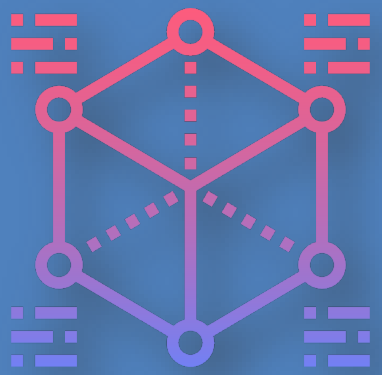

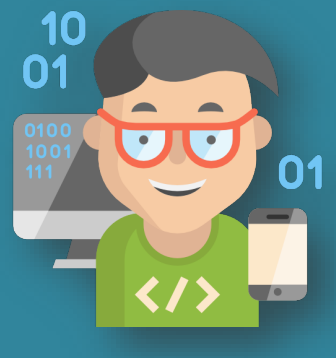


# Supervised Learning

# Agenda

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1. Why do we need Machine Learning?
2. What is Machine Learning?
3. Life cycle to build a model with ML
4. What is supervised Learning?
5. Naïve Bayes Algorithm
6. Logistic Regression

# Why do we need Machine Learning?


- In the past, we used to have data in a structured format but now as the volume of the data is increasing, so the number of structured data becomes very less, so to handle the massive amount of data we need data science techniques
- Those data can be used to get the proper business insights and the hidden trends from them.
- These insights helps the organization to predict the Future
- Helps to reduce the production cost
- Build model based on the data to give the ability to the machine to predicts on its own

# What is Machine Learning?

**Machine learning is a sub-set of artificial intelligence (AI) that allows the system to automatically learn and improve from experience without being explicitly programmed**

| | Time | V1 | V2 | V3 | V4 | V5 |
|---|---|---|---|---|---|---|
| **0** | 0.0 | -1.359807 | -0.072781 | 2.536347 | 1.378155 | -0.338321 |
| **1** | 0.0 | 1.191857 | 0.266151 | 0.166480 | 0.448154 | 0.060018 |
| **2** | 1.0 | -1.358354 | -1.340163 | 1.773209 | 0.379780 | -0.503198 |
| **3** | 1.0 | -0.966272 | -0.185226 | 1.792993 | -0.863291 | -0.010309 |
| **4** | 2.0 | -1.158233 | 0.877737 | 1.548718 | 0.403034 | -0.407193 |

**Training Data**

**Model Building**

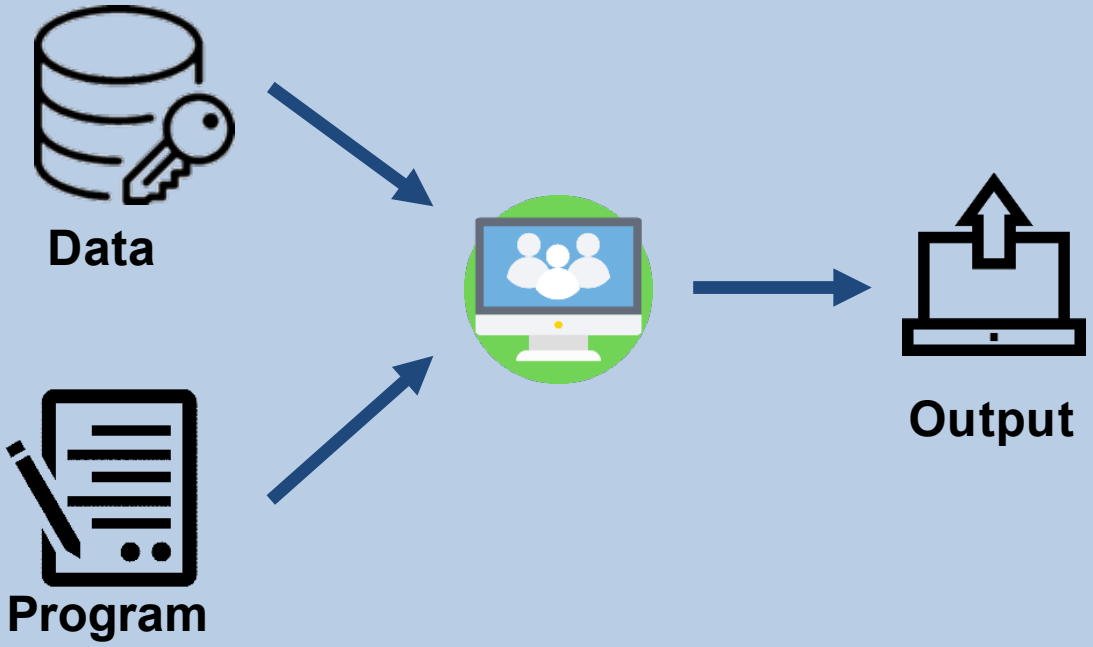
| | Time | V1 | V2 | V3 | V4 |
|---|---|---|---|---|---|
| **284802** | 172786.0 | -11.881118 | 10.071785 | -9.834783 | -2.066656 |
| **284803** | 172787.0 | -0.732789 | -0.055080 | 2.035030 | -0.738589 |
| **284804** | 172788.0 | 1.919565 | -0.301254 | -3.249640 | -0.557828 |
| **284805** | 172788.0 | -0.240440 | 0.530483 | 0.702510 | 0.689799 |
| **284806** | 172792.0 | -0.533413 | -0.189733 | 0.703337 | -0.506271 |

**Testing Data**

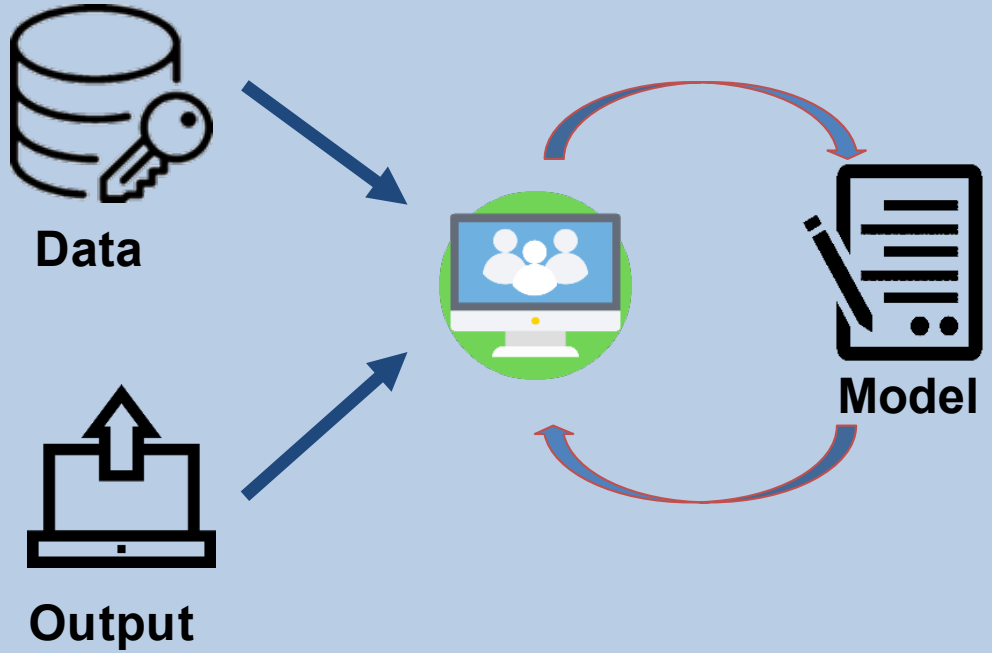
# Traditional Vs Machine Learning



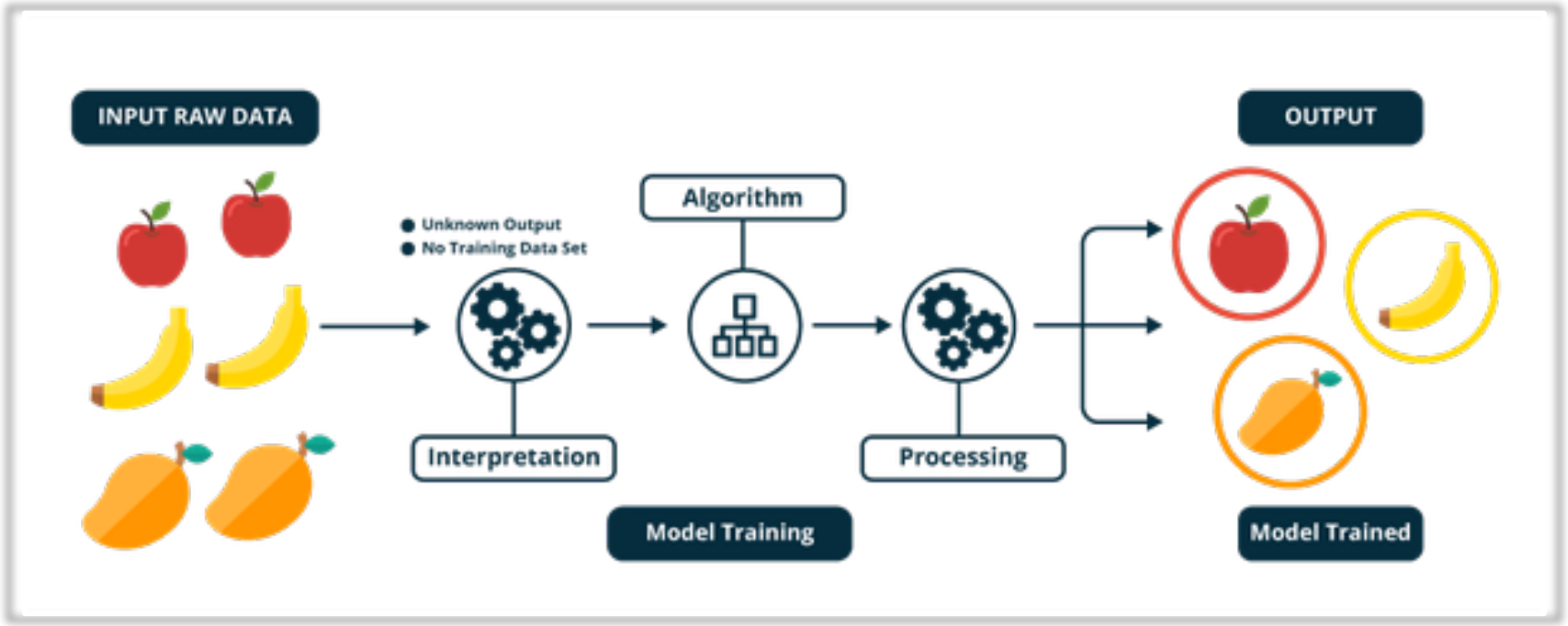
## Traditional Programming




## Machine Learning

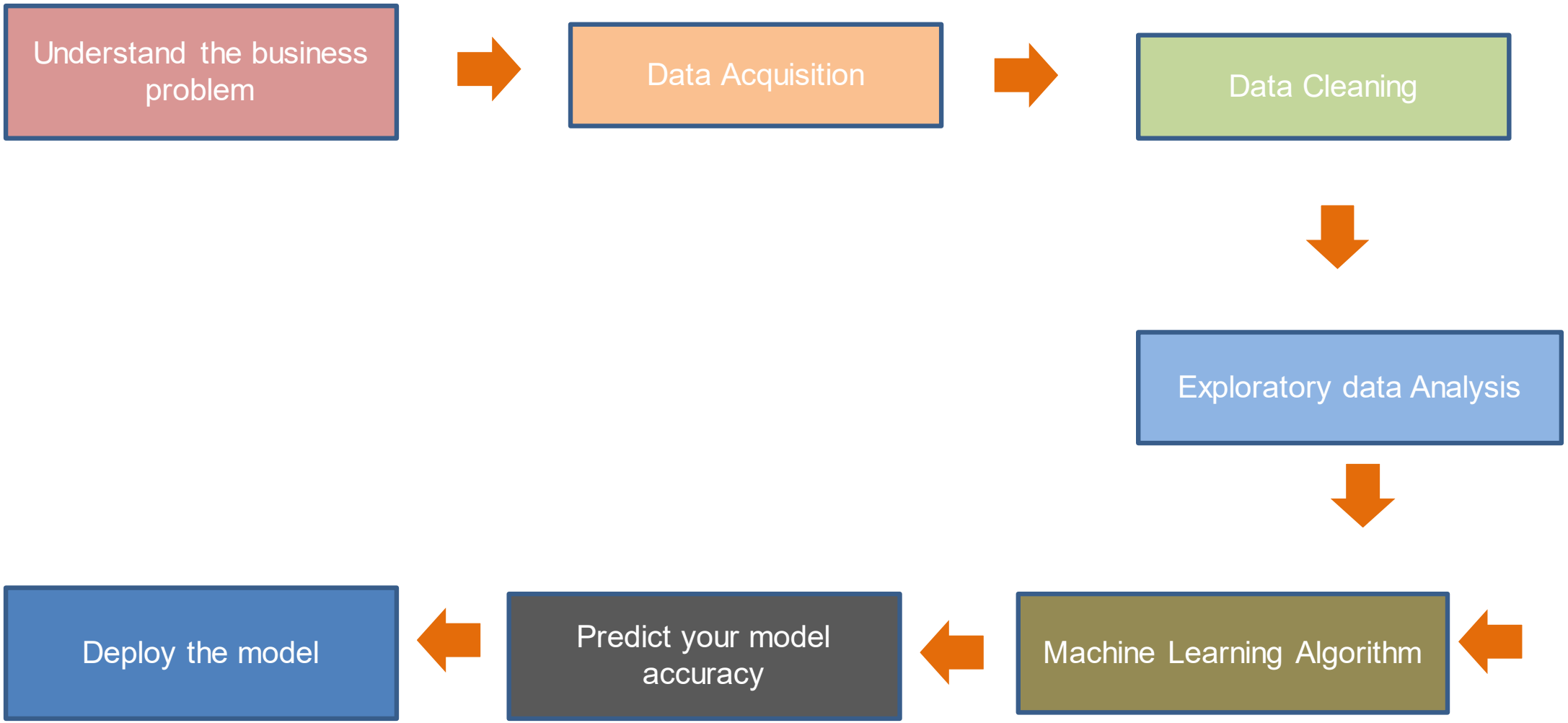


# What is Machine Learning?




**Process to train a machine Learning model**

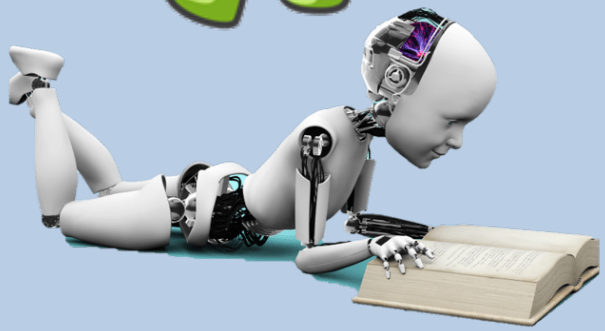
# Life cycle To build a model with Machine Learning

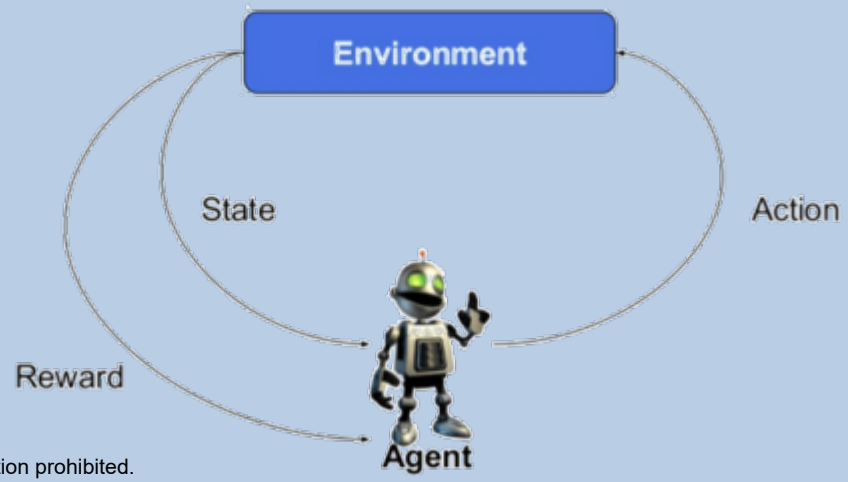


# Types Of Machine Learning



- Supervised Learning
- Unsupervised Learning
- Reinforcement Learning





# What is Supervised Learning?

Supervised learning works as a supervisor or teacher. Basically, In supervised learning, we teach or train the machine with labeled data (that means data is already tagged with some predefined class). Then we test our model with some unknown new set of data and predict the level for them

Learning from the labelled data and applying the knowledge to predict the label of the new data(test data), is known as ***Supervised Learning***

***Types of Supervised Learning:***

- **Regression**
- **Classification**

# What Is Classification?

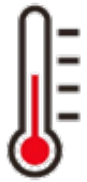
"Classification is the process of grouping similar data points"

# Classification Vs Regression


## Classification

**Predicts continuous outcome**

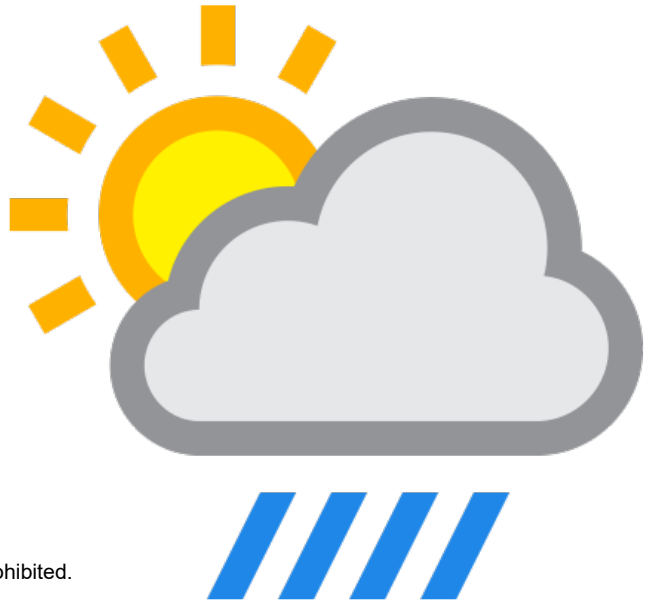
What is the temperature forecasting for tomorrow?



What will be the weather for tomorrow? rainy or sunny?

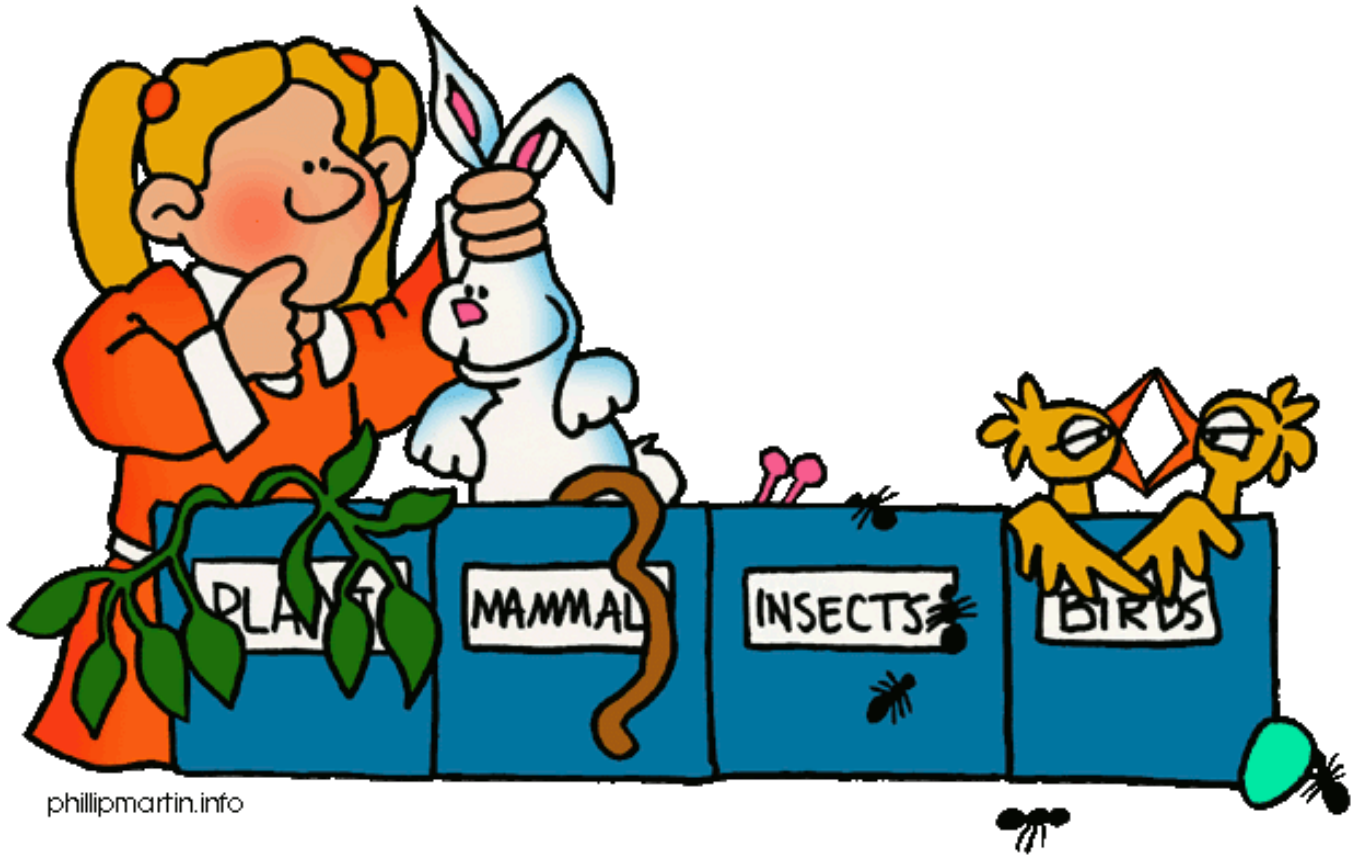
**Predicts categorical outcome**

## Regression



# Types Of Classification Algorithm

- Logistic Regression
- Decision Tree
- Random Forest
- K- Nearest Neighbor
- Naïve Bayes




# Naïve Bayes Classification

# Naïve Bayes

"Naive Bayes classifiers are belonging from simple "probabilistic classifiers" based on Bayes' theorem"

$$P(A|B) = \frac{P(B|A)P(A)}{P(B)}$$

- P(B|A) = Probability of B being true given that A is true
- P(A) = Probability of A being true
- P(B) = Probability of B being true

# What Is A Naïve Bayes Algorithm?

"Naive Bayes classifier assumes that the presence of a particular feature in a class is unrelated or independent to the presence of any other features"

For Example:

- **Colour: RED**
- **Shape: ROUND**
- **Diameter: 3 inches**

# Why Is Naïve Bayes Algorithm Called So?

## Q1: Why was the Algorithm named as Naïve?

- Assumptions are taken by the algorithms are very naïve
- Those assumptions can may or may not be correct.

## Q2: Why the Algorithm has the word Bayes in it?

Fundamentals are based on the Bayes Theorem.

# Bayes Theorem: Example

What is the probability that your flight will be on time today given that weather is sunny and humidity is low?

# Bayes Theorem: Example

For example:

Finding the probability of having a disease given you were tested positive

# Conditional Probability

Define 2 events…

Those two events are related to each other

- Event A is the probability of the event we're trying to calculate
- Event B is the condition that we know or the event that has happened

Conditional Probability : P(A|B) ,

**The probability of the occurrence of event A given that B has already happened**

$$P(A|B) = \frac{P(A \text{ and } B)}{P(B)} = \frac{\text{Probability of the occurence of both A and B}}{\text{Probability of B}}$$

# Understanding Conditional Probability: Example

- Q: Probability of getting 1 by rolling a dice.
- Given: After rolled the dice it is an odd number

Solution:

**Event A = Getting 1 by rolling the dice**

**Event B = Its is an odd number**

- P(A) = 1/6
- After given the condition
- Possibility of getting an odd dice = 3 (1,3,5)
- P(A|B) = 1/3

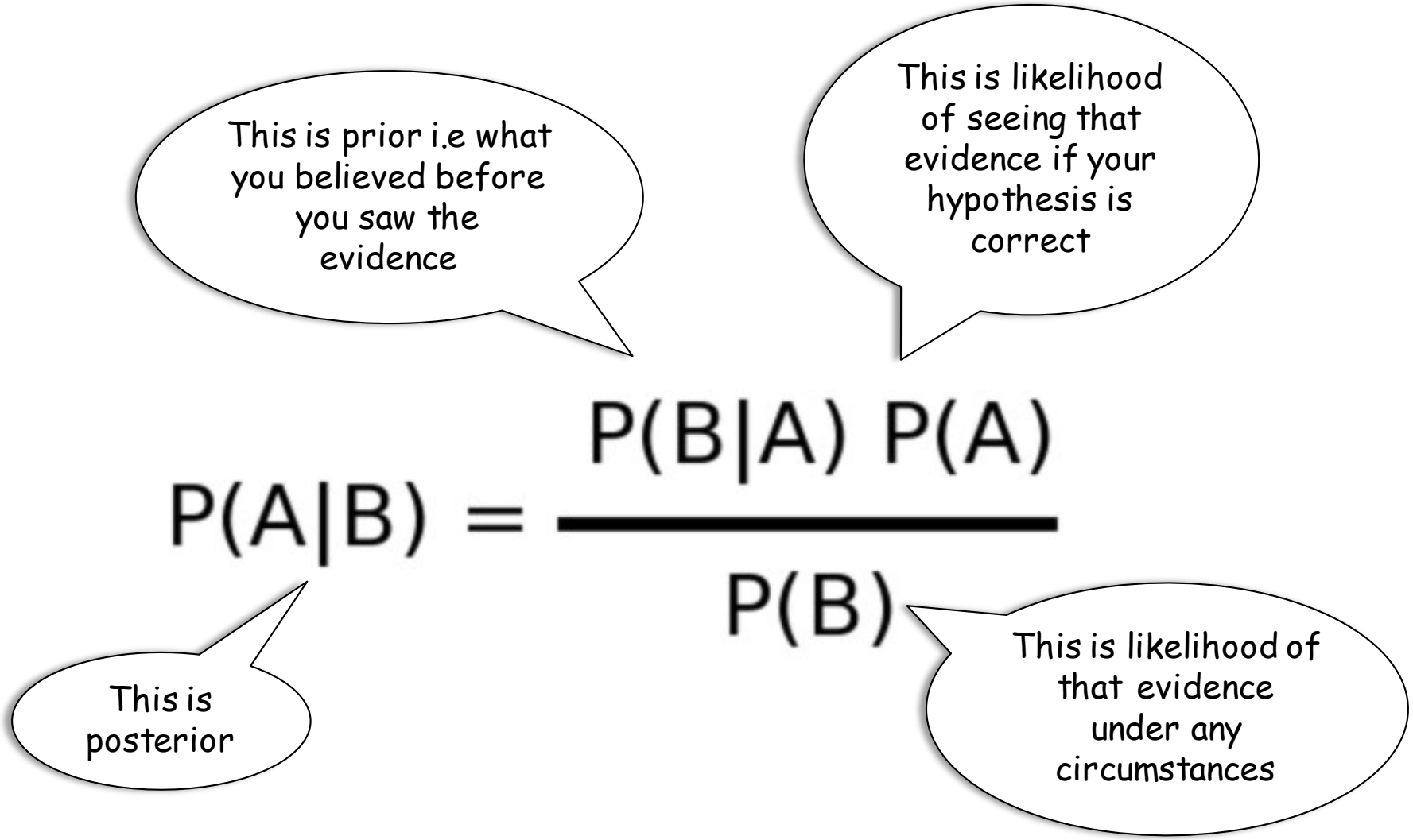
# Understanding Bayes Theorem

- The Bayes theorem describes the probability of an event based on the prior knowledge of the conditions that might be related to the event.
- **In simple words,**
- Bayes' theorem shows the relation between a conditional probability and its reverse form.

- If conditional probability = $P(A|B)$

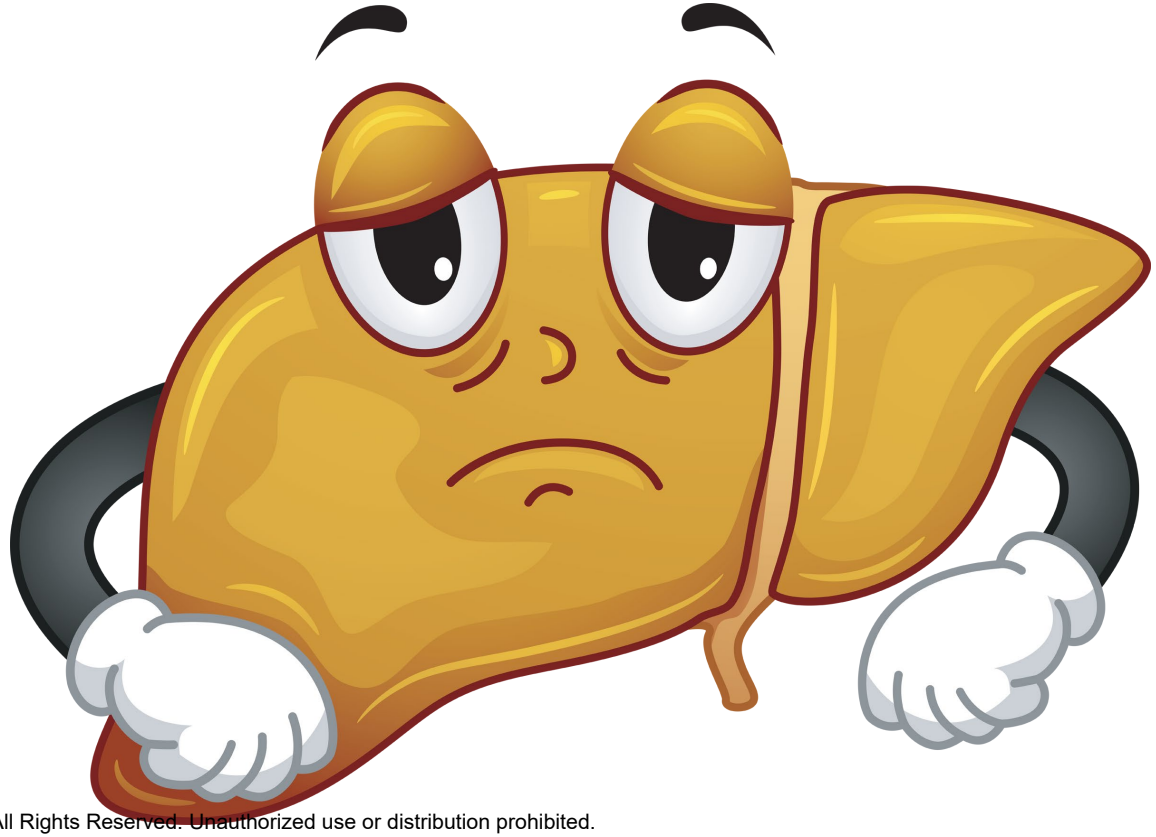
- You can use Bayes rule to find the reverse probabilities i.e. $P(B|A)$

# Explanation of Bayes Theorem:



# Bayes Theorem: Example

Find out the probability of having liver disease if the patient is an alcoholic

# Summarizing The Dataset

| | outlook | temp. | humidity | windy | On time |
|---|---|---|---|---|---|
| D1 | sunny | hot | high | false | no |
| D2 | sunny | hot | high | true | no |
| D3 | overcast | hot | high | false | yes |
| D4 | rainy | mild | high | false | yes |
| D5 | rainy | cool | normal | false | yes |
| D6 | rainy | cool | normal | true | no |
| D7 | overcast | cool | normal | true | yes |
| D8 | sunny | mild | high | false | no |
| D9 | sunny | cool | normal | false | yes |
| D10 | rainy | mild | normal | false | yes |
| D11 | sunny | mild | normal | true | yes |
| D12 | overcast | mild | high | true | yes |
| D13 | overcast | hot | normal | false | yes |
| D14 | rainy | mild | high | true | no |

## Flight will on time or not?

- Total Sample: 14
- No. of Attributes: 4
- No. of Class: 1

Total Yes: 9 P(Yes): 9/14

Total No: 5 P(No): 5/14

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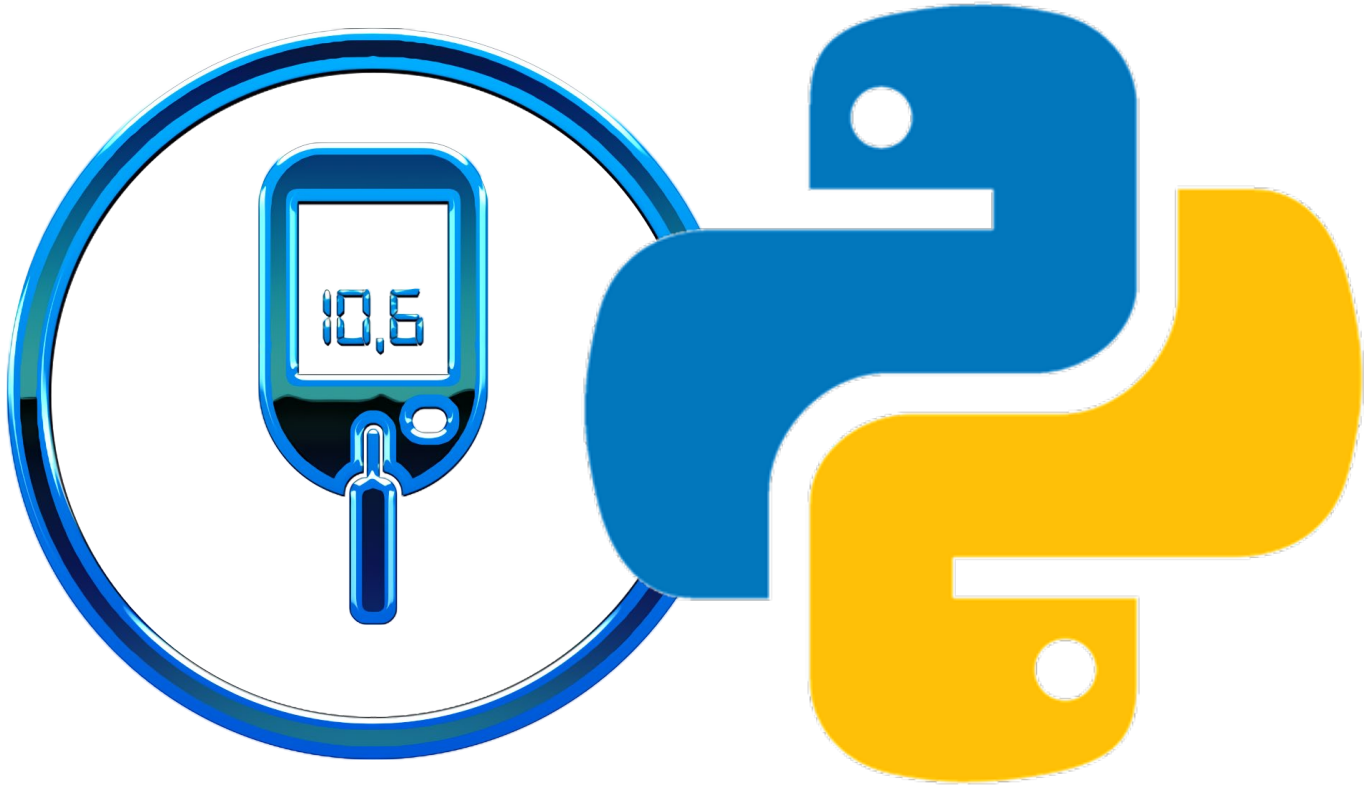



# Diabetes Prediction using Naïve Bayes

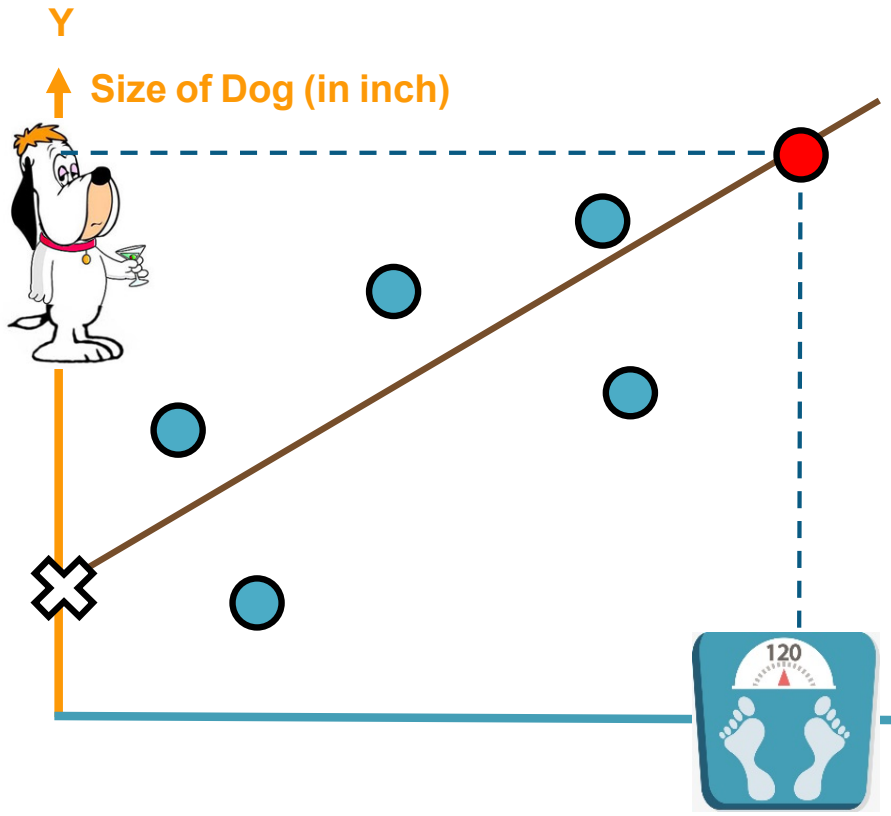
# Logistic Regression

# What is Logistic Regression?

Logistic regression is also a part of supervised learning classification algorithm. It is used to predict the probability of a target variable and the nature of target or dependent variable is discrete, so for the output there will be only two class will be present

- The dependent variable is binary in nature so that can be either 1 (stands for success/yes) or 0 (stands for failure/no).
- Logistic regression is also known as sigmoid function
- *Sigmoid function = 1 / (1 + e^-value)*

# When Logistic Regression comes into picture?




**Linear Regression**

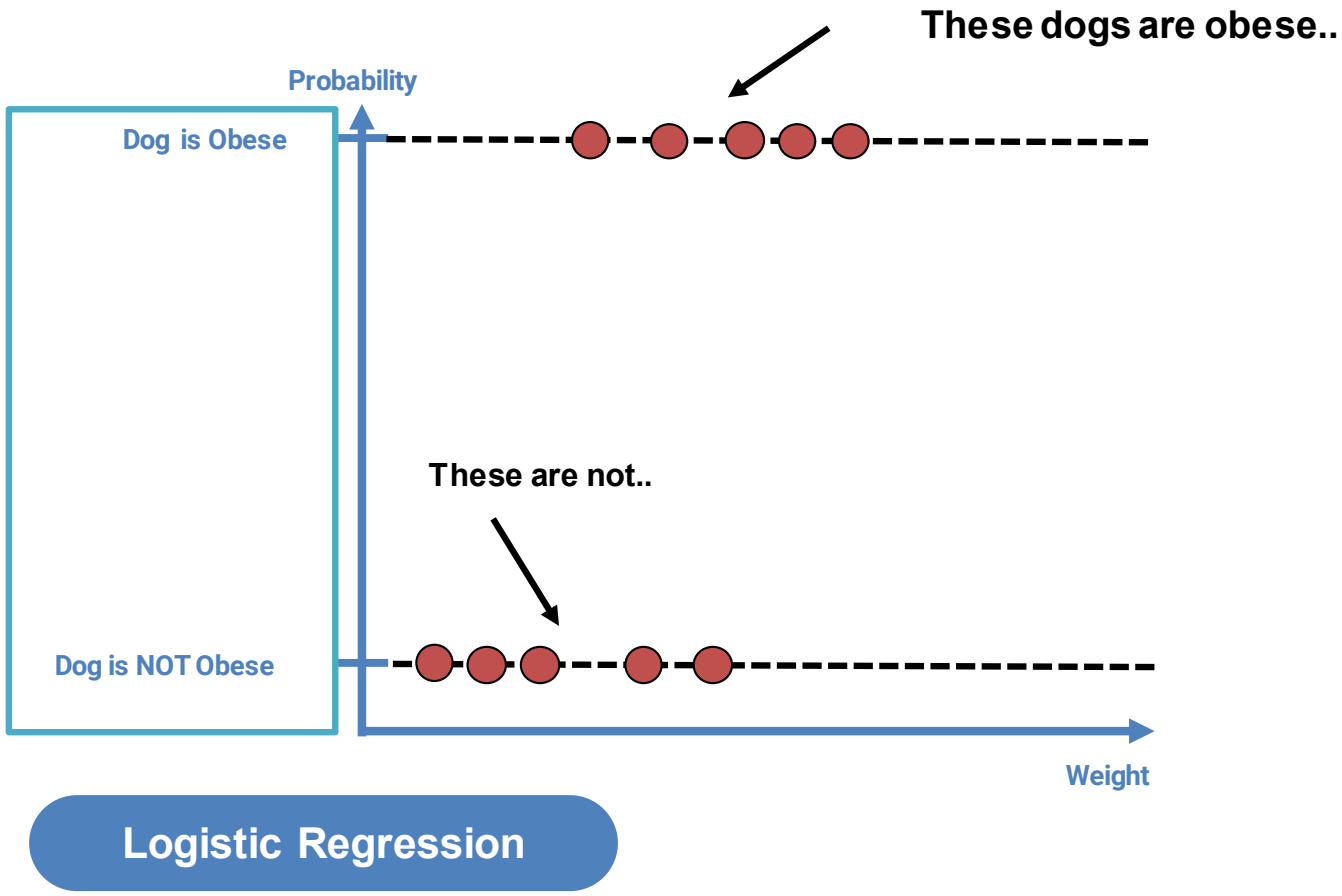
**size** = 2 . 1 x **weight** + 4

**But, if weight =** 0 kg

**Predicted Size =** 4 inches

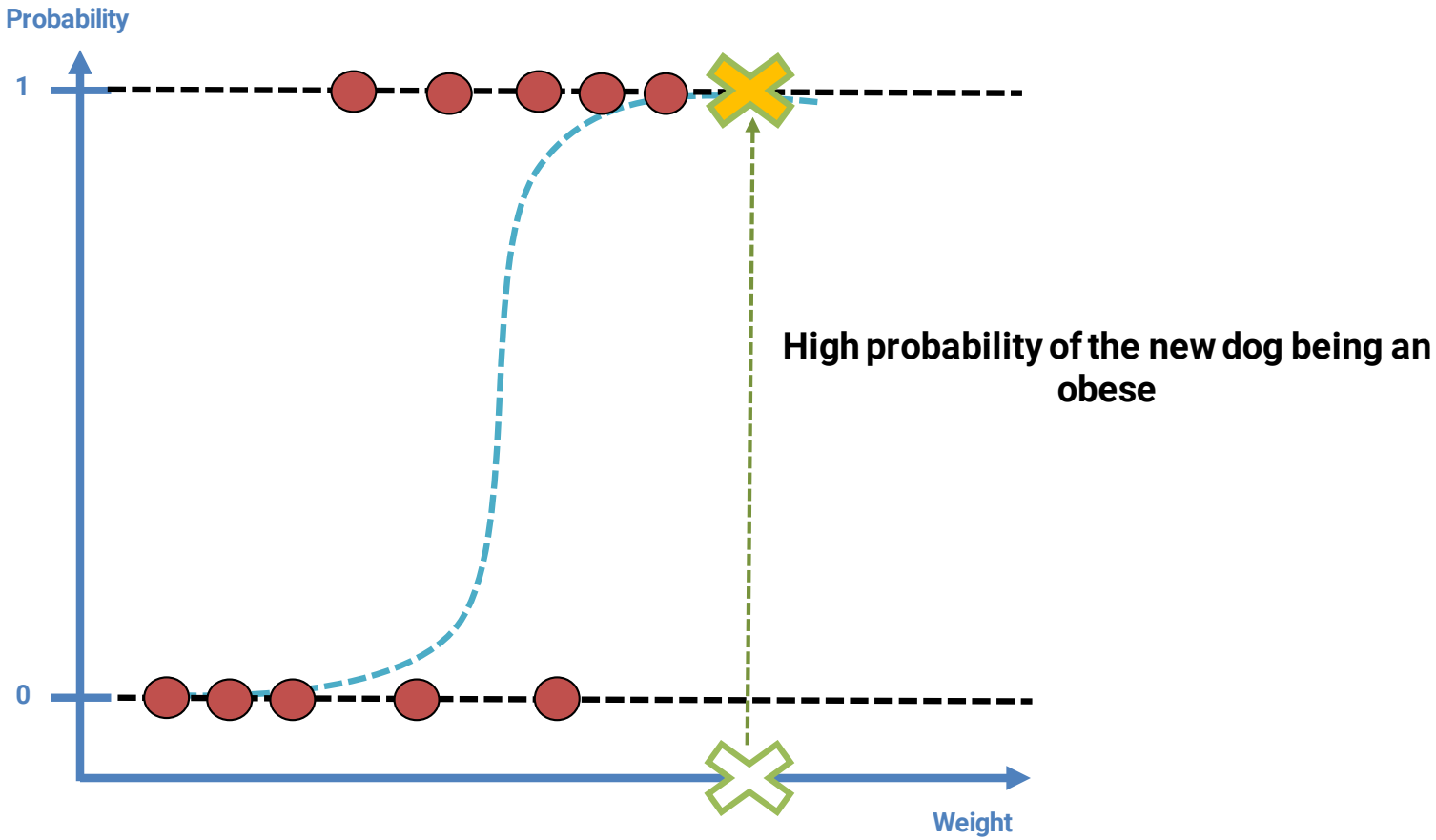
**HOW is it even possible?**

# When Logistic Regression comes into picture?




**Similar to linear regression except, it predicts whether something is TRUE or FALSE, instead predicting something continuous like *size of dog***

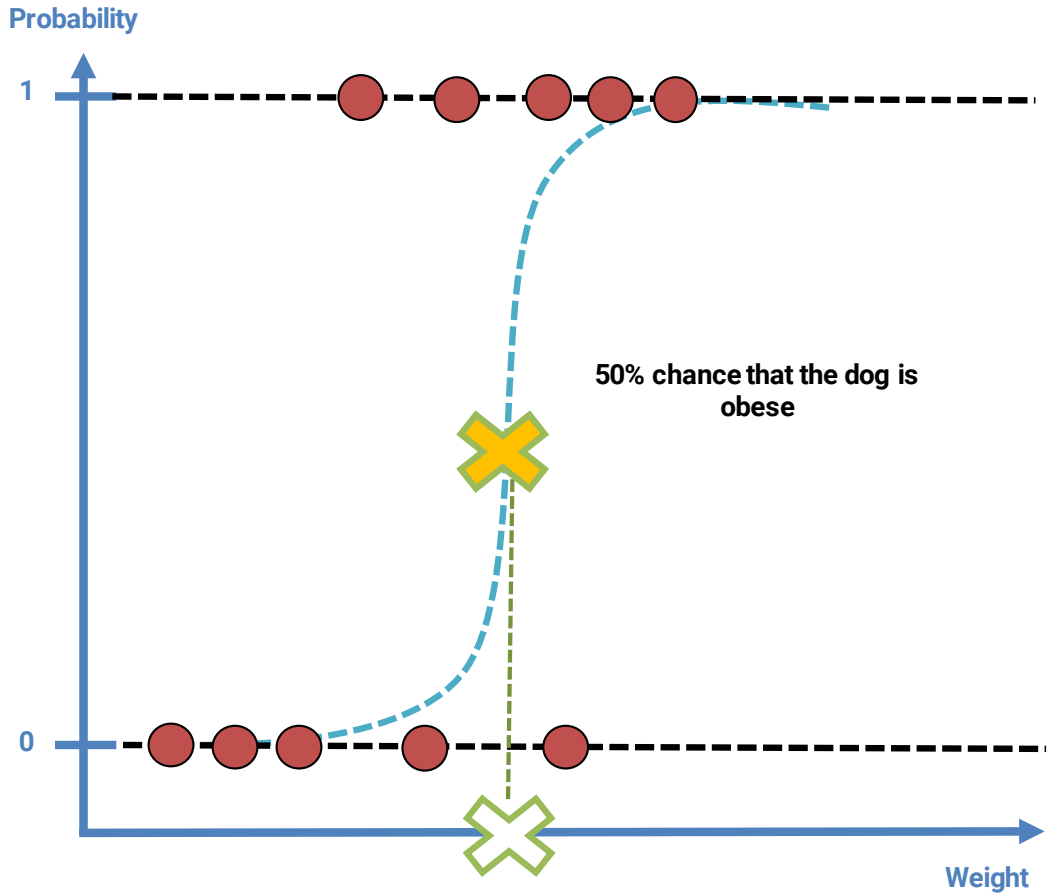
# Understanding of Logistic Regression




**Logistic Regression**

The curve tells the probability of the dog being an **obese**, based on its **weight**.

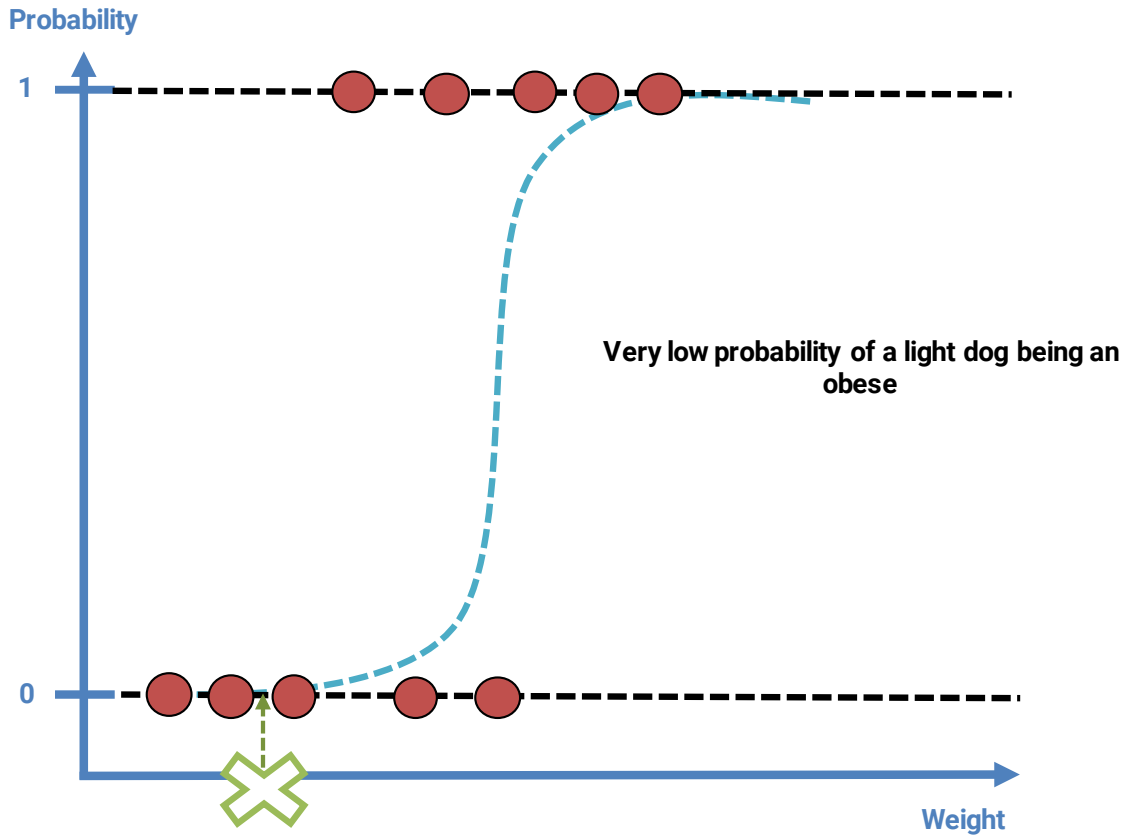
# Understanding of Logistic Regression




**Logistic Regression**

The curve tells the probability of the dog being an **obese**, based on its **weight**.

# Understanding of Logistic Regression




## Logistic Regression

It is generally used for classification.

***For example,*** If the probability of the dog being obese is > *50%* then it is classified as '**obese**' or else '**not obese**'

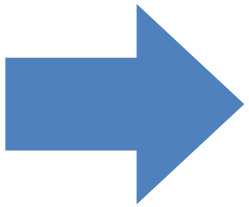
# Mathematical Explanation of Logistic Regression

## Logistic Regression is a special case of Linear Regression

**Linear Regression**

$$Y = m_1 x_1 + m_2 x_2 + \cdots + m_1 x_n + c$$

- Y → dependent variable and
- $x_1, x_2 \ldots x_n$ → independent/explanatory variables



**Sigmoid Function**

$$p = \frac{1}{1 + e^{-y}}$$

**Logistic Regression**

$$p = \frac{1}{1 + e^{-(m_1 x_1 + m_2 x_2 + \cdots + m_1 x_n + c)}}$$

# Real time Use cases that can come under Logistic Regression Problem

Will the property have a good neighborhood?

The mail is spam mail or not?

# Key points of Logistic Regression

**LOGISTIC REGRESSION**

- Categorical Variables
- Solves Classification Issue
- S-Curve
- Eg: Is the mail spam or not

# Credit Card Fraud Analysis Using Logistic Regression

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# Thank You