



Machine Learning Course





Course Info



Course Info



Course Duration

21 Sessions, 5 Labs, **63 Hours in Total**

Structure of Course



Course Projects

4 Mini Projects

(cover all course subjects)

3 Medium Projects

Prj-1 **Regression** (Car Price Prediction-Autoscout),
Prj-2 **Classification** (Soldier Race Prediction),
Prj-3 **Clustering** (Customer Segmentation)

3 Capstone Project

(Covers **Customer Segmentation**,
Churn Prediction, **Fraud Detection**)



Introduction to Machine Learning

Session-1





What is Machine Learning?

Machine Learning Process

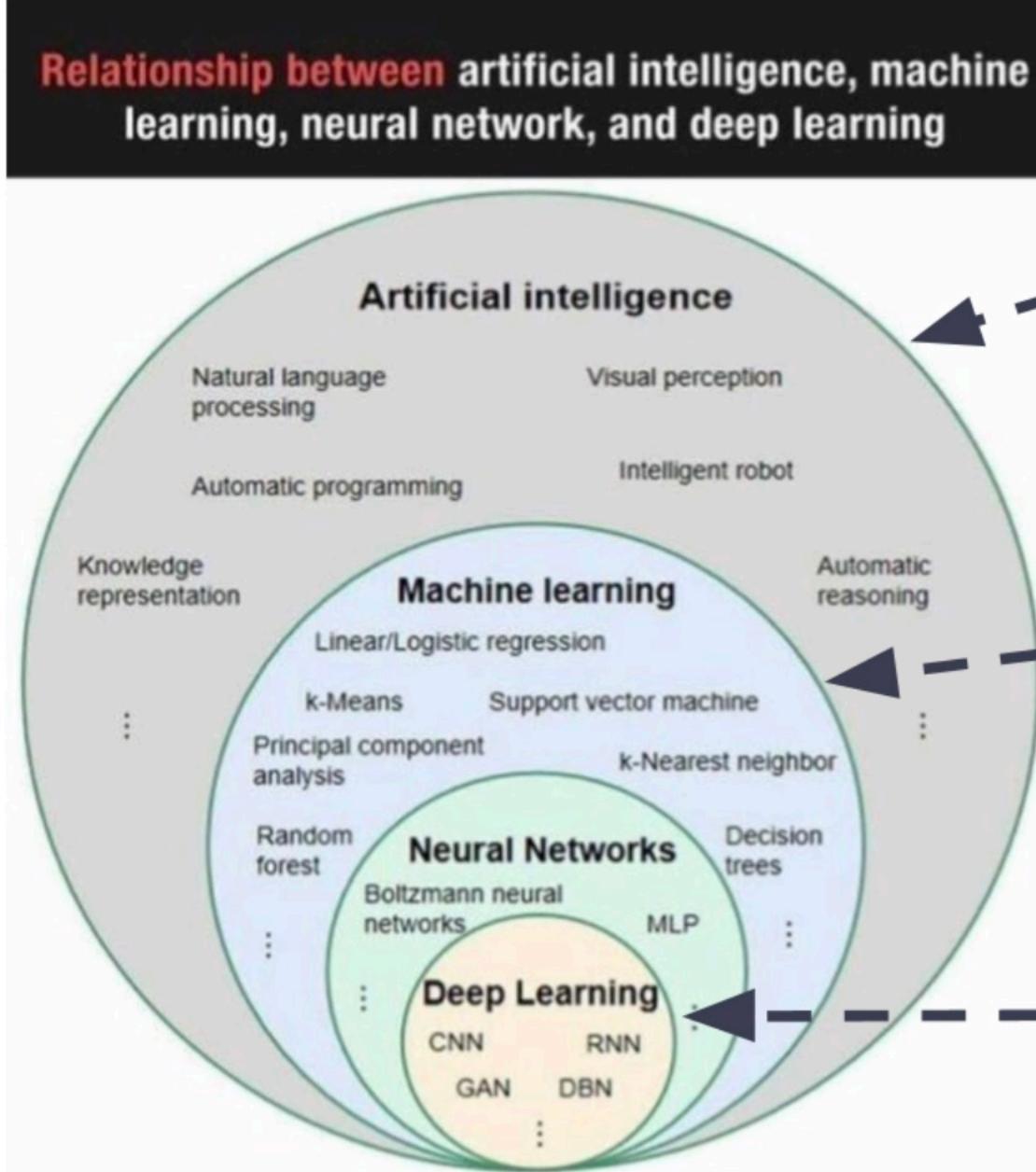
Machine Learning Types & Terminology

Overview

- *Supervised Learning*
- *Unsupervised Learning*



What is Machine Learning?



ARTIFICIAL INTELLIGENCE

A technique which enables machines to mimic human behaviour

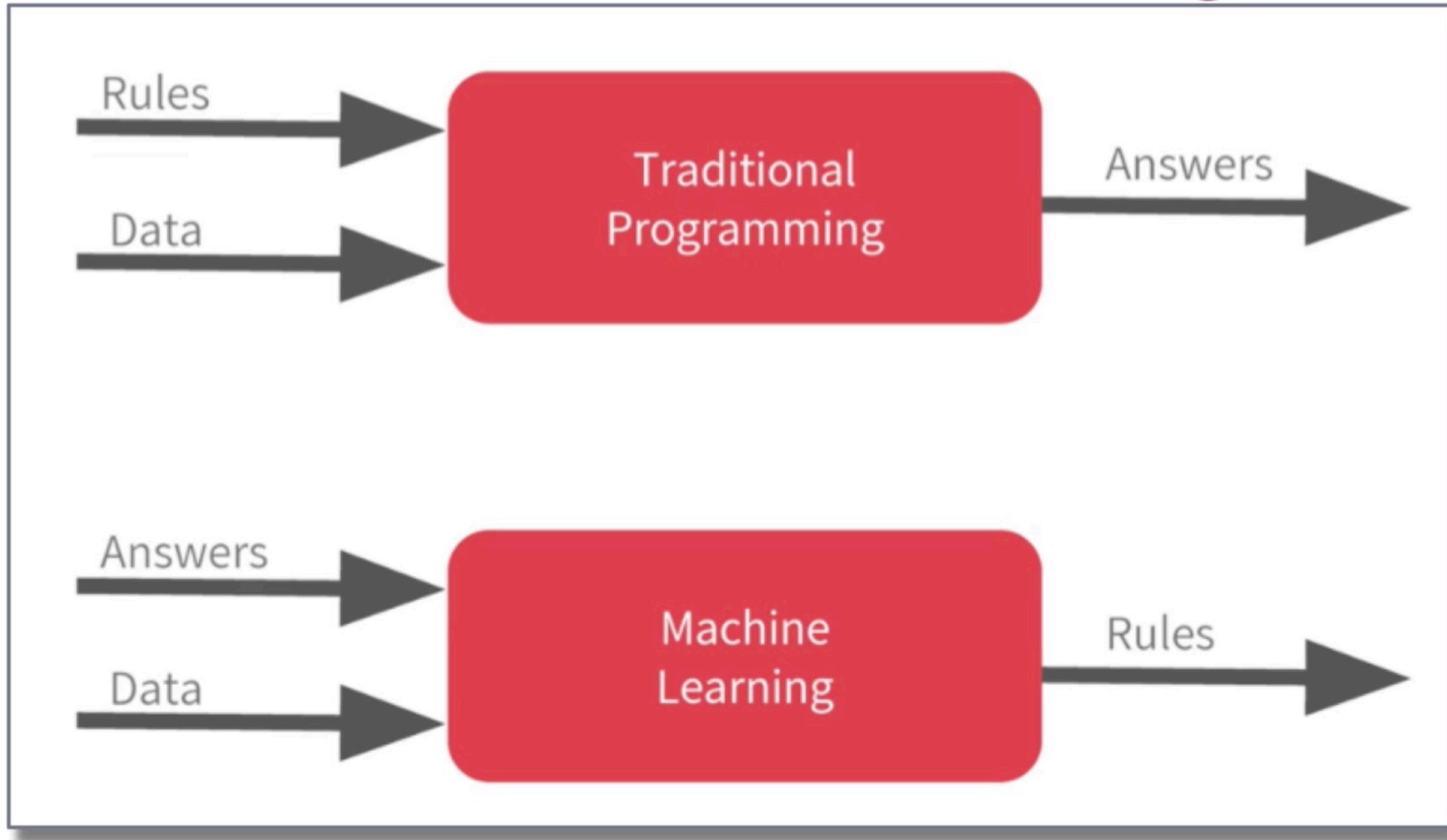
MACHINE LEARNING

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

What is Machine Learning?



What is Machine Learning?



Recommendation Engines

Customer Churn

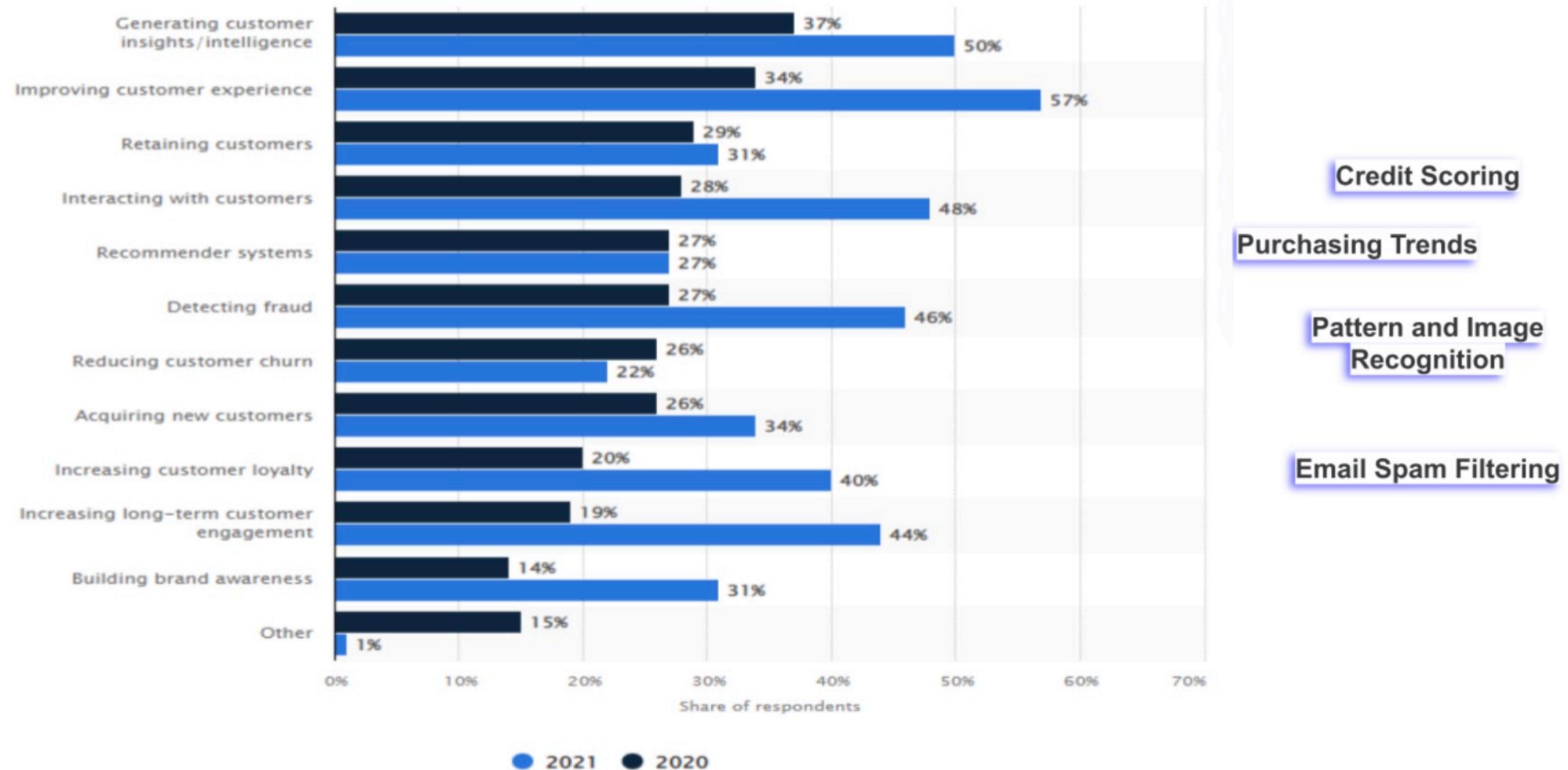
New Pricing Models

Credit Scoring

Purchasing Trends

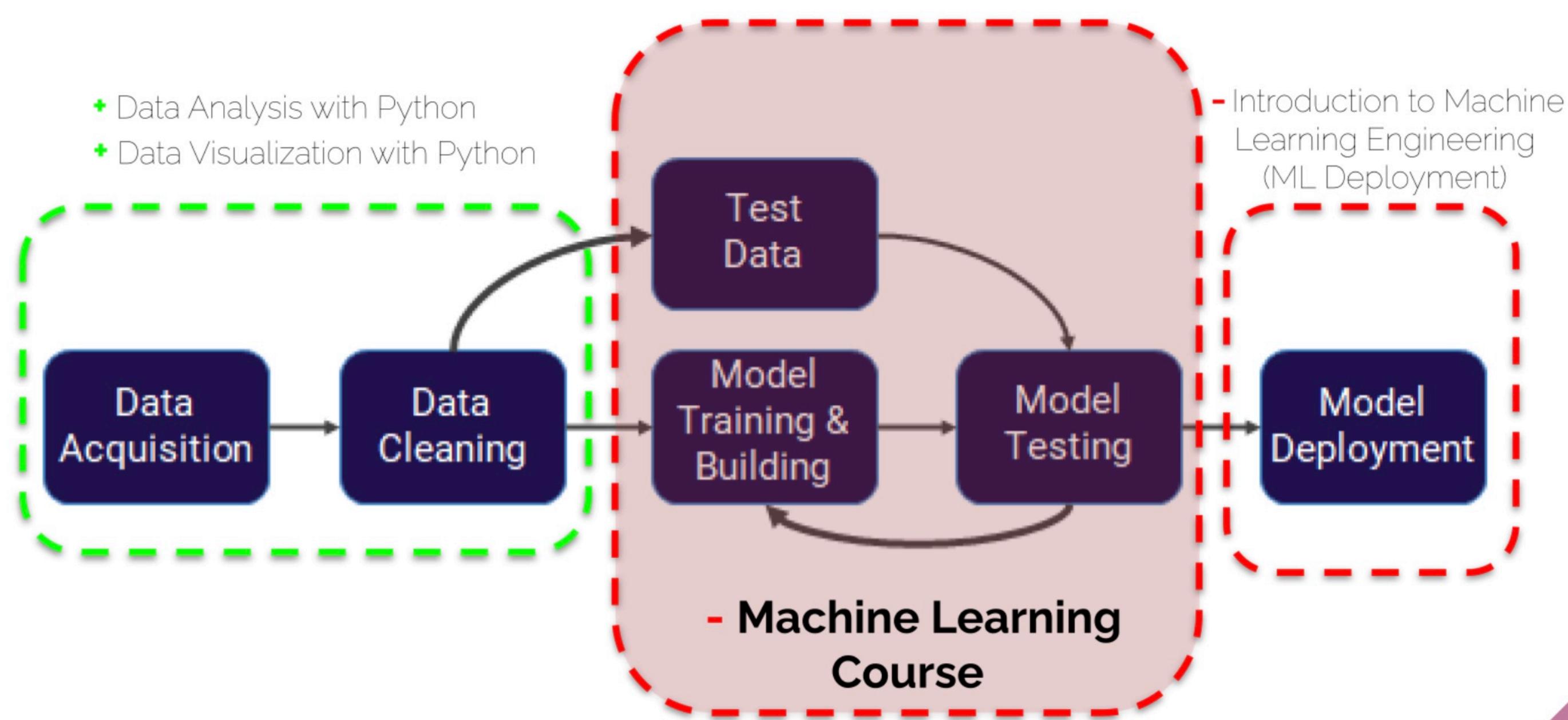
Pattern and Image Recognition

Email Spam Filtering

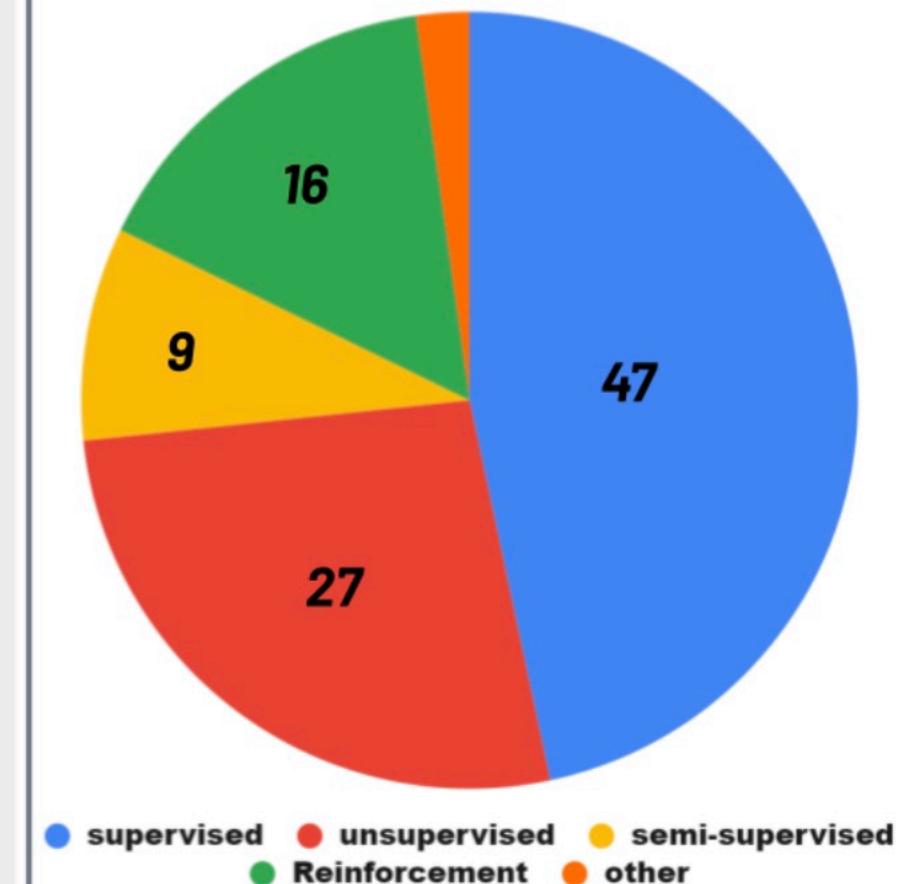
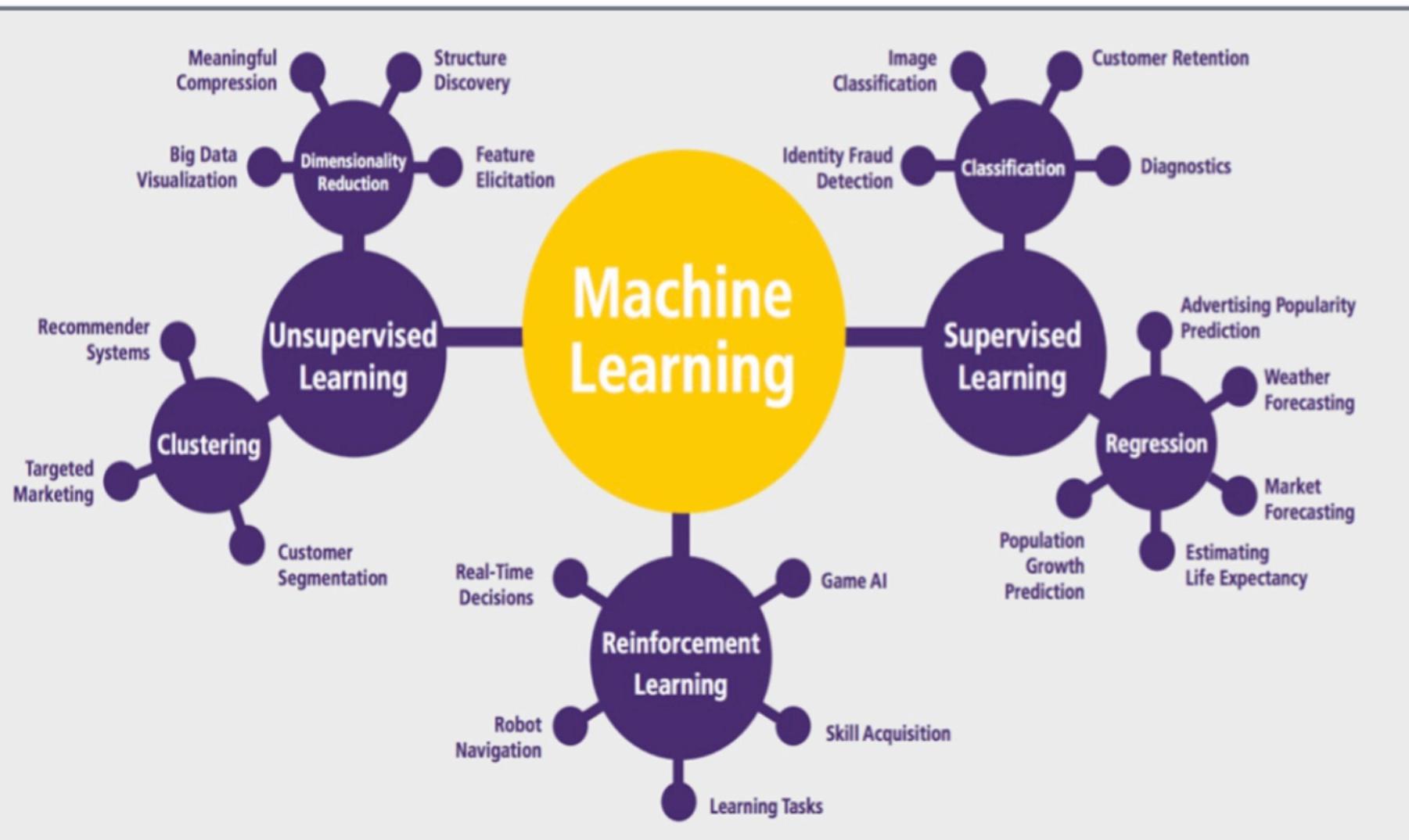


Artificial intelligence and machine learning use cases for companies worldwide from 2020 to 2021

Machine Learning Process



Machine Learning Types



Focus on **Supervised** and **Unsupervised** learning

Machine Learning Terminology



Independent Variables , "X"

Dependent Variables
Target

"y"



Train

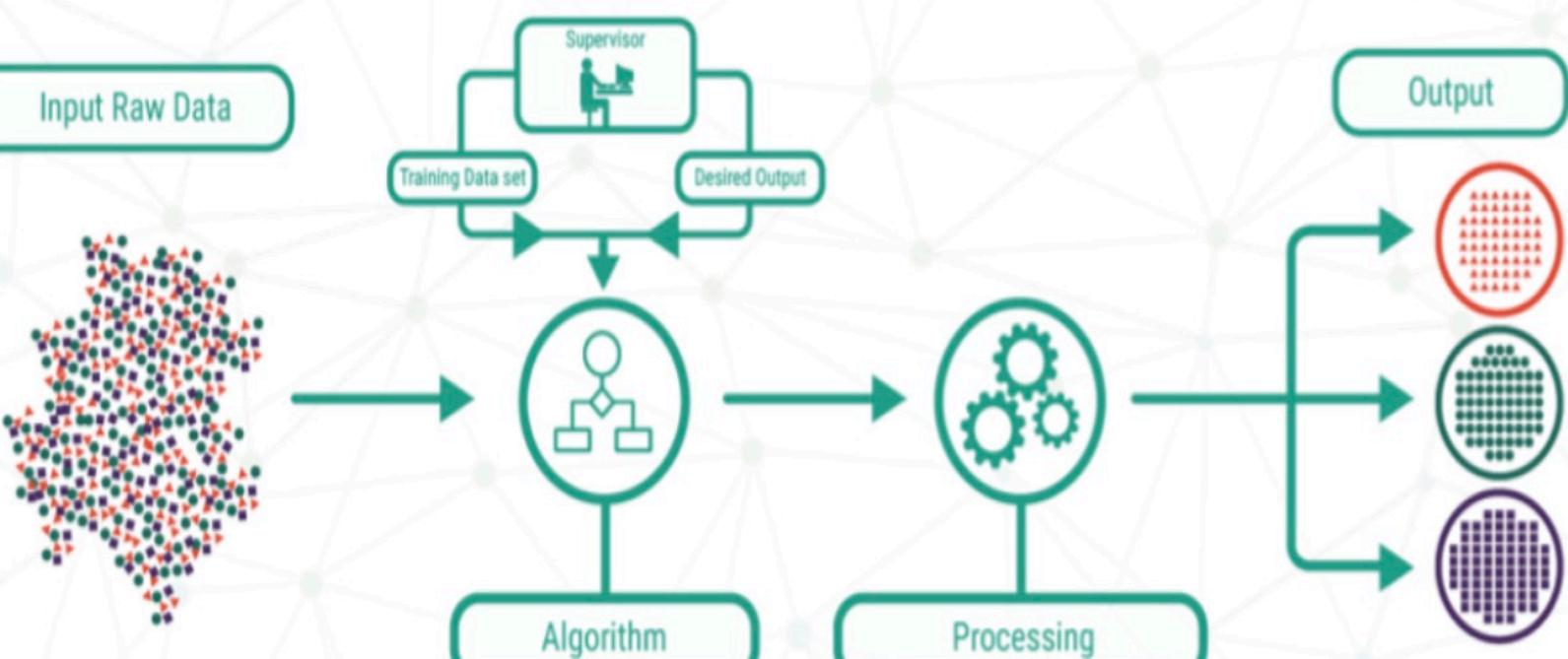
Test



Supervised Learning Overview



SUPERVISED LEARNING

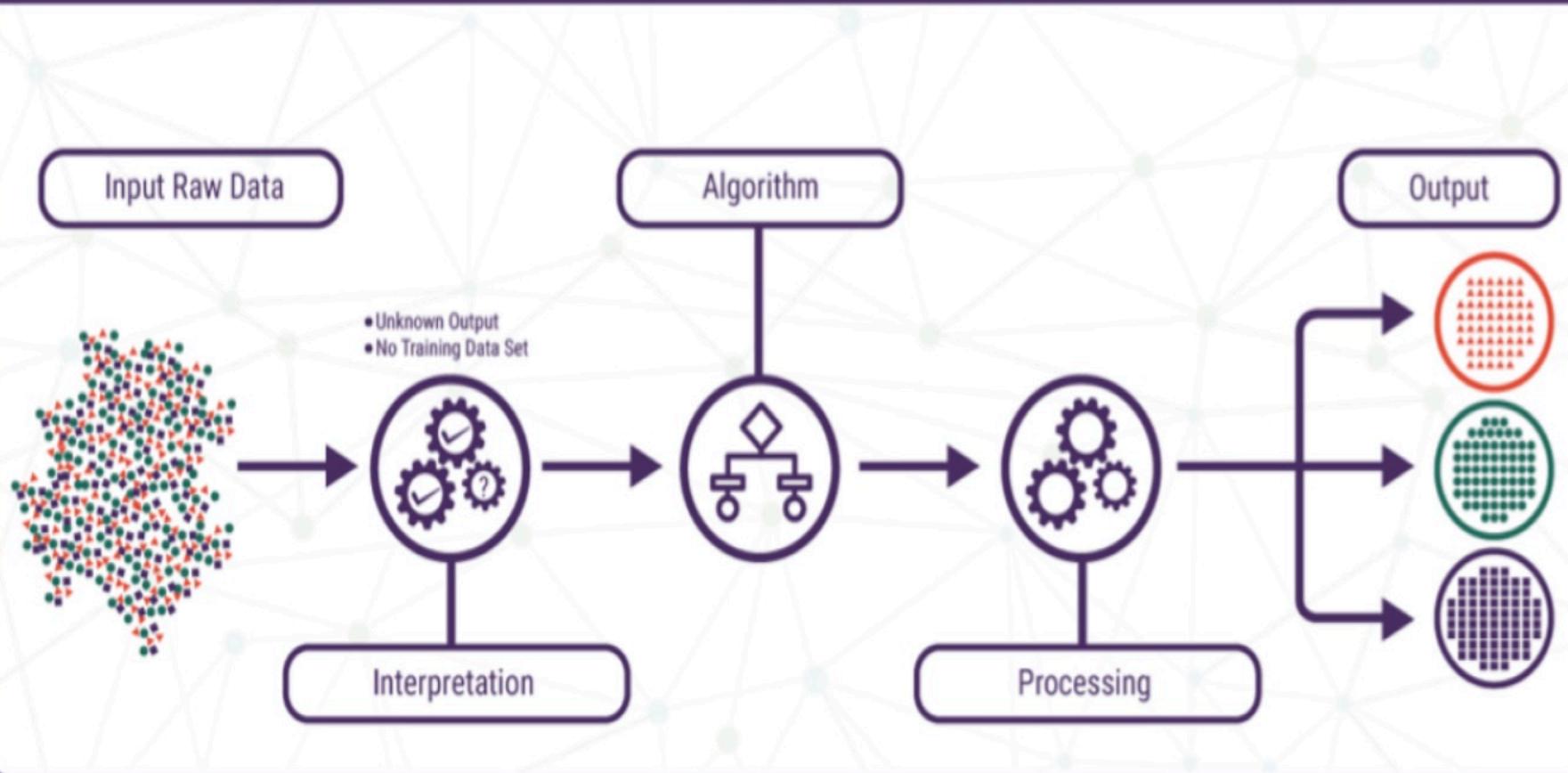


- It is the process of learning from **labeled** observations.
- **Labels teach the algorithm how to label the observations.**

Unsupervised Learning Overview



UNSUPERVISED LEARNING



- In unsupervised learning, the machine learns from **unlabeled** data.
- There is **no training data** for unsupervised learning.

Linear Regression Theory

Session-1



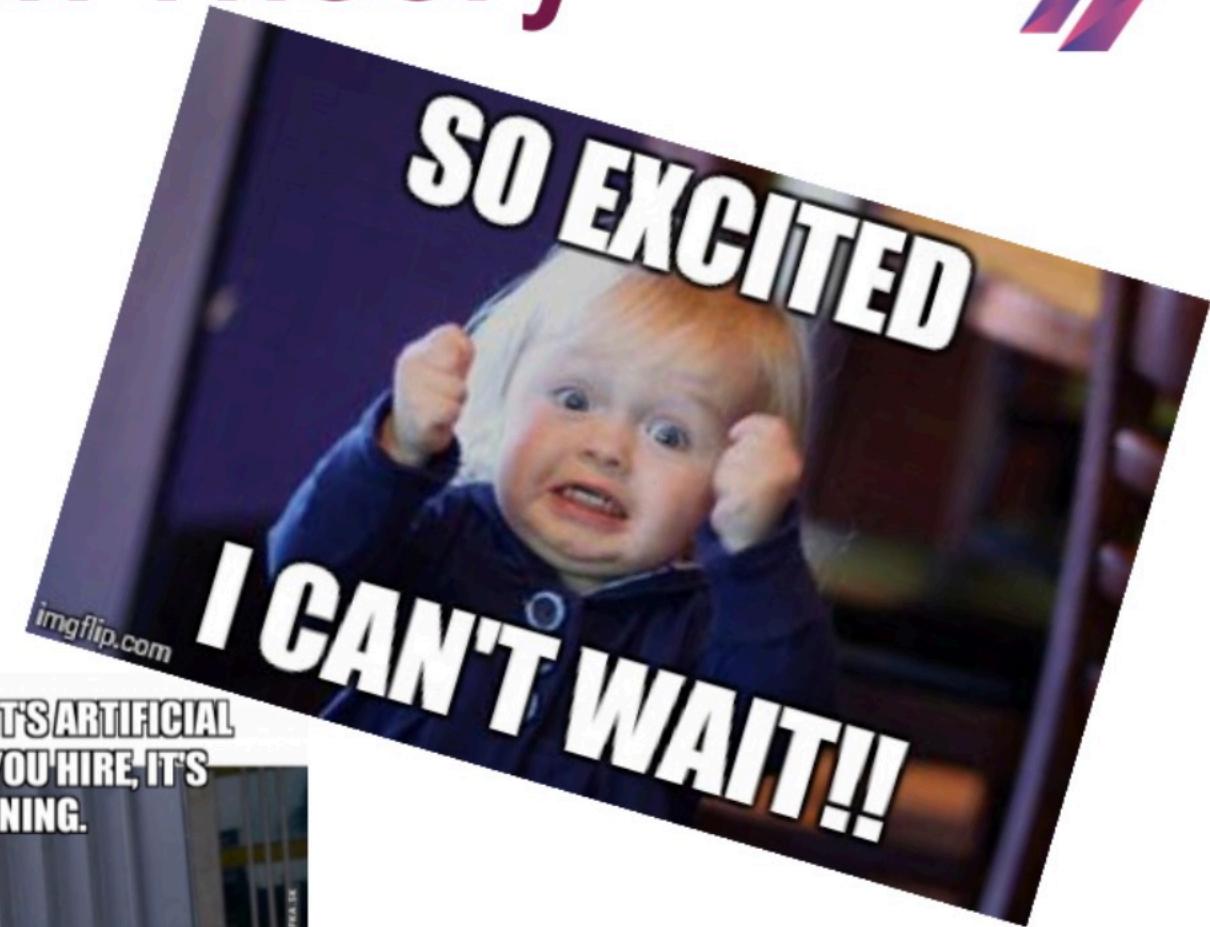
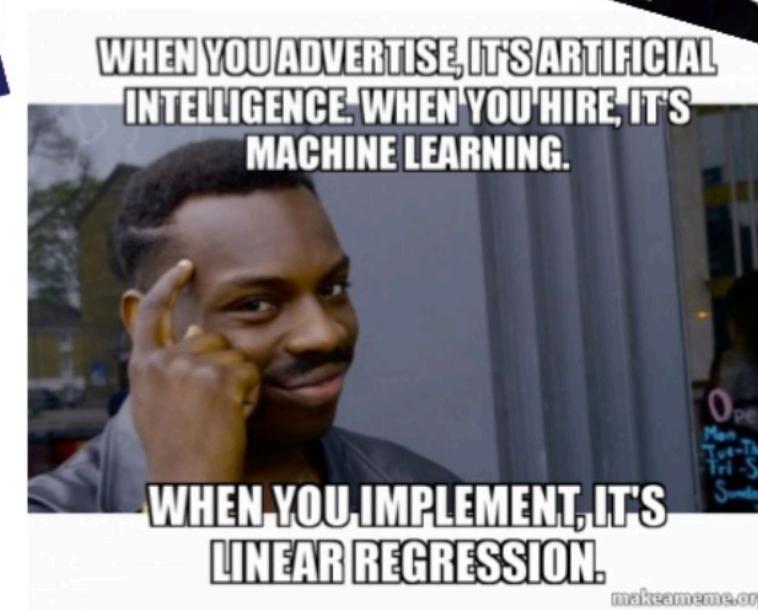


Linear Regression Theory

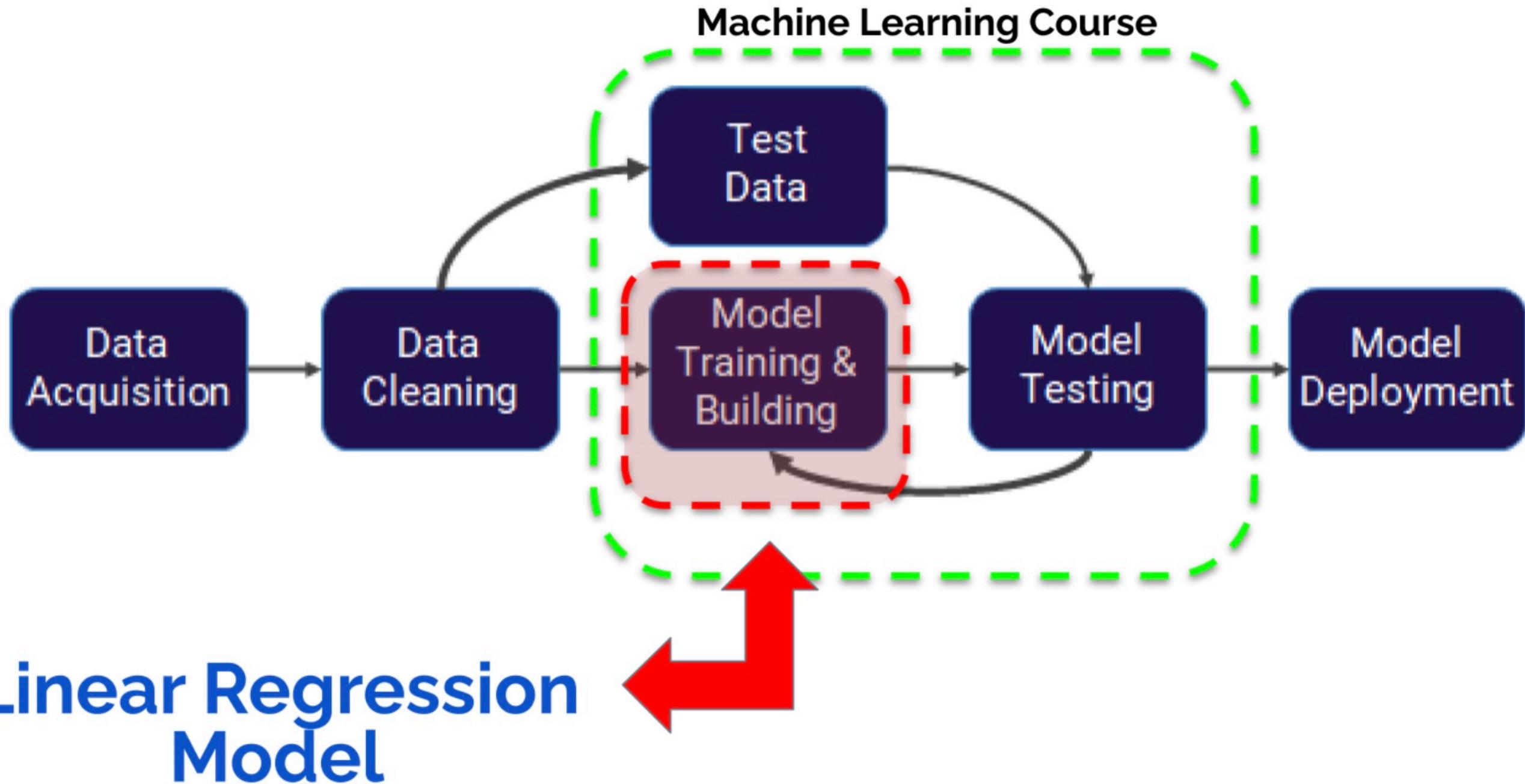
Linear Regression with Python



Linear Regression Theory



Where are we?



Correlation & Linearity Recap

The **correlation** summarizes the **direction of the association** between two quantitative variables and the **strength** of its linear (straight-line) trend.

Direction

- **Positive** : Move in same direction
- **Negative** : Move in opposite directions

Strength

- **Weak** : Widely spread
- **Strong** : Concentrated around a line

Correlation & Linearity Recap

Correlation Coefficient

Denoted by r , it takes values between **-1** and **+1**.

Strength

- Greater absolute value, stronger relationship
- Strongest relationship is correlation of -1 or 1
- Weakest relationship is correlation of zero.

Direction

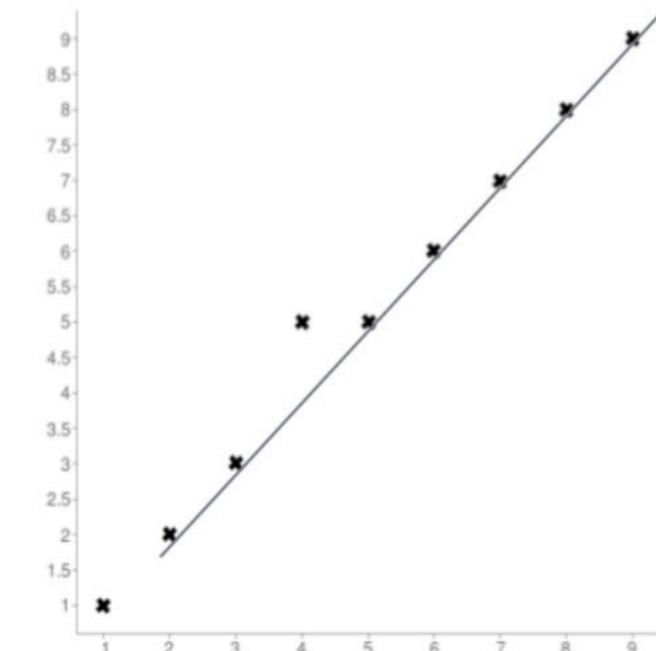
- Sign of coefficient describes direction
- Positive sign: Variables move in same direction
- Negative sign: Move in opposite directions

Correlation & Linearity Recap

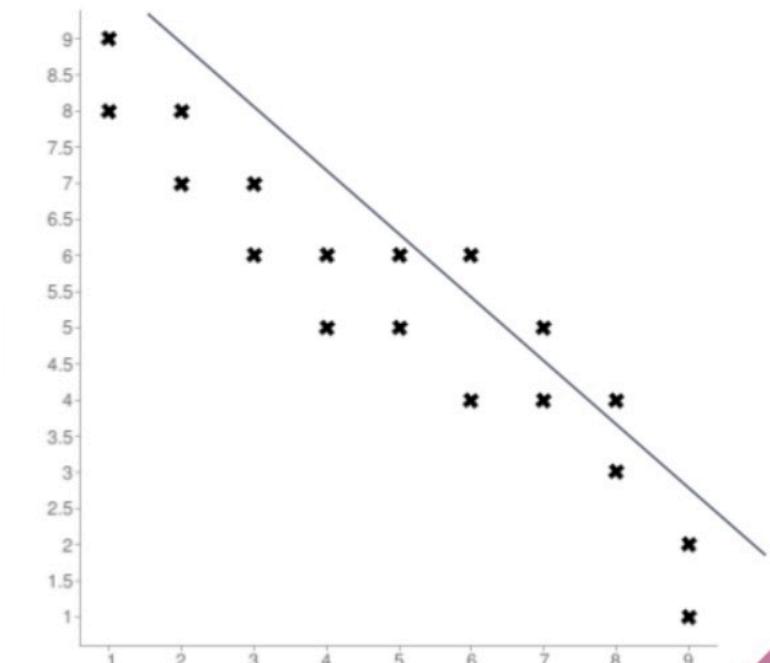
Linear Relationship

When the data points follow a roughly straight-line trend, the variables are said to have an approximately **linear relationship**.

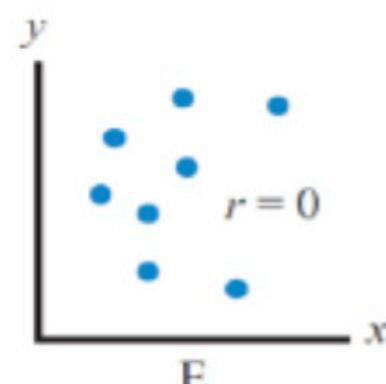
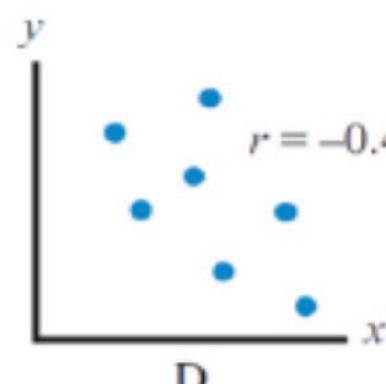
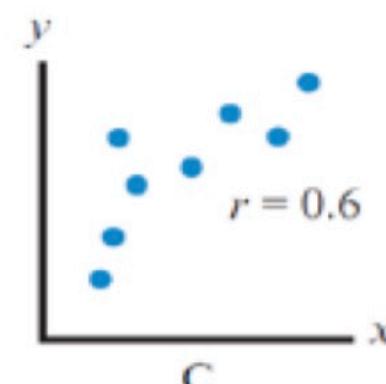
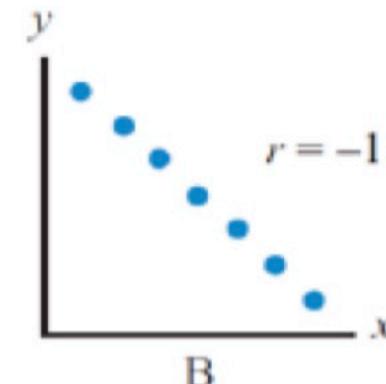
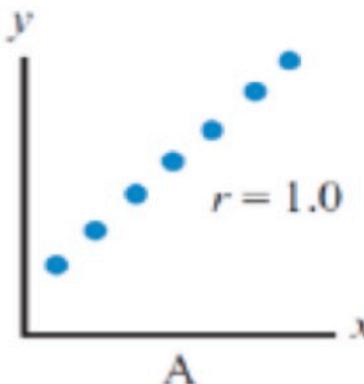
On the line



Around the line



Correlation & Linearity Recap



Graph A ($r = 1.0$): perfect positive correlation between x and y

Graph B ($r = -1.0$): perfect negative correlation between x and y

Graph C ($r = 0.6$): a moderately positive relationship: y tends to increase as x increases, but not necessarily at the steady rate we observed in Graph A

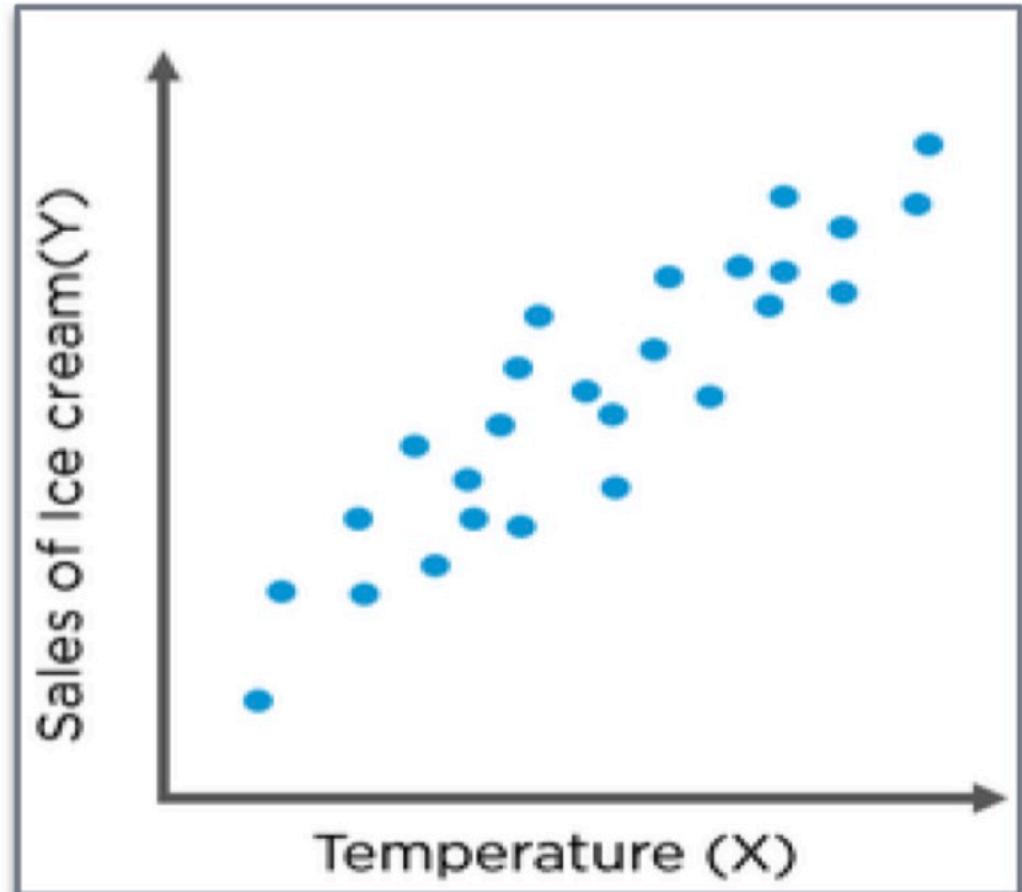
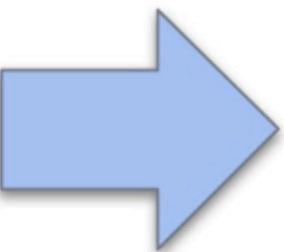
Graph D ($r = -0.4$): a relatively weak negative relationship: the correlation coefficient is closer to zero, negative r value so y tends to decrease as x increases

Graph E ($r = 0$): no relationship between x and y

Linear Regression Theory



DATA		
No:	Temp.(X)	Sales (y)
1.	35	45
2.	32	41
3.	17	10
4.	30	39
5.	12	8
6.	28	25
...

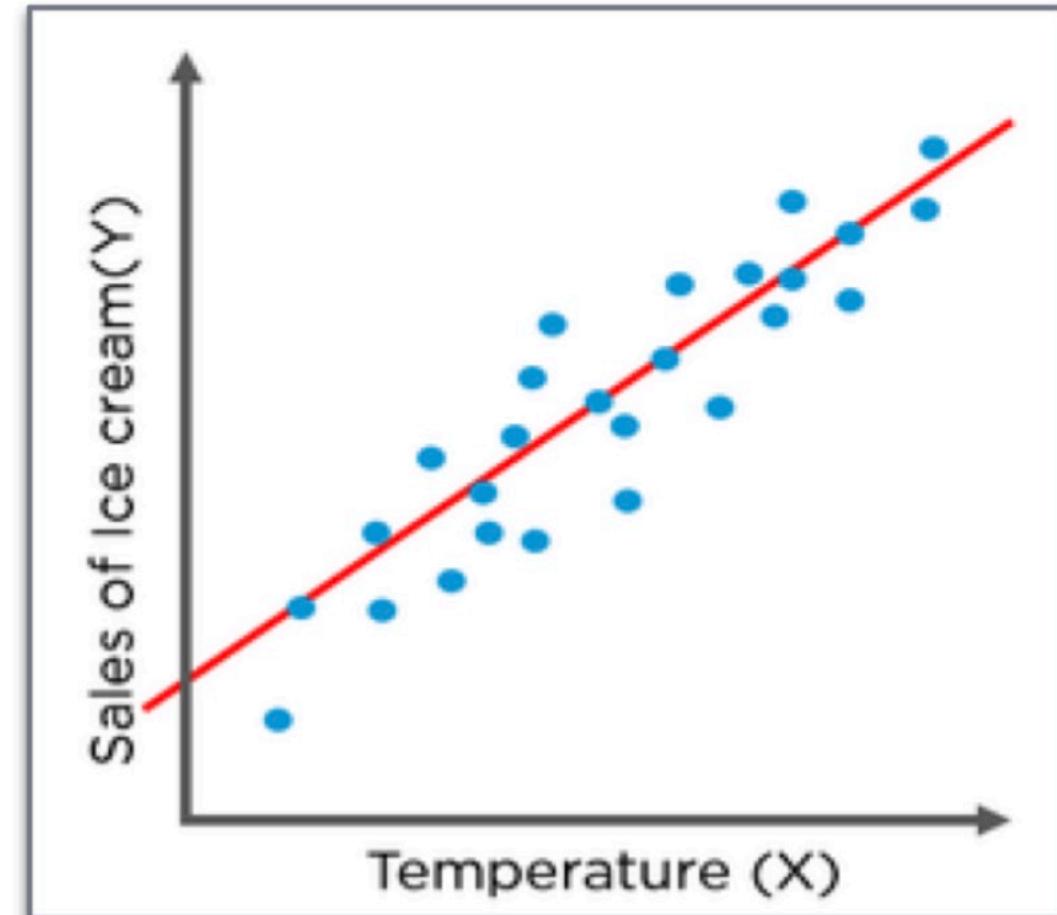
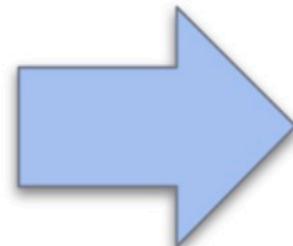
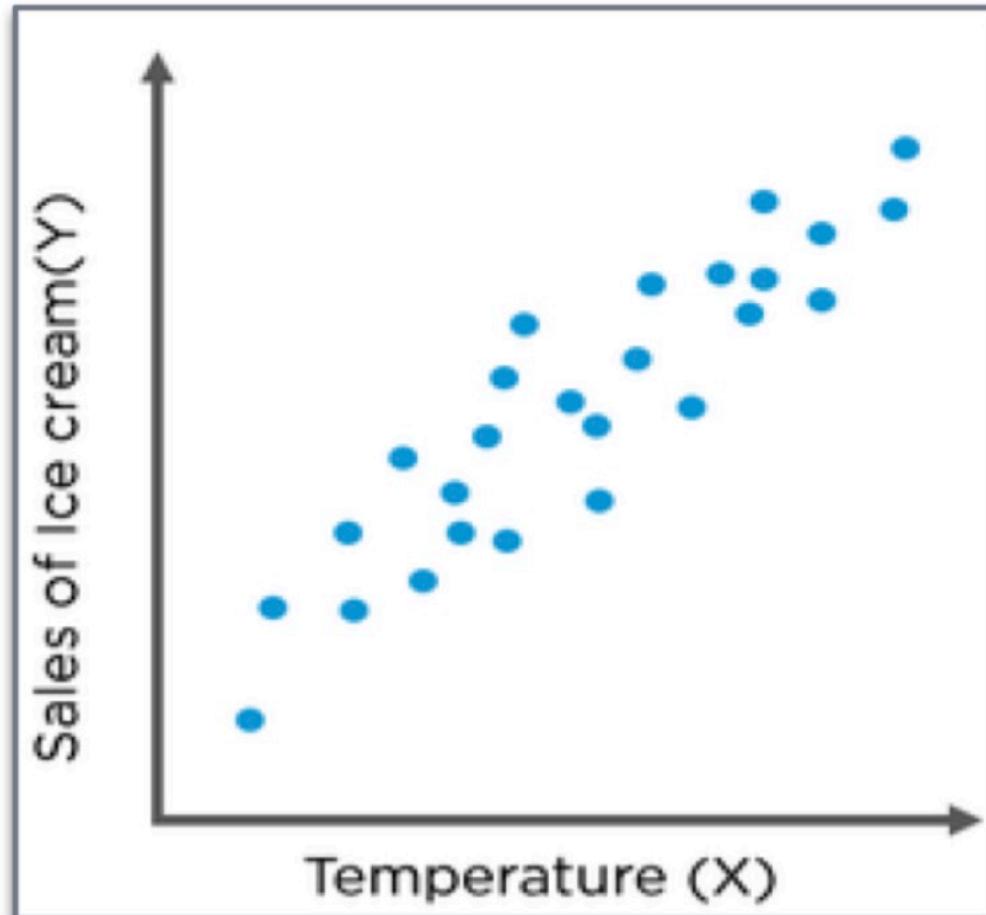


CORRELATION

Relationship



Linear Regression Theory



CORRELATION

Relationship

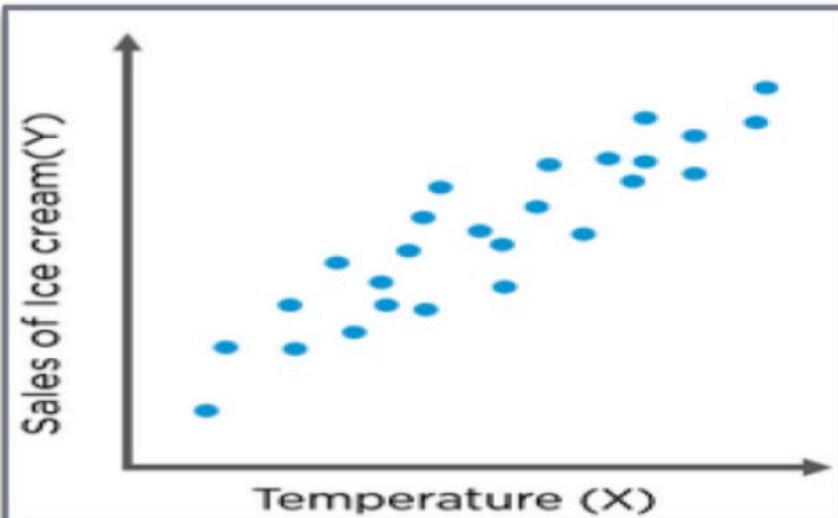


REGRESSION

One variable
affects the other

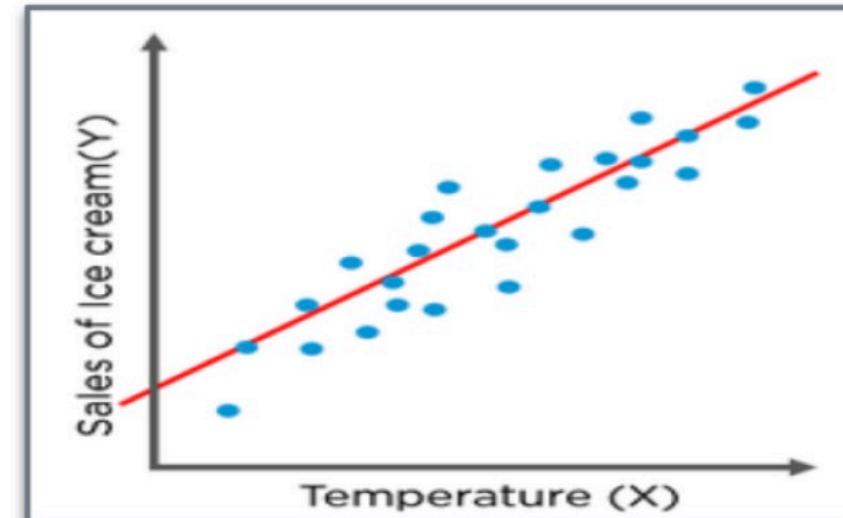


Linear Regression Theory



CORRELATION

VS



REGRESSION

- Relationship
- Variables move together
- Data represent in single point

Is there a relationship between

X and y

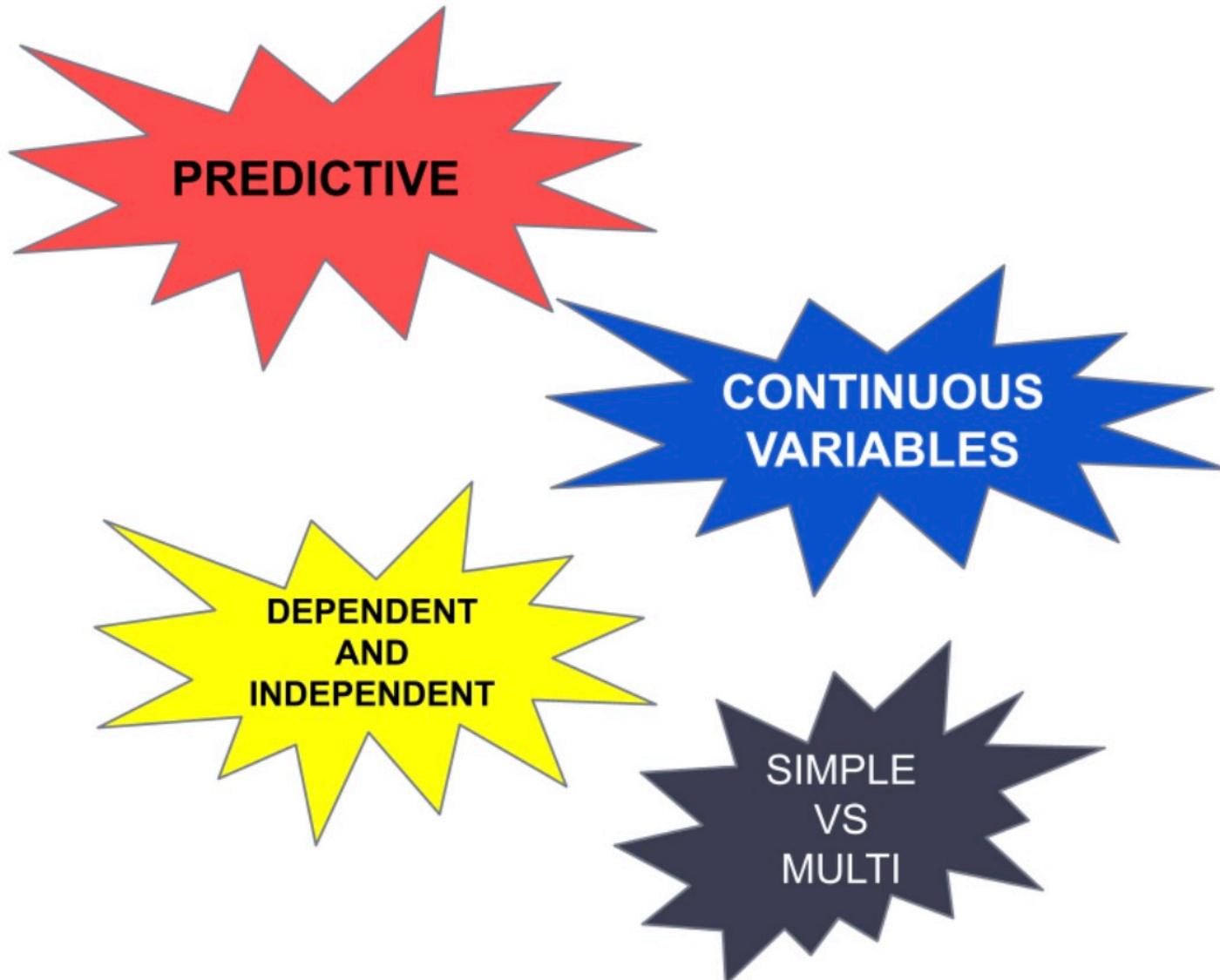
- One affects the other
- Cause and effect
- Data represent by line

What is the relationship between

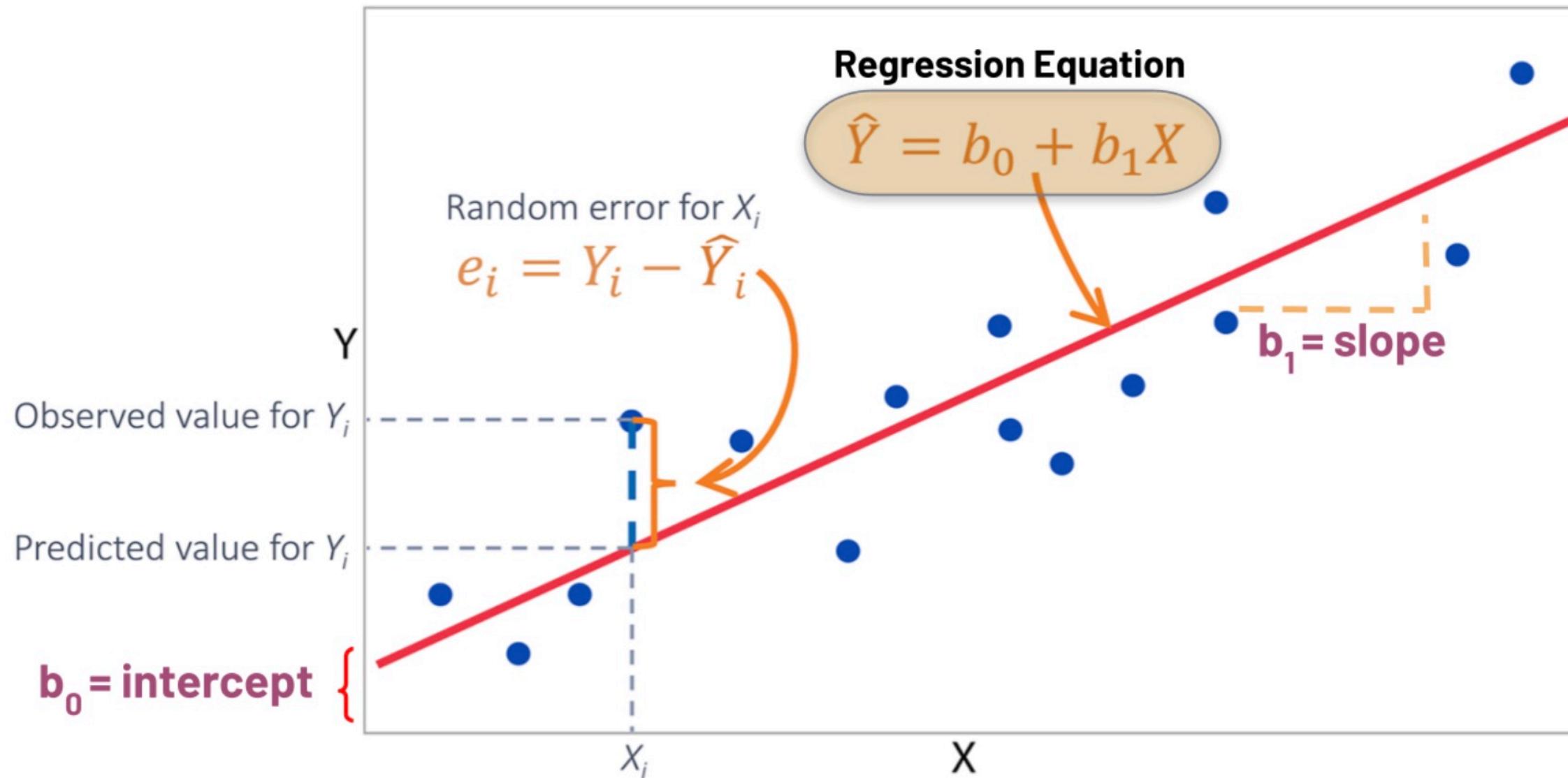
Linear Regression Theory

Linear Regression

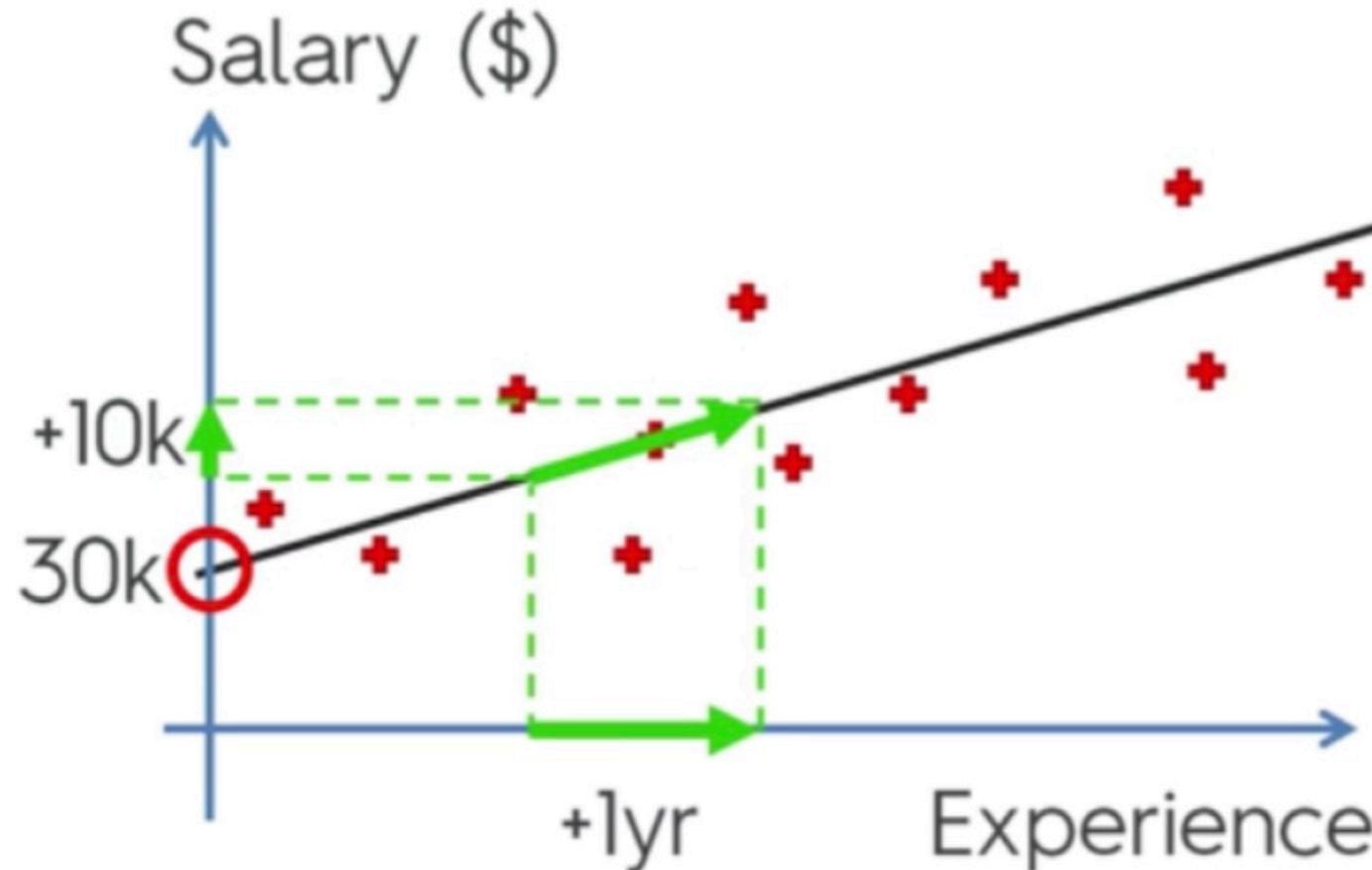
- Statistical regression method used for predictive analysis.
- Simple and easy algorithms that work on correlation and try to predict continuous variables..
- Shows the relationship between the independent variable and the dependent variable.
- if there's only one independent (feature) variable, then we call it simple linear regression. And if there is more than one it called as multiple linear regression.



Linear Regression Theory



Linear Regression Theory



$$y = b_0 + b_1 * x$$



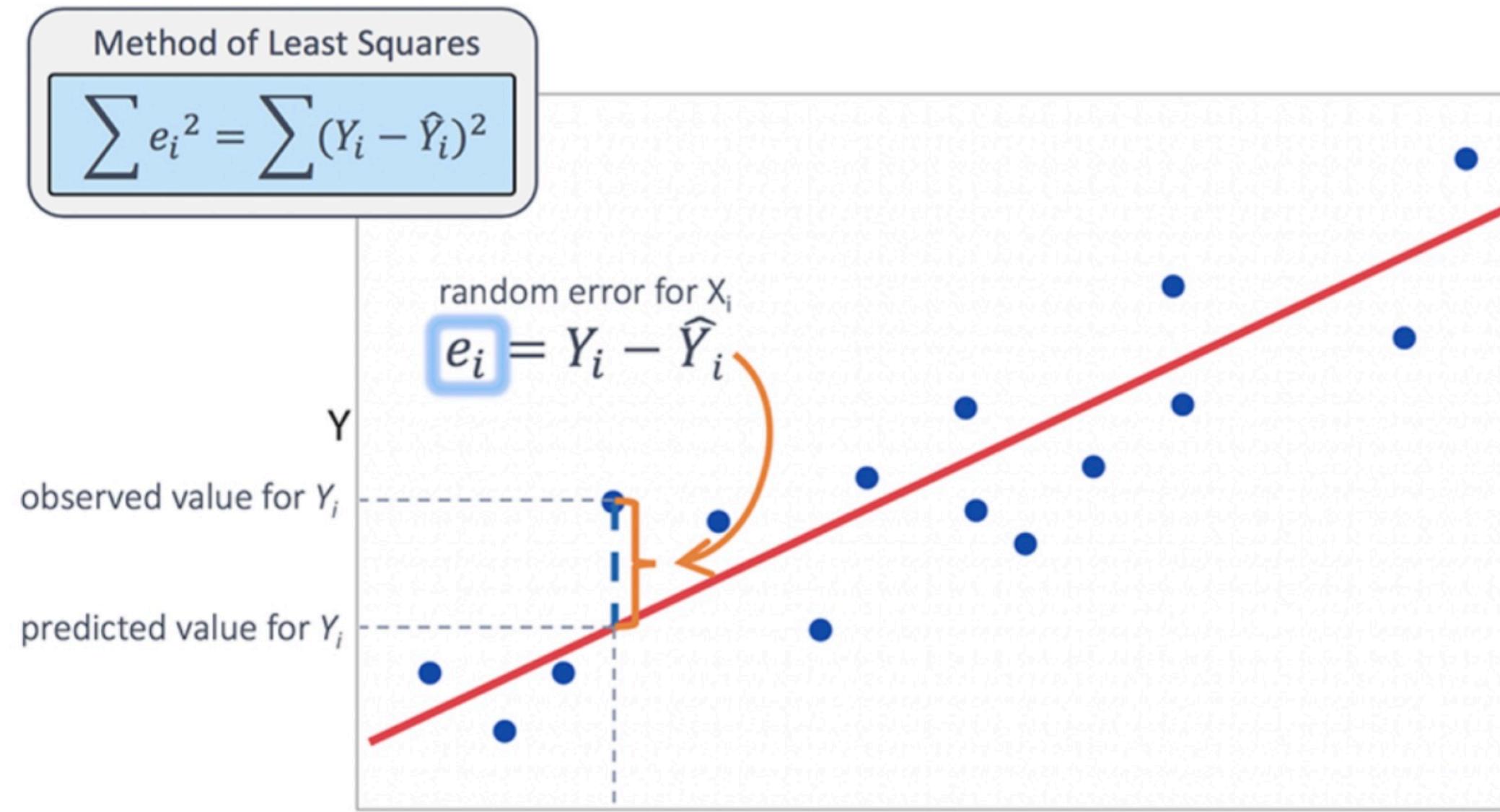
$$\text{Salary} = b_0 + b_1 * \text{Experience}$$

Example:

What will be the 7 years experience DSs' salary?

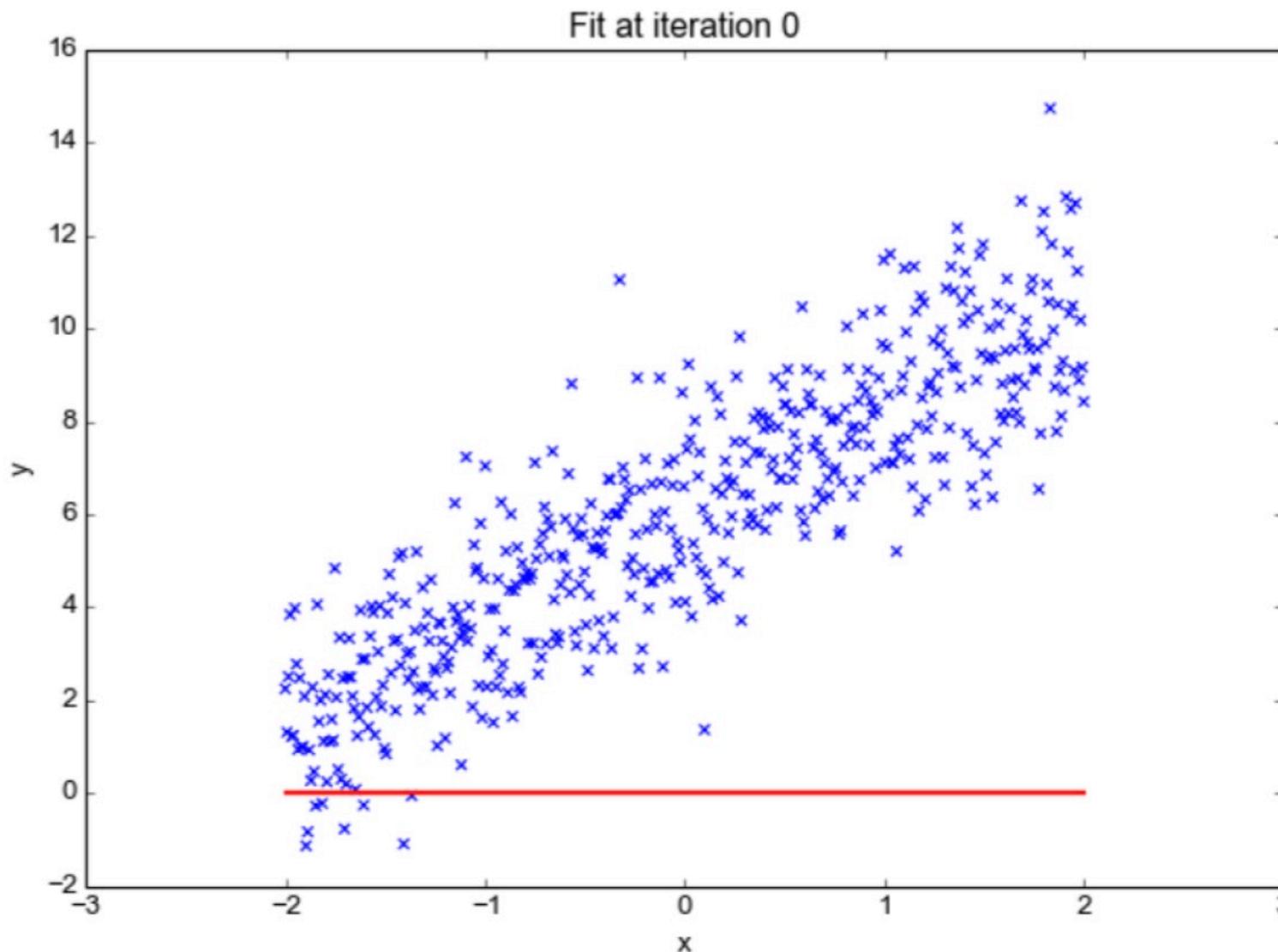
$$\text{Salary} = \mathbf{30k + 10k * 7y} = 100k$$

Linear Regression Theory

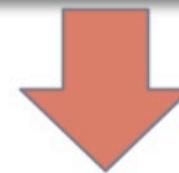


Find the best fit line by minimizing the squares of errors.

Linear Regression Theory



Which
regression line
best fits the
correlation?

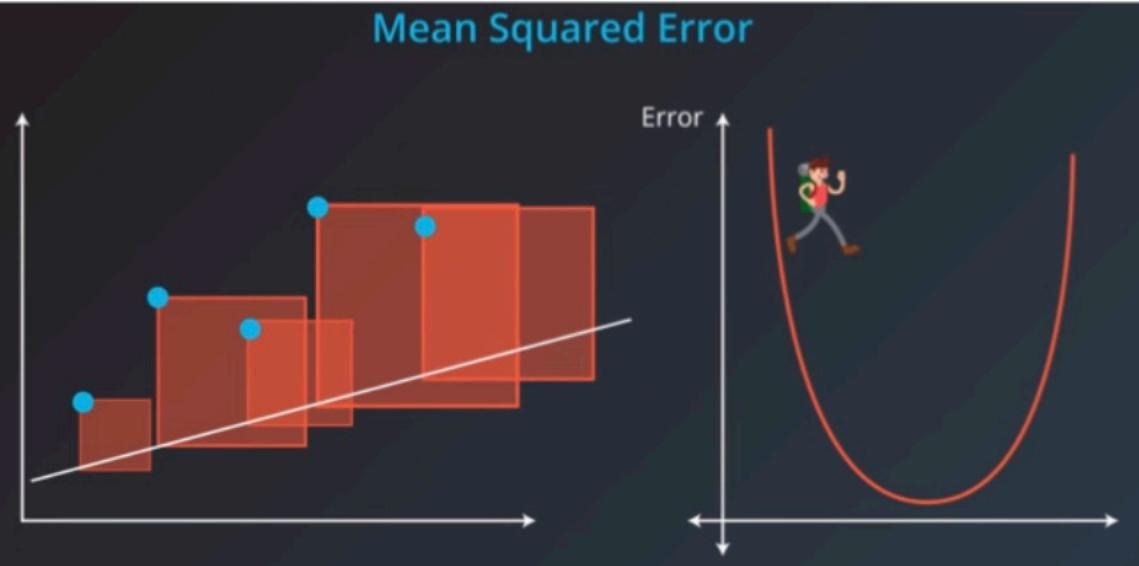


Method of The
Least Squares

Linear Regression Theory

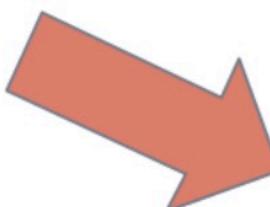


Mean Squared Error

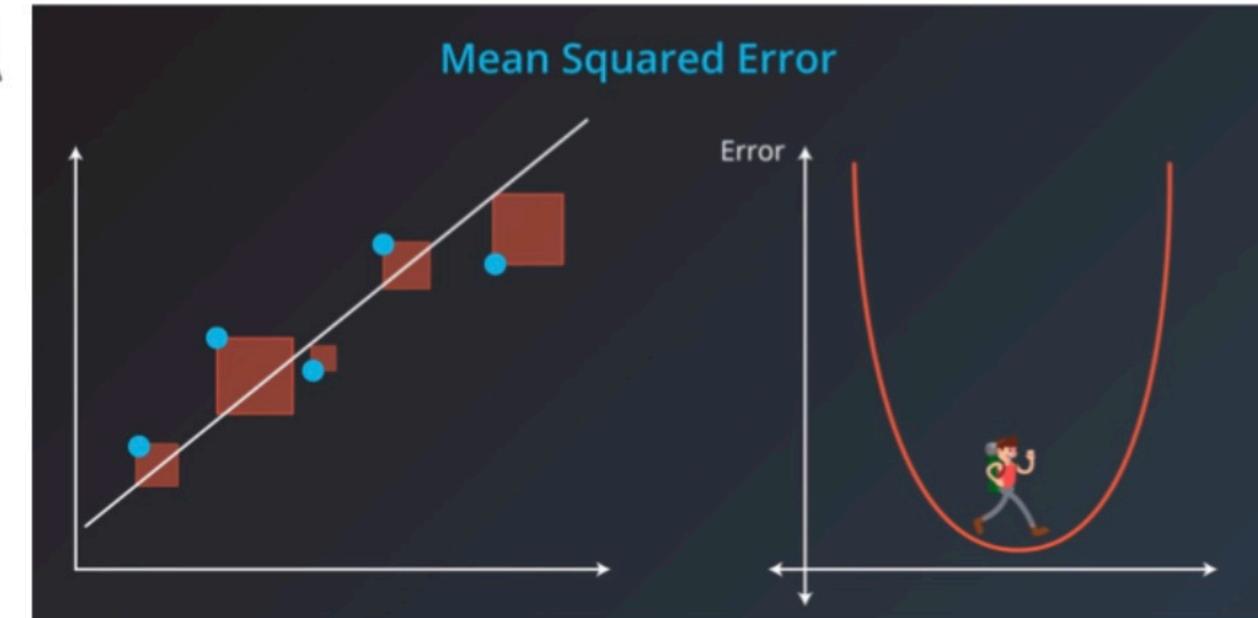


GRADIENT DESCENT

Gradient descent is an algorithm that finds best fit line for given training dataset



Mean Squared Error



Linear Regression Theory



The Coefficient of Determination (R^2)

is interpreted as the ***proportion of the variance*** in the dependent variable that is predictable from the independent variable.

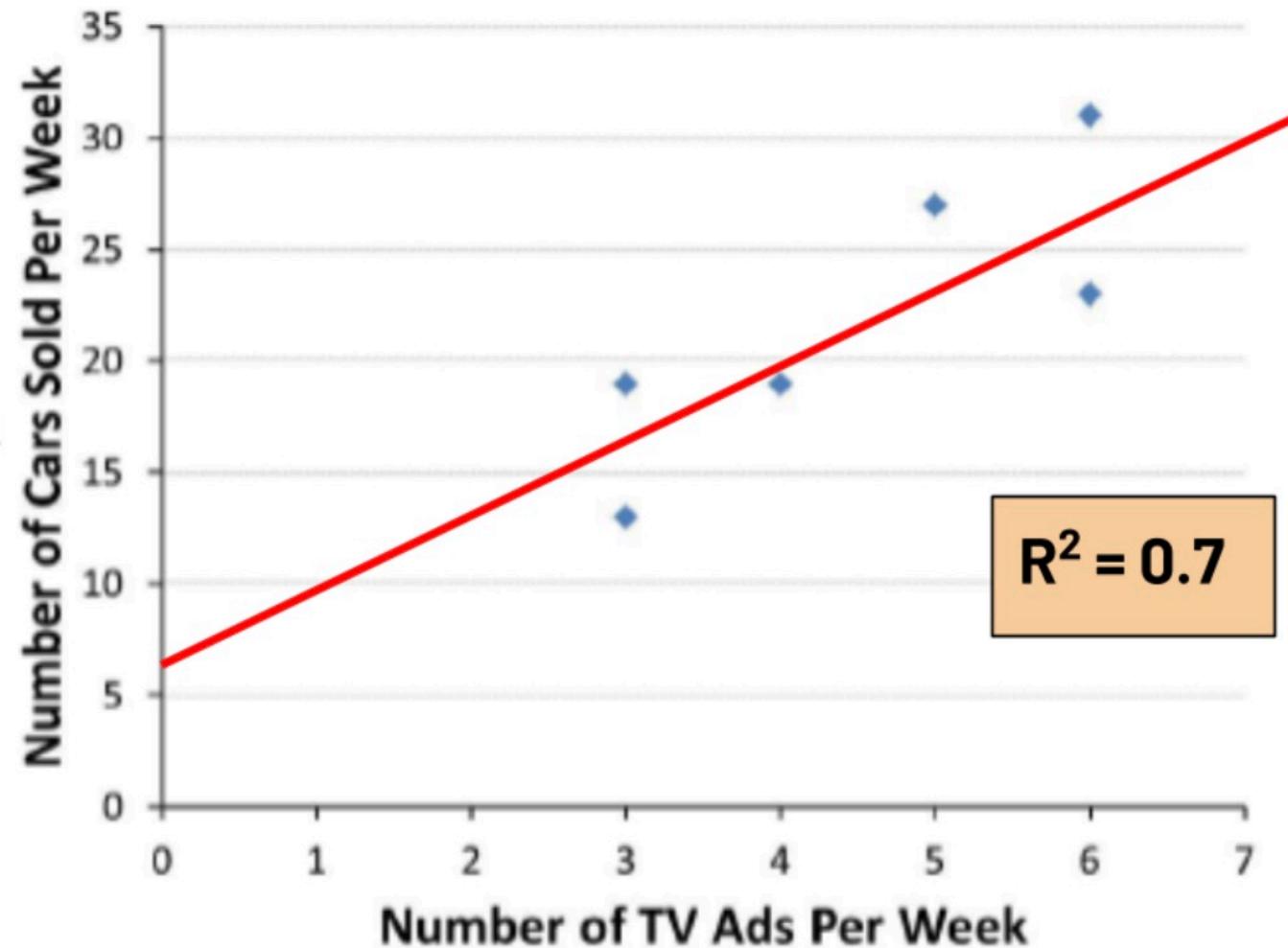
- * The coefficient of determination (R^2) is easily computed using **r** (correlation)
- * Denoted by **R^2** , it takes values between 0 and 1.
- * An R^2 of **0** means that the dependent variable **cannot be predicted from the independent variable**.
- * An R^2 of **1** means the dependent variable **can be predicted without error** from the independent variable.

Linear Regression Theory



Scatter plot of the ordered pairs (x, y)

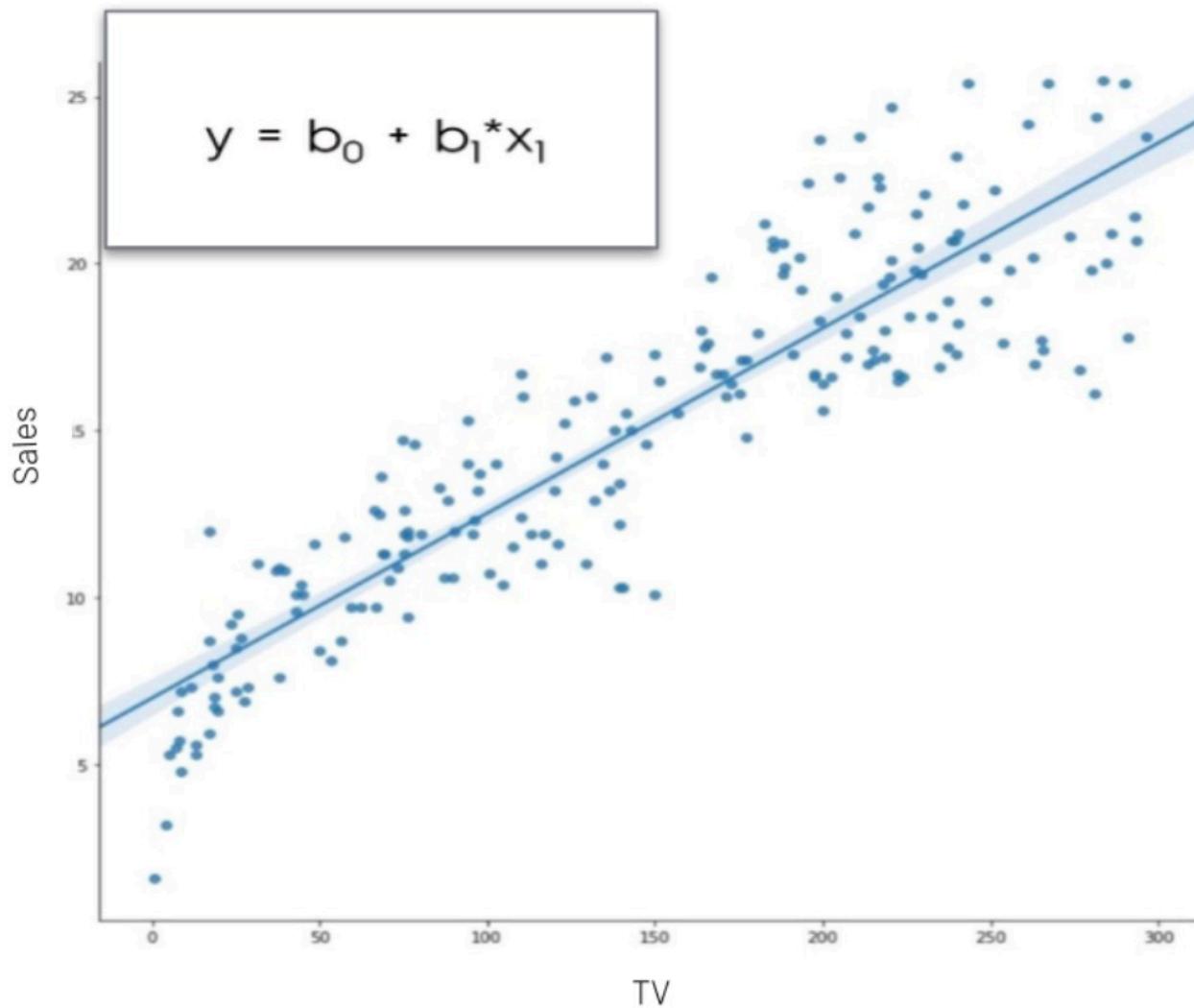
Week	Number of TV Ads <i>x</i>	Number of Cars Sold <i>y</i>
1	3	13
2	6	31
3	4	19
4	5	27
5	6	23
6	3	19



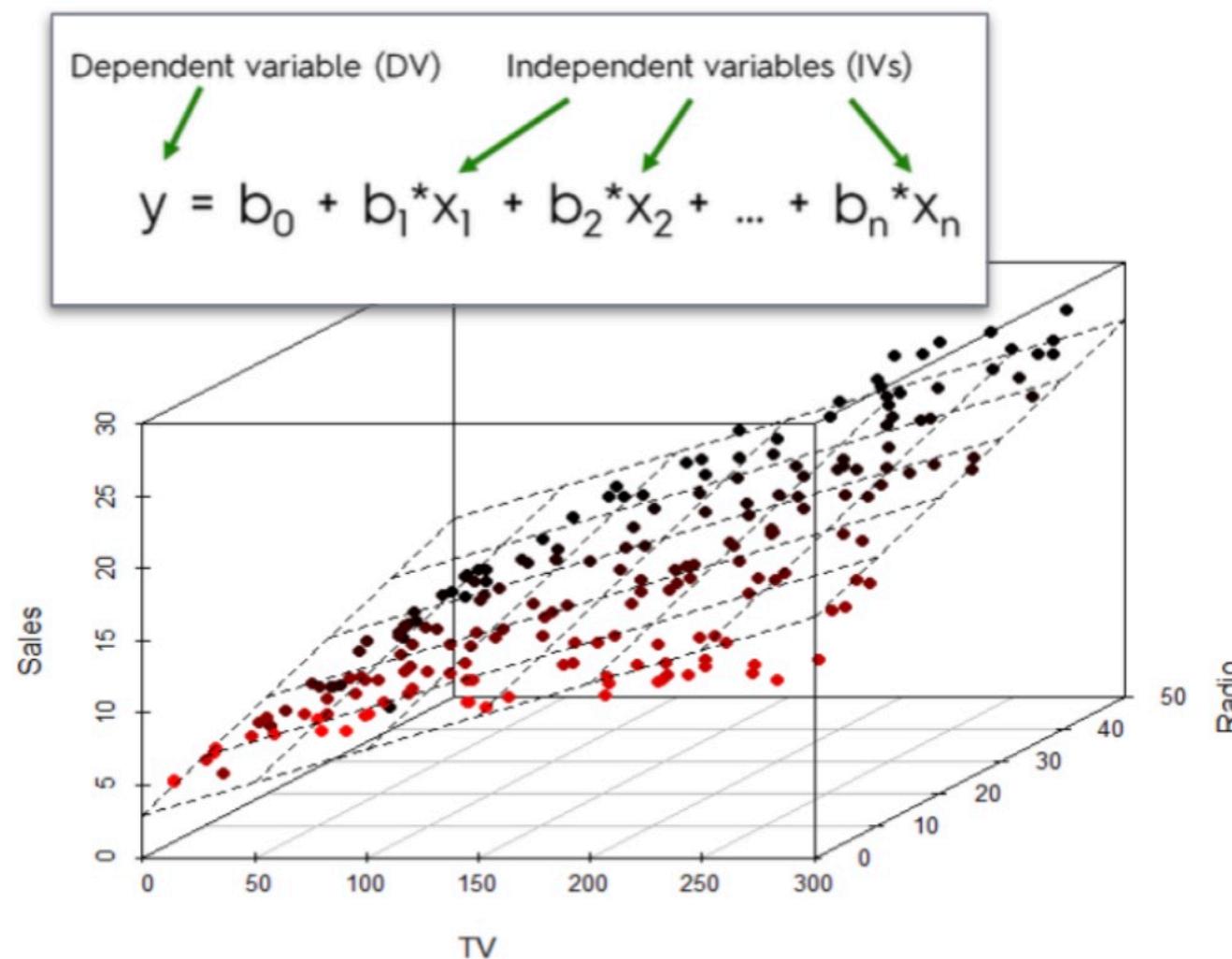
Linear Regression Theory



Simple Linear Regression



Multiple Linear Regression



Linear Regression with Python



python



Be ready for
**Linear
Regression with
Python
Session**