



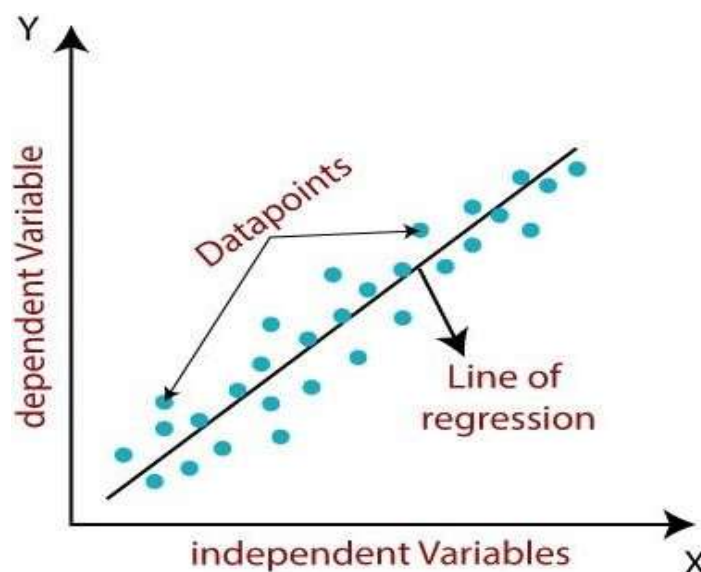
Supervised Learning:

- Find the class labels or value of the new input, given the dataset.
- MACHINE LEARNING –
- Reinforcement learning: Learn to act in a way that maximizes the future rewards (or minimizes a cost function) –
- In game theory: Learn to act in a way that maximized the future rewards, in an environment that contains other machines.

Linear regression

- Linear regression is one of the easiest and most popular Machine Learning algorithms.
- It is a statistical method that is used for predictive analysis.
- Linear regression makes predictions for continuous/real or numeric variables such as sales, salary, age, product price, etc.

The linear regression model provides a sloped straight line representing the relationship between the variables. Consider the below image:





Types of Linear Regression

- Linear regression can be further divided into two types of the algorithm:
- **Simple Linear Regression:**
If a single independent variable is used to predict the value of a numerical dependent variable, then such a Linear Regression algorithm is called Simple Linear Regression.
- **Multiple Linear regression:**
If more than one independent variable is used to predict the value of a numerical dependent variable, then such a Linear Regression algorithm is called Multiple Linear Regression.

Linear Regression Line

- A linear line showing the relationship between the dependent and independent variables is called a **regression line**.
- **Positive Linear Relationship:**
If the dependent variable increases on the Y-axis and independent variable increases on X-axis, then such a relationship is termed as a Positive linear relationship.
- **Negative Linear Relationship:**
If the dependent variable decreases on the Y-axis and independent variable increases on the X-axis, then such a relationship is called a negative linear relationship.

Cost function-

- The different values for weights or coefficient of lines (a_0, a_1) gives the different line of regression, and the cost function is used to estimate the values of the coefficient for the best fit line.
- Cost function optimizes the regression coefficients or weights. It measures how a linear regression model is performing.
- We can use the cost function to find the accuracy of the **mapping function**, which maps the input variable to the output variable. This mapping function is also known as **Hypothesis function**.

Gradient Descent:

- Gradient descent is used to minimize the MSE by calculating the gradient of the cost function.



- A regression model uses gradient descent to update the coefficients of the line by reducing the cost function.
- It is done by a random selection of values of coefficient and then iteratively update the values to reach the minimum cost function.

Model Performance:

- **R-squared method:**
- R-squared is a statistical method that determines the goodness of fit.
- It measures the strength of the relationship between the dependent and independent variables on a scale of 0-100%.
- The high value of R-square determines the less difference between the predicted values and actual values and hence represents a good model.
- It is also called a **coefficient of determination**, or **coefficient of multiple determination** for multiple regression.

Simple Linear regression algorithm has mainly two objectives:

- **Model the relationship between the two variables.** Such as the relationship between Income and expenditure, experience and Salary, etc.
- **Forecasting new observations.** Such as Weather forecasting according to temperature, Revenue of a company according to the investments in a year, etc.

LEAST SQUARES

- The Least Squares Regression Line is the line that makes the vertical distance from the data points to the regression line as small as possible.
- The best line of fit is one that minimizes the variance (the sum of squares of the errors).



- Ordinary least squares regression (OLS) is usually just called “regression” in statistics.
- In the linear regression formula,
The slope is the a in the equation $y = b + ax$.

PEARSON CORRELATION EQUATION for calculating is used

LEAST SQUARE FITTING

- Least squares fitting (also called least squares estimation) is a way to find the [best fit](#) curve or line for a set of points.
- In this technique, the [sum of the squares](#) of the offsets ([residuals](#)) are used to estimate the best fit curve or line instead of the absolute values of the offsets.
- The resulting equation gives you a y-value for any x-value, not just those x and y values plotted with points.

Ordinary Least Squares

- [Ordinary least squares regression is a way to find the line of best fit for a set of data. It does this by creating a model that](#) minimizes the sum of the squared vertical distances ([residuals](#)).