LECTURE-2 ML INTRO CONTD. + LINEAR REGRESSION

Tom Mitchell ML - Experience, Task, Performance

Based on types of tasks -
- Classification } In detail
- Regression
- Clustering } Next-to Next module
- Recommendation
- Forecasting

Based on type of 'learning'
- supervised } Detail
- unsupervised } Next-to-Next.
- Reinforcement } OPTIONAL

Agenda:

- Complete ML Introduction
  - Data for Classification, Regression
  - Regression V/s Classification
  - Supervised learning
  - ~~Clustering & Recommendation~~
- Linear Regression-1

CLASSIFICATION

Recalling the fish 🐡 Sorting example

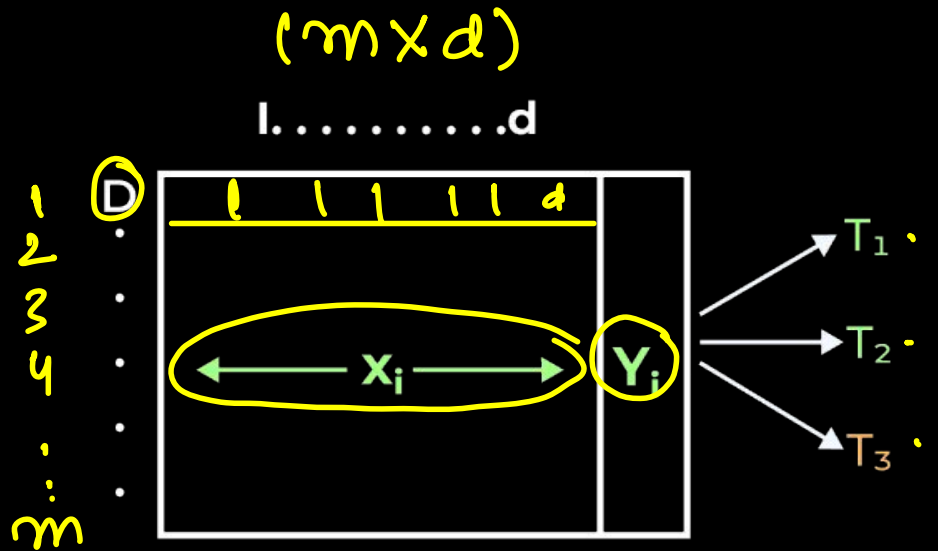
Data for fish sorting

(m) samples of fishes

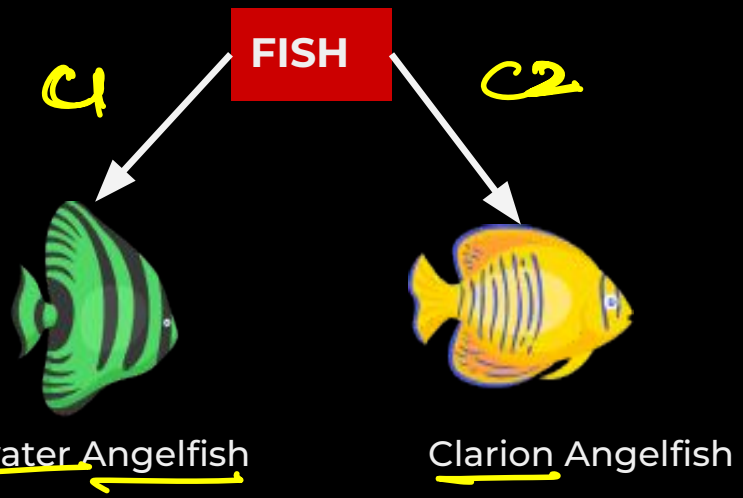
1 sample - d features

| 1 | 2 | 3 | 4 | 5 | 6 | .. | d |

D = X (capital X)



Maths 4 ML

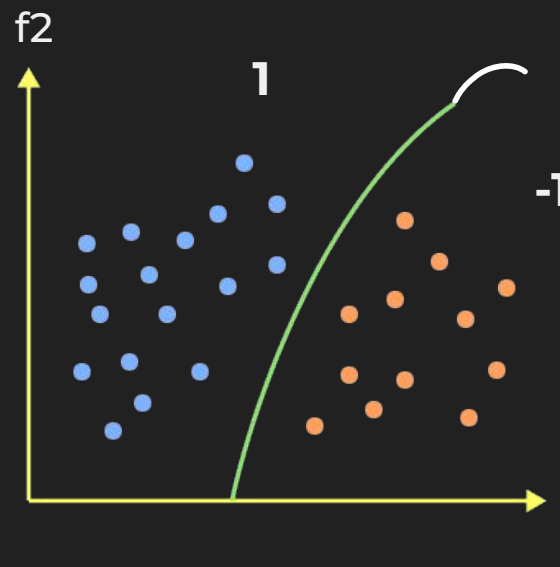


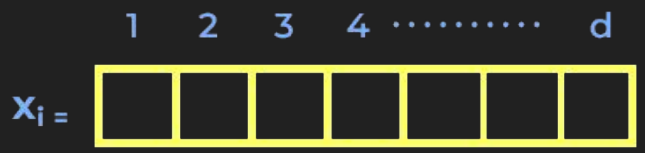
#classes - 2 (Freshwater & Marion) - Binary Classification

↓ T1 ↓ T2

#classes > 2 T1, T2, T3 - Multiclass Classification.

CLASSIFICATION





Y_i = {-1, 1} - categorized

X - (m, d)

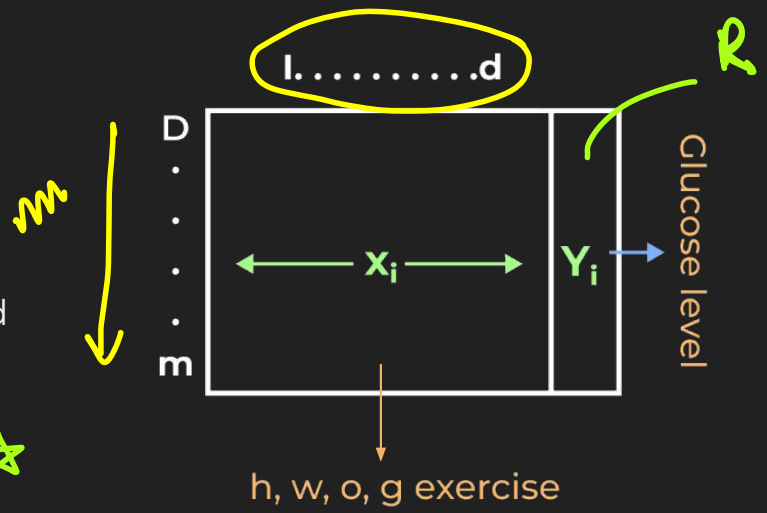
$x^{(i)}$ - ith sample

$y^{(i)}$ - ith target

$$D = \{(x^i, y^i)_{i=1 \text{ to } m};\ x^i \in R^d,\ y^i \in \{0, 1\}\}$$

REGRESSION

- If we had **d-dimension** features of blood samples of m patients
- Now instead of Y being ~~**Diabetic/ non-diabetic**~~ Y is blood glucose level this becomes a **Regression problem**
- What is the **Range (y)**? ~~{0,1}~~ ~~{+1,-1}~~ R



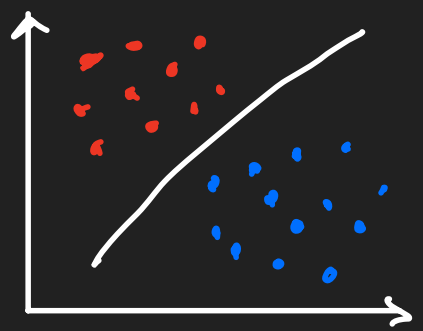
Target will be a real value

$$D = \{ (X^i, y^i)_{i=1 \text{ to } m} ; X^i \in R^d, y^i \in R \}$$

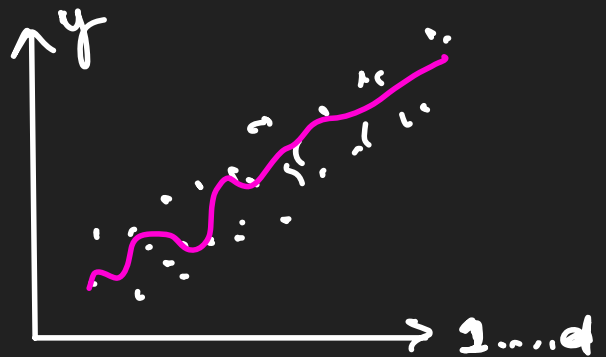
Regression V/S Classification

The main **DIFFERENCE** between Regression and Classification is:

1. Regression - $y \in R$
   Classification - $y \in \{-1, -1, -1, -1\}$

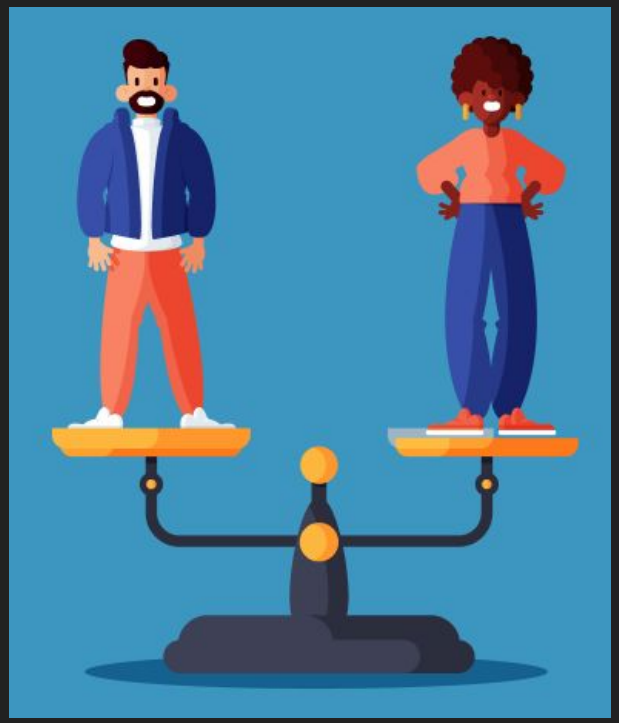
2. 

   Classification

   Regression.

Regression V/S Classification



2. The thing COMMON between them is Historical Data.

Hint : :D

Both are supervised learning

Common - $D = \{(x^i, y^i) \mid i \to m,$

$x^i \in R^q, y^i \in \{-1, 1\}$ / $R\}$

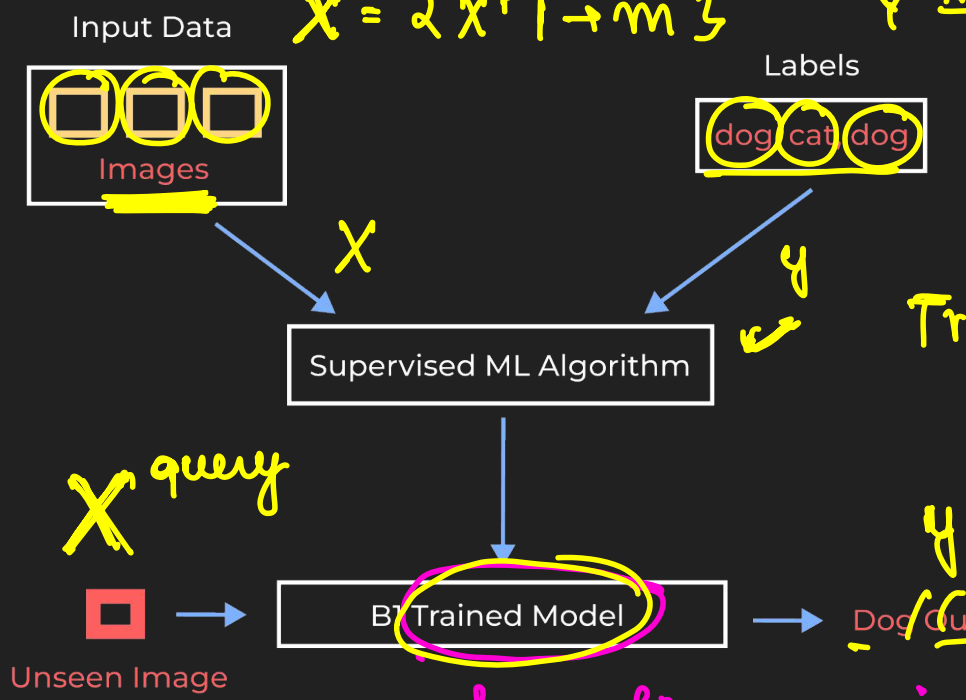
Reg

Labelled Data.

Supervised Learning

Image Classification.

$X = \{x^i, i \to m\}$ $Y = \{y^i, i \to m\}$



Training Data for training the model

↓

Learning patterns.

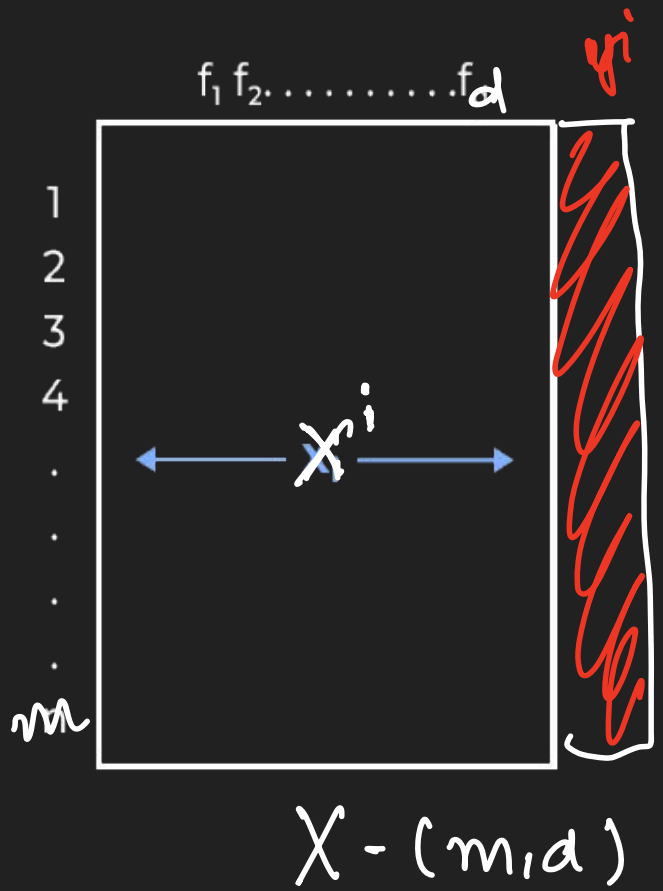
h_0 - Hypothesis

f - function $y = f(x)$

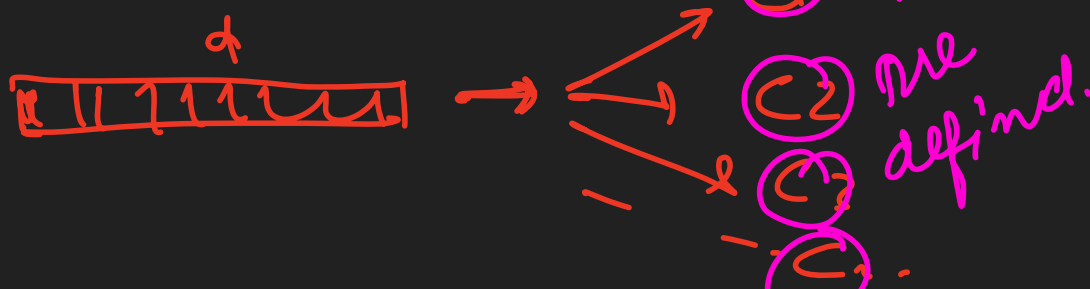
POINTS TO REMEMBER ✓

- Types of task based on learning - supervised, unsupervised, reinforcement learning
- Output in regression is continuous (numeric) while in classification is categorical
- Both regression and classification are supervised since labelled data is present

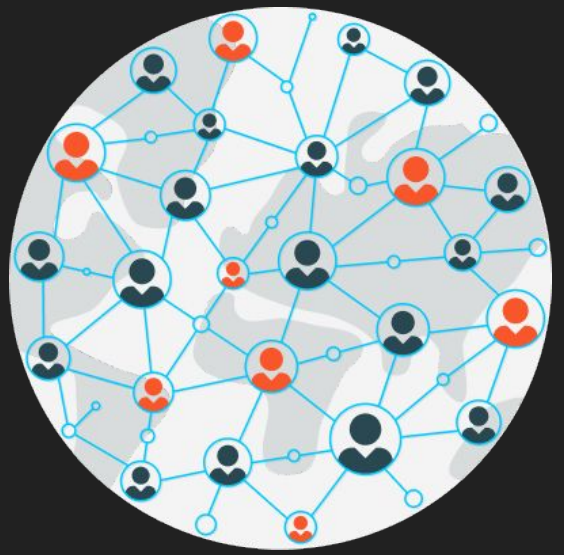
Clustering - Unsupervised ML



- Imagine 100M Amazon customers with features like location, average $ dollar value per purchase



- **There are no labels** yi here - we are looking to find the hidden labels of these data-points
- Since there are no yi involved in the training data D, this is an example of **Unsupervised Learning**

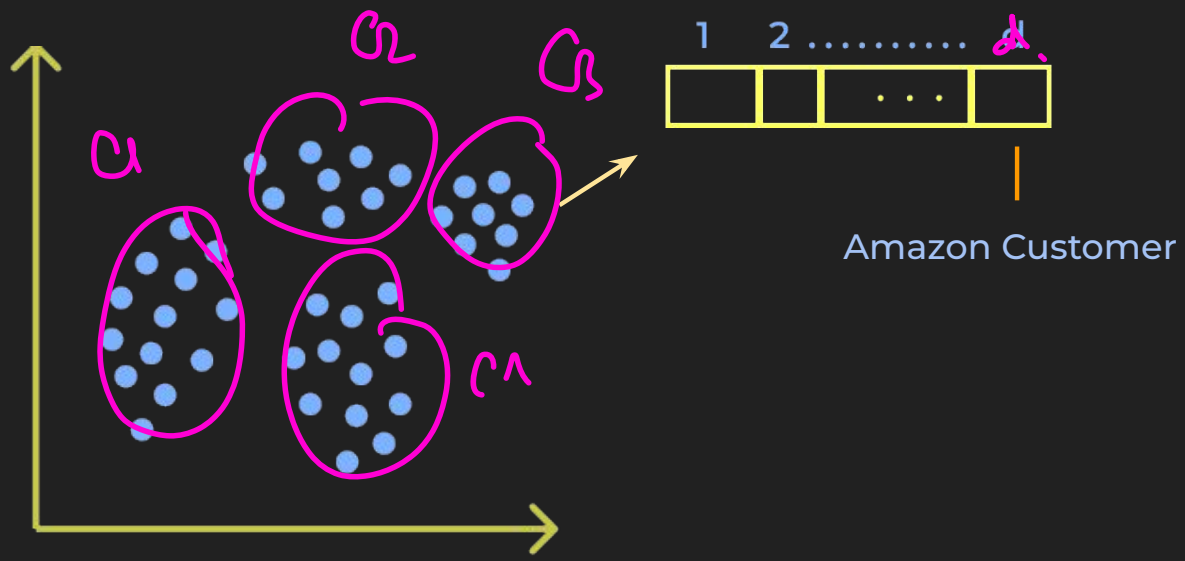


This is called **Clustering** - **means to group the similar data-points (customers)**

Why would we want to cluster customers?

Unsupervised Learning

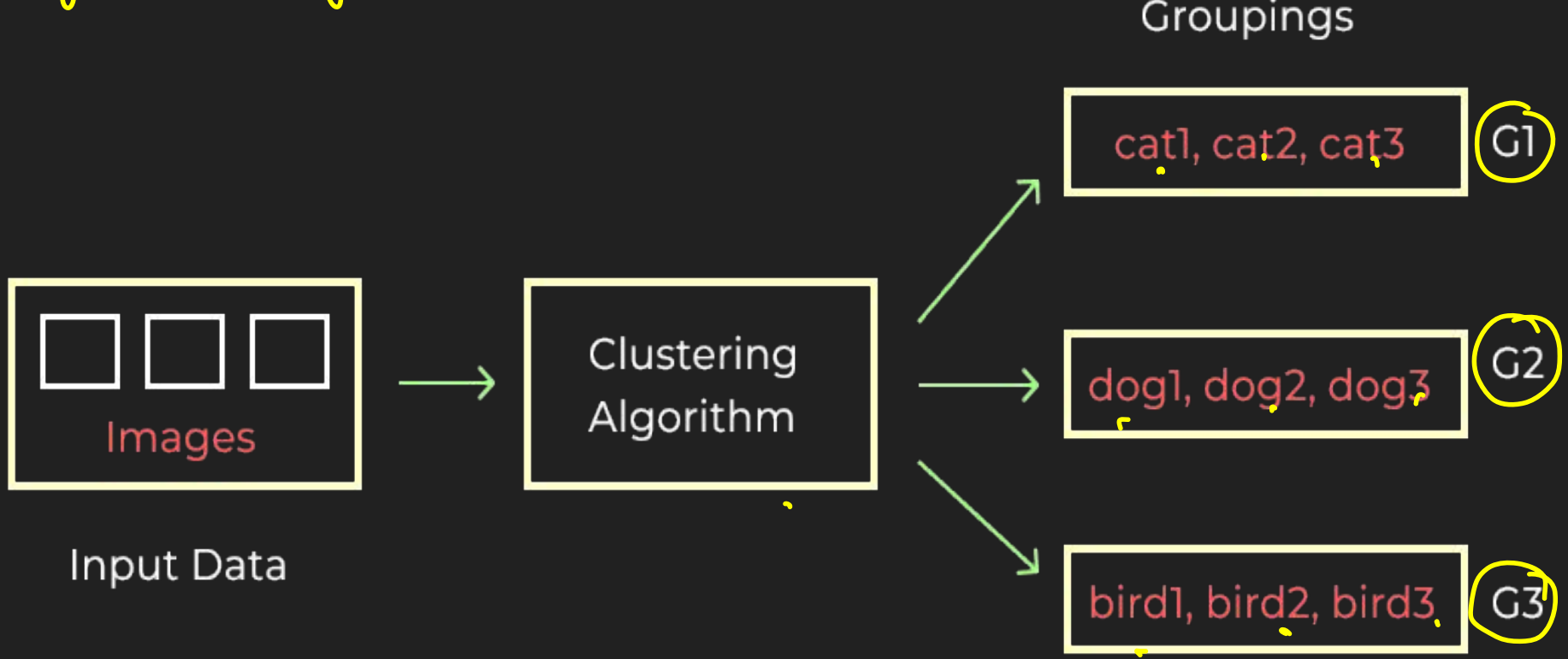
Notice that the customer data has been grouped into clusters - each data point can be represented in d-dimensional space



Q. How can we cluster similar points?

Unsupervised Learning Pipeline

Dog, Cat Images.



Recommendation

There is another sub-area of ML systems called **Recommender Systems**

Take the example of Youtube - **while watching a video, you get**

see similar videos in your right

Let's say I am a Youtube user

Linear Regression

Data scientist

PROBLEM :

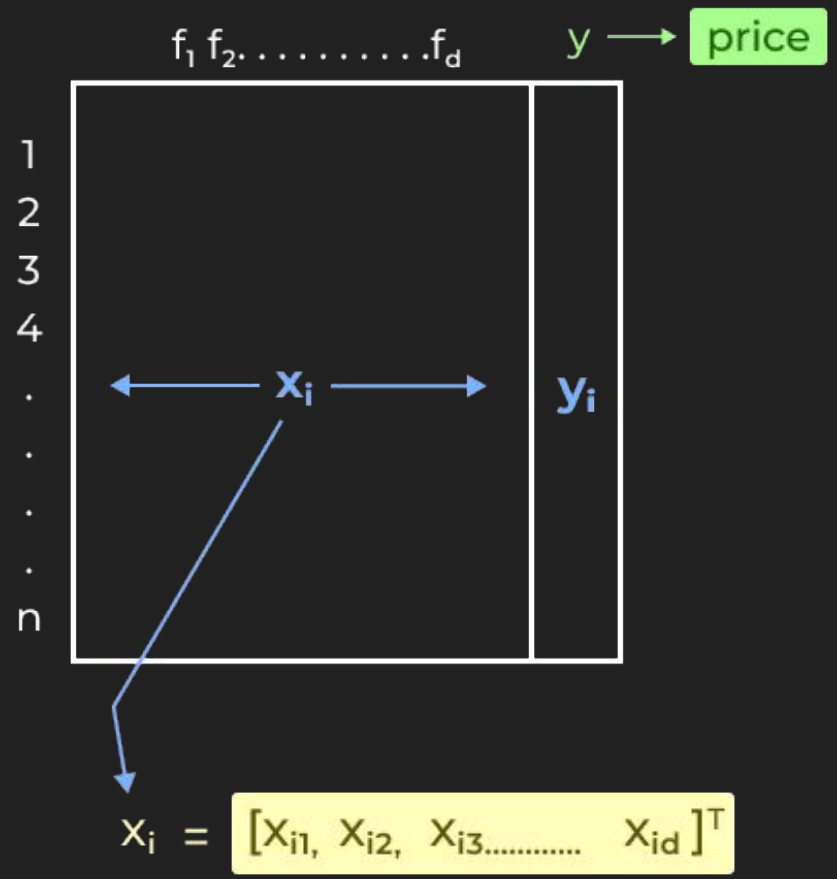
Cars24 - price prediction - sell preowned cars

↳ Automate a process of PRICING the car

TASK :

Predict the **resale price** of a car

Features.



GOAL:

$$f(x) = y$$

d- dim features (IR)

(IR) (real valued)

Given the features xi , we want to find f(x) which maps from x ⟶ y