# Soft Computing

4th Year/ 2nd semester

# Machine Learning

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**University of Diyala**

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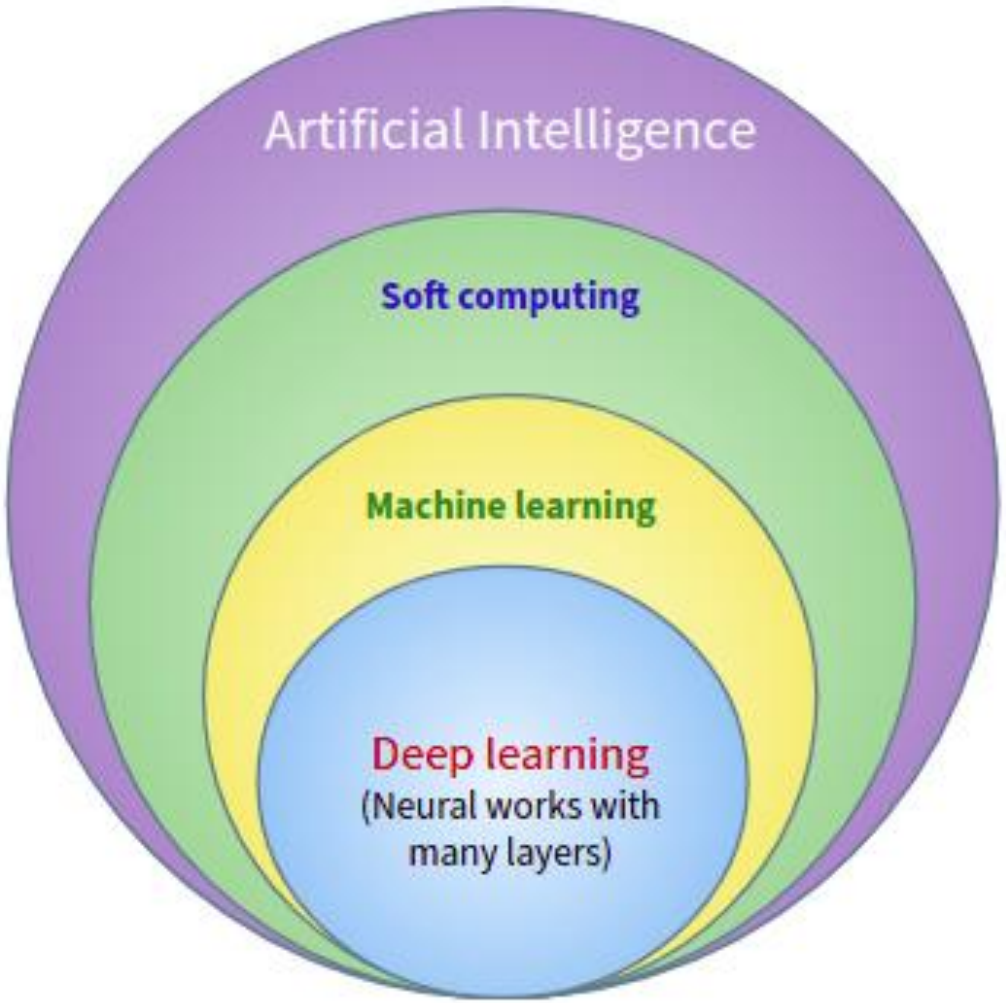
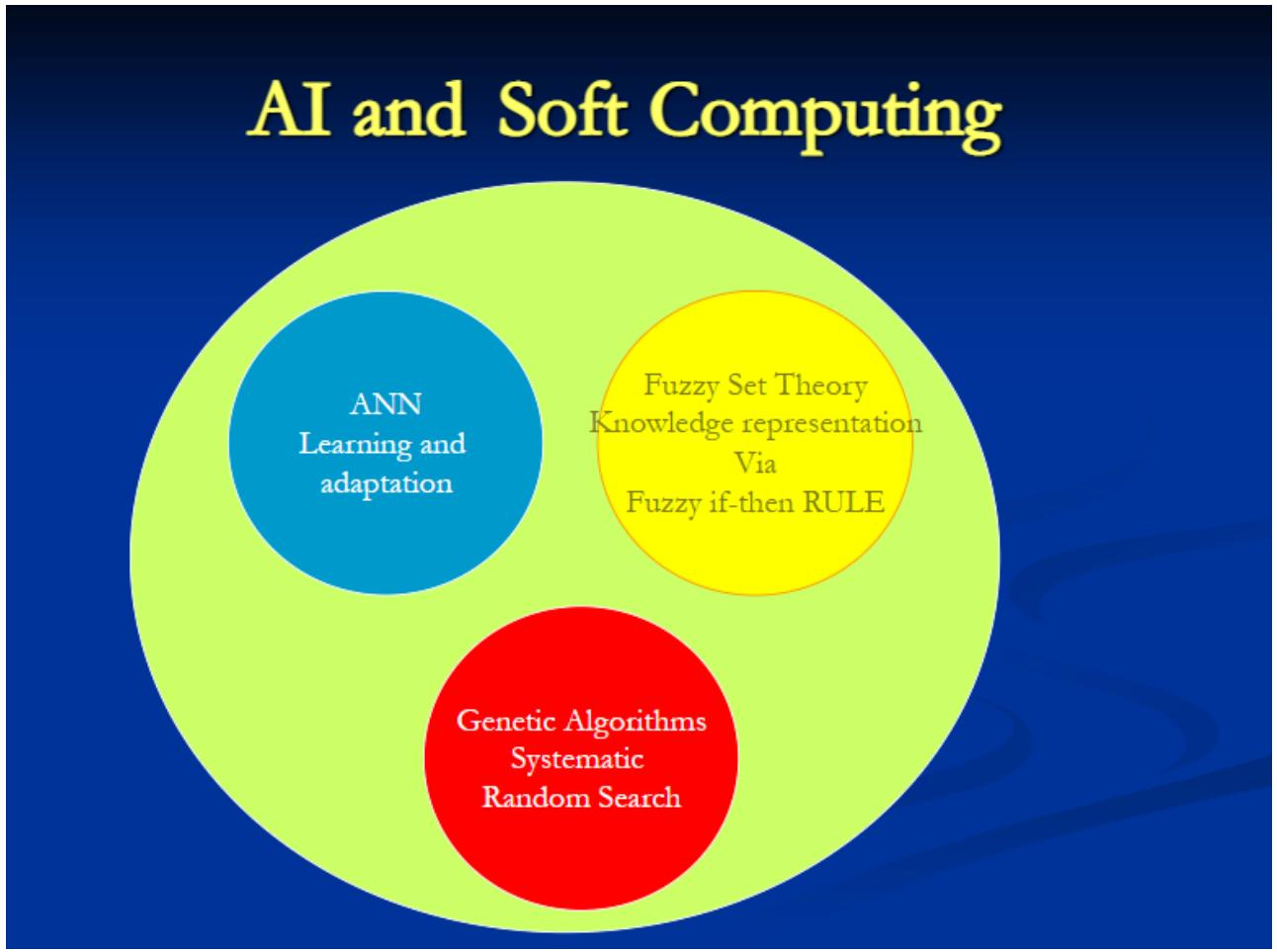
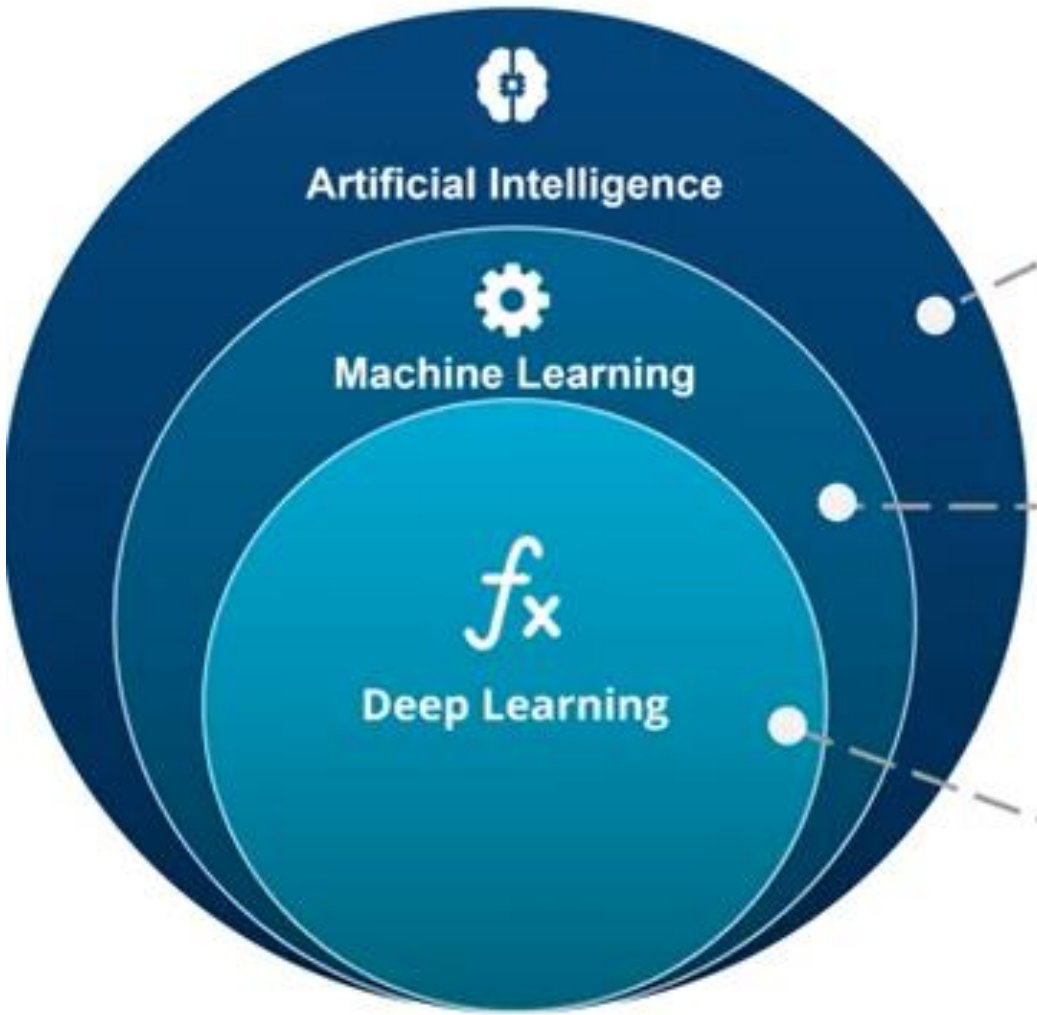

Artificial Intelligence
Soft computing
Machine learning
Deep learning
(Neural works with
many layers)


AI and Soft Computing
ANN
Learning and
adaptation
Fuzzy Set Theory
Knowledge representation
Via
Fuzzy if-then RULE
Genetic Algorithms
Systematic
Random Search




## ARTIFICIAL INTELLIGENCE

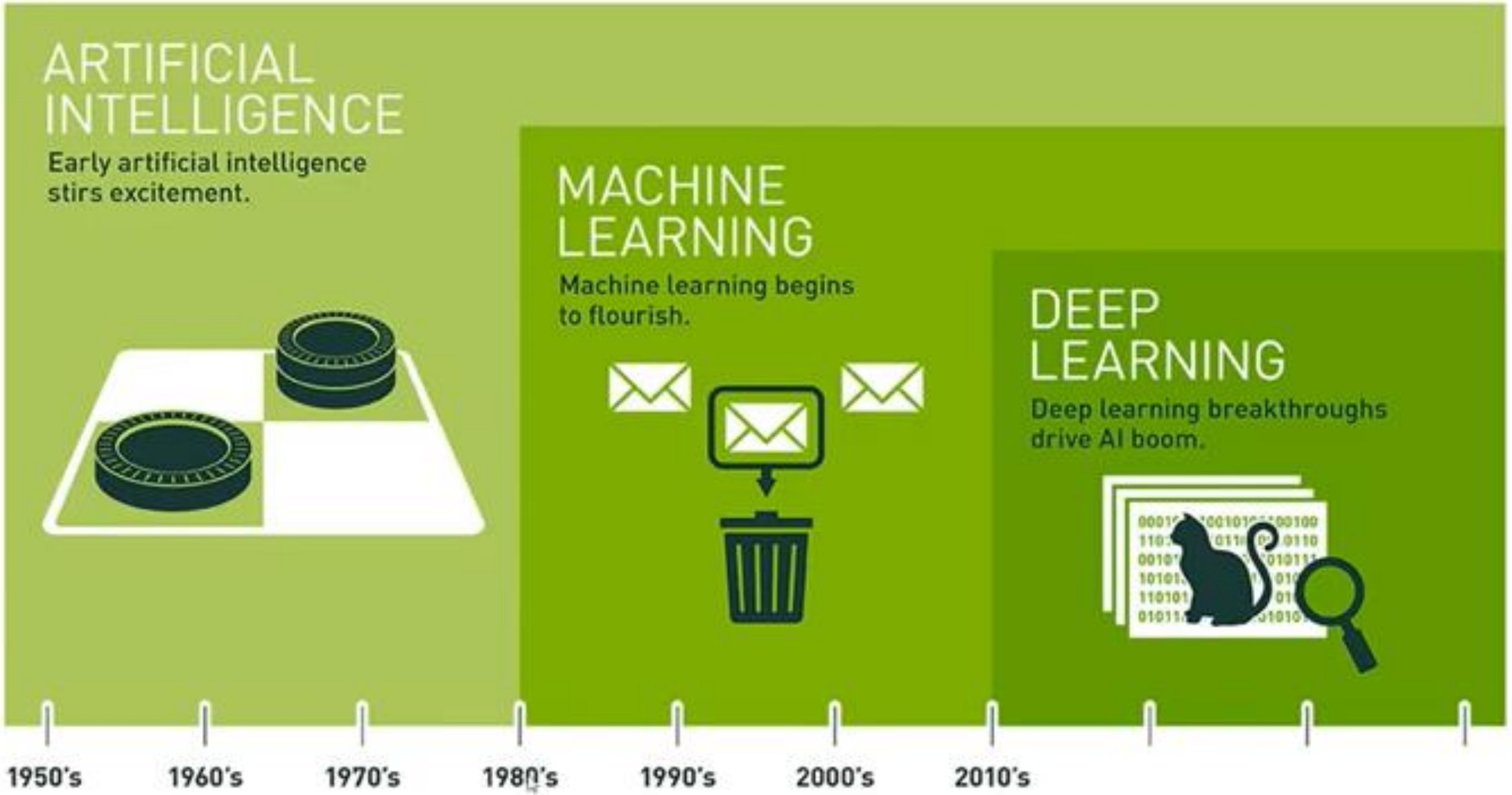
A technique which enables machines to mimic human behaviour

## MACHINE LEARNING

Subset of AI technique which use statistical methods to enable machines to improve with experience

## DEEP LEARNING

Subset of ML which make the computation of multi-layer neural network feasible




Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

# Real World Applications of Machine Learning

Face Recognition

Siri and Cortana

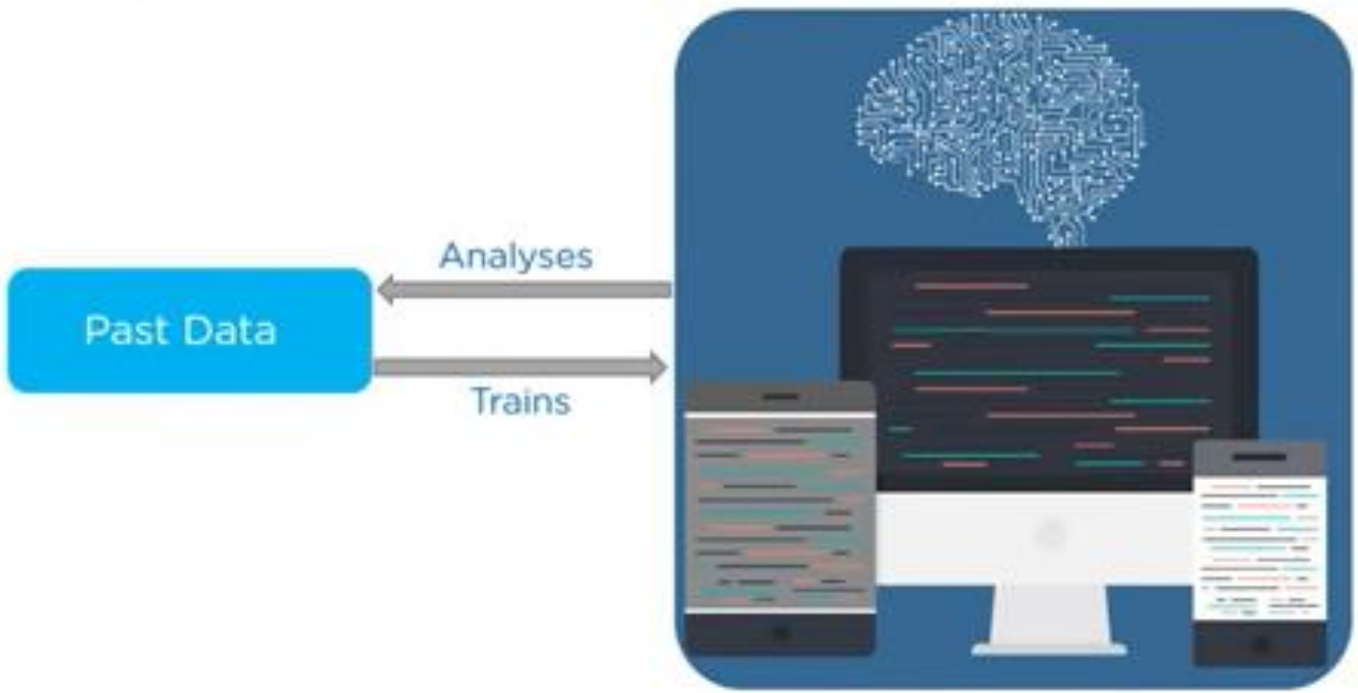
Healthcare Industry

Weather Forecasting

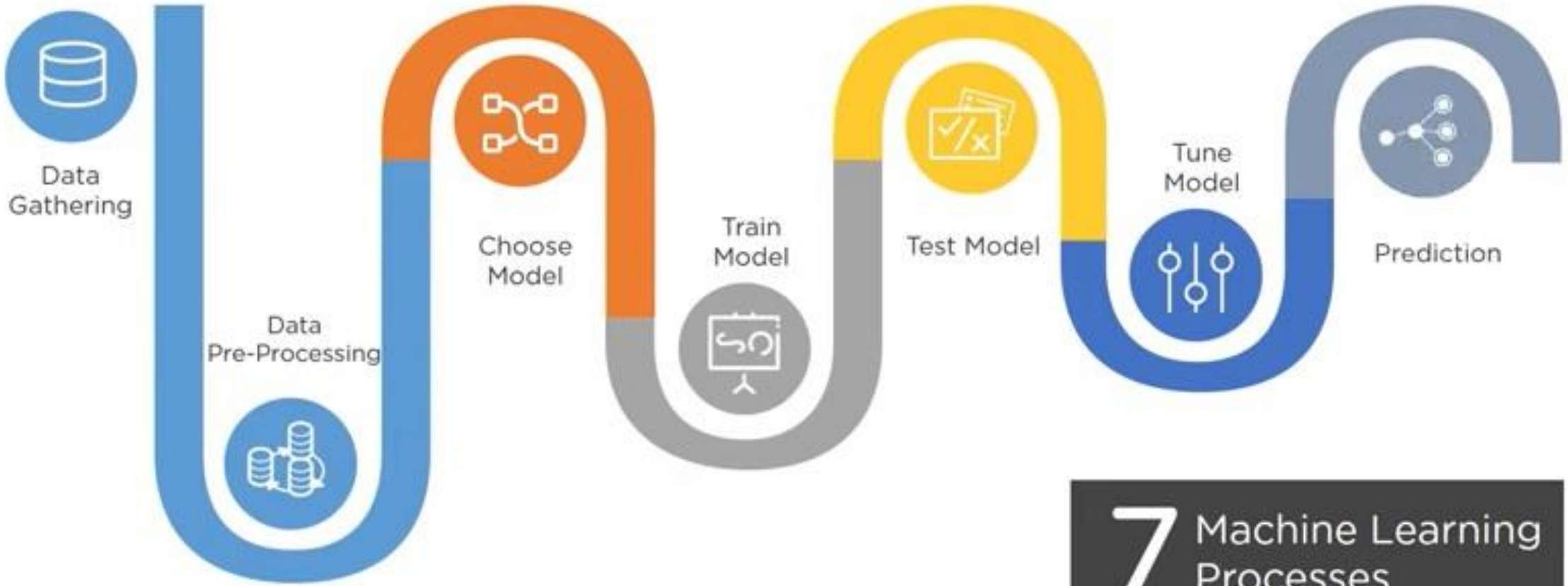

Produce a Web Series

# What is Machine Learning?

Machine Learning is the science of making computers learn and act like humans by feeding data and information without being explicitly programmed.



# Processes involved in Machine Learning



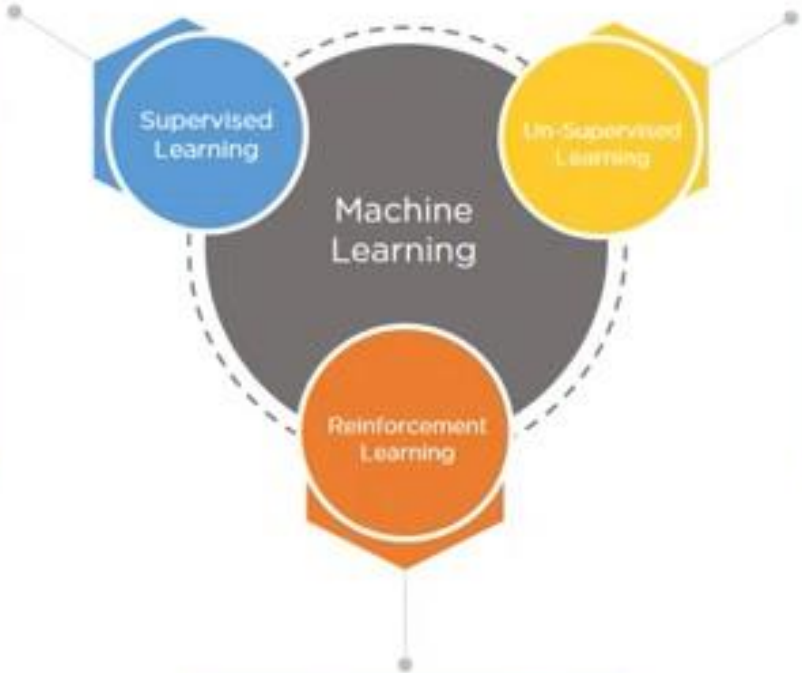
# Types of Machine Learning Algorithms

**Classification**

- Fraud Detection
- Email Spam Detection
- Image Classification

**Regression**

- Weather Forecasting
- Risk Assessment
- Score Prediction




**Association**

- Market Basket Analysis
- Text Mining
- Face Recognition

**Clustering**

- Medical Research
- City Planning
- Targeted Marketing

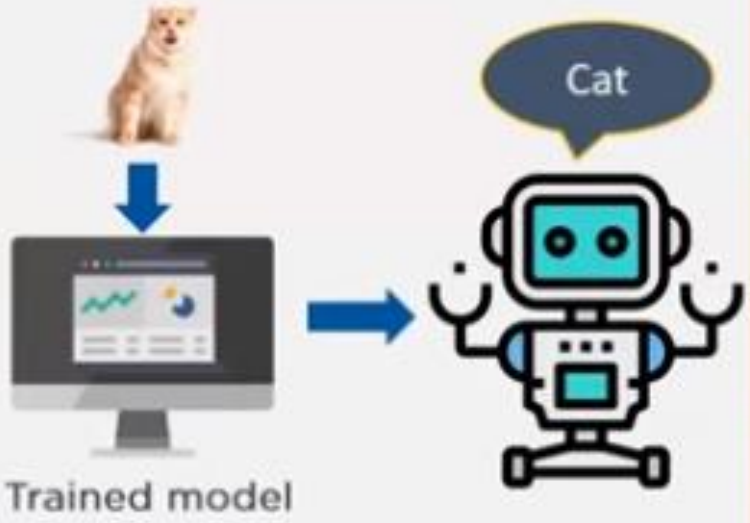
**Reinforcement Learning**

- Gaming
- Robot Navigation
- Stock Trading
- Assembly Line Processes

# Definition

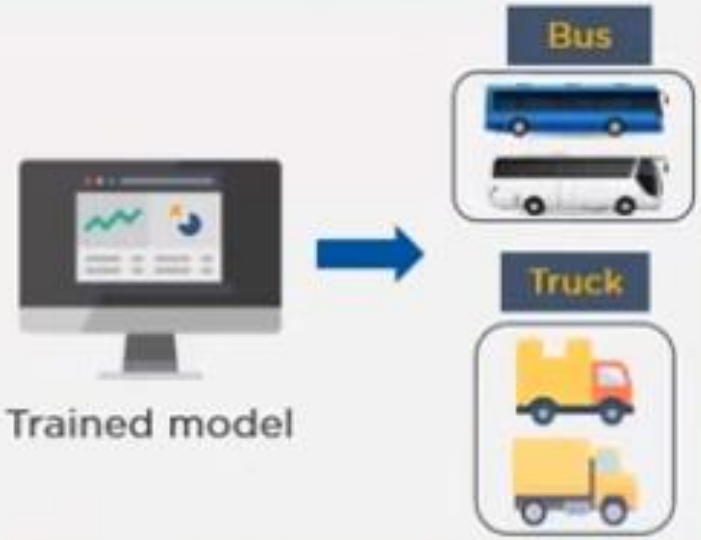
## Supervised Learning

Supervised Learning is used to train machines using labeled data



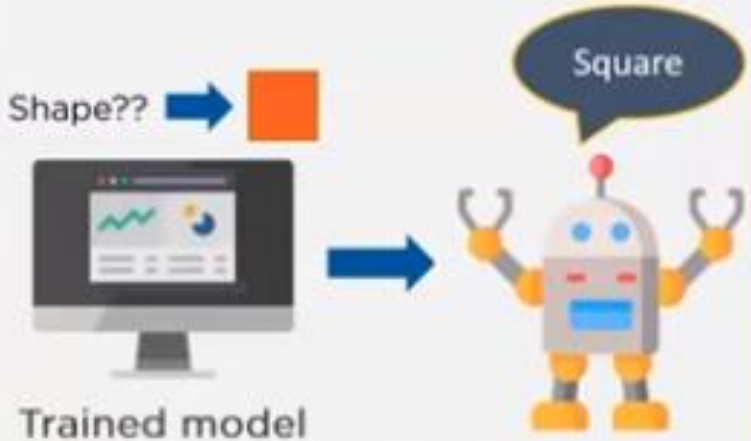

## Unsupervised Learning

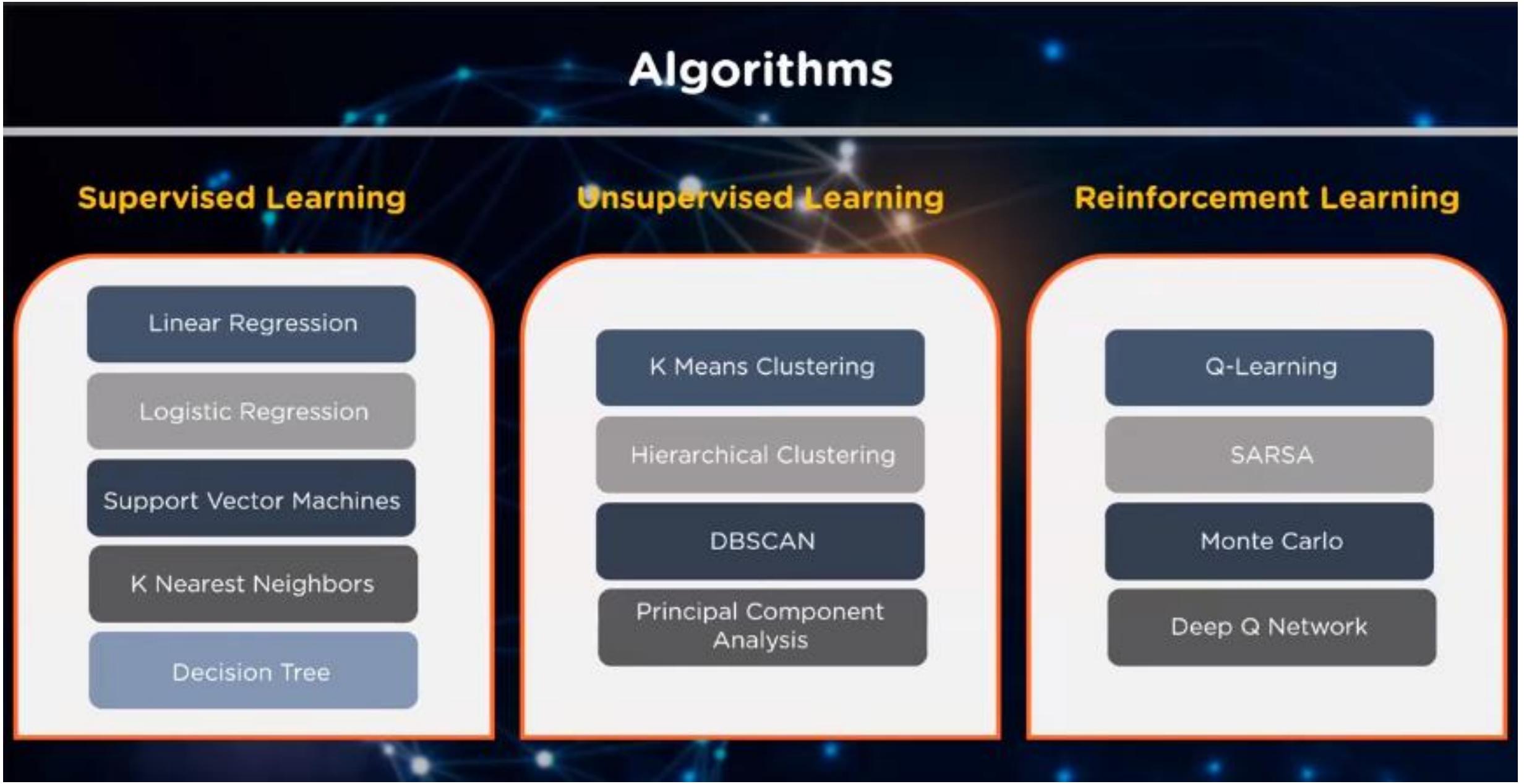
Unsupervised Learning uses unlabeled data to train machines




## Reinforcement Learning

Reinforcement Learning uses an agent and an environment to produce actions and rewards




Algorithms
Supervised Learning
Linear Regression
Logistic Regression
Support Vector Machines
K Nearest Neighbors
Decision Tree
Unsupervised Learning
K Means Clustering
Hierarchical Clustering
DBSCAN
Principal Component Analysis
Reinforcement Learning
Q-Learning
SARSA
Monte Carlo
Deep Q Network

# Approach

## Supervised Learning

Takes labeled inputs and maps it to the known outputs

## Unsupervised Learning

Understands patterns and trends in the data and discovers the output

## Reinforcement Learning

Follows trial and error method to arrive at the desired solution

# Training

## Supervised Learning

Supervised Learning techniques need external supervision to train models

## Unsupervised Learning

Unsupervised Learning techniques do not need any supervision to train models

## Reinforcement Learning

Reinforcement Learning techniques do not need any supervision to train models

# Type of Problems

## Supervised Learning

Classification and Regression

## Unsupervised Learning

Clustering and Association

## Reinforcement Learning

Reward based

# Applications

## Supervised Learning

Weather Prediction

Sales Forecast

Stock Price Analysis

## Unsupervised Learning

Customer Segmentation

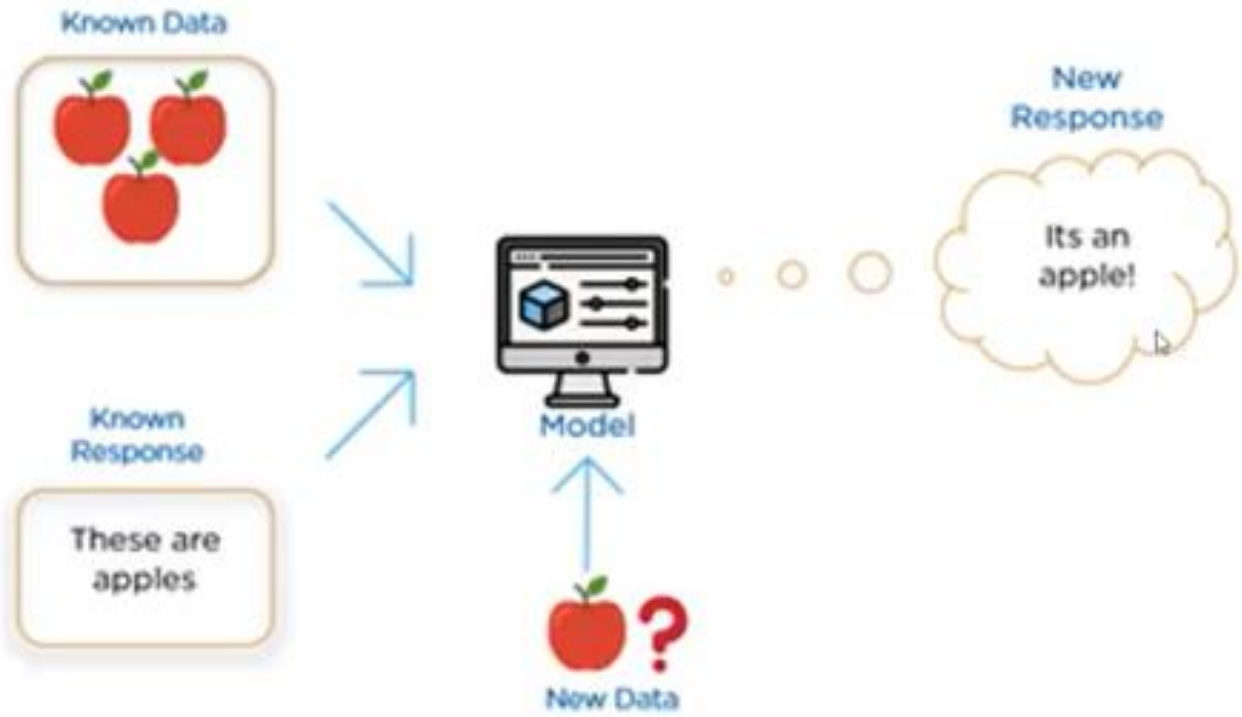
Churn Analysis

## Reinforcement Learning

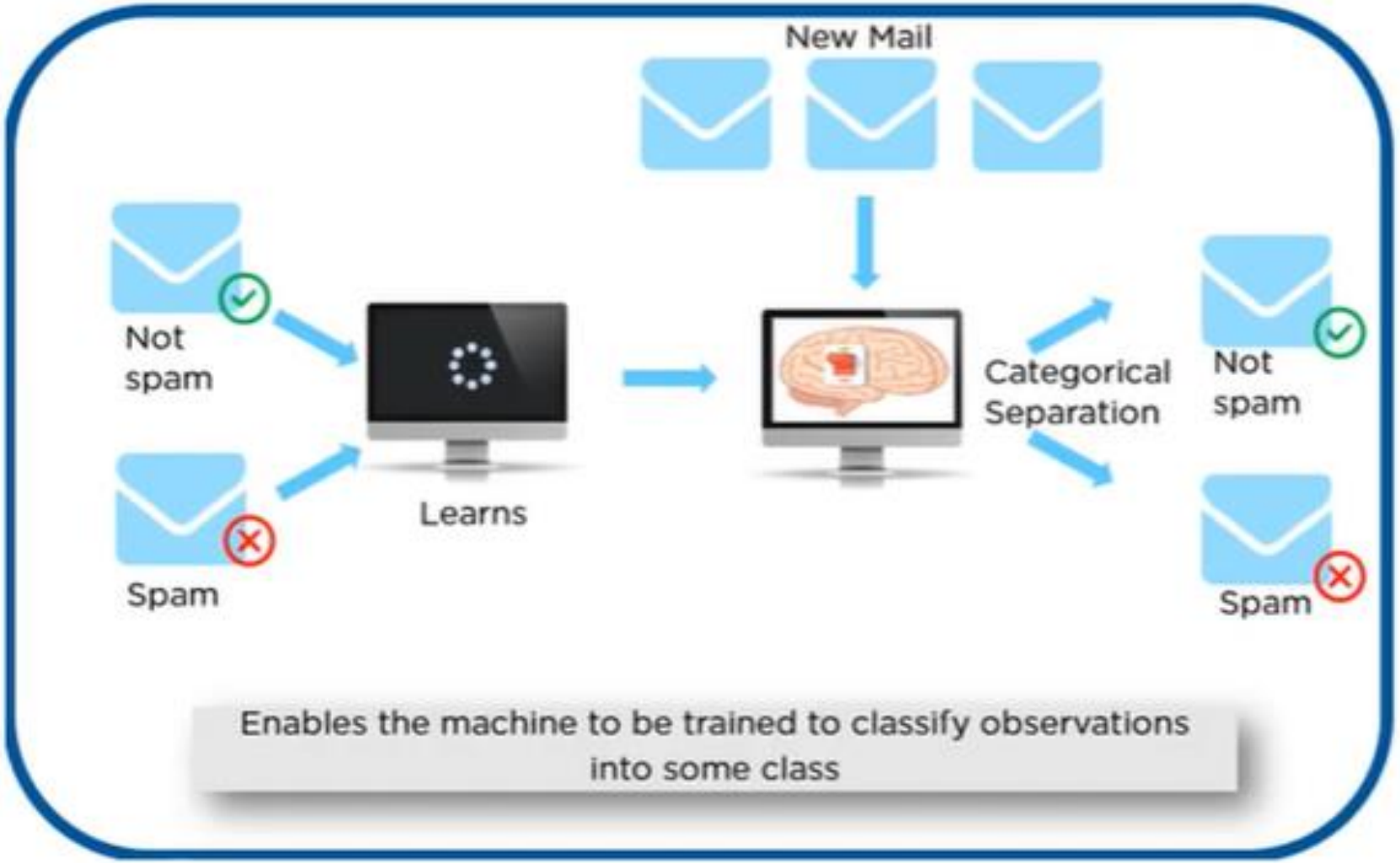
Building Games

Training Robots

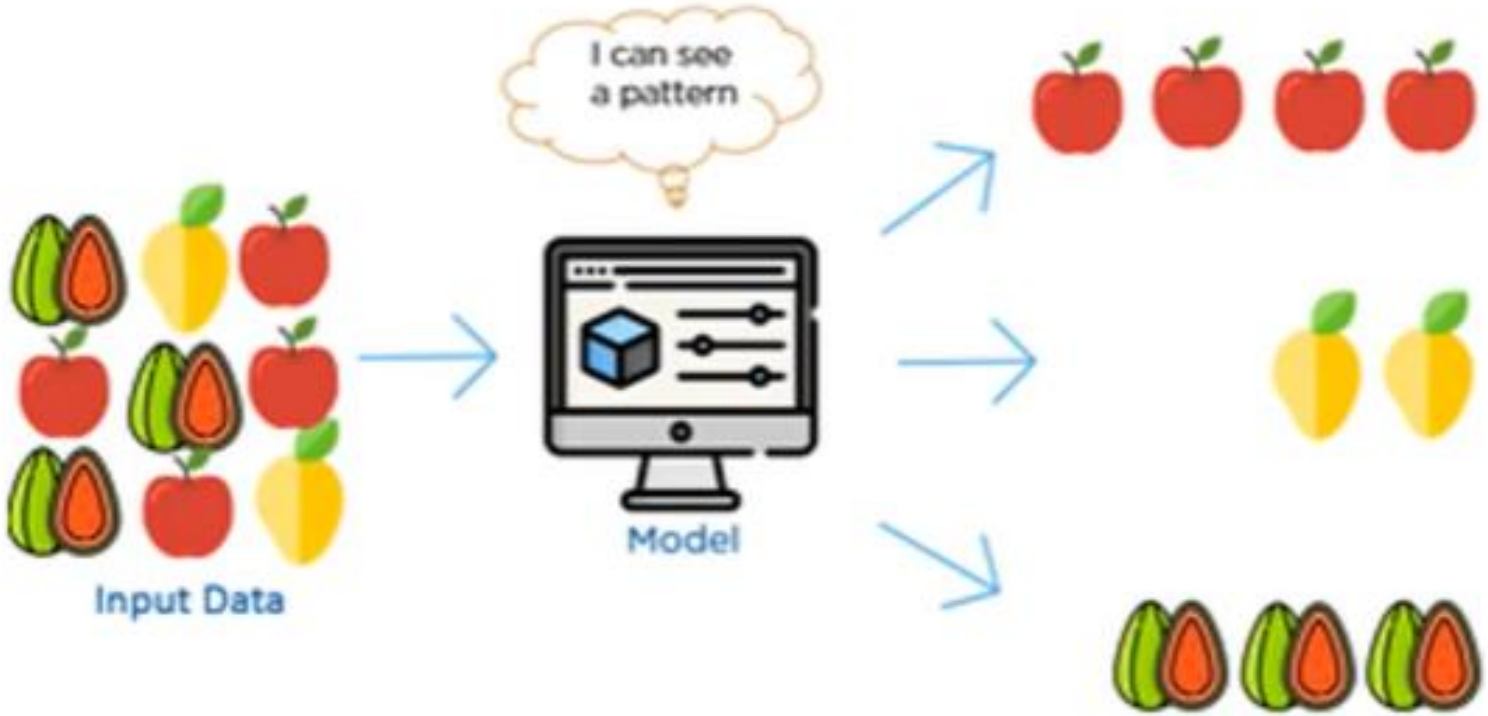
# Supervised Learning



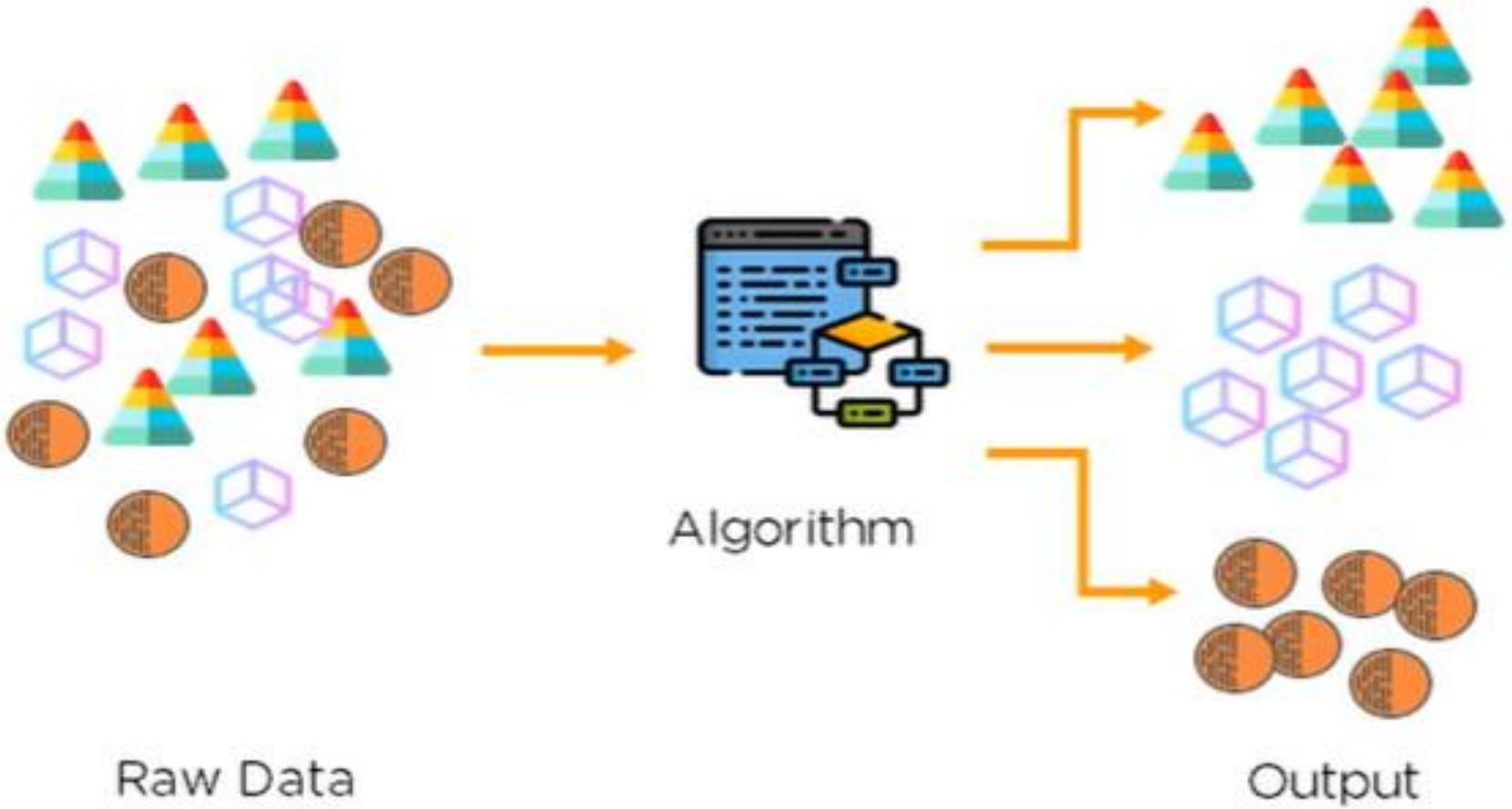
# Supervised Learning



# Unsupervised Learning



# Unsupervised Learning



## Reinforcement Learning

*Reinforcement Learning is an area of Machine Learning concerned with how intelligent agents take actions in an environment to maximize its rewards.*

1. *Environment*
2. *Agent*
3. *Action*
4. *Reward*

*Agent*

*Environment*

# Summary of Learning Rules

Summary of learning rules and their properties.

| Learning rule | Single weight adjustment $\Delta w_{ij}$ | Initial weights | Learning | Neuron characteristics | Neuron / Layer |
|---|---|---|---|---|---|
| Hebbian | $co_i x_j$<br>$j = 1, 2, \ldots, n$ | 0 | U | Any | Neuron |
| Perceptron | $c\left[d_i - \text{sgn}\left(\mathbf{w}_i^t \mathbf{x}\right)\right] x_j$<br>$j = 1, 2, \ldots, n$ | Any | S | Binary bipolar, or Binary unipolar* | Neuron |
| Delta | $c(d_i - o_i) f'(net_i) x_j$<br>$j = 1, 2, \ldots, n$ | Any | S | Continuous | Neuron |
| Widrow-Hoff | $c(d_i - \mathbf{w}_i^t \mathbf{x}) x_j$<br>$j = 1, 2, \ldots, n$ | Any | S | Any | Neuron |
| Correlation | $cd_i x_j$<br>$j = 1, 2, \ldots, n$ | 0 | S | Any | Neuron |
| Winner-take-all | $\Delta w_{mj} = \alpha(x_j - w_{mj})$<br>$m$-winning neuron number<br>$j = 1, 2, \ldots, n$ | Random Normalized | U | Continuous | Layer of $p$ neurons |
| Outstar | $\beta(d_i - w_{ij})$<br>$i = 1, 2, \ldots, p$ | 0 | S | Continuous | Layer of $p$ neurons |

c, $\alpha$, $\beta$ are positive learning constants
S — supervised learning, U — unsupervised learning

https://www.youtube.com/watch?v=1FZ0A1QCMWc

المفاهيم الأساسية لتعلم الآلة

https://academy.hsoub.com/programming/artificiaintelligence/%D8%A7%D9%84%D9%85%D9%81%D8%A7%D9%87%D9%8A%D9%85%D8%A7%D9%84%D8%A3%D8%B3%D8%A7%D8%B3%D9%8A%D8%A9%D9%84%D8%AA%D8%B9%D9%84%D9%85%D8%A7%D9%84%D8%A2%D9%84%D8%A9r1009/#%D8%AA%D8%B9%D9%84%D9%85-%D8%A7%D9%84%D8%A2%D9%84%D8%A9-%D8%A7%D9%84%D8%AA%D9%82%D9%84%D9%8A%D8%AF%D9%8A

# *Thank you for listening*

***Taqwa Altameemi***