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# Machine Learning 101

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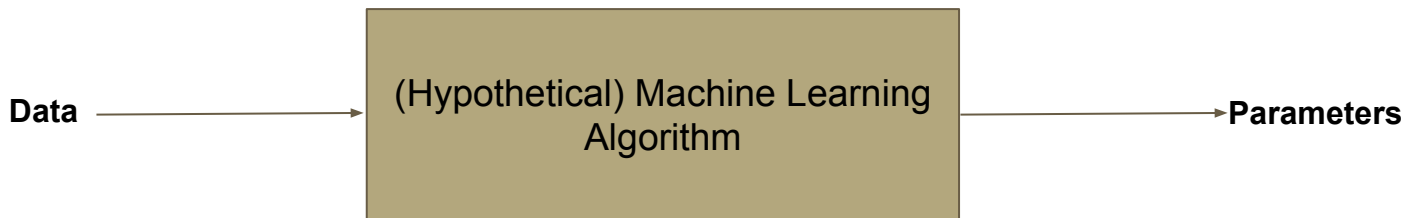
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# Machine Learning

- What is Machine Learning (Informal Definition)
  - **Machine** receives data, machine then **finds out (or learn)** some **parameters** that describe **data**

# Machine Learning

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# Classification of Famous Machine Learning Algorithms

- Supervised Learning
- Semi-Supervised Learning
- Unsupervised Learning
- Reinforcement Learning

# Classification of Machine Learning Algorithms

- Supervised Learning
  - Perceptron
  - Neural Networks
    - Deep Architecture lies here
  - Support Vector Machines
    - Binary, Multiclass, Structural SVM
  - Linear regression
  - Logistic Regression
  - ....
- Semi-Supervised Learning
- Unsupervised Learning
  - Clustering algorithms (K-Means)
  - Neural Networks
    - Autoencoders, Generative Adversarial Networks ...
  - ....

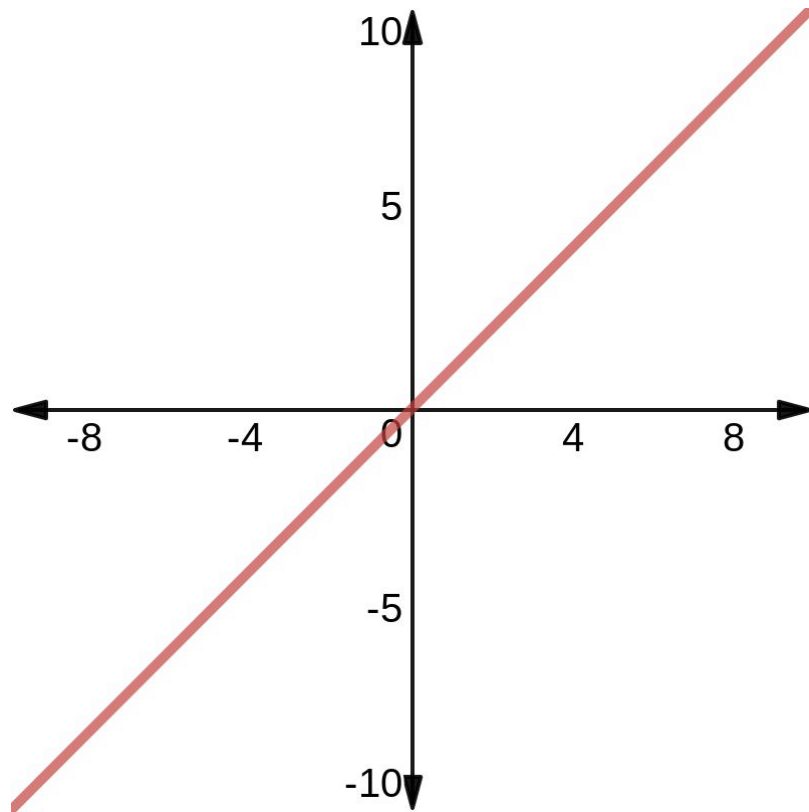
# Classification of Machine Learning Algorithms

- Reinforcement Learning
  - Policy Iteration (Algorithm to solve basic Markov Decision Process (MDP) )
  - Value Iteration (Algorithm to solve basic Markov Decision Process (MDP) )

# Throughout this presentation

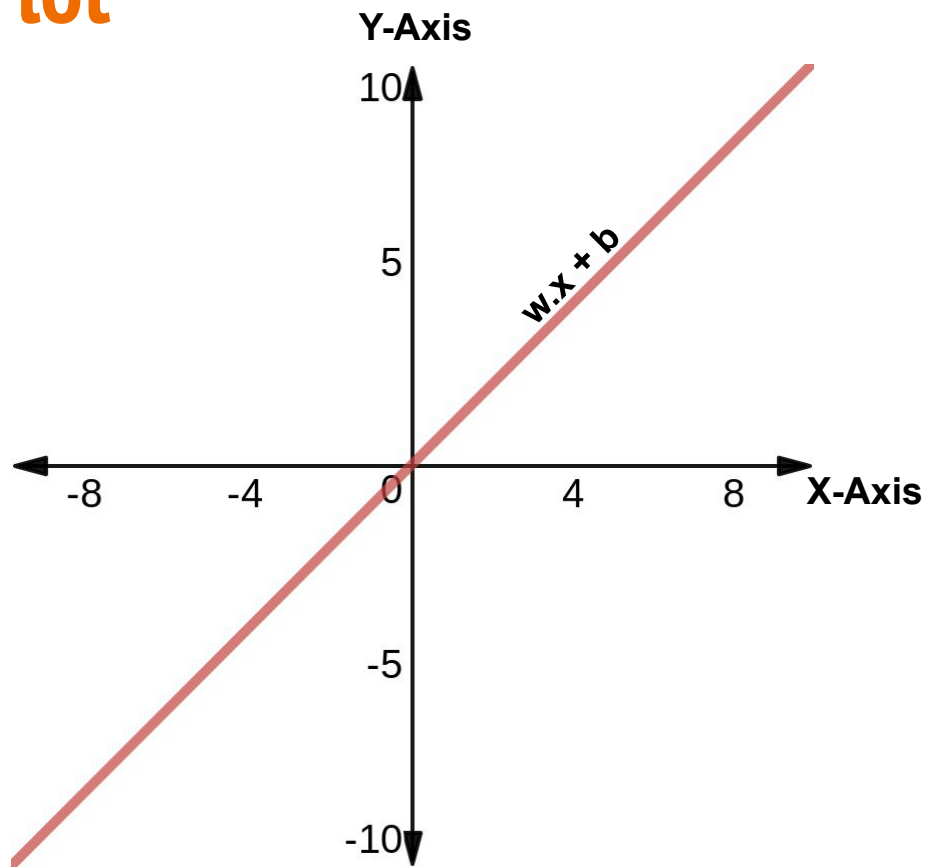
- We will see Supervised Machine Learning in pictures

# Simple Line Plot

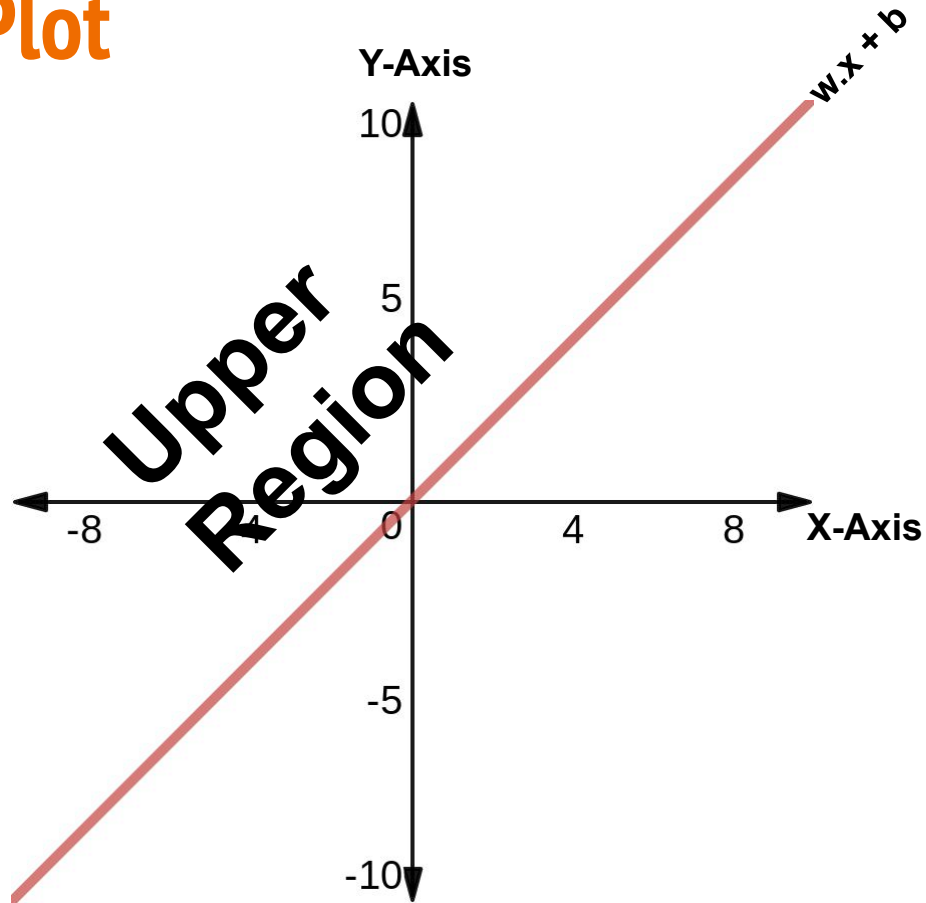




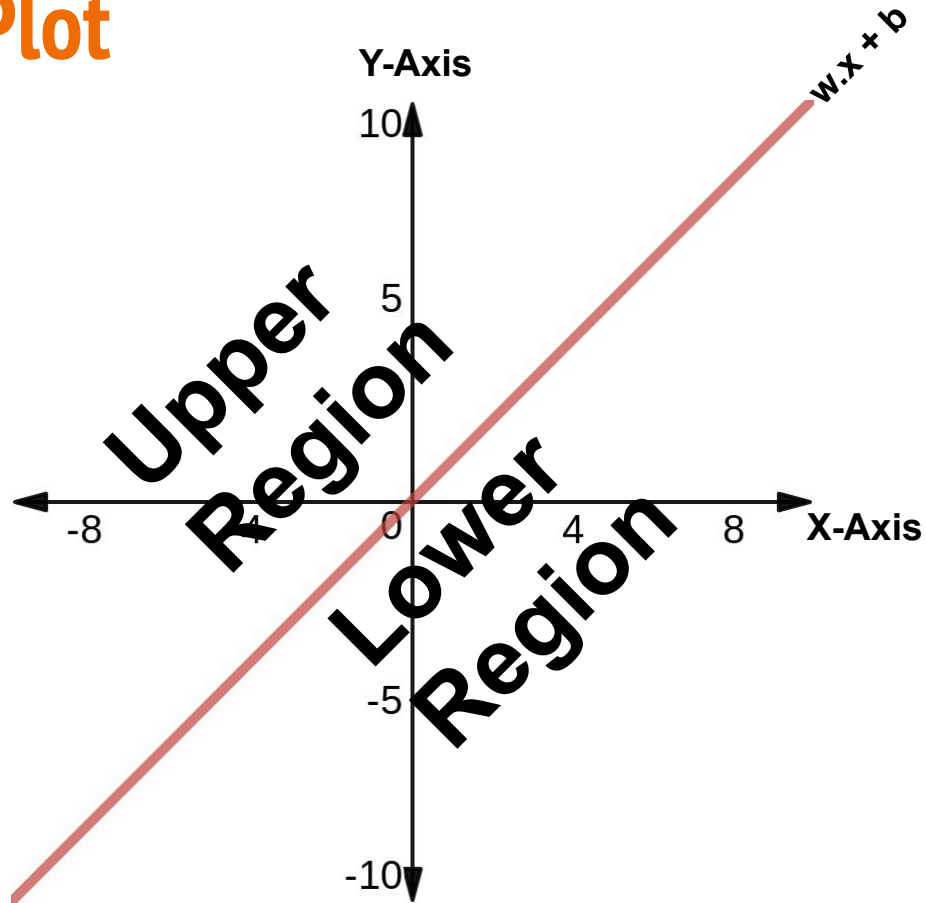
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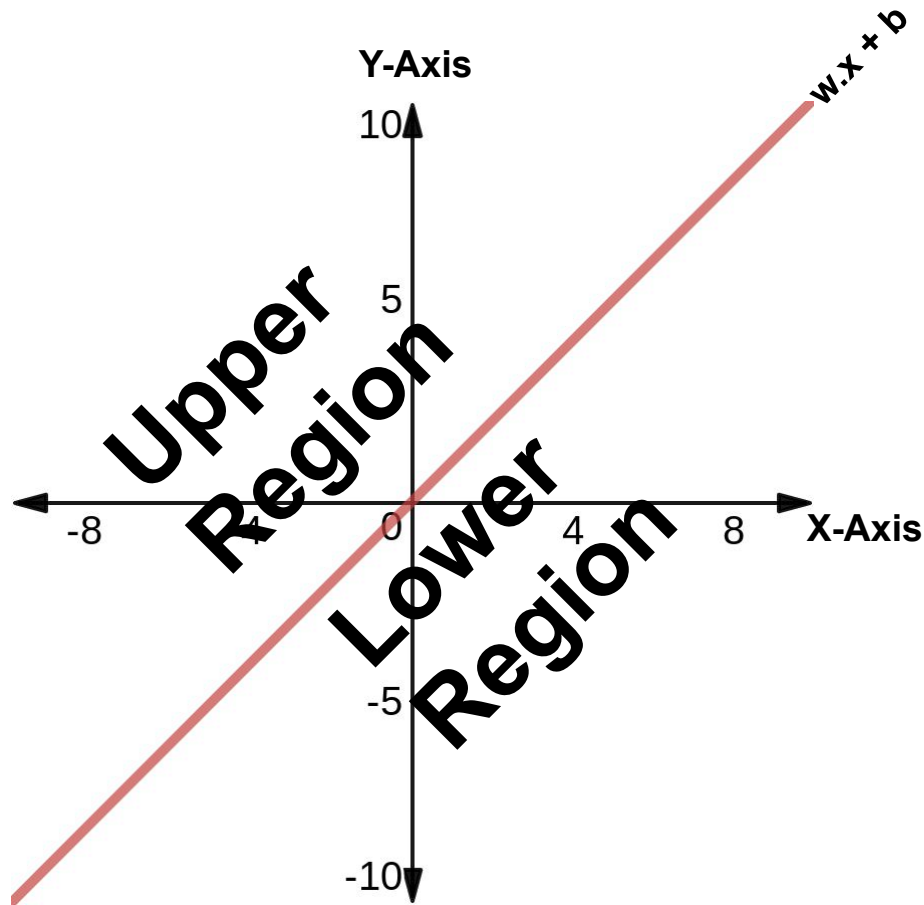


# Simple Line Plot



# Simple Line Plot





Our depicted line:

- Has parameters  $(w,b)$
- Divides the entire 2D space into two portions
  - Upper Region
  - Lower Region

# The Perceptron Algorithm

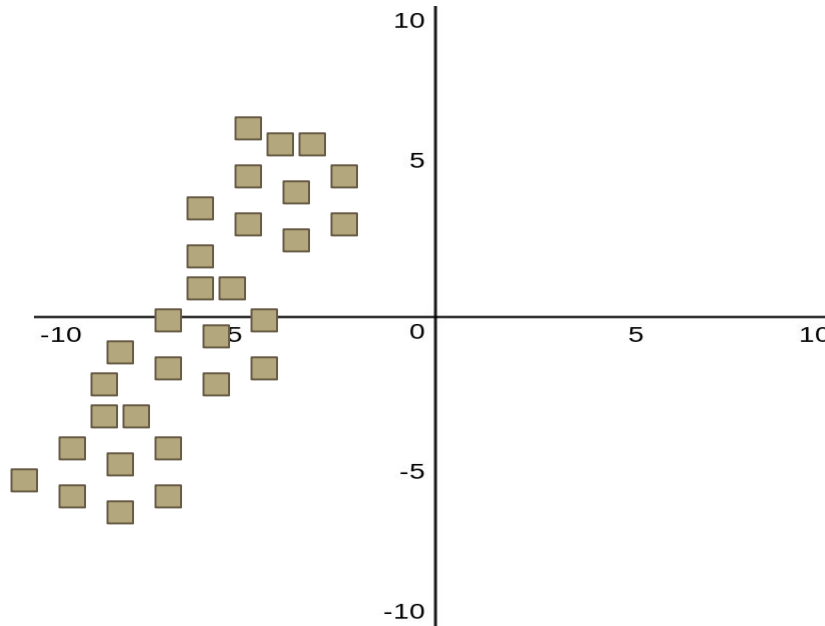
- NO EQUATIONS HERE
- The most basic (yet powerful) supervised machine learning algorithm
- Given data  $(x)$ , it **finds out** the parameters of **linear decision boundary**  **$(w, b)$**
- We will see **BINARY CLASSIFICATION** ONWARDS

# The Perceptron Algorithm

Imagine you have some data points of TWO types (■ and ▲)

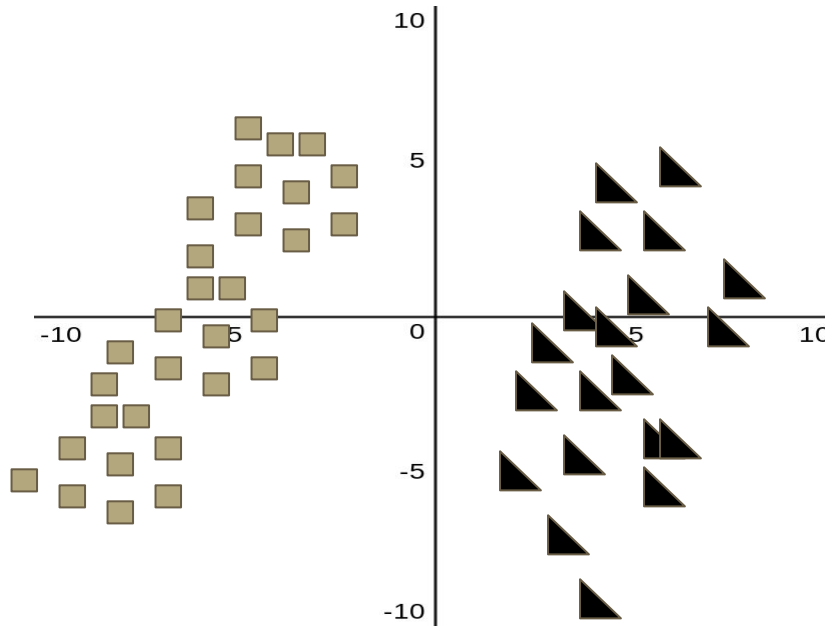
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# The Perceptron Algorithm

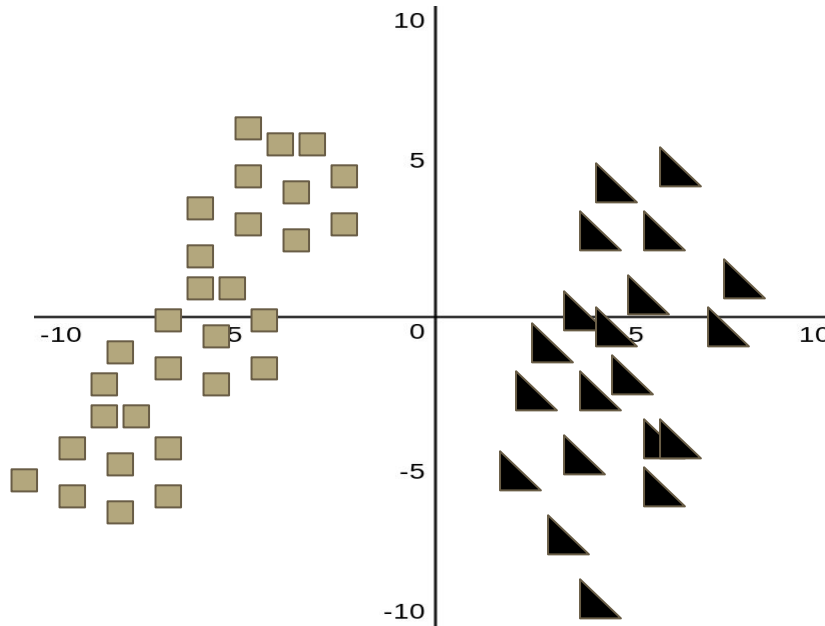
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# The Perceptron Algorithm

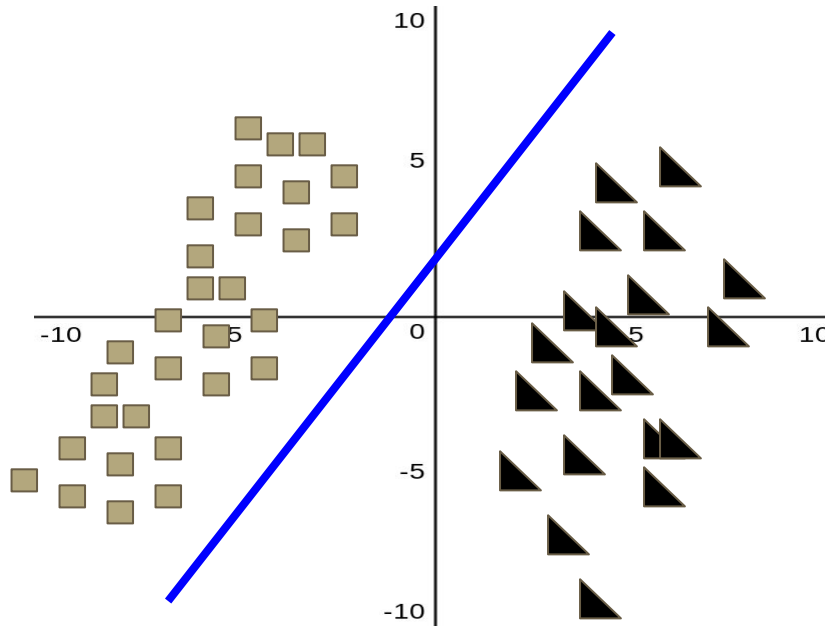
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**Perceptron** will try to find a line or decision boundary that separates these points

# The Perceptron Algorithm

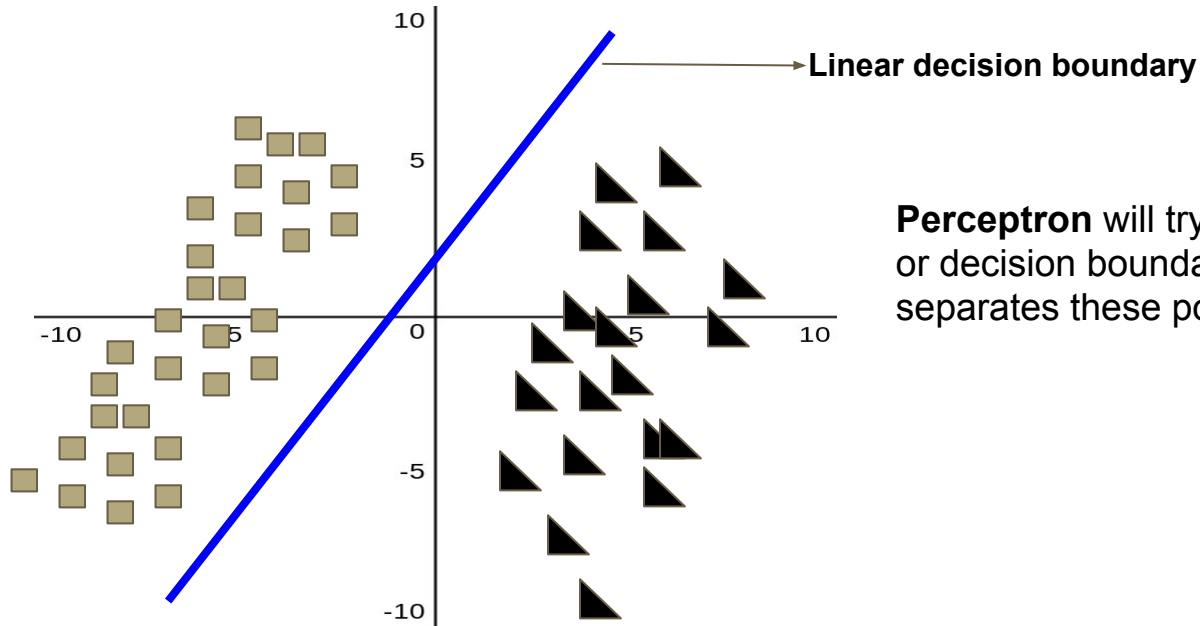
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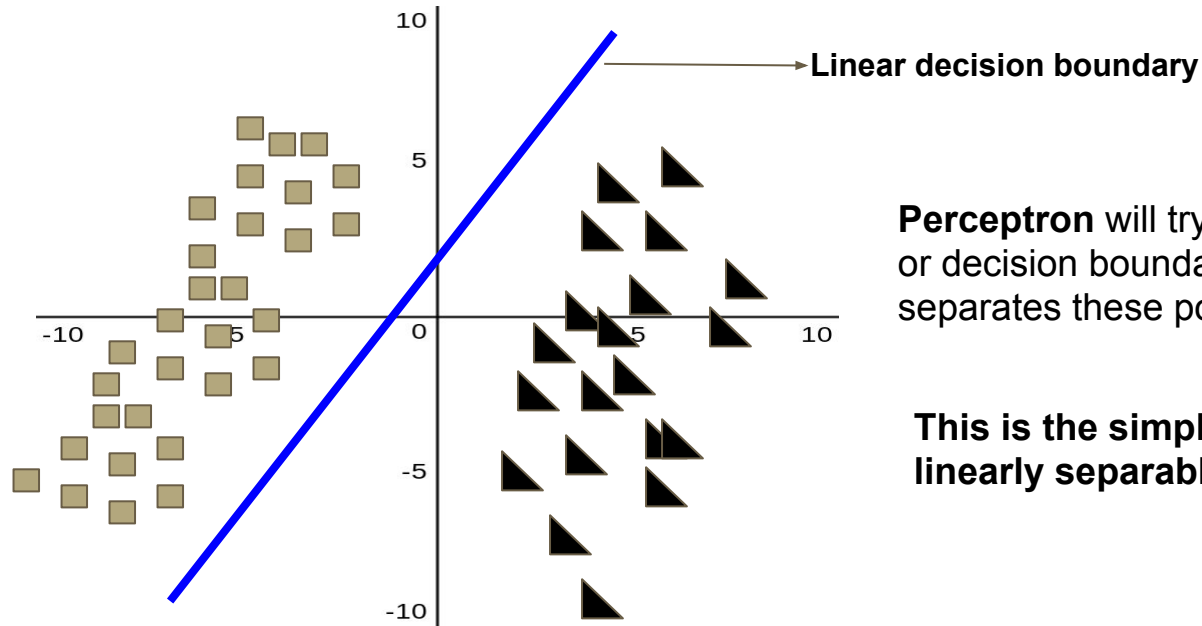
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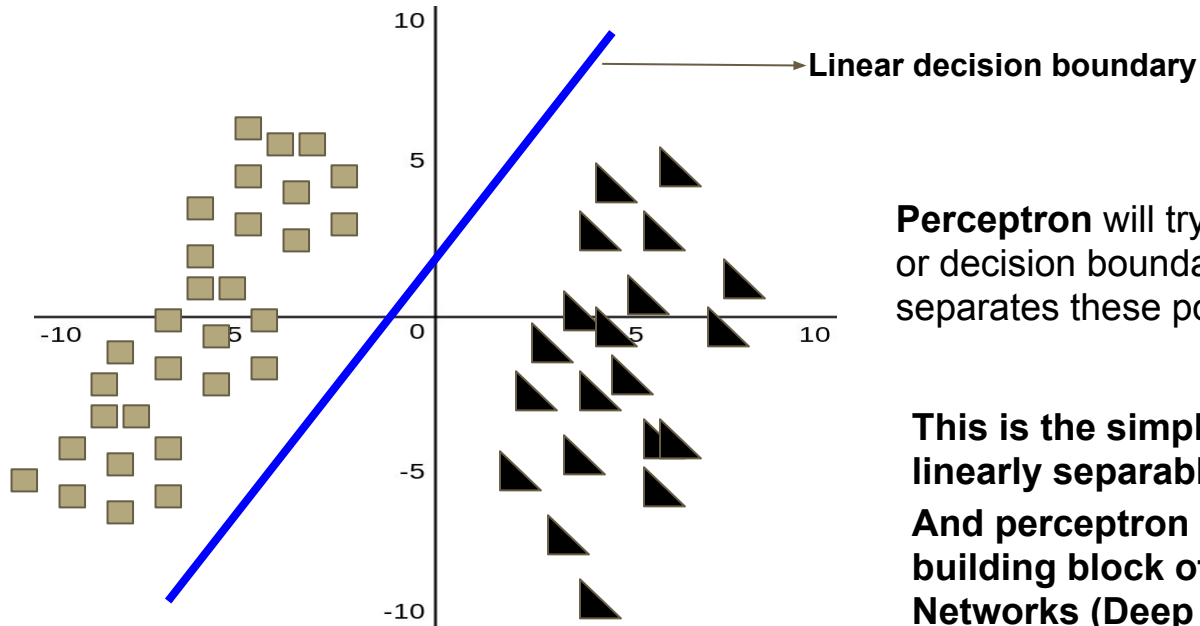


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**This is the simplified case of linearly separable points!**

# The Perceptron Algorithm

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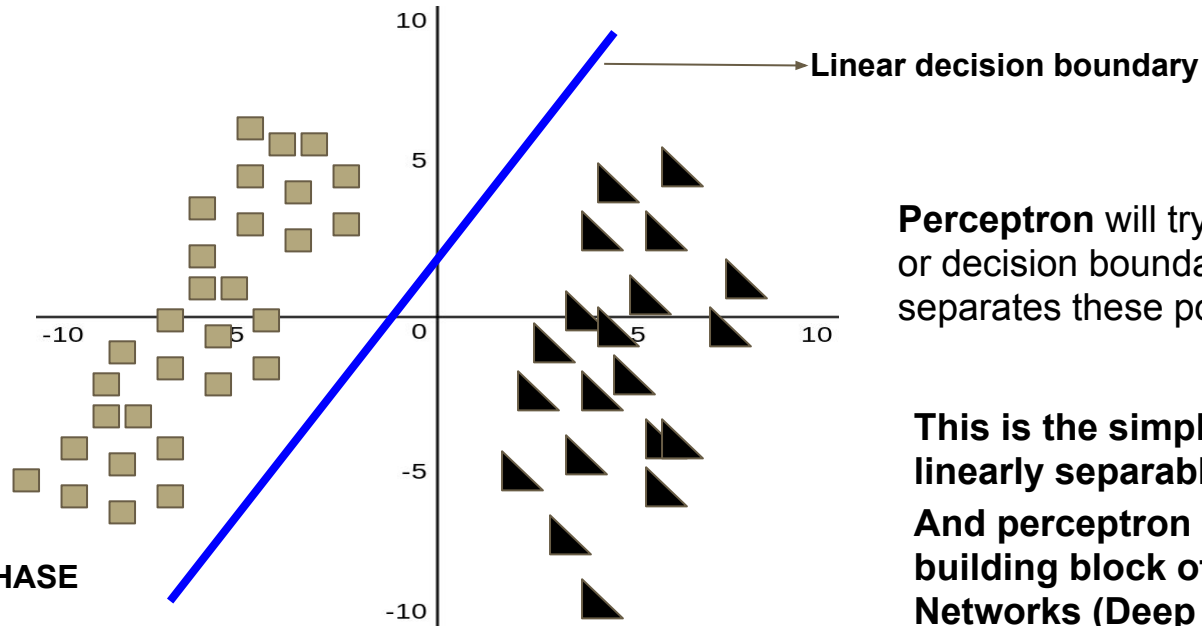


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**This is the simplified case of linearly separable points!**  
**And perceptron is the basic building block of Neural Networks (Deep learning these days)**

# The Perceptron Algorithm

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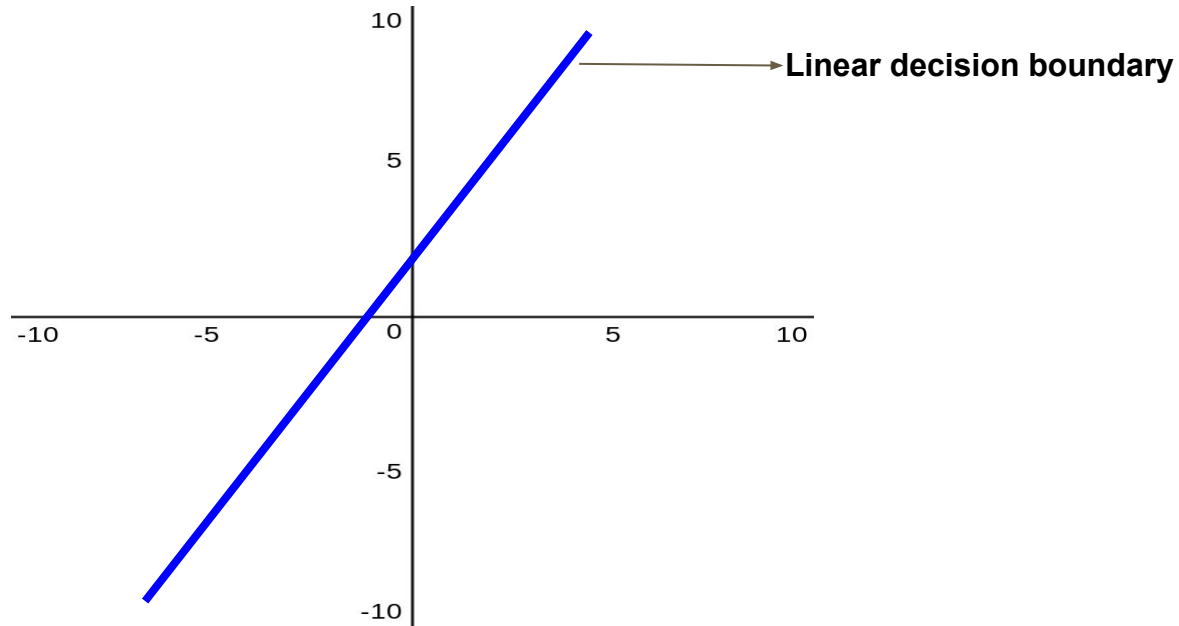
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**This is THE LEARNING PHASE**

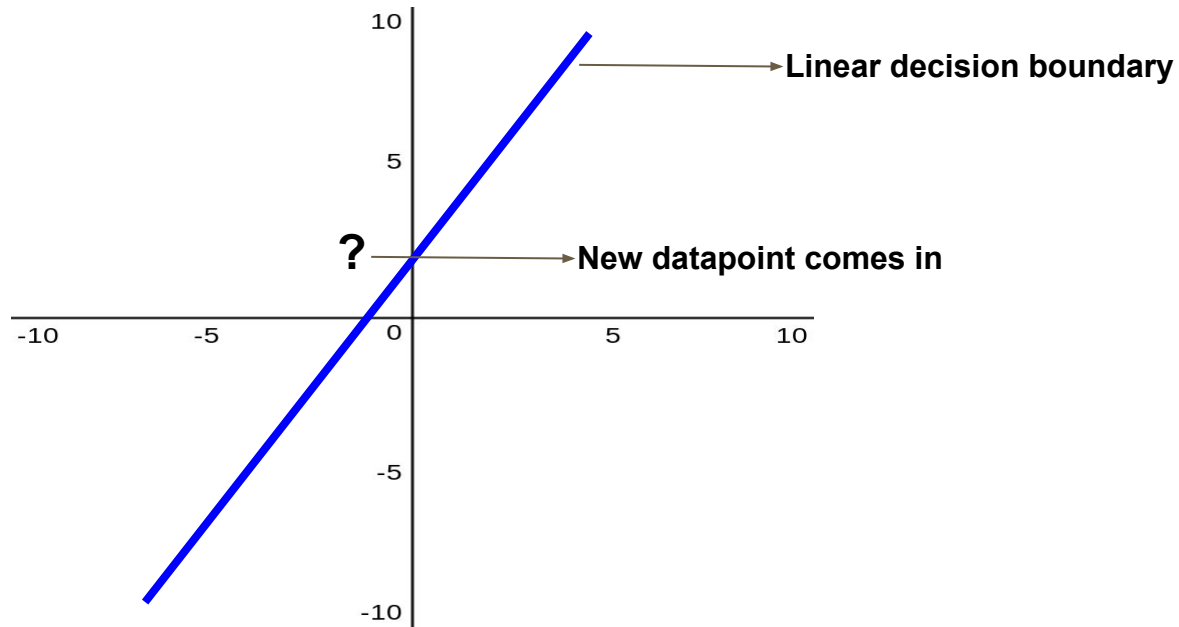
# The Perceptron Algorithm

What happens after the Learning phase?



# The Perceptron Algorithm

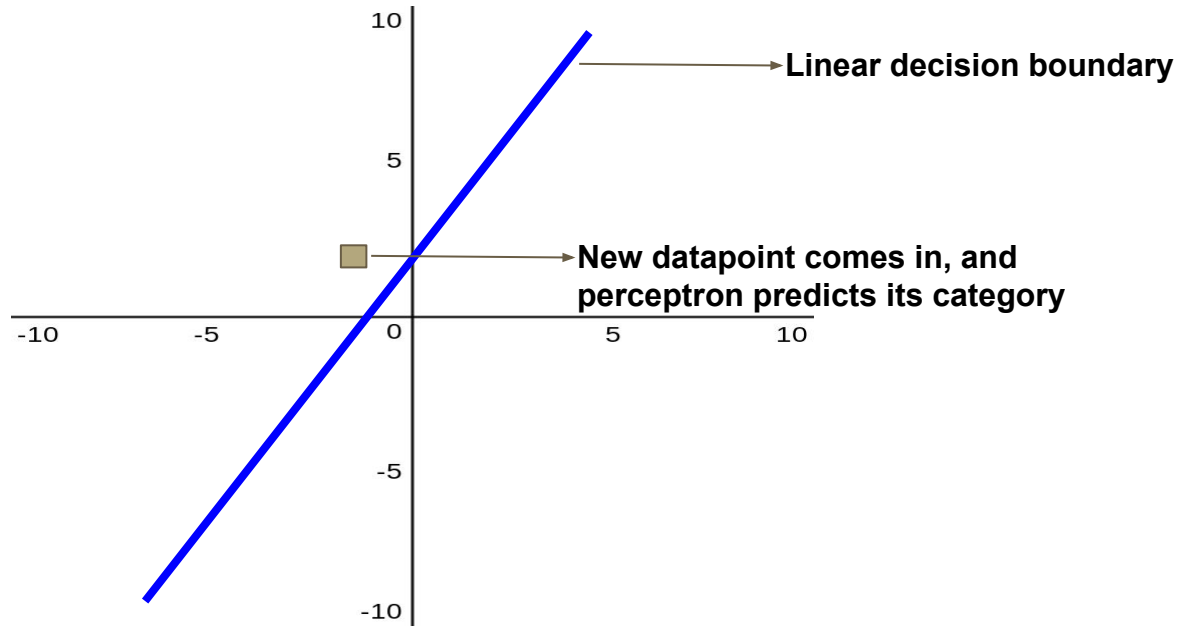
What happens after the Learning phase?





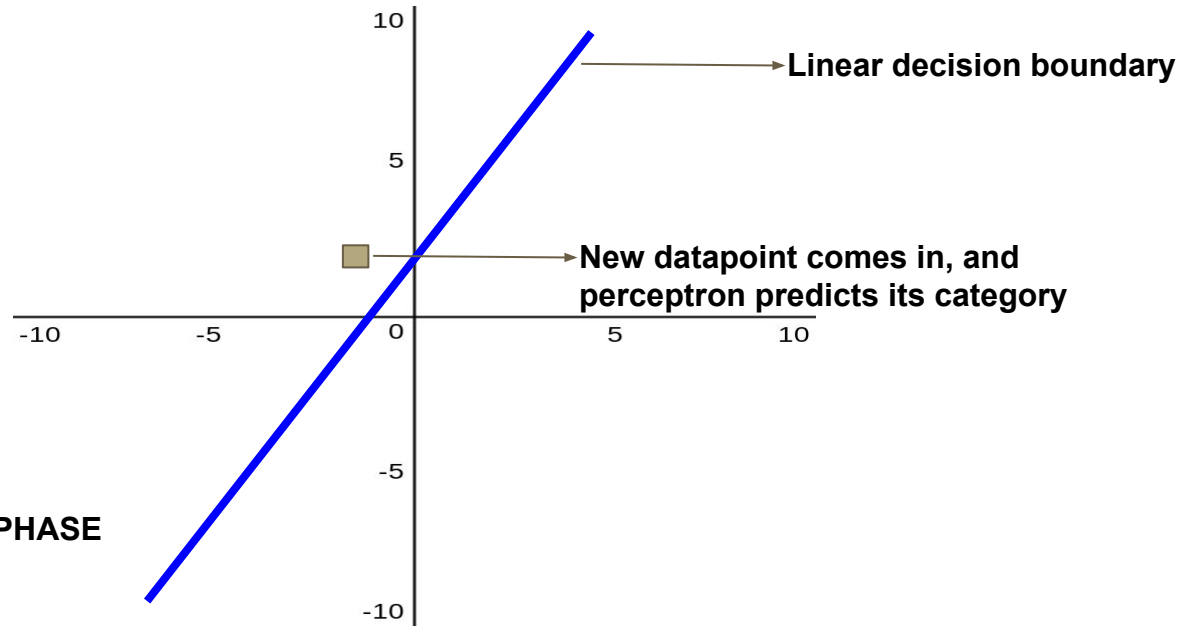
# The Perceptron Algorithm

What happens after the Learning phase?



# The Perceptron Algorithm

What happens after the Learning phase?



**This is THE PREDICTION PHASE**

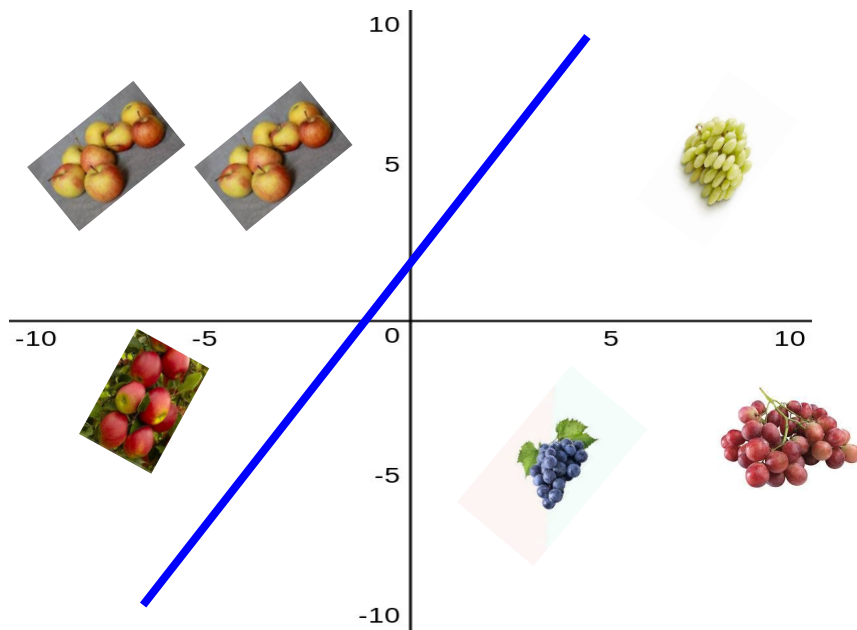
# What we have seen until now

- Supervised machine learning algorithm
- Learning and Prediction phases

# Algorithmic Flow

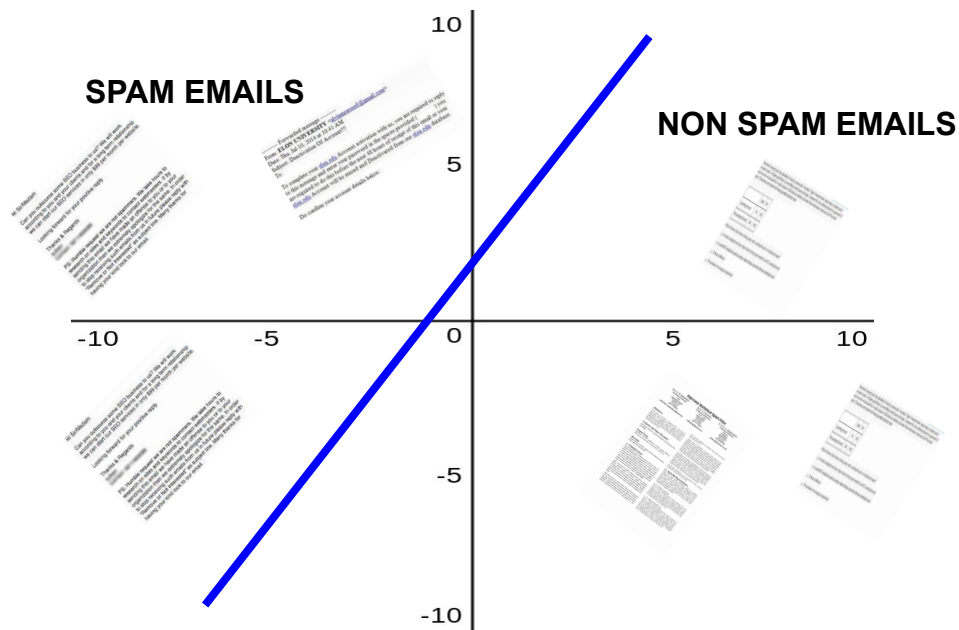
- ML-Algorithms goes through the following phases
  - Learning
    - algorithm estimates the desired parameters
  - Inference
    - Smart searching and estimation of values needed by algorithm
  - Classification / Regression
    - Once learning is concluded, new data points are assigned **classes/values respectively**

# Image Classification



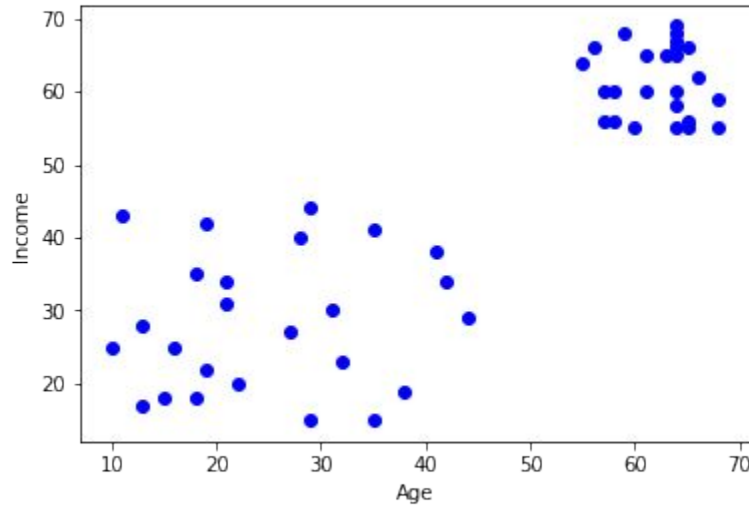
- Data points are images of apples and grapes
- This is just an illustration for the sake of understanding only

# Document Classification

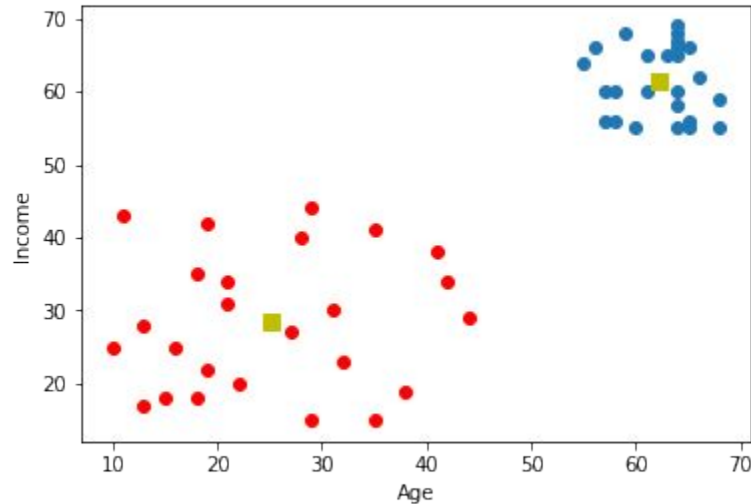


- Data points are documents (Spam and Non-Spam Emails)
- This is just an illustration for the sake of understanding only

# k-means Clustering



# k-means Clustering Continued (k=2)





# What is happening these days

- As of today, May 2019
  - Deep learning dominates
  - Majority of classification problems in Computer Vision and Natural Language Processing are now being addressed by a variant of Deep Architecture (multilayered CNNs and BiLSTMS in general)
  - Such Deep Architecture needs
    - Computing resources
    - Large training times
    - And lots of data
  - But once training is done, you **MAY BE** rewarded by State-of-the-art performance (“**May be or hopefully**”)

# What we covered

- An intuition of what is meant by “machine learning”
- What happens when we build “machine learning classifier”
- Went through the classification of machine learning algorithms

**Thank you and Questions please!**