




**Title:** Linear Regression in Machine Learning

**Introduction:** Welcome to the presentation on Linear Regression, one of the fundamental algorithms in machine learning.



## ► Agenda:

- Definition and purpose of linear regression.
- Assumptions and limitations.
- Simple linear regression.
- Multiple linear regression.
- Evaluation metrics.
- Real-world applications.
- Conclusion and Q&A.

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- ▶ **Definition:** Linear regression is a supervised learning algorithm used to model the relationship between a dependent variable and one or more independent variables by fitting a linear equation to observed data.
  - ▶ **Purpose:** It is primarily used for predicting continuous numeric values and understanding the relationship between variables.



## ► Assumptions of Linear Regression:

- Linear relationship: Assumes a linear relationship between the independent and dependent variables.
- Independence: Assumes that the observations are independent of each other.
- Homoscedasticity: Assumes constant variance of errors.
- Normality: Assumes that errors are normally distributed.
- No multicollinearity : Assumes no high correlation among the independent variables.

## ▶ Simple Linear Regression:

### ▶ Definition:

Simple linear regression involves a single independent variable and one dependent variable.

### ▶ Equation:

$y = mx + c$ , where  $y$  is the dependent variable,  $x$  is the independent variable,  $m$  is the slope, and  $c$  is the intercept.

### ▶ Training process:

Minimizing the sum of squared errors to obtain the best-fit line.

### ▶ Example:

Predicting house prices based on the area of the house.

## ► Multiple Linear Regression:

### ► Definition:

Multiple linear regression involves multiple independent variables and one dependent variable.

### ► Equation:

$y = b_0 + w_1x_1 + w_2x_2 + \dots + w_nx_n$ , where  $y$  is the dependent variable,  $x_1, x_2, \dots, x_n$  are the independent variables, and  $b_0, w_1, w_2, \dots, w_n$  are the coefficients.

### ► Training process:

Using methods like Ordinary Least Squares (OLS) or gradient descent to estimate the coefficients.

### ► Example:

Predicting a car's fuel efficiency based on various factors such as engine displacement, weight, and horsepower.





## ► Evaluation Metrics:

- **Mean Squared Error (MSE):**

Measures the average squared difference between the predicted and actual values.

- **R-squared ( $R^2$ ):**

Represents the proportion of the variance in the dependent variable that is predictable from the independent variables.

- **Root Mean Squared Error (RMSE):**

The square root of MSE, providing the error magnitude in the original units.



## ► Real-World Applications:

- Stock market prediction.
- Sales forecasting.
- Medical diagnosis and prognosis.
- Weather prediction.
- Demand forecasting.
- Economic modeling.
- Sports analytics.





## ► Conclusion:

- Linear regression is a powerful and widely-used algorithm for predicting continuous numeric values and understanding relationships between variables.
- It assumes a linear relationship between the independent and dependent variables.
- Simple linear regression involves one independent variable, while multiple linear regression deals with multiple variables.
- Proper evaluation metrics are essential to assess the model's performance.
- Linear regression finds applications in various fields and domains.



Thank you !