

Machine Learning

MTE - 20 } Practical / Implementation
ETE - 40 }

PRS - 25

CWS - 15

→ Attendance: 5

795 : 5
90-94 - 4
85-89 - 3
80-84 - 2
75-79 - 1
≤ 75 → 0

Test: 2

Assignment: 1

Pre-requisite:

Probability

Differentiation

$$\frac{\partial}{\partial x}(2) = 0$$

$$\frac{\partial (x^n)}{\partial x} = nx^{n-1}$$

44 ✓
52
BB
39

$$\frac{1}{3}$$

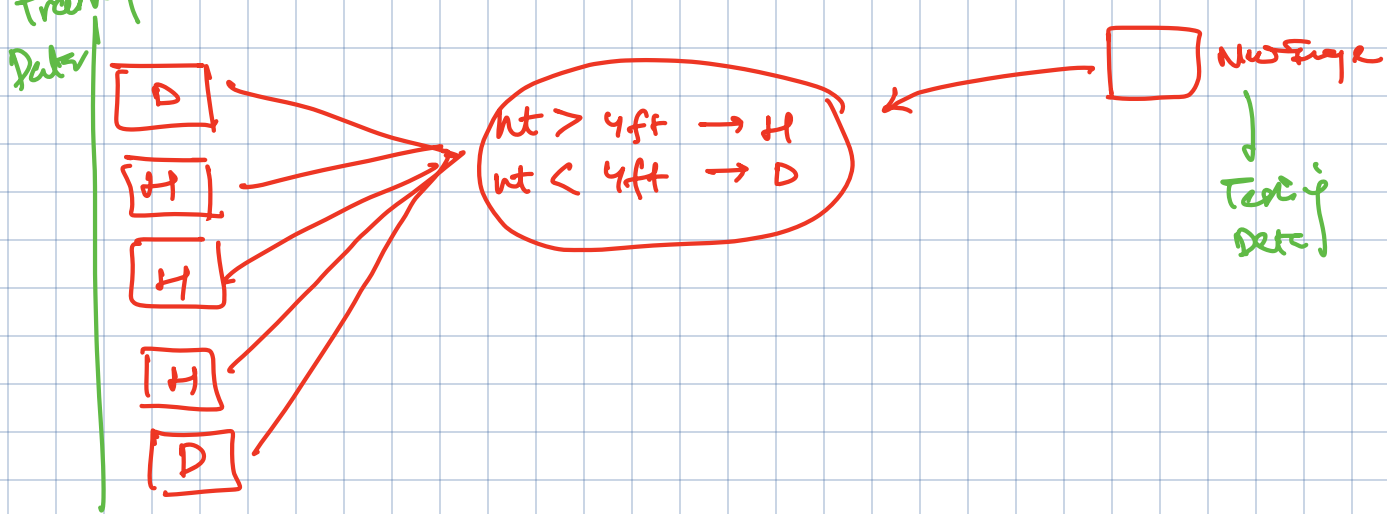
ML?

External data

Data → Patterns

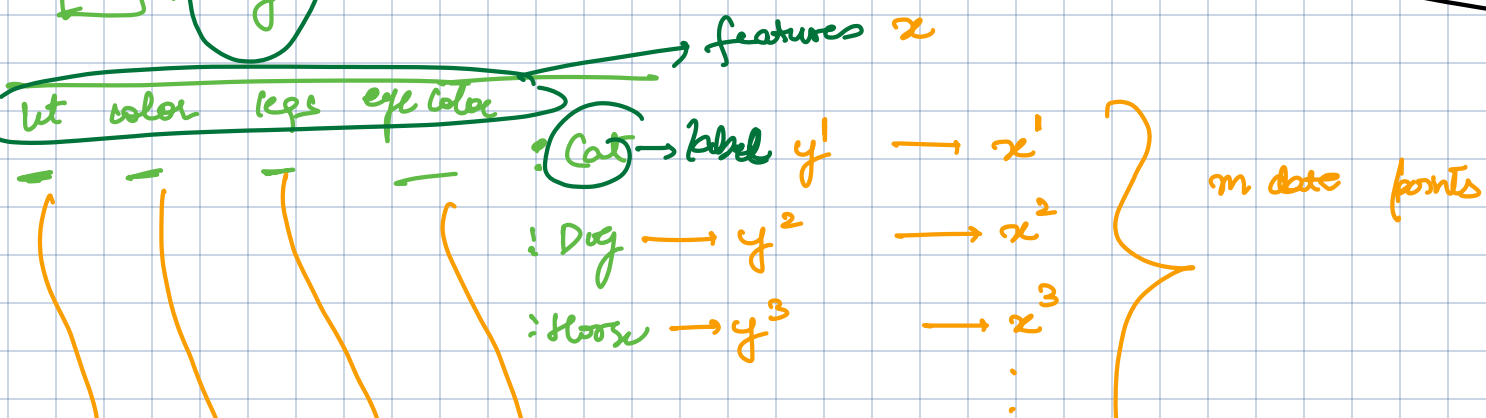
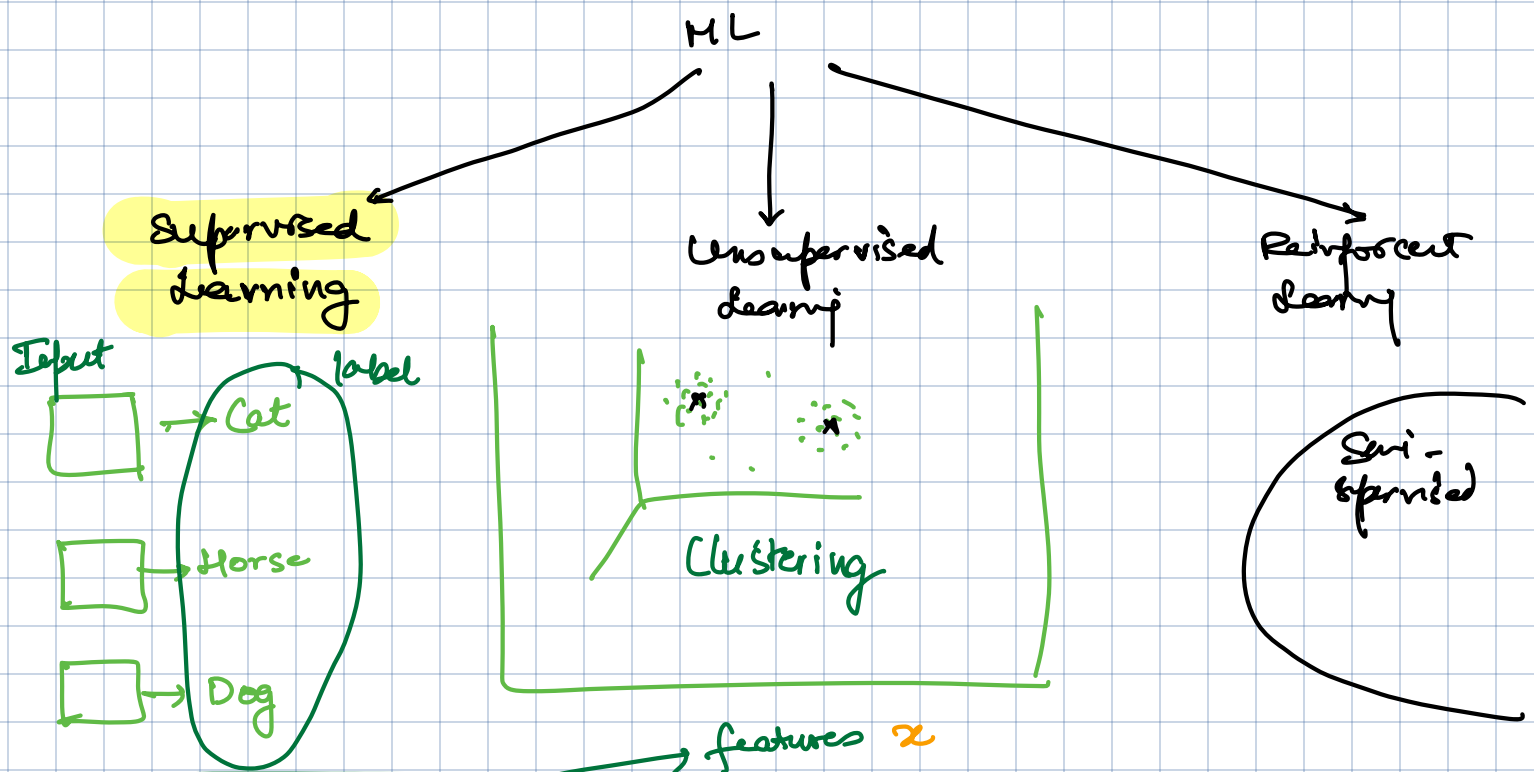
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Data Analytics



why?

- Data
- Computational
- Algorithm/Mathematical Model



x_1^i x_2^i x_3^i x_4^i x_n^i

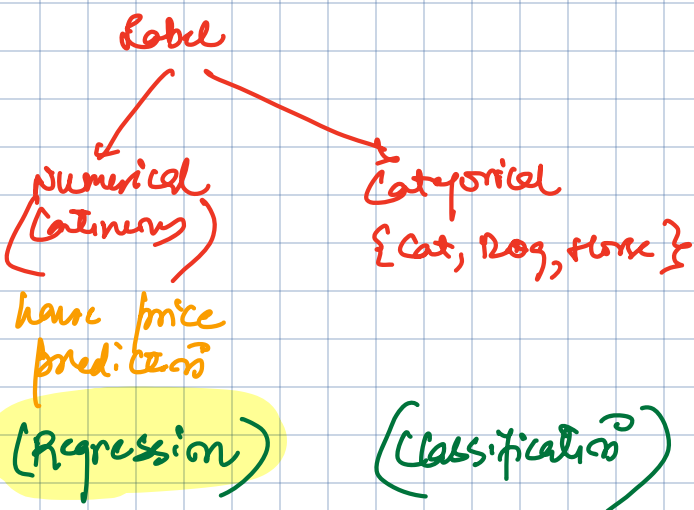
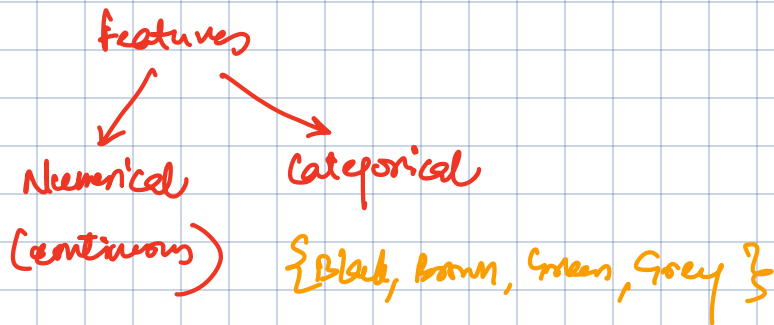
Supervised learning: $\{x^{(i)}, y^{(i)}\}_{i=1}^m$

$$x^{(i)} = \{x_1^i, x_2^i, \dots, x_n^i\}$$

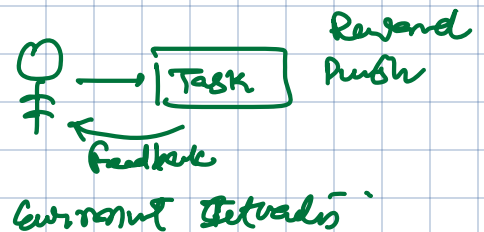
x^i has n features

✓ $x^i \in \mathbb{R}^n$

$x_{j,i}^i$ = j th feature of i th example



Reinforcement



LINEAR REGRESSION

Eg:

Training Data

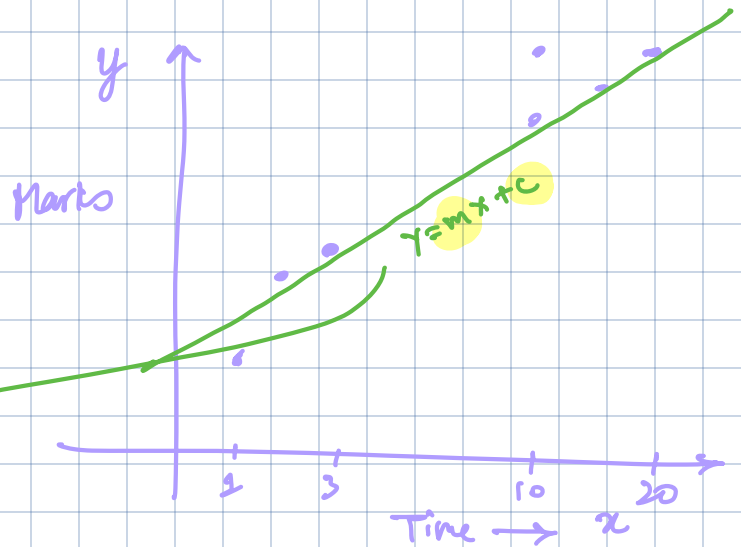
(Feature)		(Label)
Time	Spent	Marks
1		4
3		7
10		8
20		10

$$x^{(i)} \in \mathbb{R}$$

$$y^{(i)} \in \mathbb{R}$$

MODEL ?
(Pattern)

Q: 8hrs ? Score ? } Test Data



$$y = mx + c$$

$$= m \cdot 8 + c$$

Hypothesis

$$y = \theta_1 x + \theta_0$$

$$\theta = \begin{bmatrix} \theta_0 \\ \theta_1 \end{bmatrix}$$

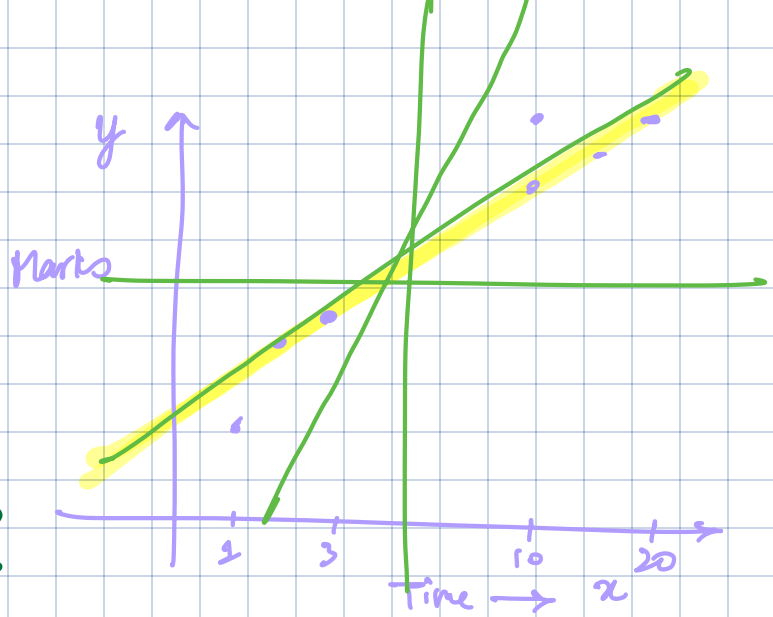
$$h_0(x) = \theta_1 x + \theta_0$$

x_1	x_2	x_3	x_4
Hours	C914	Classes	Assign

$$y = \theta_1 x_1 + \theta_2 x_2 + \theta_3 x_3 + \theta_4 x_4 + \theta_0$$

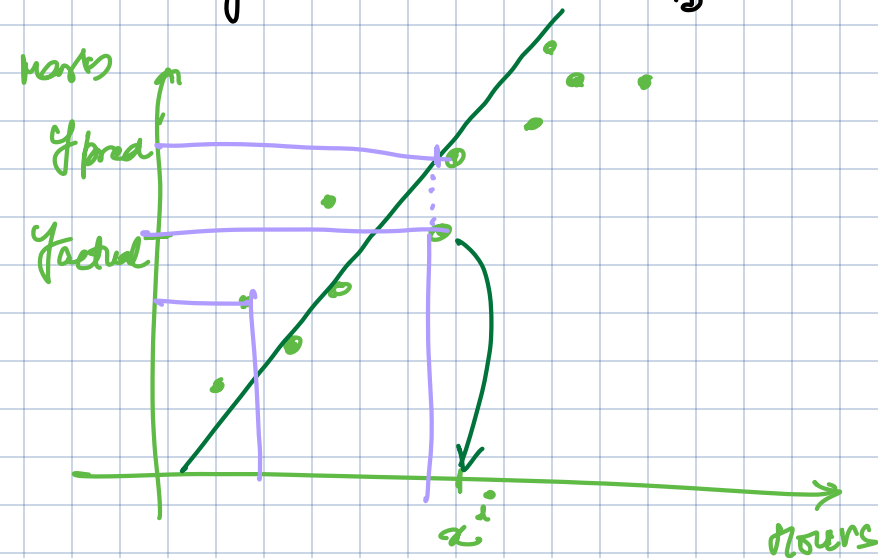
Aim:

To learn best line which fits through data points



- (a) Random value of Θ start
- (b) How good the line is?
- (c) Θ change/update good performance

How good our Θ is?



$$E^{(i)} = |y_{\text{pred}}^{(i)} - y_{\text{actual}}^{(i)}|$$

Error for i th example

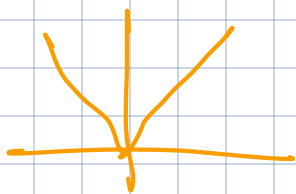
$$\text{Total Error for all points} = \sum_{i=1}^m |y_{\text{pred}}^{(i)} - y_{\text{actual}}^{(i)}|$$

$$\text{Total Error for all points} = \sum_{i=1}^m |y^{(i)} - y^{(i)}|$$

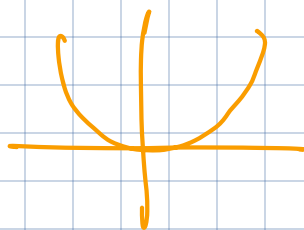
$$\text{Average Error} = \frac{1}{m} \sum_{i=1}^m |y^{(i)} - y^{(i)}|$$

(Average Absolute Error)

$|x|$



x^2



Total Error for all points = $\sum_{i=1}^m [y^{(i)} - y^{(i)}]^2$

Mean Squared Error (MSE) = $\frac{1}{m} \sum_{i=1}^m [\underbrace{y^{(i)}}_{\text{predicted}} - \underbrace{y^{(i)}}_{\text{actual}}]^2$

Loss function
 J

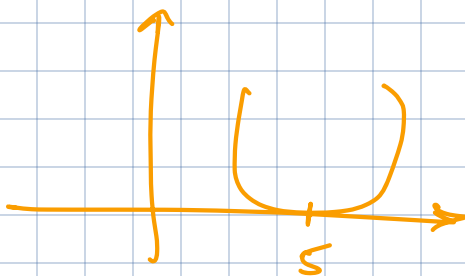
minimize

$$J(\theta) = \frac{1}{m} \sum_{i=1}^m [\theta_1 x^{(i)} + \theta_0 - y^{(i)}]^2$$

- make updation to your θ , so that it becomes a better θ

$$y = (x-5)^2$$

for what value of x
y will be minimum?



$$\frac{\partial y}{\partial x} = \frac{\partial (x-5)^2}{\partial x} = 2(x-5) = 0$$

$x=5$

Gradient Descent