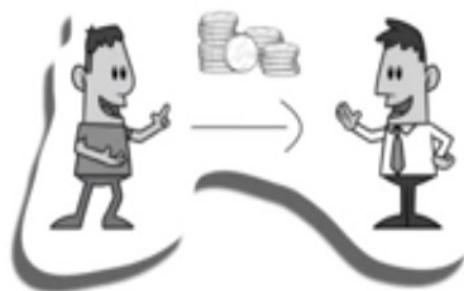
- Testing data is used to test the system.
- It is the set of data which is used to verify whether the system is producing the correct output after being trained or not.
- Generally, 30% of the data of the dataset is used for testing.
- Testing data is used to measure the accuracy of the system.

Types of Machine Learning



Supervised learning

SUPERVISED LEARNING



3 GRAMS



7 GRAMS



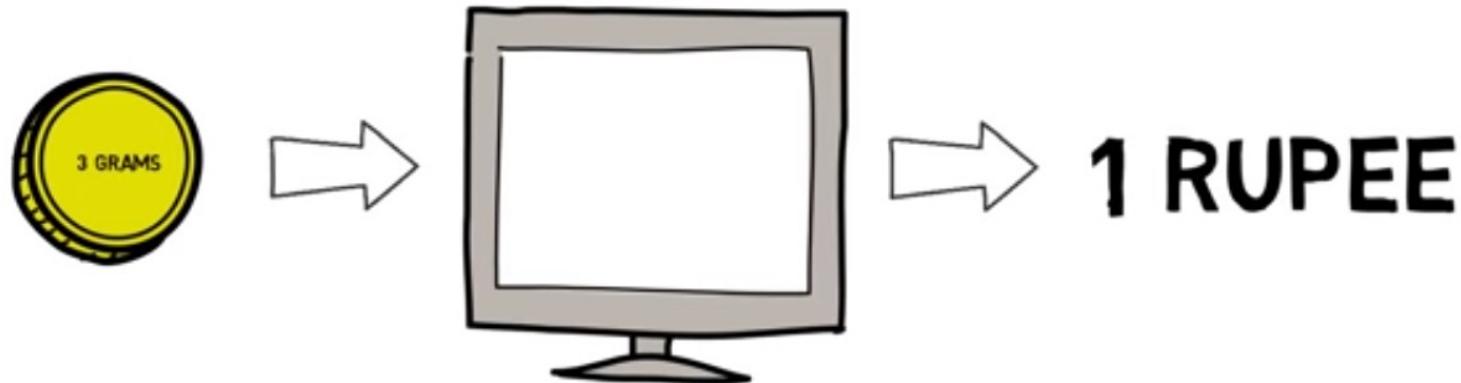
4 GRAMS

WEIGHT = FEATURE
CURRENCY = LABEL



Supervised learning

SUPERVISED LEARNING



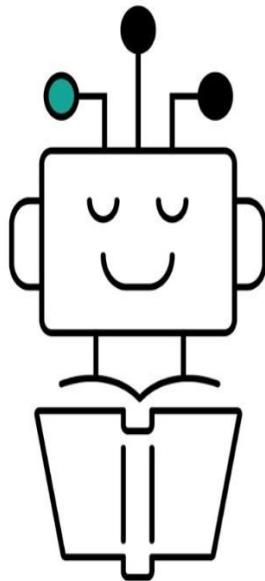
LABELED DATA



Supervised learning

- **Supervised learning is when the model is getting trained on a labeled dataset.**
- **Labeled dataset is one which have both input and output parameters.**

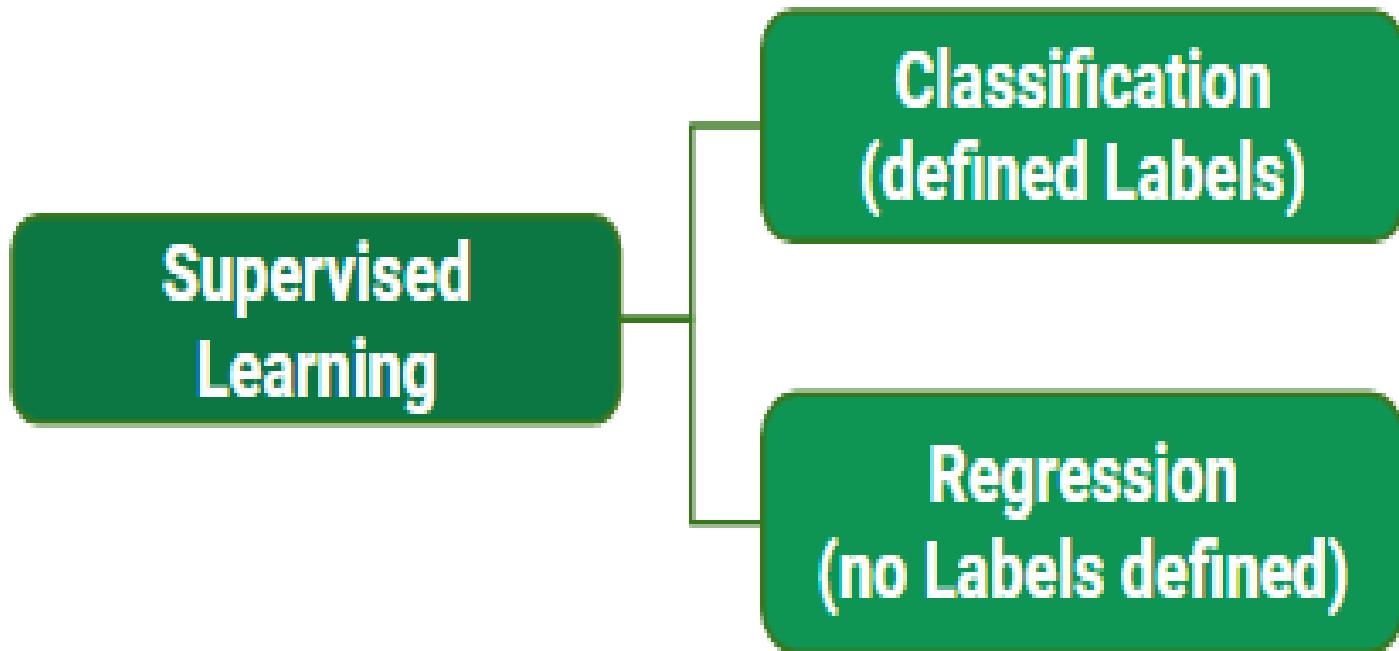
Supervised learning



Supervised
Learning

- 1** Load labeled input data.
- 2** Train model on the data: connection to input variables and output is made.
- 3** Apply new data to algorithm.
- 4** Provides output.

Supervised learning Types



Supervised learning Types

- **Classification :** It is a Supervised Learning task where output is having defined labels(discrete value).
- A classification problem is when the output variable is a category, such as “Red” or “blue” or “disease” and “no disease”.
- **Regression:** A regression problem is when the output variable is a real value, such as “dollars” or “weight”.
- It is a Supervised Learning task where output is having continuous value.



Regression

What is the temperature going to be tomorrow?

PREDICTION

84°



Classification

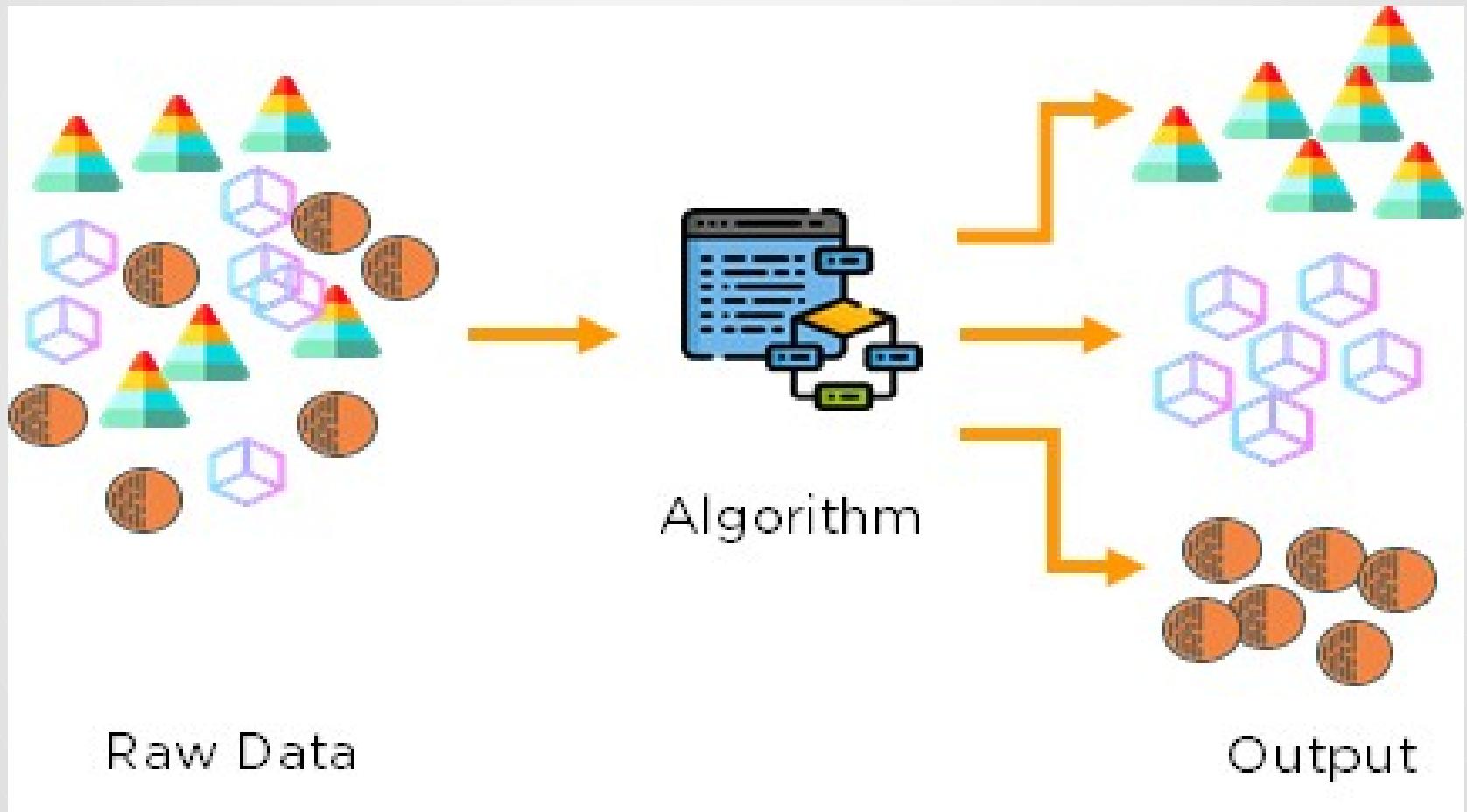
Will it be Cold or Hot tomorrow?

PREDICTION

HOT



Unsupervised learning



Unsupervised learning

- Unsupervised learning is the training of machine using information that is **neither classified nor labeled** and allowing the algorithm to act on that information without guidance.
- Here the task of machine is to group unsorted information according to similarities, patterns and differences without any prior training of data.

Unsupervised learning

- **For instance**, suppose it is given an image having both dogs and cats which have not seen ever.



- Thus the machine has no idea about the features of dogs and cat so we can't categorize it in dogs and cats.
- But it can categorize them according to their similarities, patterns, and differences i.e., we can easily categorize the above picture into two parts.
- First may contain all pictures having **dogs** in it and second part may contain all pictures having **cats** in it.
- Here you didn't learn anything before, means no training data or examples.

Unsupervised learning types

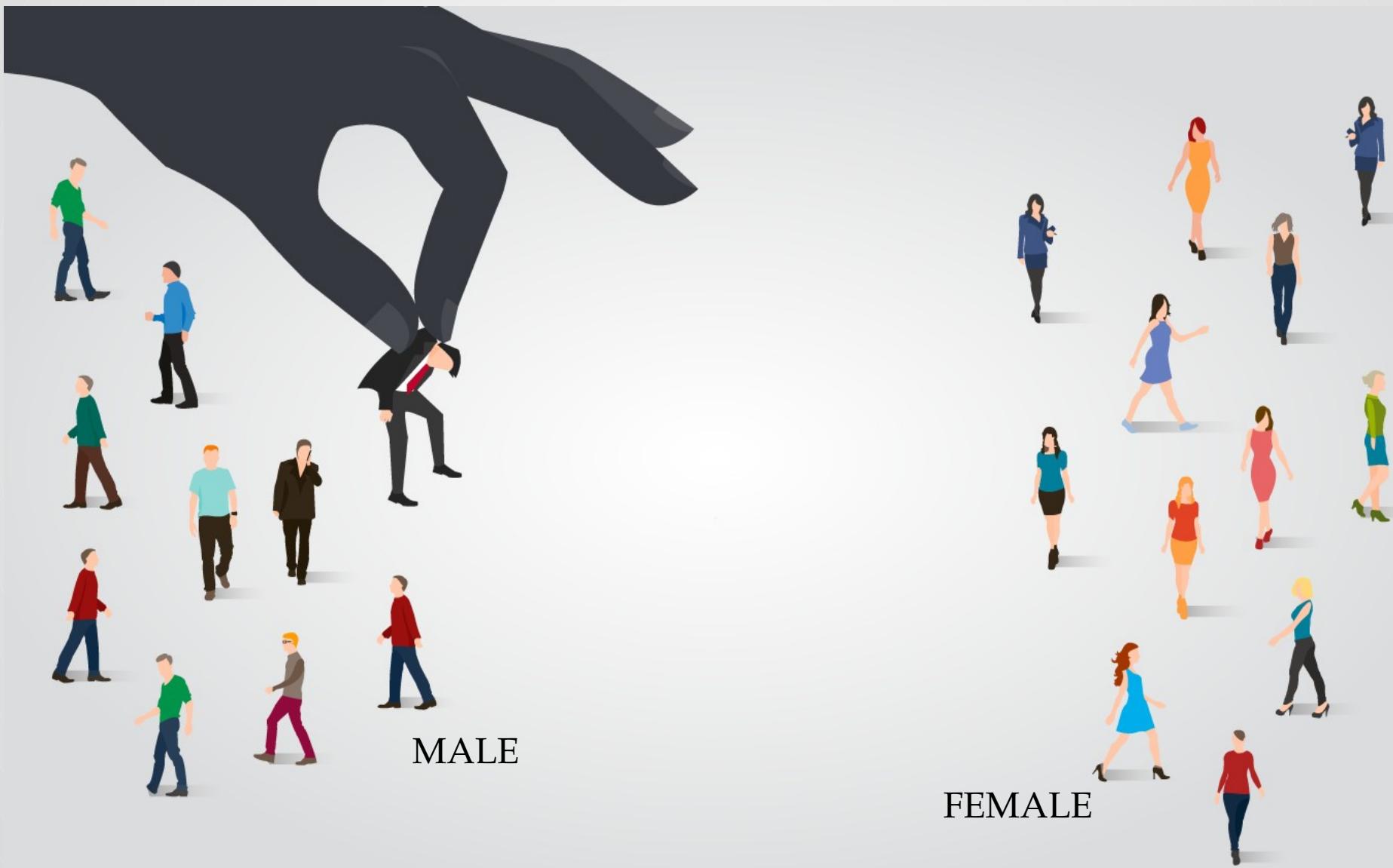
- **Clustering:** A clustering problem is where you want to discover the inherent groupings in the data, such as grouping customers by purchasing behavior.
- **Association:** An association rule learning problem is where you want to discover rules that describe large portions of your data, such as people that buy X also tend to buy Y.

Reinforcement learning

- Rewards based learning & based on Principle of feedback.



Classification



Classification

It is a process of assigned objects into prescribe classes.

- It is a Supervised Learning task where output is having defined labels(discrete value).
- A classification problem is when the output variable is a category, such as “Red” or “blue” or “disease” and “no disease”.
- Classifier is a machine which performs Classification.



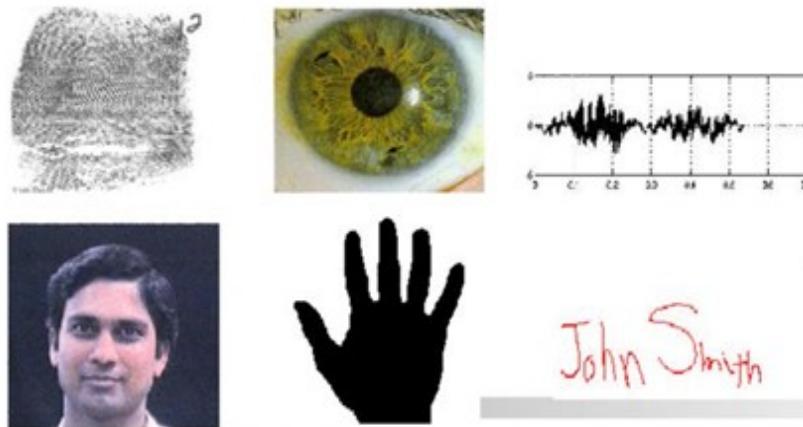
Classification Algorithms

- **KNN**
- **SVM**
- **DT**
- **ANN**

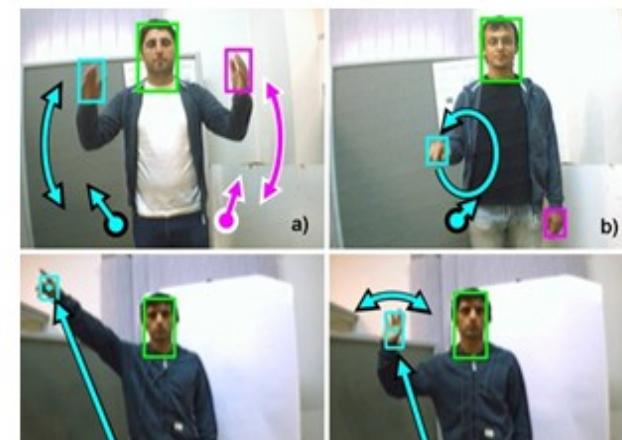
What is a Pattern?

- A pattern could be an **object** or **event**.
 - Typically, represented by a vector \mathbf{x} of numbers

biometric patterns

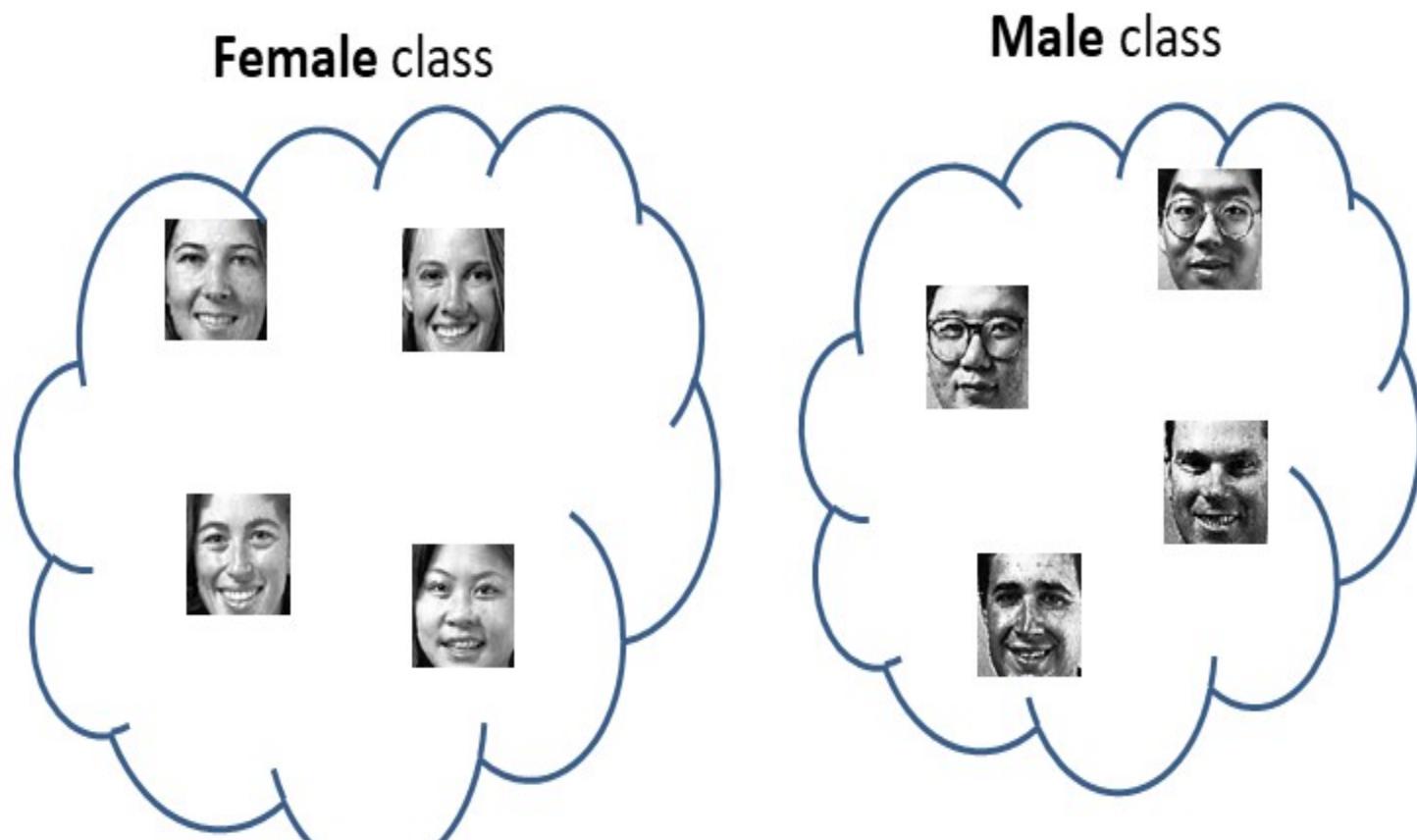


hand gesture patterns



Pattern Class

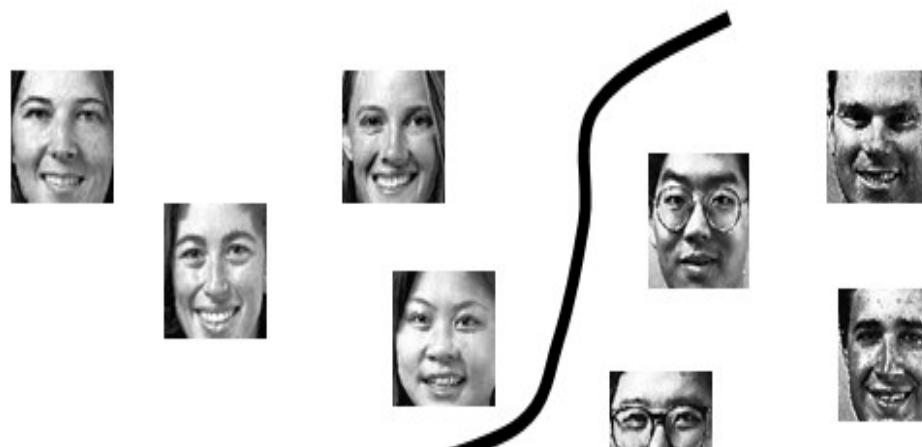
- A collection of “**similar**” objects.



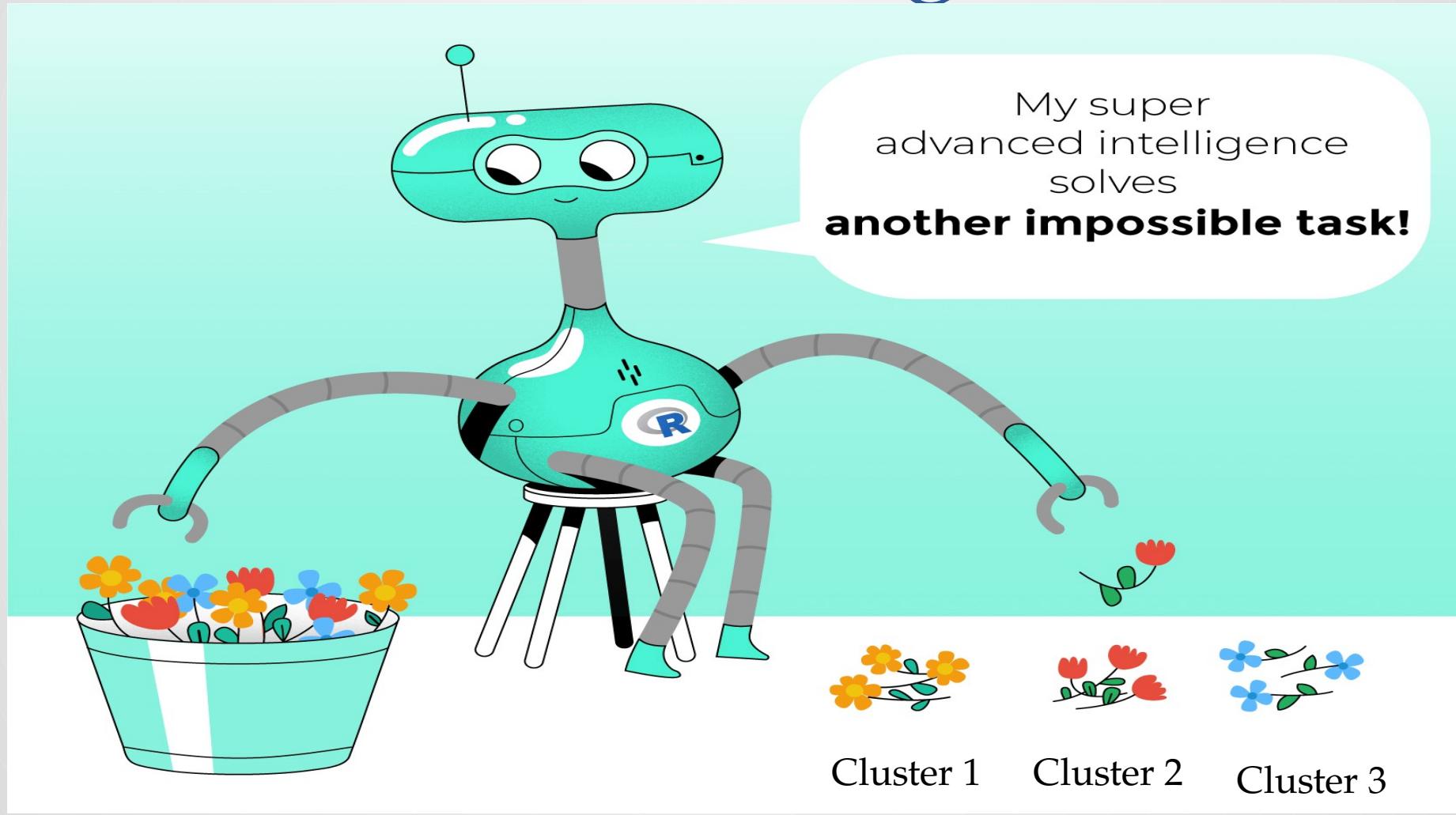
Main Objectives

- Find a “**way**” to separate the data belonging to different classes.
- Given “**new**” data, assign them to the closest category.

Gender Classification



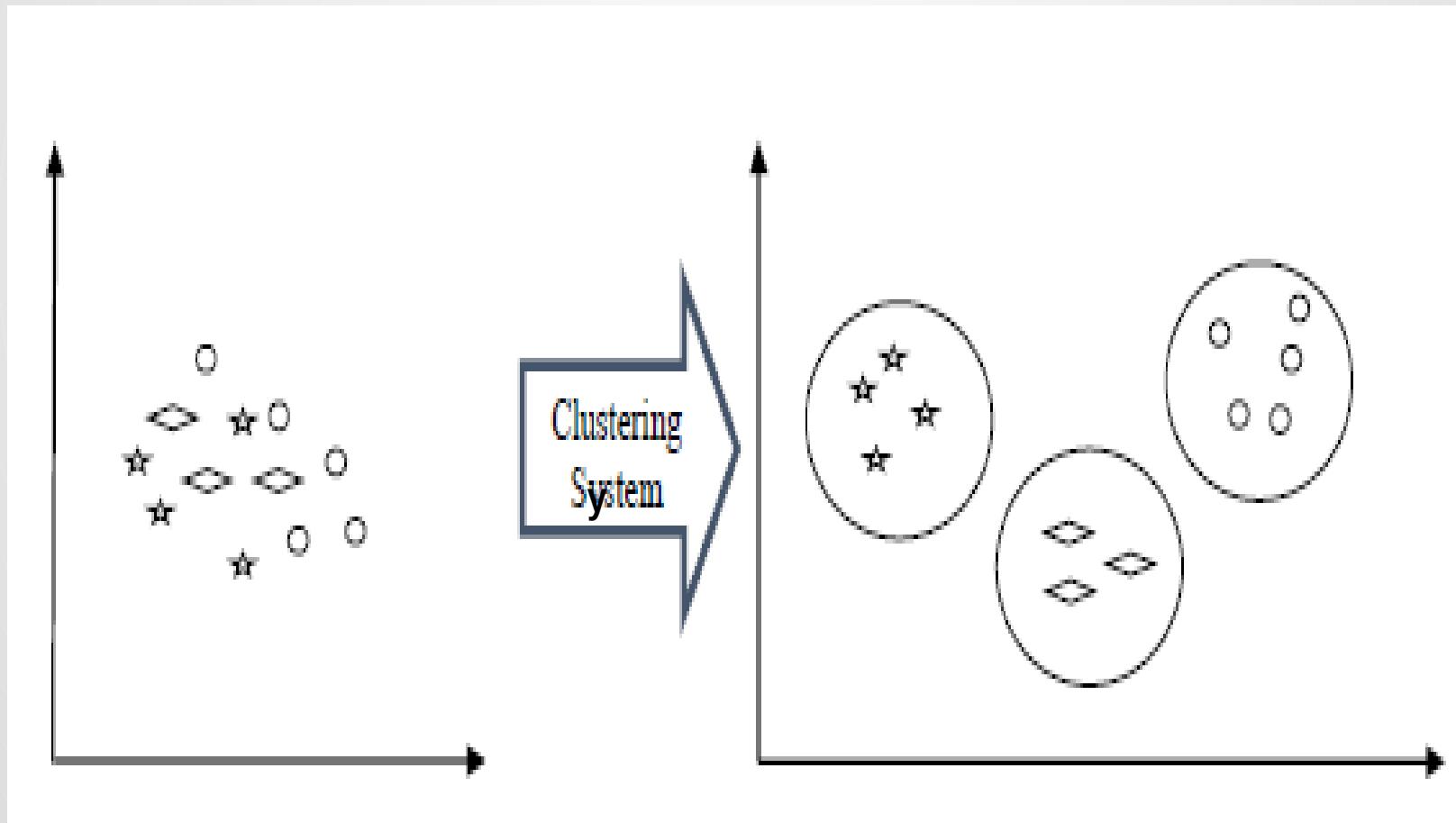
Learning Through Clustering



Learning Through Clustering

- It is a process of grouping or classifying objects on the basis of a close association or shared characteristics .
- It is basically a type of *unsupervised learning method* .
- An unsupervised learning method is a method in which we draw references from datasets consisting of input data without labeled responses.
- Generally, it is used as a process to find meaningful structure, generative features, and groupings inherent in a set of examples.

Learning Through Clustering



Clustering Algorithm

The *K-Means* Clustering Method

- Given the number of desired clusters k , the *k-means* algorithm follows four steps:
 - Randomly assign objects to create k nonempty initial partitions (clusters)
 - Compute the centroids of the clusters of the current partitioning (the centroid is the center, i.e., *mean point*, of the cluster)
 - Assign each object to the cluster with the nearest centroid (**reallocation step**)
 - Go back to Step 2, stop when the assignment does not change

Clustering Algorithm

K-MEANS ALGORITHM (3 steps)

- Take mean value (random)
- Find nearest number of mean and put cluster.
- Repeat one and two until we get mean.

Example

Data sets {2,3,4,10,11,12,20,25,30}

K=2 (two cluster form)

M1=4 M2=12

➤ **K1={2,3,4} K2={10,11,12,20,25,30}**

M1=9/3=3 M2=108/6=18

➤ **K1={2,3,4,10} K2={11,12,20,25,30}**

M1=19/4=4.5(5) M2=98/5=19.6(20)

➤ **K1={2,3,4,10,11,12} K2={20,25,30}**

M1=42/6=7 M2=75/3=25

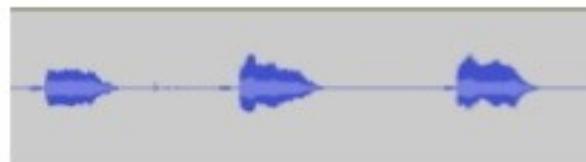
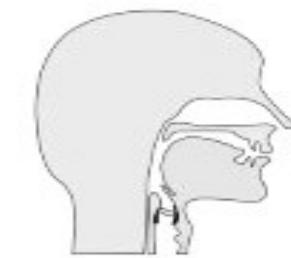
➤ **K1={2,3,4,10,11,12} K2={20,25,30}**

Hence we are getting same mean and stop.

Recognizing and understanding speech

Speech Recognition

- Also known as “ASR”
 - “Speech to Text” ?



“See the cat.”

*Spoken
language*



*Machine-
readable
format*

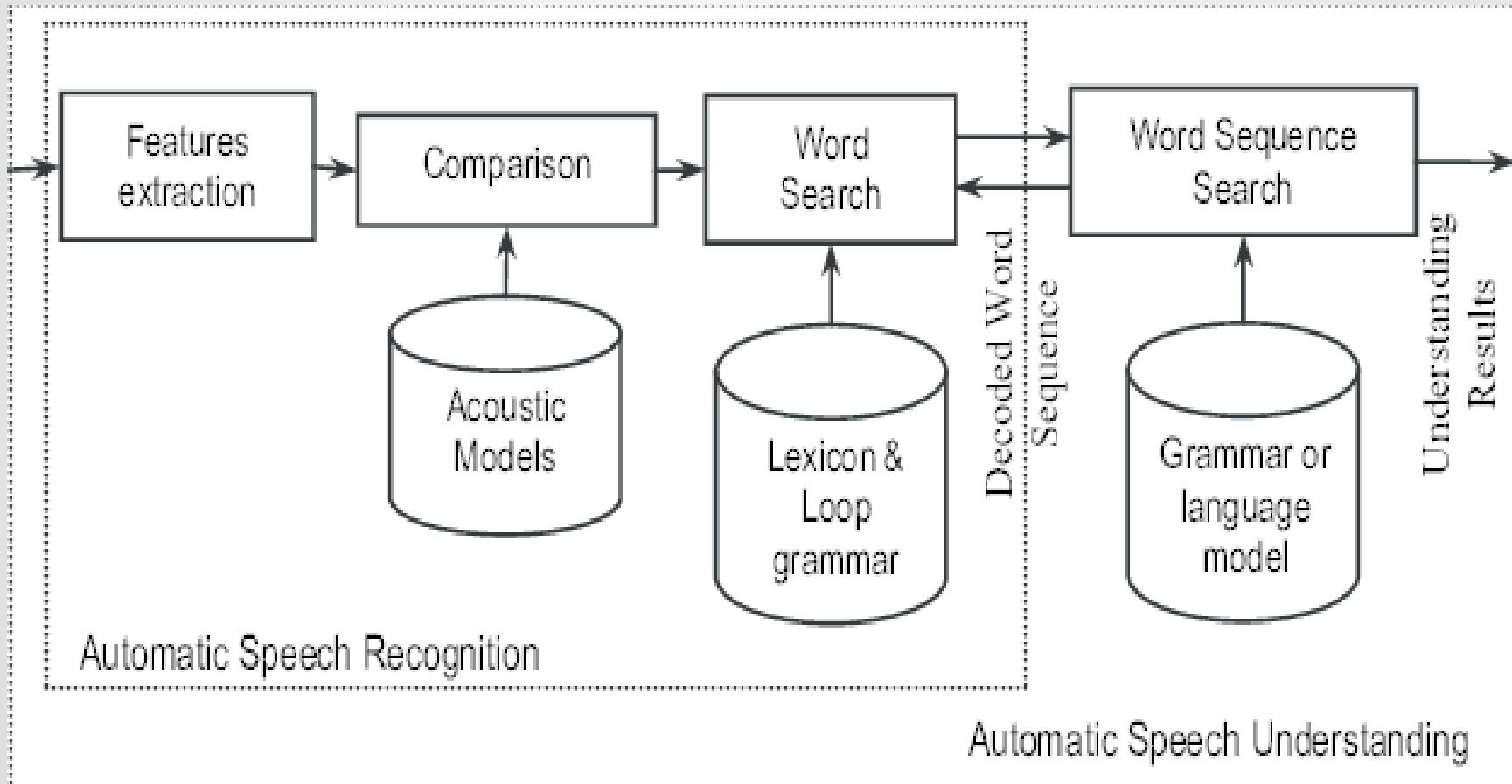
Recognizing and understanding speech

- **Speech recognition** means *Speech to text*"
- **Speech recognition** develops methodologies and technologies that enables the recognition and translation of spoken language into text by computers.
- It is also known as **automatic speech recognition (ASR)**, **computer speech recognition** or **speech to text (STT)**.

□ Where can it be used?

- System control/navigation
 - e.g. GPS-connected digital maps: “How far is it to the motorway junction?”
- Commercial/Industrial applications
 - in-car steering systems
- Voice dialing
 - hands-free use of mobile in car e.g. “Dial office”

Recognizing and understanding speech



□ Acoustic Model

- An acoustic model is created by taking audio recordings of speech, and their text transcriptions, and using software to create statistical representations of the sounds that make up each word. It is used by a speech recognition engine to recognize speech.

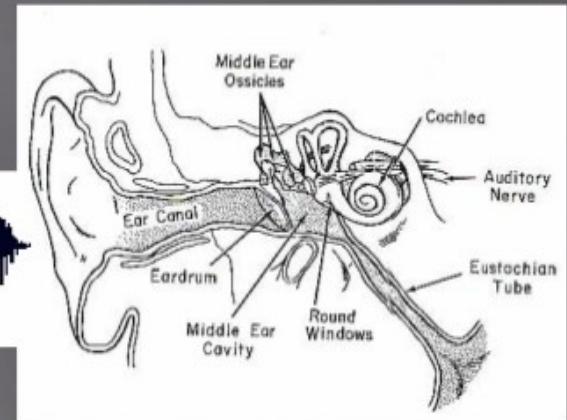
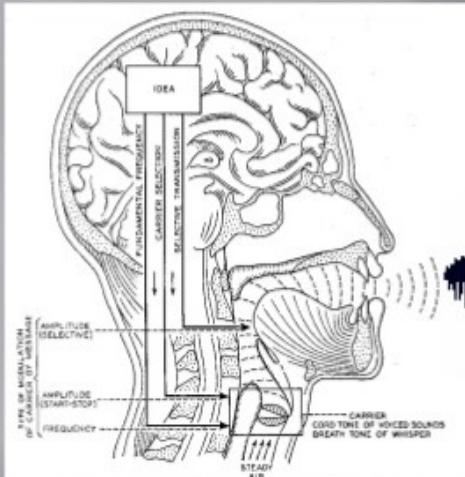
□ Language Model

- Language model is used in many natural language processing applications such as speech recognition tries to capture the properties of a language, and to predict the next word in a speech sequence.

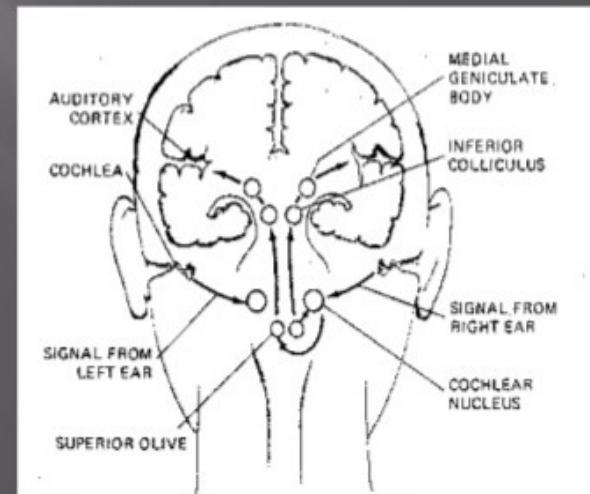
TYPES OF VOICE RECOGNITION

- Two types of speech recognition.
 - *Speaker-Dependent*
is commonly used for dictation software
 - *Speaker-Independent*
is more commonly found in telephone applications.

How do humans do it?



- Articulation produces
- sound waves which
- the ear conveys to the brain
- for processing



How might computers do it?



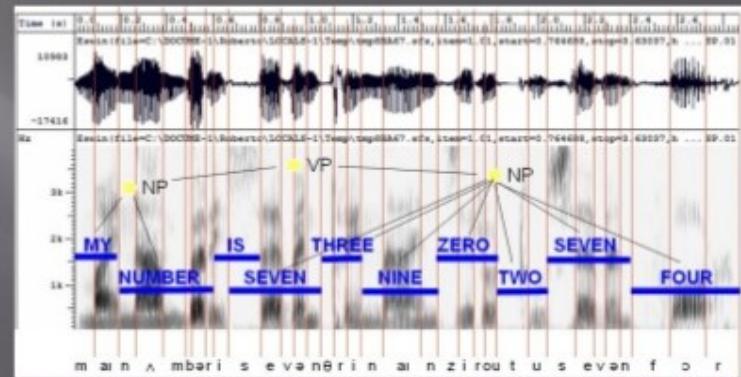
Acoustic waveform



Acoustic signal



- Digitization
- Acoustic analysis of the speech signal
- Linguistic interpretation



Speech recognition

DIFFERENT PROCESSES INVOLVED

- Digitization
 - Analogue to digital conversion
 - Sampling and quantizing
 - ✓ Sampling is converting a continuous signal into a discrete signal
 - ✓ Quantizing is the process of approximating a continuous range of values
- Signal processing
 - Separating speech from background noise
- Phonetics
 - Variability in human speech
- Phonology
 - Recognizing individual sound distinctions (similar phonemes)
 - is the systematic use of sound to encode meaning in any spoken human language

Cont...

- Semantics and pragmatics
 - Semantics tells about the meaning
 - Pragmatics is concerned with bridging the explanatory gap between sentence meaning and speaker's meaning
- Lexicology and syntax
 - **Lexicology** is that part of linguistics which studies *words*, their nature, and meaning.
 - Syntax tell about the arrangement of words and phrases to create well-formed sentences.