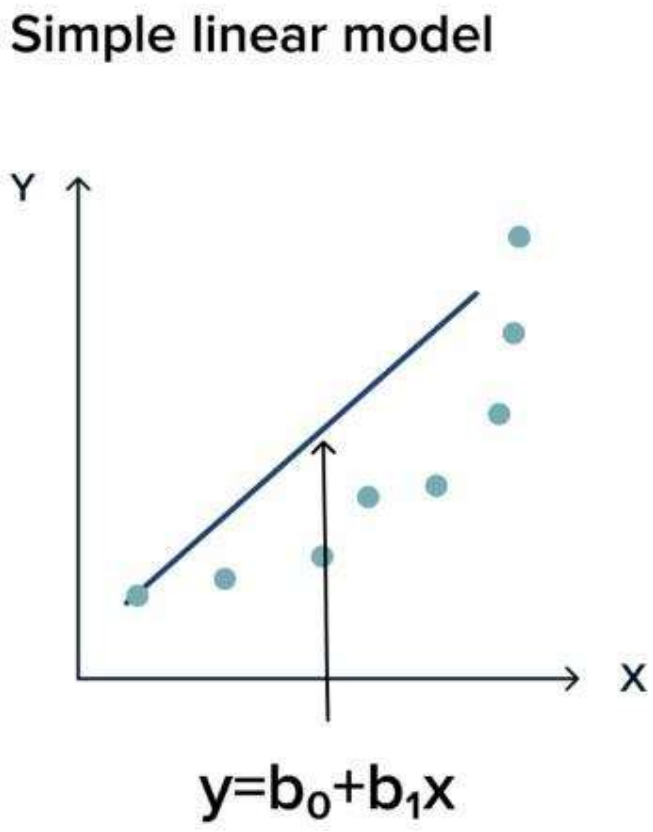
Linear Regression is a versatile statistical technique used for modeling the relationship between a dependent variable and one or more independent variables. There are various types of linear regression models, each designed to address specific scenarios and data characteristics.

1. Simple Linear Regression

Simple linear regression involves predicting a dependent variable based on a single independent variable.



Simple Linear Regression

Formula:

$Y=\beta 0+\beta 1X+\epsilon$

where,

- Y is the dependent variable
- X is the independent variable
- $\beta 0$ is the intercept
- $\beta 1$ is the slope
- ϵ is the error term.

Example: Predicting a student's test score (Y) based on the number of hours he studied (X).

2. Multiple Linear Regression

Multiple linear regression extends simple linear regression by incorporating multiple independent variables.

Formula:

$Y=\beta 0+\beta 1X1+\beta 2X2+\cdots+\beta nXn+\epsilon$

where,

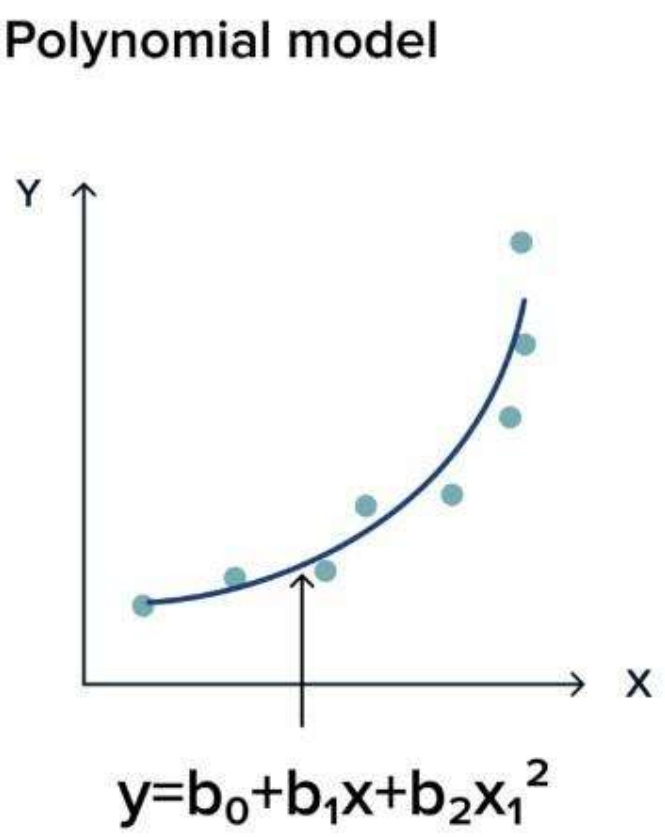
- $X1, X2, \ldots, Xn$ are the independent variables
- $\beta 1, \beta 2, \ldots, \beta n$ are their respective coefficients
- $\beta 0$ is the intercept

The goal of the algorithm is to find the best-fit Line equation that can predict the values based on the independent variables.

Example: Predicting house prices (Y) based on variables like square footage (X_1), number of bedrooms (X_2), and location (X_3).

3. Polynomial Regression

Polynomial regression captures non-linear relationships by including polynomial terms of the independent variable.



Polynomial Regression

Formula:

$Y=\beta 0+\beta 1X+\beta 2X2+\beta 3X3+\cdots+\beta nXn+\epsilon$

where,

- $X$is the independent variable
- n determines the degree of the polynomial
- $\beta 1,\beta 2,\ldots,\beta n$ are their respective coefficients

Example: Modeling the trajectory of a projectile (Y) based on time (X) using a quadratic equation.