Linear Models

1. Simple Linear Regression

Simple Linear Regression is a statistical method used to find the relationship between two variables by fitting a straight line.

Components:

1. **Dependent Variable (Y)**: The variable you want to predict (e.g., house price).
2. **Independent Variable (X)**: The variable used for prediction (e.g., square footage).

Formula

$$y = \alpha + \beta x$$

β = slope

α = y-intercept

y = y- coordinate

x = x-coordinate

Steps:

1. **Collect Data**: Gather data on the dependent and independent variables.
2. **Fit the Model**: Use the data to find the best-fit line by calculating β0\beta_0β0 and β1\beta_1β1.
3. **Make Predictions**: Use the line to predict Y based on new X values.

Example:

- **Data**: Square footage of houses and their prices.
- **Goal**: Predict house price based on square footage.
- **Fit Line**: Find the line that best fits the data points.

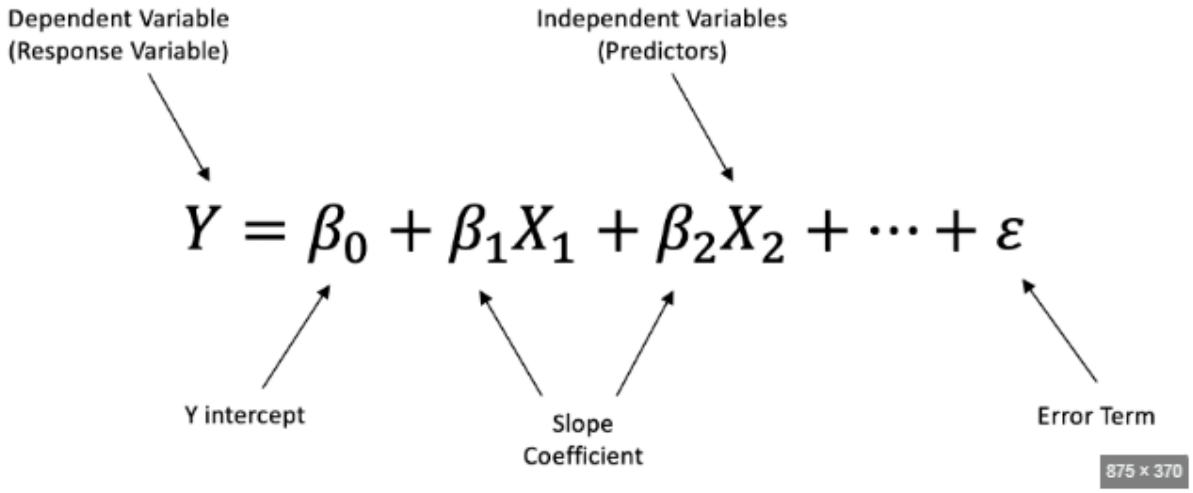
2. Multiple Linear Regression

Multiple Linear Regression is an extension of simple linear regression where multiple independent variables are used to predict a single dependent variable.

Components:

1. **Dependent Variable (Y)**: The variable you want to predict (e.g., house price).
2. **Independent Variables (X1,X2,X3,……)**: Multiple variables used for prediction (e.g., square footage, number of bedrooms, age of the house).

Equation:



Example:

- **Data**: Square footage, number of bedrooms, and age of houses along with their prices.
- **Goal**: Predict house price using these multiple factors.
- **Fit Model**: Determine the best-fit line considering all the variables.

Summary: Multiple linear regression helps predict an outcome by considering the combined effects of several independent variables.

3.Polynomial Regression

Polynomial Regression is a type of regression analysis where the relationship between the independent variable(s) and the dependent variable is given as nth-degree polynomial.

Components:

1. **Dependent Variable (Y)**: The variable you want to predict (e.g., car price).
2. **Independent Variable (X)**: The variable used for prediction, but raised to various powers (e.g., mileage, mileage squared, etc.).

Equation:

$$y = b_0 + b_1 x_1 + b_2 x_1^2 + \ldots + b_n x_1^n$$

Example:

- **Data**: Mileage of cars and their prices.
- **Goal**: Predict car price using mileage with a polynomial relationship (e.g., price may decrease rapidly at first, then level off).
- **Fit Model**: Determine the best-fit curve that follows the data trend.

Summary: Polynomial regression models complex, non-linear relationships by fitting a curve (rather than a straight line) to the data, providing a better fit for certain types of data where the relationship isn't strictly linear.