Linear Regression

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Types of ML

Supervised Learning

Unsupervised Learning

Reinforcement Learning

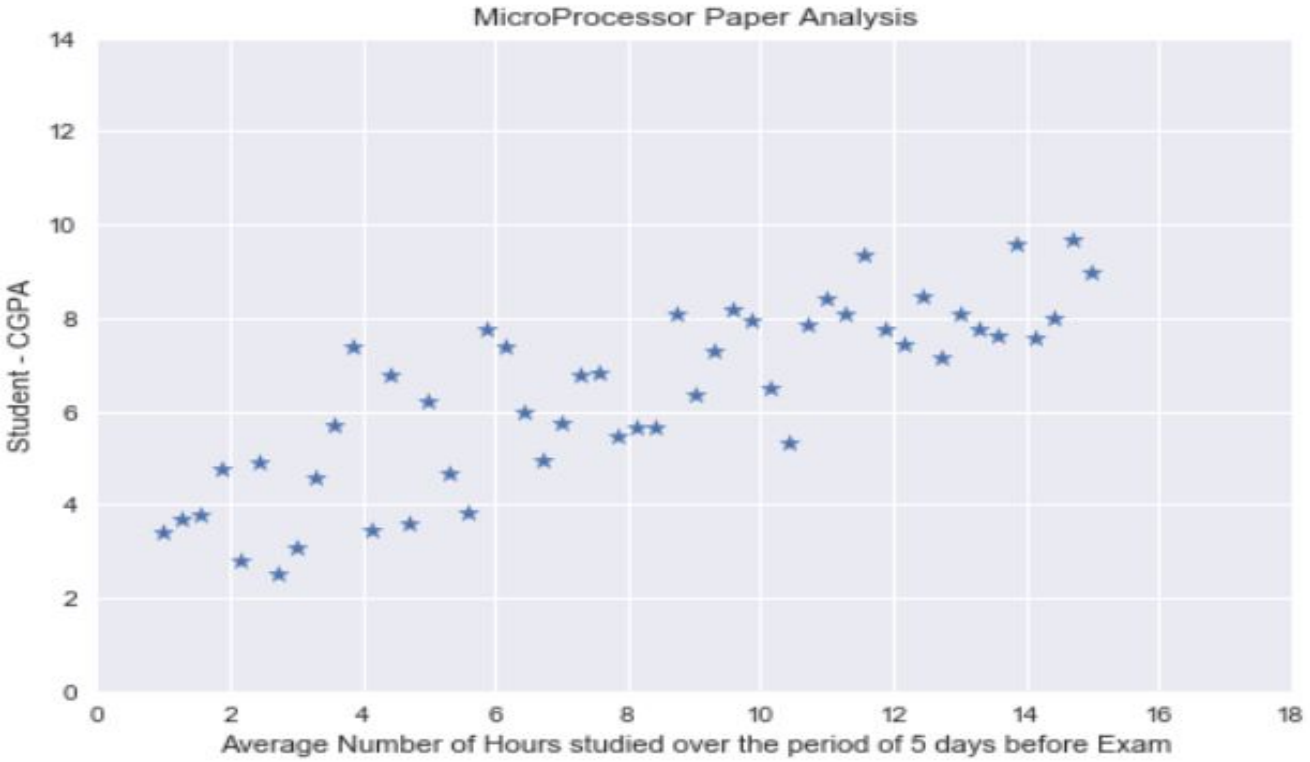
Univariate Linear Regression

Univariate linear regression focuses on determining relationship between one independent variable(X) and one dependent variable(Y).

X(CGPA)	Label(Y) (Number of hrs. study)
7.8	6.6
9.4	12
8.8	10
8.3	9.5
7.3	6
…..	…..

Dataset

Focus : - CGPA Vs Hours of Study(Not Attendence)



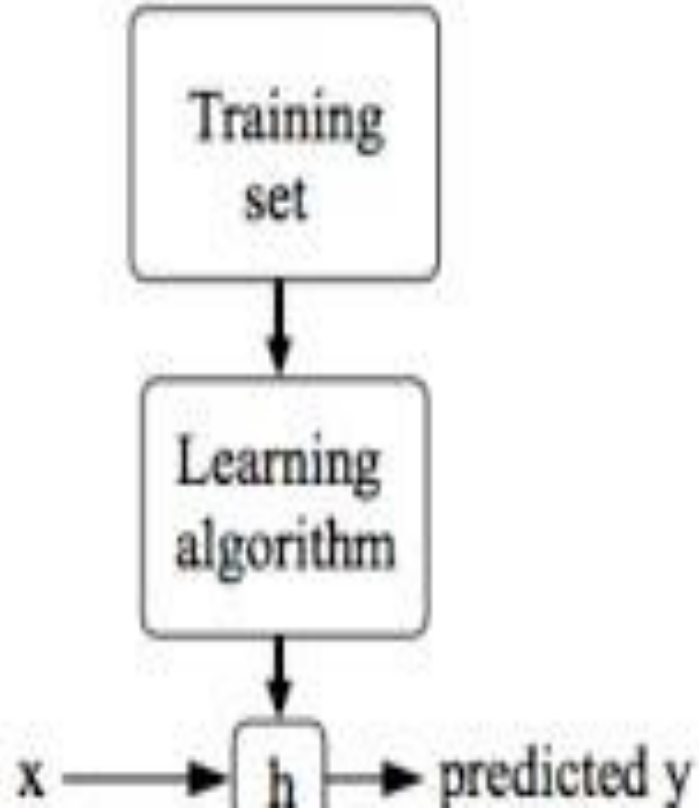
Some Common Terms

Input Features

Training Set

Test Set

Hypothesis


Training set
Learning algorithm
x
h
predicted y

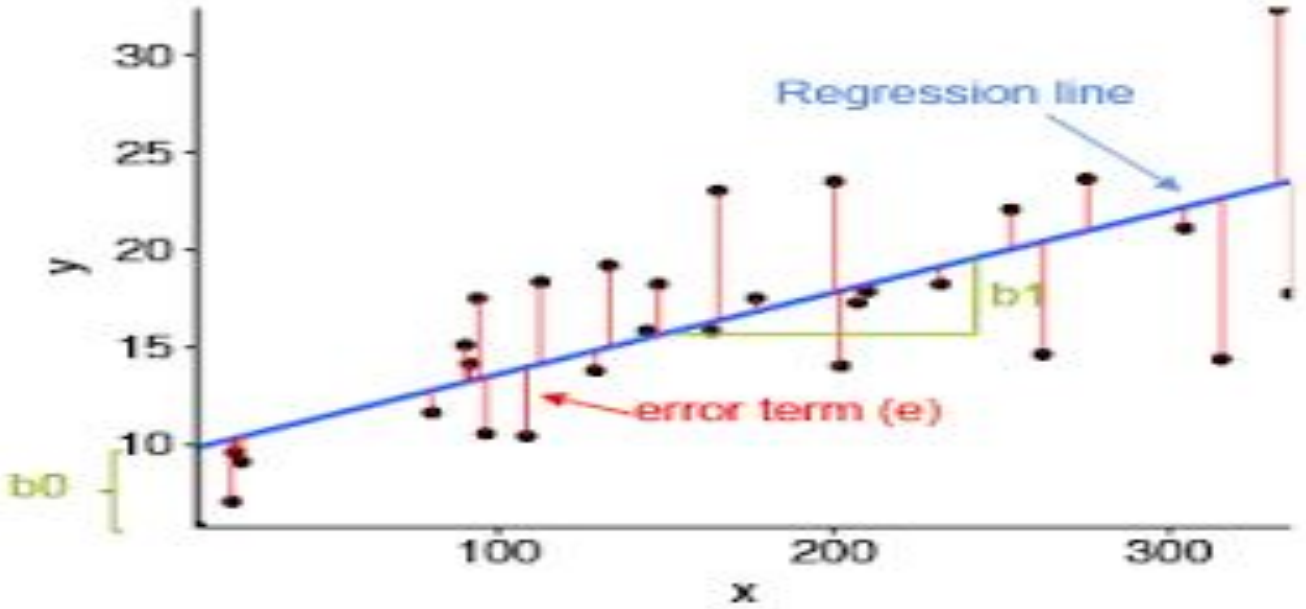
Supervised Learning

Goal : To find a hypothesis that maps X(input) to Y(output)

$$H : X \rightarrow Y$$

Q - How to find line(hypothesis)?

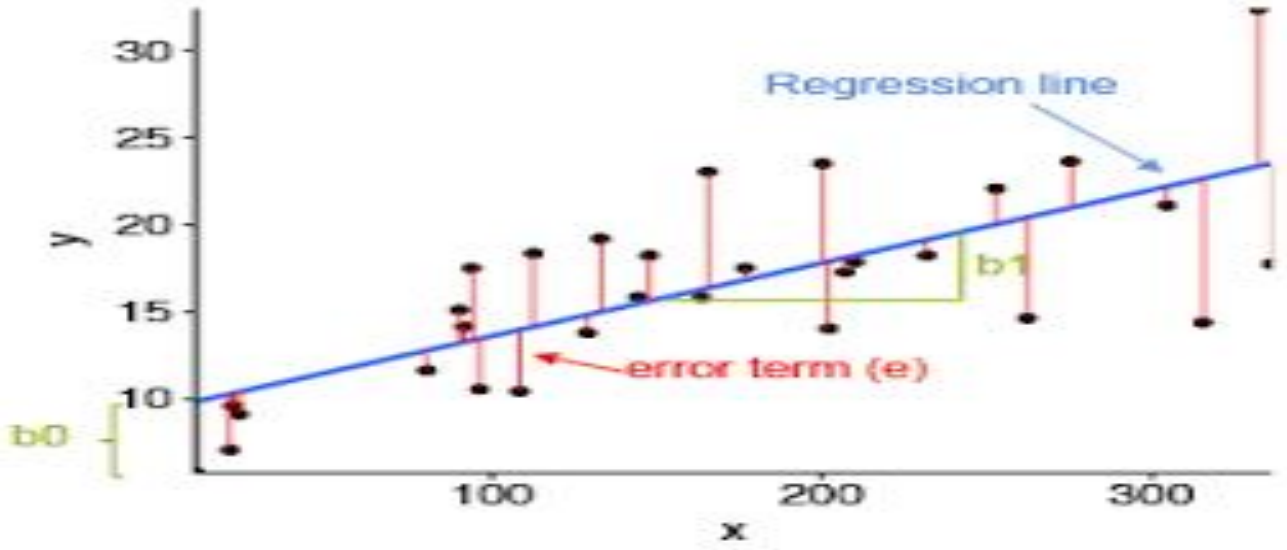
Q - What is the measure of finding Best line ?



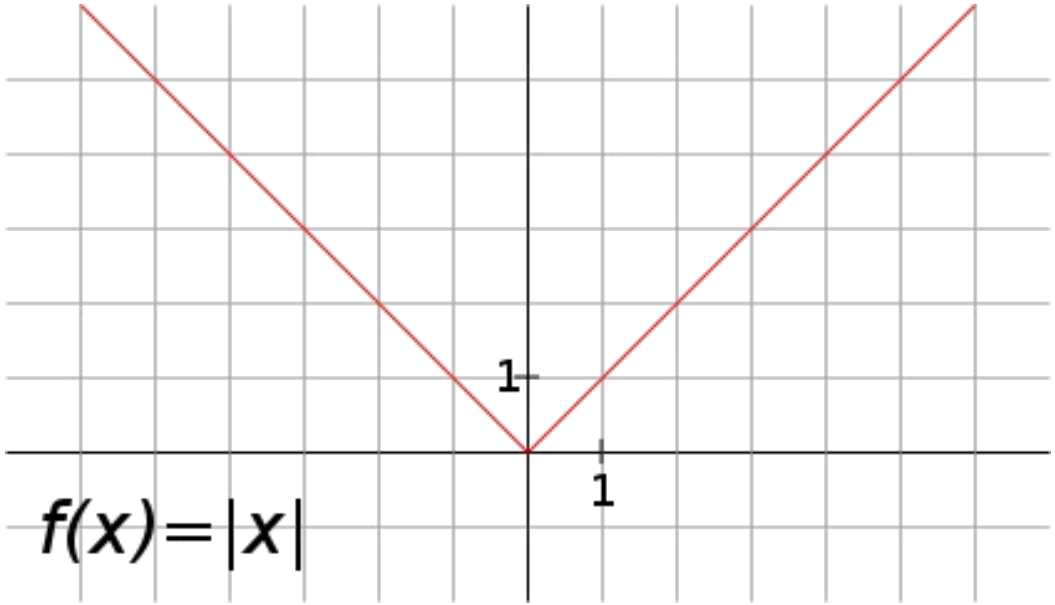
Ans - Error Function (How?)

Choice of Error Function

1. $\sum (Y_{pred} - Y_{actual})$ -ve and +ve error added up

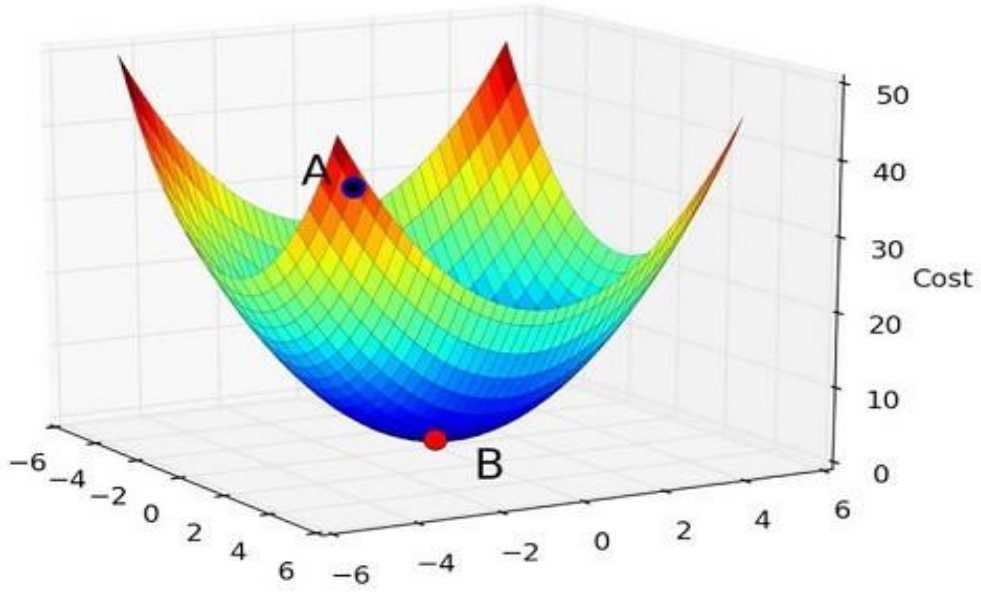


2. $\sum | (Y_{pred} - Y_{actual}) |$ Non-differentiable at (Ypred == Yactual)



3. $$\sum (Y_{pred} - Y_{actual})^2$$

Perfect, and this function is Convex in Nature(Helpful)

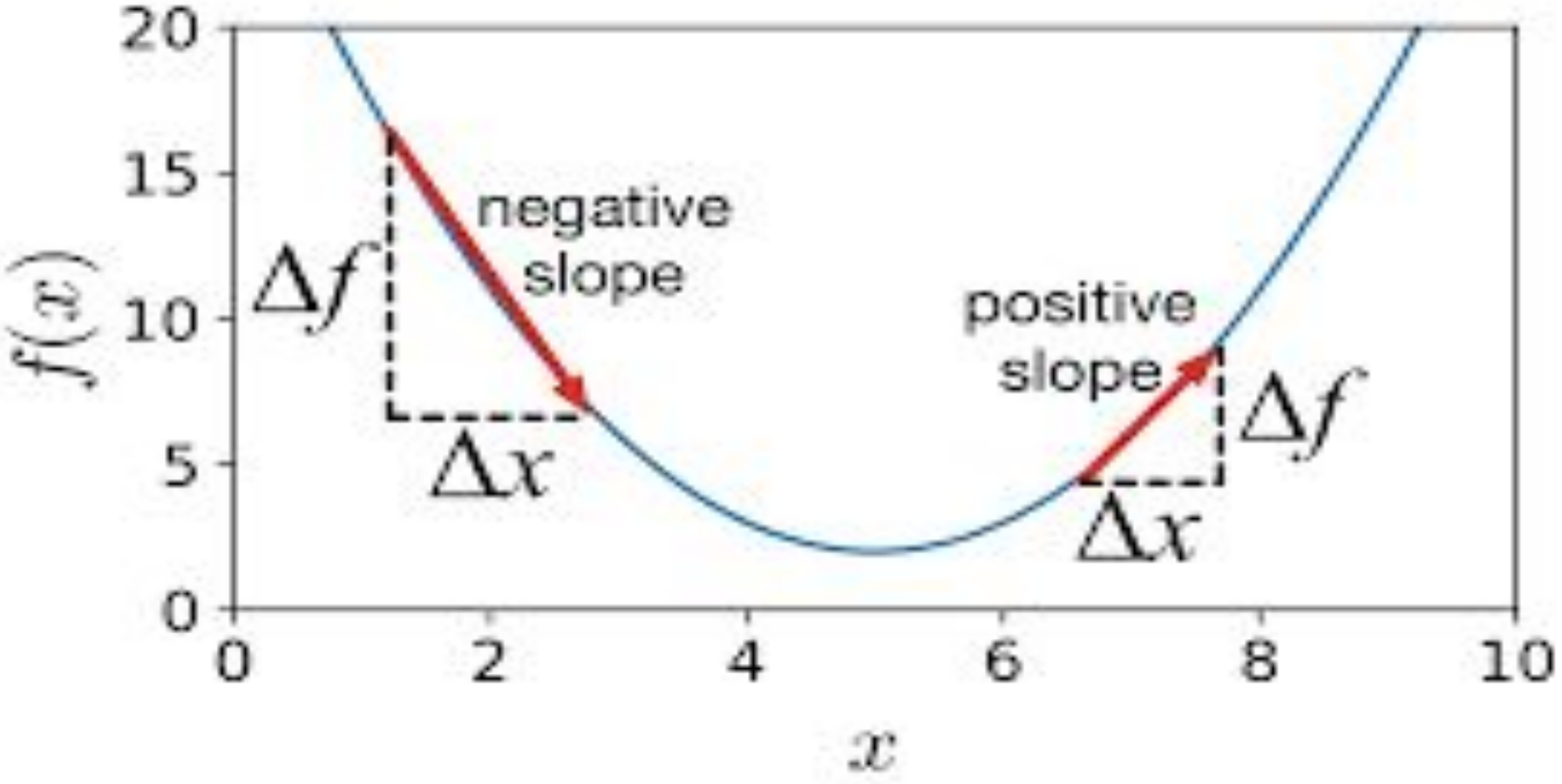


Goal - Minimizing the Error Function

Gradient Descent

1. *An Iterative method to move toward the minimum point(using Gradient).*

2. **Gradient descent** is an optimization algorithm used to minimize some function by iteratively moving in the direction of **steepest descent** as defined by the negative of the **gradient**. In machine learning, we use **gradient descent** to update the parameters of our model.


20
15
10
5
0
0
2
4
6
8
10
$f(x)$
x
Δf
Δx
negative
slope
positive
slope
Δf
Δx

Updation Rule

Hypothesis: $h_\theta(x) = \theta_0 + \theta_1 x$

repeat until convergence {

$$\theta_j := \theta_j - \alpha \frac{\partial}{\partial \theta_j} J(\theta_0, \theta_1)$$

(for $j = 1$ and $j = 0$)

}

Convergence Criteria

- Number of Iteration

- Change in Error

Let’s See the code (Working!)

- Visualizing Line(Hypothesis)
- Behaviour of Error Function using no. of iteration, change in error.
- Learning rate Variation
- Visualizing Convex Function