What is machine Learning
→ various algorithms

Business problem
↓
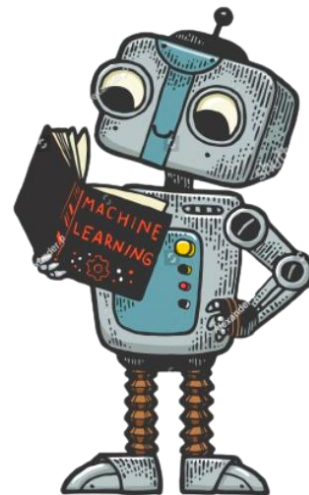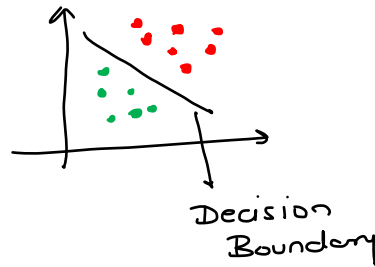
ML: Intro to Machine Learning

Classification

{ → perceptron
→ Gradient Descent

→ +ve   (+1)
→ -ve   (-1)

Maths → Vectors
→ Linear algebra
→ calculus
→ optimisation

Decision Boundary

Summary

$$ML \rightarrow 1 \longrightarrow \text{Supervised Learning}$$
$$ML \rightarrow 1 \cdot 2 \longrightarrow \text{Unsupervised Learning}$$
$$ML \rightarrow 2 \longrightarrow \text{Time series \& Recommendation System}$$

$\underline{\text{Pick one}}$ $\{ \text{NLP / NN / CV /}$

Please don't Ask any question
while I am at teaching

$\downarrow$

Put that question in
QNA Tab

$\underline{\underline{\text{END}}}$

$\underline{\text{Agenda}}$

① What is machine Learning
② Branches of ML
③ Application of ML

Motivation

As a Loan Approval Manager at a bank, I have gained valuable experience in approving and rejecting loans for customers over the past 5 years. Through this experience, I have observed a pattern: customers with a monthly income above 50k and an age between 18 to 30 consistently have their loans approved, whereas customers earning below 50k a month and having a credit score below 500 tend to default on their loans.

To streamline and automate the loan approval process based on this information, write a pseudo code that can be used as an automatic machine for future loan approvals

Rule based Logic
"Hard coding"

Loan-Applicant

Income > 50k a month

Yes

age between 18 to 30

Yes

Approved

No

Rejected

No

Credit Score < 500

Yes

Rjeded

No

Approved
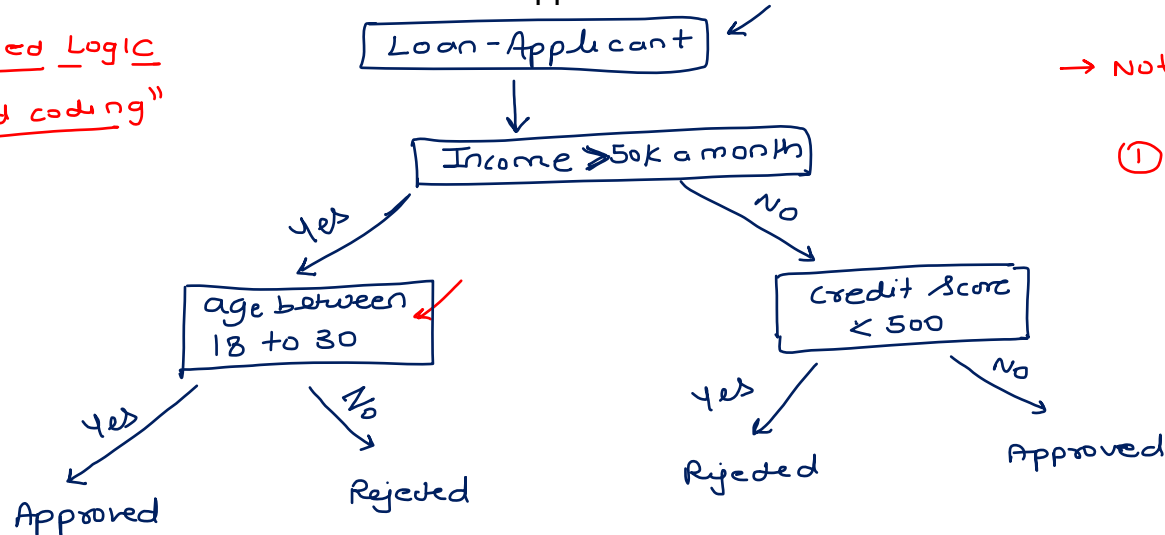
→ Not Submitted credit Score

① unable to capture all cases

Motivation Behind Rule Based Modelling

→ Predict if I can play golf or not
based on the humidity

one parameter

Humidity	Play golf
High	No
High	No
High	No
Normal	Yes
Normal	Yes

10M

If Humidity = High
then Play golf = No

else
    play glof = Yes

Motivation Behind Rule Based Modelling

2 parameter

Outlook	Humidity	Play golf
Rainy	High	No
Rainy	High	No
Sunny	High	Yes
Sunny	Normal	Yes
Sunny	Normal	No
Rainy	High	No
Rainy	Normal	Yes
Sunny	Normal	Yes
Rainy	Normal	Yes
Sunny	High	No

Outlook	Humidity	Play golf
Rainy	High	No
Rainy	High	No
Rainy	High	No
Rainy	Normal	Yes
Rainy	Normal	Yes
Sunny	High	Yes
Snny	Normal	Yes
Sunny	Normal	No
Sunny	Normal	Yes
Sunny	High	No

outlook

Rainy   Sunny
                 ↓
Humidity   difficult

High   Normal

playgolf   Play golf
= No   = Yes
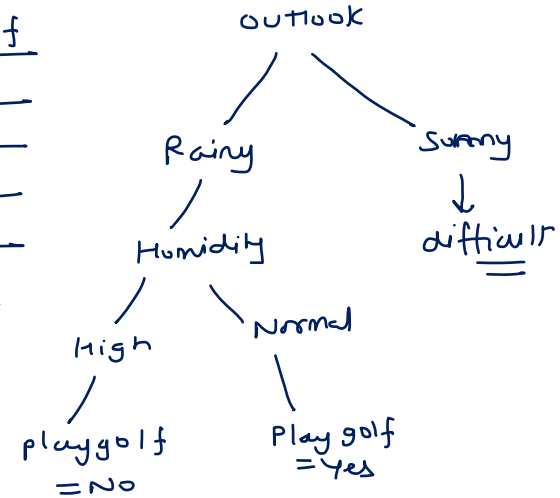
Motivation Behind Rule Based Modelling

Outlook	Temperature	Humidity	Windy	Play golf
1	2	3	4	
Rainy	Hot	High	FALSE	No
Rainy	Hot	High	TRUE	No
Overcast	Hot	High	FALSE	Yes
Sunny	Mild	High	FALSE	Yes
Sunny	Cool	Normal	FALSE	Yes
Sunny	Cool	Normal	TRUE	No
Overcast	Cool	Normal	TRUE	Yes
Rainy	Mild	High	FALSE	No
Rainy	Cool	Normal	FALSE	Yes
Sunny	Mild	Normal	FALSE	Yes
Rainy	Mild	Normal	TRUE	Yes
Overcast	Mild	High	TRUE	Yes
Overcast	Hot	Normal	FALSE	Yes
Sunny	Mild	High	TRUE	No

① Difficult to formulate rules when provided with huge data and multiple features

② The rule will fail if new feature is introduce or if the rule is provided with inputs which are not coded in the logic

ML VS Classical Programming

$$output = \frac{input-1 + input-2}{3}$$

Input1	Input2	Output
1	2	1.00
2	4	2.00
4	6	3.33
5	9	4.67
3	1	1.33
9	0	3.00
3	6	3.00

find out how output is getting generated
using input-1 & input-2

mathematical
formula

ML VS Classical Programming

using formula learnt in the last slide

predict the output
of this new entry

Input1	Input2	~~Output~~
10	4	4.67

$$\frac{input-1 + input-2}{3} = o/p$$

Data

i/p1	i/p2	o/p

Human Brain

Learning
(How input-1 &
input-2 is generating
the output using
the formula)

predict the outcome
using the formula
learnt

ML VS Classical Programming

Machine Leaning

{ Mathematical Algo } → ✓

age	Sex	Yr-of-exp	Salary

500 current employees
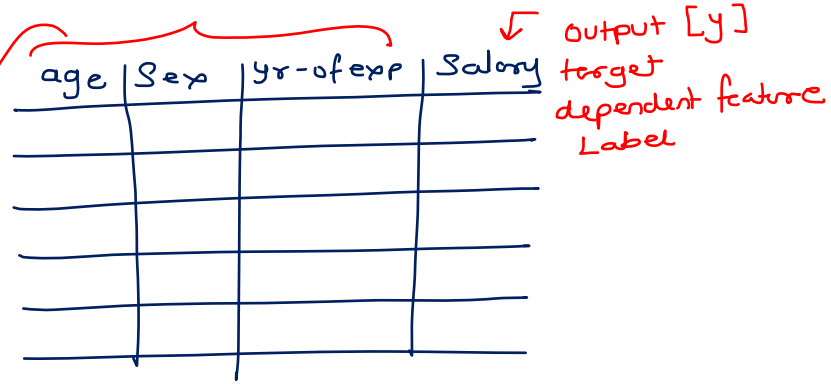
$Salary = f(age, sex, yr\text{-}of\,exp)$

→ Predict the Salary of a new employee

27 → age →

male → Sex →

6 → Yr-of exp →

$f(age, Sex, yr\text{-}of\,exp)$

current year

→ Predicted Salary

(66 K/month)

(New employee)
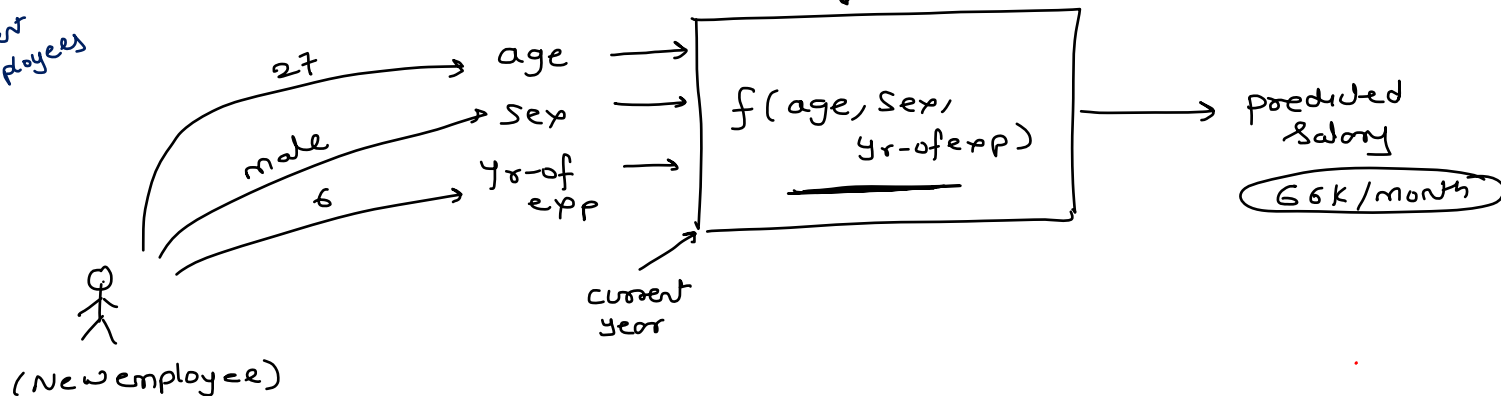
ML VS Classical Programming

output → chosen based on what we are interested in predicting

age	Sex	yr-of exp	Salary

↙ output [y]
target
dependent feature
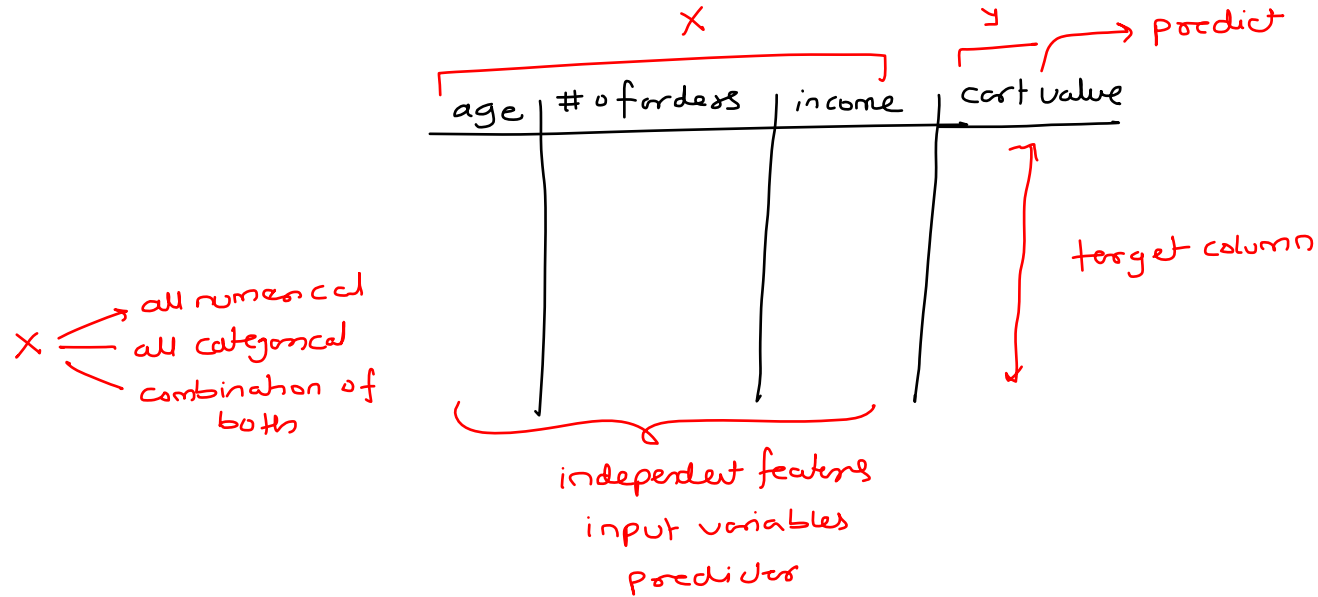Label

① Set of Examples

② Input data

③ Historical data

Independent features
predictors
input variables

ML VS Classical Programming

X

y → predict

age	# o f orders	income	cart value

target column

X → all numerical
all categorical
combination of both

independent features
input variables
predictors

ML VS Classical Programming

Process of ML

$-X-$	Y

}

"Historical Data"

→ ML - Algo → ML - Model → Predictions

$y = f(x)$

This ML-Algo will try to learn / find out out X is associated with Y

New Data

ML VS Classical Programming

70 — 📄 → 🧍 → examination

100 question → 30 → some
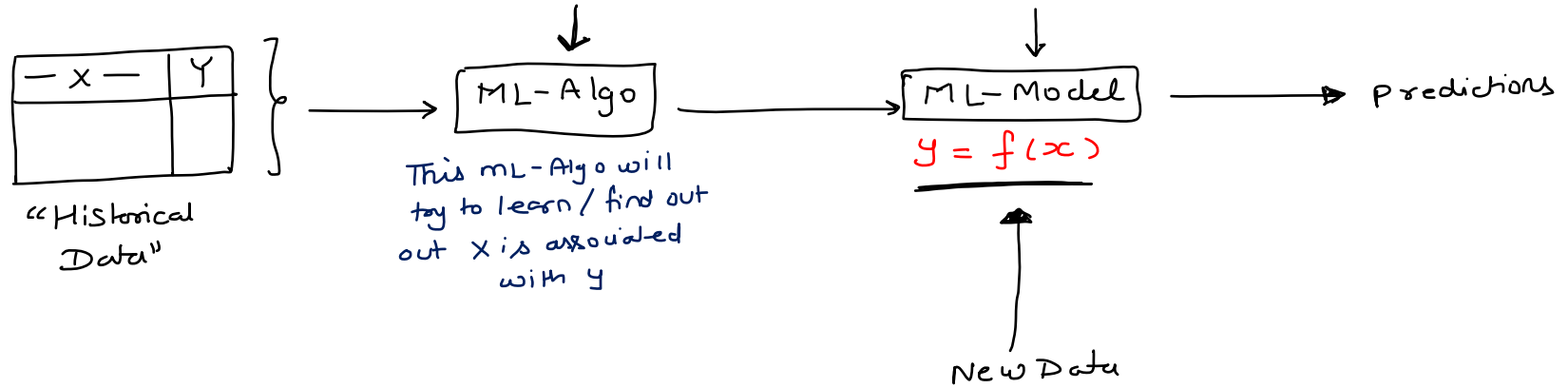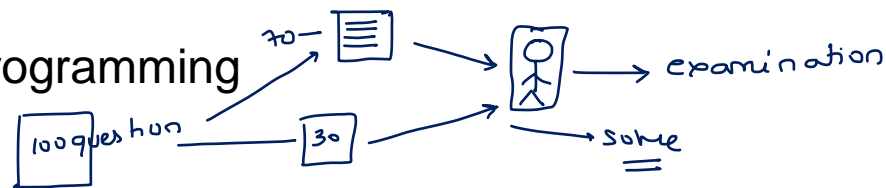
Data

	x_1	x_2	y
a	1	10	1
b	2	9	0
c	3	8	1
d	4	7	0
e	5	6	0
f	6	5	0
g	7	4	1
h	8	3	0
i	9	2	0
J	10	1	1

70% → Train

	x_1	x_2	y
b			
c			
d			
g			
h			
i			
J			

→ ML-Algo → M2-Model

$$y = f(x_1, x_2)$$

30% → Test

	x_1	x_2	y_a	y_p
a				
e				
f				

compare it to test / check
the performance of the model
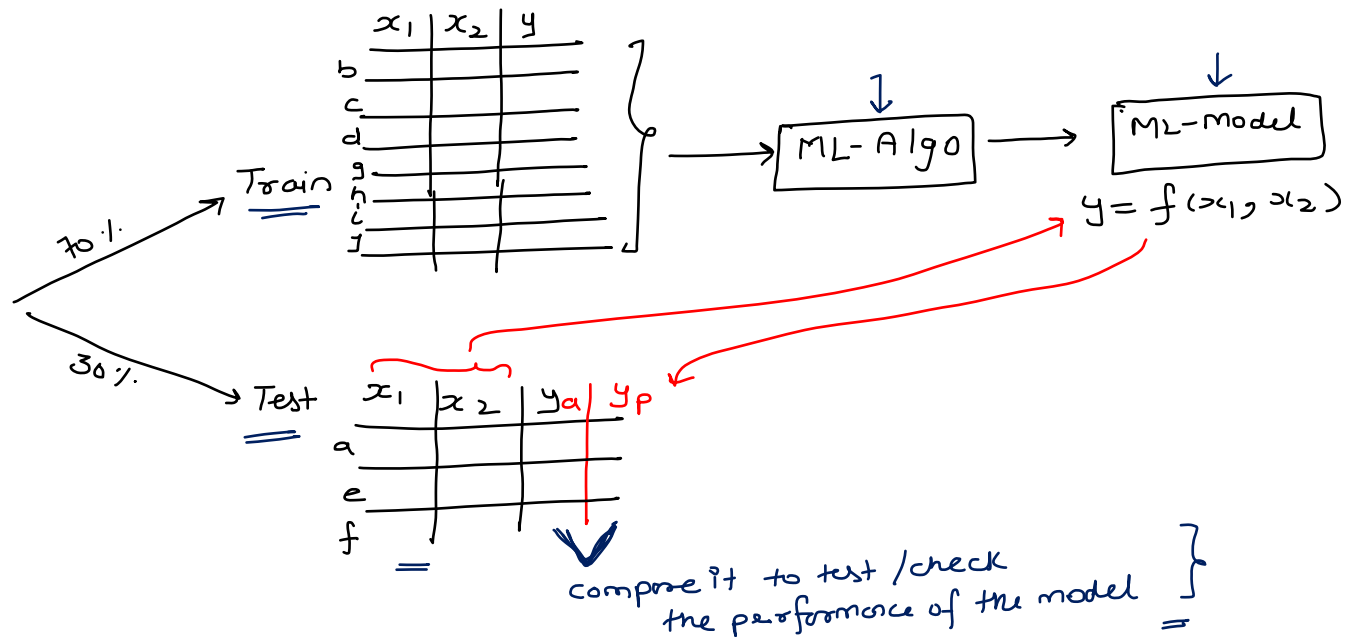
What is Machine Learning

CMU → ML

Tom Mitchell provides a more modern definition: "A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P, if its performance at tasks in T, as measured by P, improves with experience E."

computer program

ML-Algo

Experience

Historical data

x_1	x_2	y

Task

objective:
Predict salary
of an employee
based on various
inputs (features)
of the employee

Performance

compare the actual
outcome with
predicted outcome.
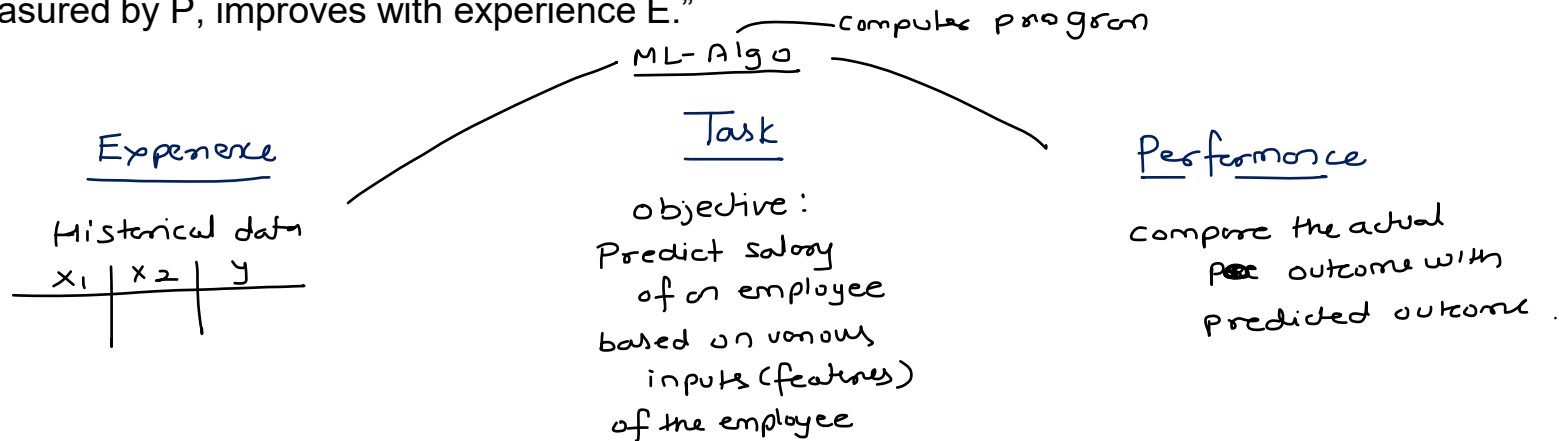
Branches Of Machine Learning

Machine Learning

Supervised mL-Algo

x_1	x_2	...	x_n	y

Reinforcement Learning

Supervised
(presence of Supervision)

(Data with inputs & outputs)

unsupervised
(Data with only features)
(No target variable)

un-Supervised mL-Algo

x_1	x_2	...	x_n
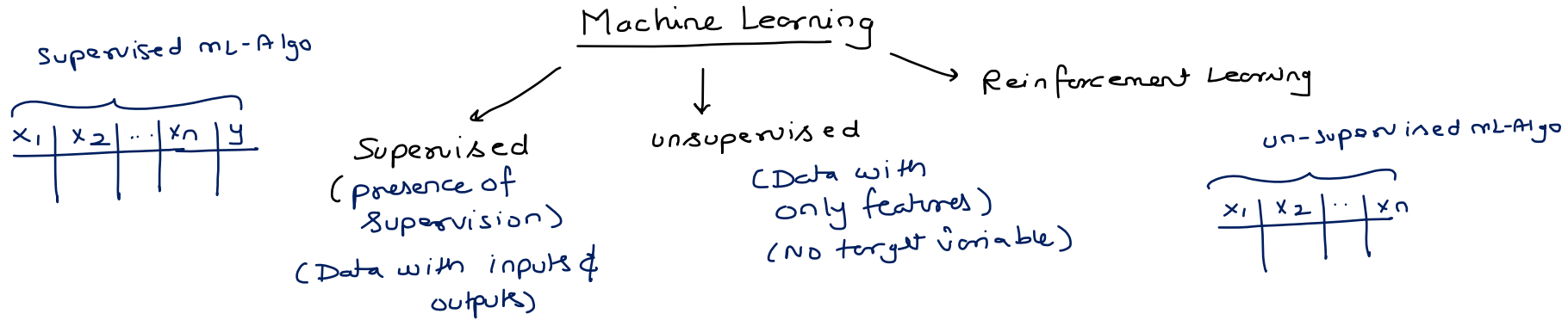
These class of mL-Algo requires data that comes with both input & outputs (independent & Dependent) variables

Regression
(If target variable of the Data is continuous)

Classification
(If target variable of the Data is categorical)
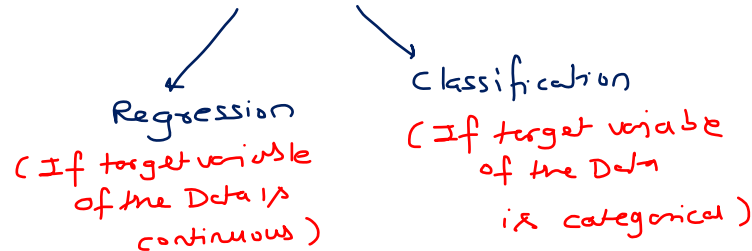
Quiz

1. Which of the following provides the best explanation of Machine Learning?
   a. Machine learning learns from labelled data
   b. Machine learning is the field of giving robots the ability to act intelligently.
   c. ML enables computers to learn without explicit programming
   d. Machine learning is the science of programming computers.

1. What is the main objective of an ML pipeline?
   a. To optimize code performance
   b. To build and train ML models for data analysis and prediction
   c. To handle real-time data input and output
   d. To interact with users and provide real-time responses

Machine Learning Explained

Supervised ML-Algo

(Regression)

x

y

age	yr-of-exp	gender	Salary

Task ⟶ predict Salary

⟶ continuous

↕ target
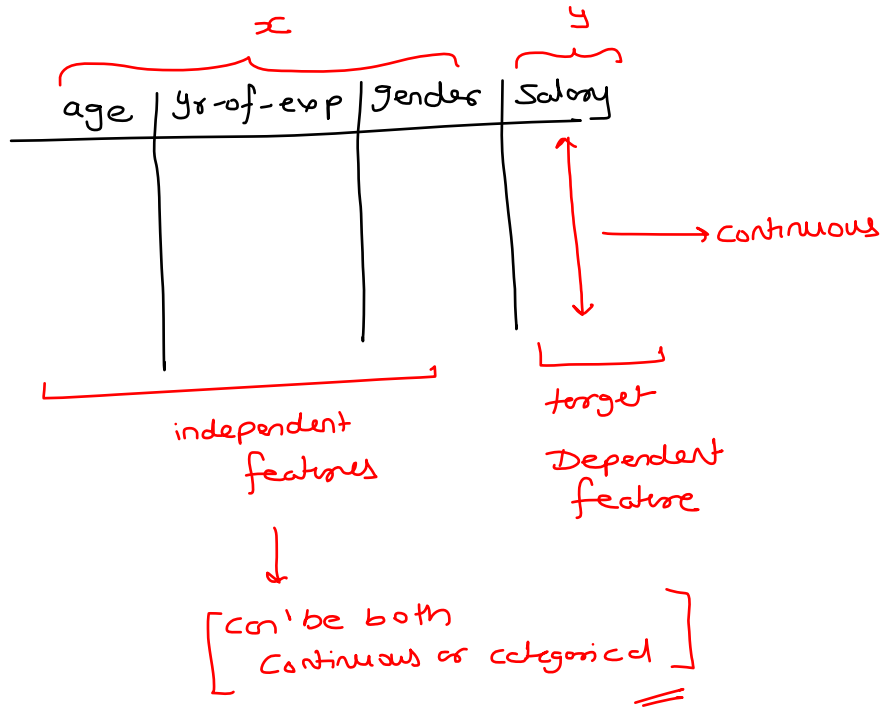
Dependent feature

ML-Algo

Supervised Regression

independent features

↓

[can't be both Continuous or categorical]

Machine Learning Explained

Supervised x Classification

age	income	# of cars	Default
			Yes
			No
			Yes
			No
			Yes

X
independent features

y
dependent feature

Data type
→ Categorical

Task → predict if a customer will default or not

class → ML-Algo

Supervised classification

Binary class classification
two classes

classification → Target
                    ⟋ two classes
                    ⟍ multiple classes

multi-class classification
more than 2 classes

Machine Learning Explained

Unsupervised Machine - Learning

task is not to predict anything

Task ⟶ find Similarity among various customers

age	income	total purchase value	# of orders
c1			
c2			
c3			
c4			
c5			
.			
.			

clustering ⟶ to find groups.

$\frac{RFM}{|||}$ ⟶ unsupen ML - Algo

↓