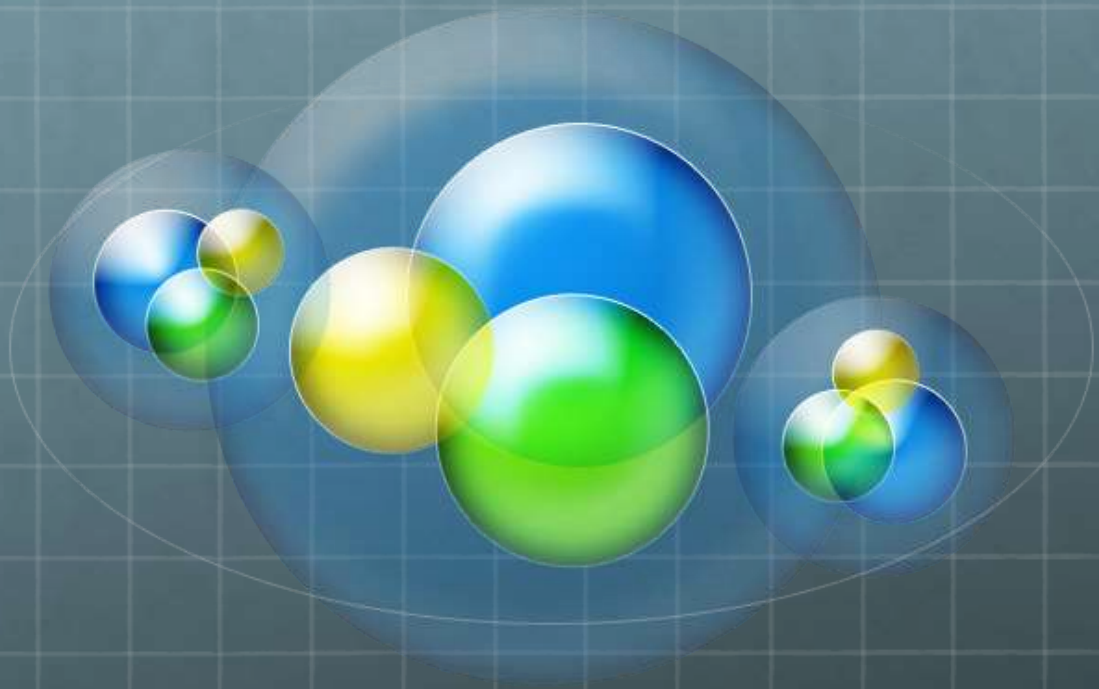


Artificial Intelligence

Dr. O. I. Adelaiye

Machine Learning

Lecture 7

Machine Learning IN ACTION

Peter Harrington

MANNING

Introduction

- We all have been using GPS navigation services.
- Our current locations and velocities are being saved at a central server for managing traffic.
- This data is then used to build a map of current traffic.
- Machine learning in such scenarios helps to estimate the regions where congestion can be found on the basis of daily experiences.

Introduction

- *Some areas for applying machine learning*
  - Traffic Alerts
  - Social Media
  - Transportation and Commuting
  - Products Recommendations
  - Virtual Personal Assistants
  - Self Driving Cars
  - Dynamic Pricing
  - Google Translate
  - Online Video Streaming
  - Fraud

Introduction

- Here is another cool application of Machine Learning.
- People are already using it.
- Machine Learning used in Self Driving Cars (Tesla).
- The leader in this business and their current *Artificial Intelligence* is driven by hardware manufacturer NVIDIA
- This is based on Unsupervised Learning Algorithm.

What is machine Learning

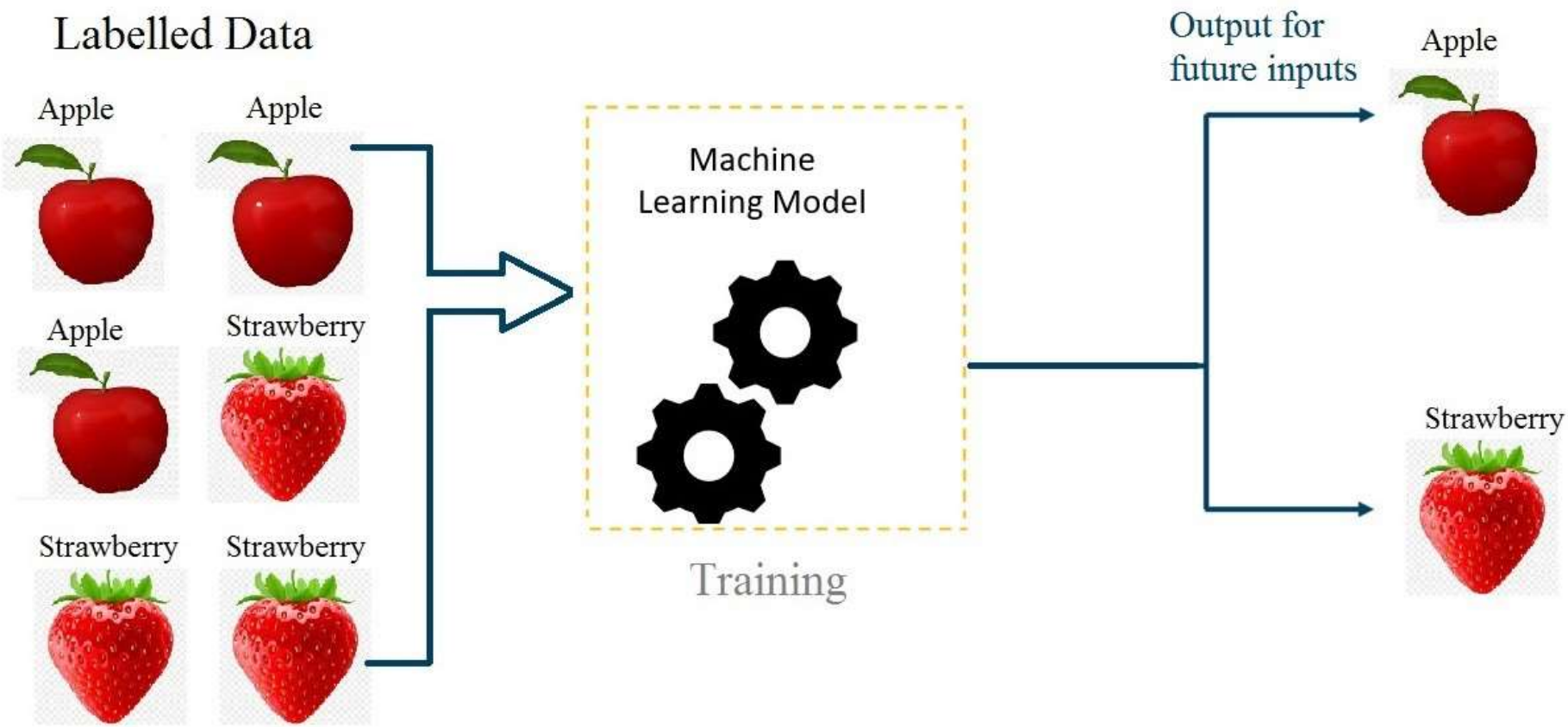
- Machine learning (ML) is the subset of artificial intelligence (AI)
- ML focuses on building systems that learn or improve performance based on the data they consume.
- Machine learning and AI are often discussed together, and the terms are sometimes used interchangeably, but they don't mean the same thing. An important distinction is that although all machine learning is AI, not all AI is machine learning.

Approaches

- Algorithms are the engines that power machine learning.
- Two major types of machine learning algorithms are used today
- Supervised learning and unsupervised learning.
- The difference between them is defined by how each learns about data to make predictions.

Supervised Learning

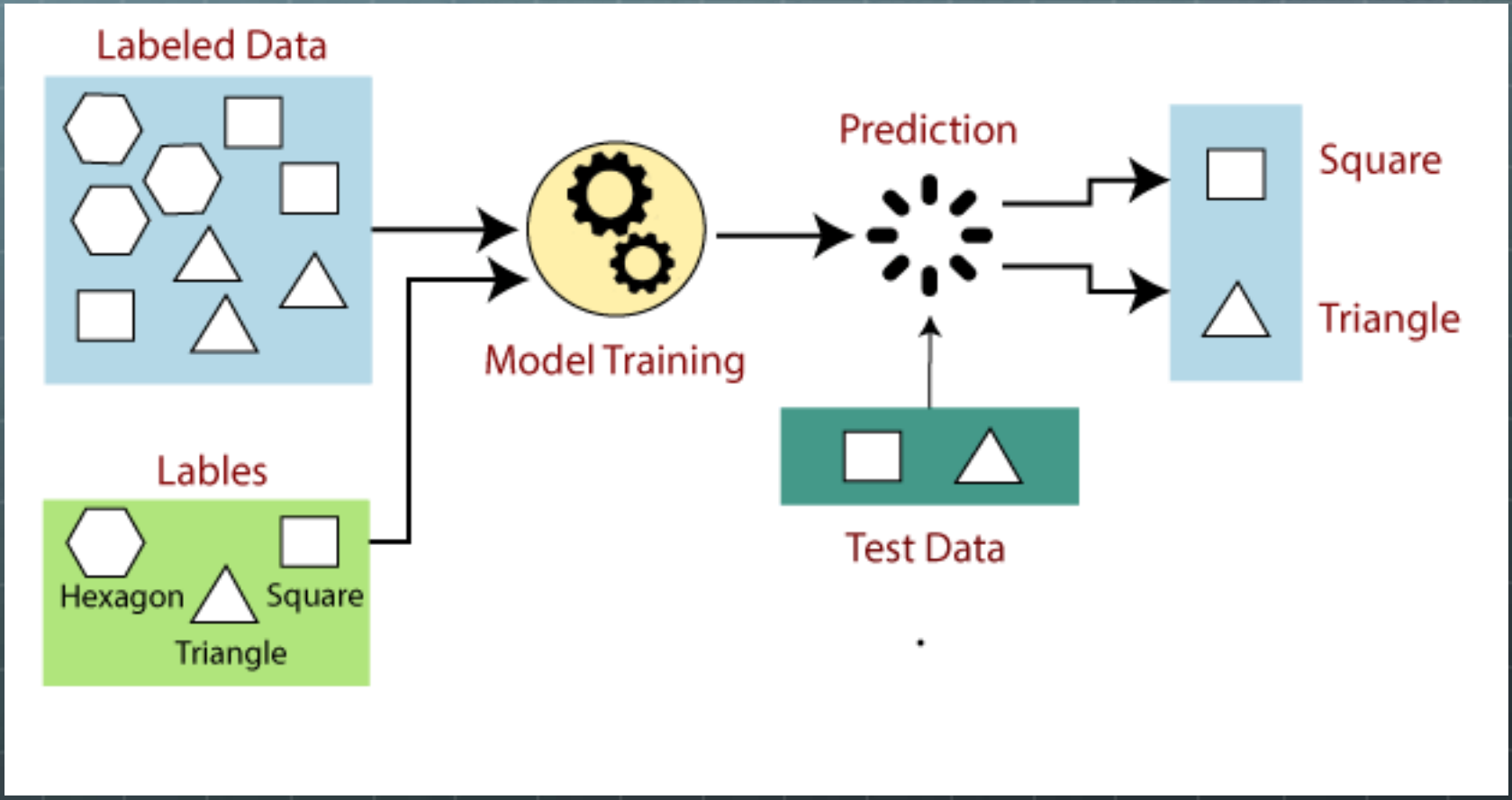
- Training the machine using data which is well "labelled."
- It means the data is already tagged with the correct answer.
- It can be compared to learning which takes place in the presence of a supervisor or a teacher.
- A supervised learning algorithm learns from labelled training data, helps you to predict outcomes for unforeseen data.


Labelled Data
Apple
Apple
Apple
Strawberry
Strawberry
Strawberry
Machine
Learning Model
Training
Output for
future inputs
Apple
Strawberry

Why Supervised Learning

- Supervised learning allows you to collect data or produce a data output from the previous experience.
- Helps you to optimize performance criteria using experience
- Supervised machine learning helps you to solve various types of real-world computation problems.

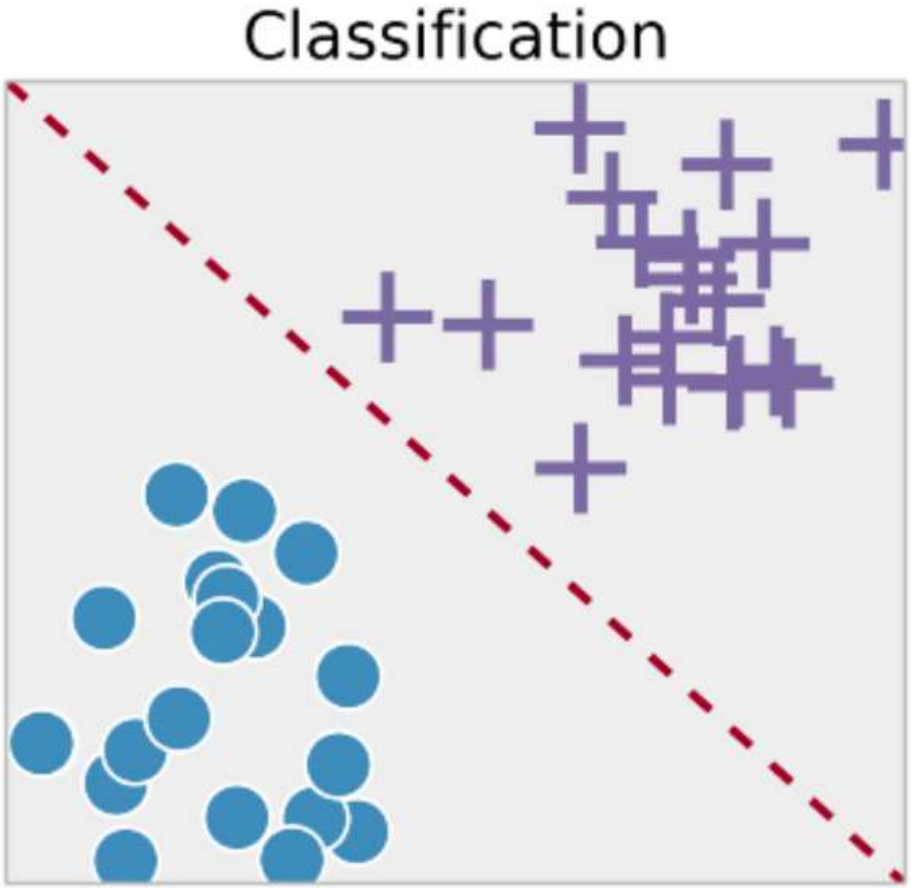
How it works

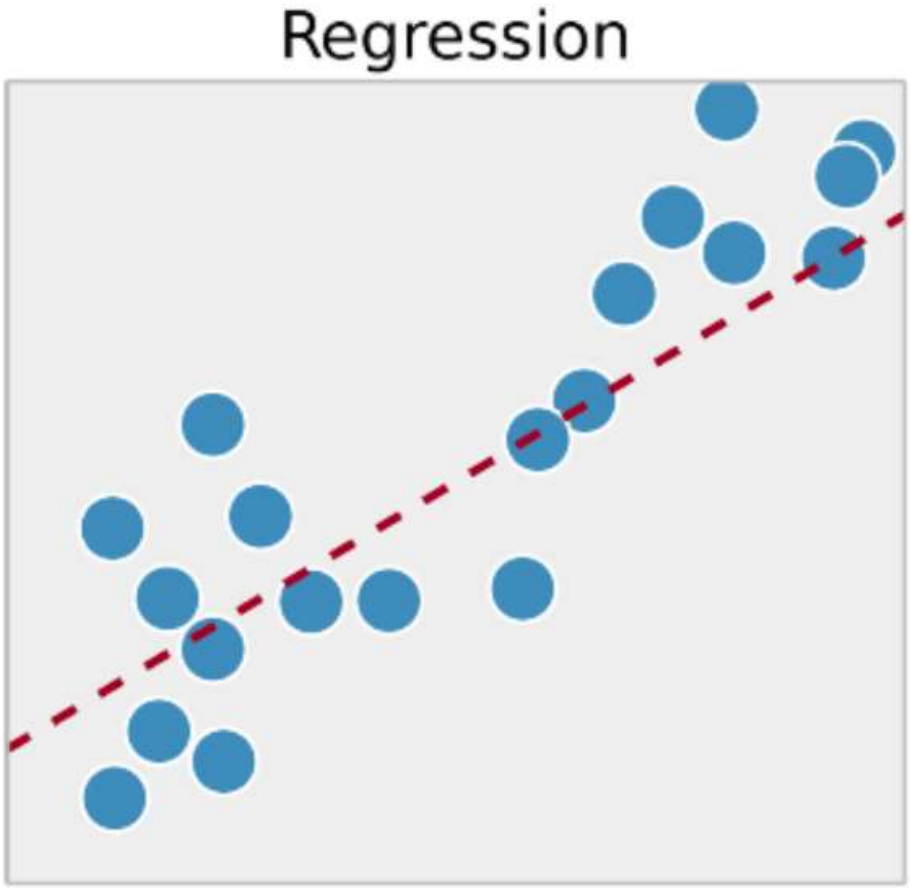

Labeled Data
Lables
Hexagon
Square
Triangle
Model Training
Prediction
Square
Triangle
Test Data

Types of Supervised Machine Learning Techniques

- Classification:
  - To group the output inside a class. If the algorithm tries to label input into two distinct classes, it is called binary classification. Selecting between more than two classes is referred to as multiclass classification.
- Regression:
  - Predicts a single output value using training data.
  - Example: You can use regression to predict the house price from training data. The input variables will be locality, size of a house, etc.

Types of Supervised Machine Learning Techniques



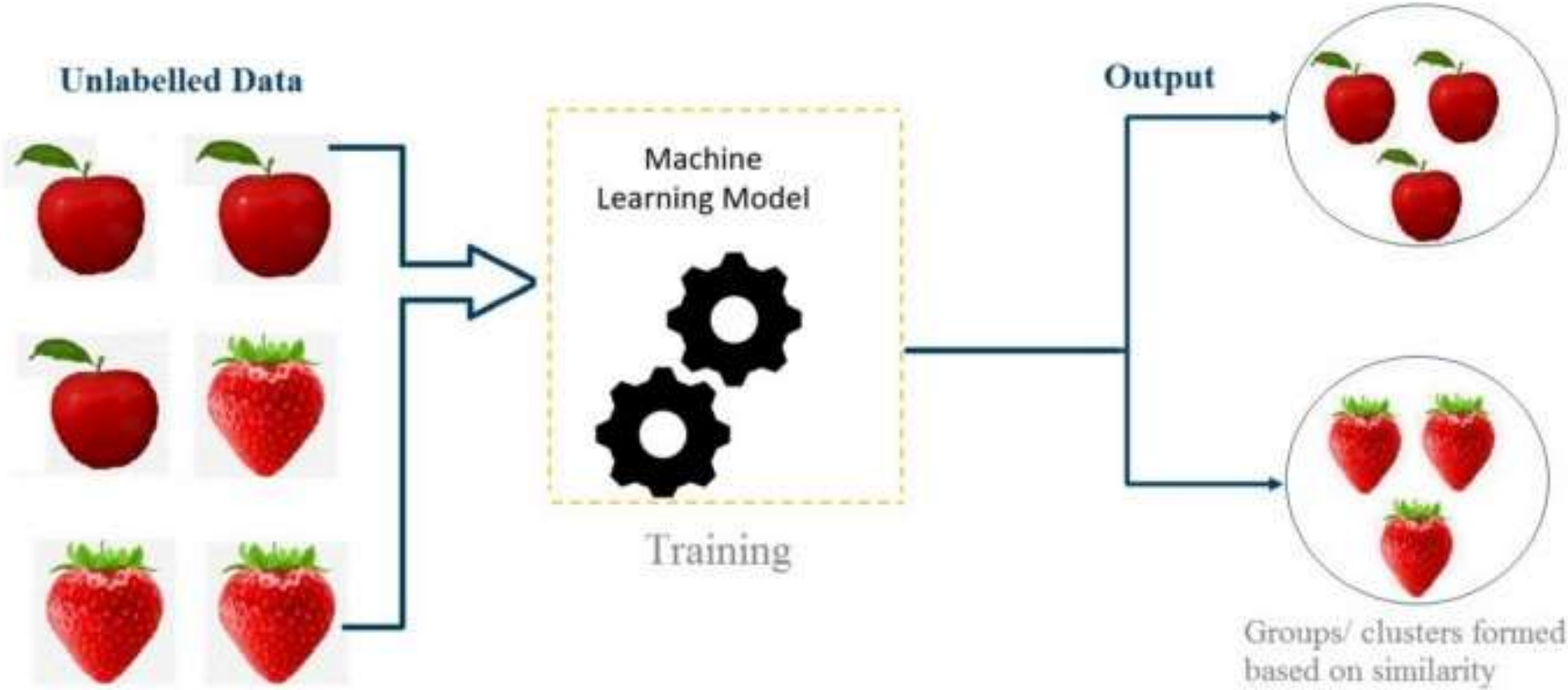


Basic steps involved in Supervised Learning

- Step 1 : Defining problem and gathering data for it.
- Step 2 : Pre-processing data.
- Step 3 : Split data into train and test sets.
- Step 4 : Training the model.
- Step 5 : Evaluating model.
- Step 6 : Improve model.
- Step 7 : Deploying model and monitoring.

Unsupervised Learning

- No need to supervise the model.
- Instead, you need to allow the model to work on its own to discover information.
- It mainly deals with the unlabelled data.
- Unsupervised learning algorithms allow you to perform more complex processing tasks compared to supervised learning.


Unlabelled Data
Machine
Learning Model
Training
Output
Groups/ clusters formed
based on similarity

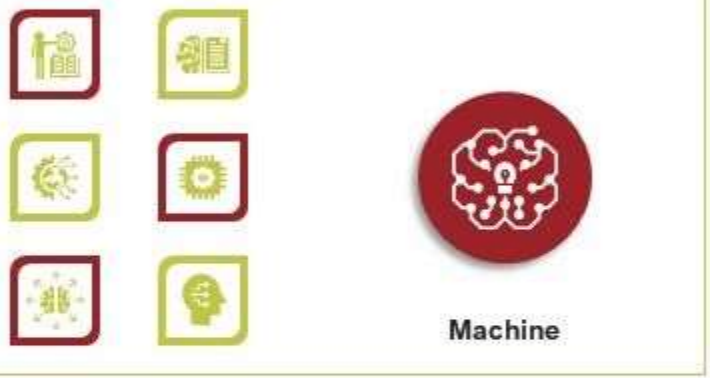
Why Unsupervised Learning

- It finds all kind of unknown patterns in data.
- It help you to find features which can be useful for categorization.
- It is taken place in real time, so all the input data to be analysed and labelled in the presence of learners.
- It is easier to get unlabelled data from a computer than labelled data, which needs manual intervention.

How Unsupervised Machine Learning works

Step 1

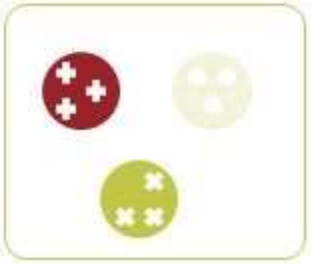
Provide the machine learning algorithm uncategorized, unlabeled input data to see what patterns it finds



Step 2

Observe and learn from the patterns the machine identifies

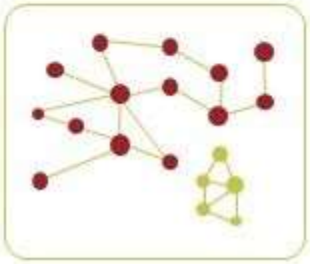
Types of Problems to Which it's Suited



Clustering

Identifying similarities in groups

For Example: Are there patterns in the data to indicate certain patients will respond better to this treatment than others?



Anomaly Detection

Identifying abnormalities in data

For Example: Is a hacker intruding in our network?

Types of Unsupervised Machine Learning Techniques

- Clustering
  - Mainly deals with finding a structure or pattern in a collection of uncategorized data.
  - Clustering algorithms will process your data and find natural clusters (groups) if they exist in the data.
  - You can also modify how many clusters your algorithms should identify. It allows you to adjust the granularity of these groups.

Clustering

sample

Cluster/group

Types of Unsupervised Machine Learning Techniques

- Association
  - Association rules allow you to establish associations amongst data objects inside large databases.
  - It is about discovering exciting relationships between variables in large databases.
  - For example, people that buy a new home most likely to buy new furniture.

Association

Transaction 1	
Transaction 2	
Transaction 3	
Transaction 4	
Transaction 5	
Transaction 6	
Transaction 7	
Transaction 8	

Difference Between Supervised and Unsupervised Learning

Parameters	Supervised machine learning technique	Unsupervised machine learning technique
Process	In a supervised learning model, input and output variables will be given.	In unsupervised learning model, only input data will be given
Input Data	Algorithms are trained using labeled data.	Algorithms are used against data which is not labeled
Algorithms Used	Support vector machine, Neural network, Linear and logistics regression, random forest, and Classification trees.	Unsupervised algorithms can be divided into different categories: like Cluster algorithms, K-means, Hierarchical clustering, etc.
Computational Complexity	Supervised learning is a simpler method.	Unsupervised learning is computationally complex

Difference Between Supervised and Unsupervised Learning

Parameters	Supervised machine learning technique	Unsupervised machine learning technique
Use of **Data**	Supervised learning model uses training data to learn a link between the input and the outputs.	Unsupervised learning does not use output data.
Accuracy of Results	Highly accurate and trustworthy method.	Less accurate and trustworthy method.
Real Time Learning	Learning method takes place offline.	Learning method takes place in real time.
Number of Classes	Number of classes is known.	Number of classes is not known.
Main Drawback	Classifying big data can be a real challenge in Supervised Learning.	You cannot get precise information regarding data sorting, and the output as data used in unsupervised learning is labelled and not known.

Let's get started

```
>>>
```

it will mean the Python shell. In the Python shell type the following command.

```
>>> from numpy import *
```

This imports all of the NumPy modules into the current namespace. This is shown in figure 1.3 on the Mac OS.

Next, type the following in the Python shell:

```
>>> random.rand(4,4)
array([[ 0.70328595,  0.40951383,  0.7475052 ,  0.07061094],
       [ 0.9571294 ,  0.97588446,  0.2728084 ,  0.5257719 ],
       [ 0.05431627,  0.01396732,  0.60304292,  0.19362288],
       [ 0.10648952,  0.27317698,  0.45582919,  0.04881605]])
```

Some more

You can always convert an array to a matrix by calling the `mat()` function; type in the following:

```
>>> randMat = mat(random.rand(4,4))
```

You will probably have different values than I have here because we're getting random numbers:

```
>>> randMat.I
matrix([[ 0.24497106,  1.75854497, -1.77728665, -0.0834912 ],
        [ 1.49792202,  2.12925479,  1.32132491, -9.75890849],
        [ 2.76042144,  1.67271779, -0.29226613, -8.45413693],
        [-2.03011142, -3.07832136,  1.4420448 ,  9.62598044]])
```


WHERE? WHEN? WHY? WHO? WHERE? WHAT? HOW? WHAT? HOW? WHY? WHEN? WHY? WHO? WHAT? WHERE? WHEN? HOW? HOW? WHEN? WHERE? WHERE? WHICH? WHOSE? WHEN? WHY? WHOSE? WHERE? WHICH? WHOSE? WHEN? WHY? WHICH? WHOSE? WHEN? WHY? WHOSE? WHEN? WHY? WHAT? HOW? WHY? WHO? WHERE? WHAT? HOW? WHERE? WHICH? WHOSE? WHEN? WHY? WHY? HOW? WHAT? HOW? WHY? WHO? WHERE? WHAT? HOW? WHERE? WHICH? WHOSE? WHEN? WHY? WHY? HOW? WHERE? WHAT? HOW? WHO? WHOSE? WHERE? WHAT? HOW? WHERE? WHICH? WHOSE? WHEN? WHY? WHO? WHERE? WHAT? HOW? WHERE? WHICH? WHOSE? WHEN? WHY? HOW? WHERE? WHY? WHAT? HOW? WHERE? HOW? WHAT? HOW? WHO? WHERE? WHAT? HOW? WHAT? HOW? WHY? WHERE? WHAT? HOW? HOW? WHERE? HOW?

Q1

- A Nigerian version of Apple's Siri was developed. The machine was meant to interact with mobile phone users and present them with immediate answers and solutions. A user asked, "I wanna chop meat". The machine was confused as to whether the user meant "I wanna cut meat" or I wanna eat meat". As an AI expert, if you were presented with this problem, what will be your approach in solving it?

Q2

- Using this text "*London is the capital and most populous city of England and the United Kingdom. Standing on the River Thames in the south east of the island of Great Britain, London has been a major settlement for two millennia. It was founded by the Romans, who named it Londinium.*"

As a human reading this sentence, you can easily figure out that "*it*" means "*London*". Explain how the machine can figure this out.

Q3

- Differentiate between syntax and semantics as it concerns knowledge representation.