

## **Linear Regression (Difficulty: 1/3)**

Linear Regression is one of the simplest and most widely used machine learning algorithms. It helps us understand the relationship between two variables by fitting a straight line to the given data points.

### **1. What is Linear Regression?**

Linear Regression tries to model the relationship between a dependent variable ( $y$ ) and an independent variable ( $x$ ) by fitting a line of the form:

$$y = m \cdot x + c$$

- $m$  = slope of the line
- $c$  = intercept (value of  $y$  when  $x = 0$ )

### **2. Why is it useful?**

- Predicting future values
- Identifying trends
- Understanding how two variables are related

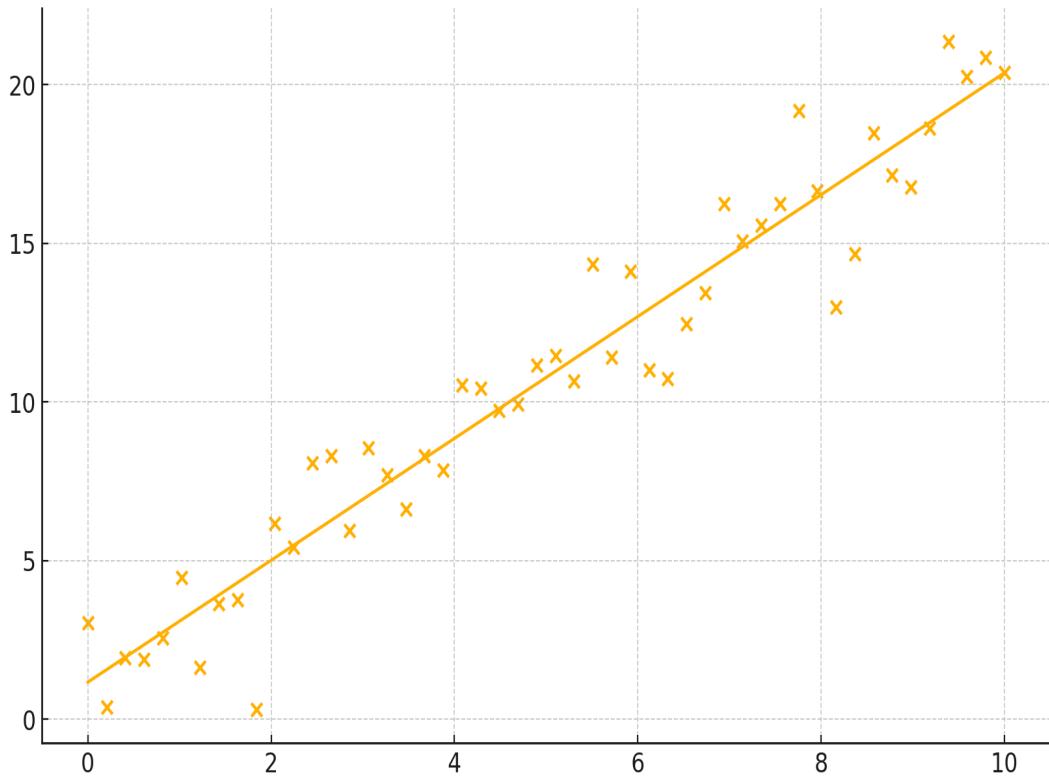
### **3. How does it work?**

Linear Regression finds the best-fitting line by minimizing the error between the predicted values and actual values. This is usually done using the "Least Squares Method."

### **4. Example**

If we want to predict a student's marks based on hours studied, Linear Regression can help discover a pattern and form an equation that predicts marks for any number of hours studied.

Below is a simple example of Linear Regression plotted on a graph:



## 5. Key Terms

- **Data Points:** The actual observed values.
- **Regression Line:** The line that best fits the data.
- **Error:** Difference between actual and predicted values.
- **Overfitting/Underfitting:** When the model learns too much noise or too little pattern.

## 6. Advantages

- Very simple to understand
- Fast to compute
- Works well for linearly related data

## 7. Limitations

- Doesn't work well for non-linear data
- Sensitive to outliers

## Conclusion

Linear Regression is the foundation of many advanced machine learning models. Understanding it makes it easier to learn more complex algorithms later.

## End of Notes