Regression – Variants

Multiple Linear regression

- Multiple linear regression is a machine learning model used to model the relationship between two or more independent variables (also known as predictors or features) and a dependent variable (also known as the response variable or target).
- It extends simple linear regression, which models the relationship between one independent variable and a dependent variable, to accommodate multiple predictors.
- $\hat{y} = \theta_0 x_0 + \theta_1 x_1 \, \theta_2 x_2 + \ldots + \theta_d x_d$

Polynomial Regression

- Polynomial regression is a form of regression model where the relationship between the independent variable x and the dependent variable y is modeled as an k-degree polynomial.
- Unlike simple linear regression or multiple linear regression, which assume a linear relationship between features and the target, polynomial regression allows for more complex, nonlinear relationships to be captured.

Polynomial Regression

- $y = \theta_0 x_0 + \theta_1 x_1 + \theta_2 x_1^2 + \cdots + \theta_k x_1^k$
- $y = \theta_0 x_0 + \theta_1 x_1 + \theta_2 x_2 + \theta_3 x_1^2 + \theta_4 x_2^2 + \theta_5 x_1 x_2$

Simple Polynomial Regression

- $y = \theta_0 x_0 + \theta_1 x_1 + \theta_2 x_1^2 + \theta_3 x_1^2$
- $X = \begin{bmatrix} 1 & 2.5 \\ 1 & 1.7 \\ \dots & \dots \\ \dots & \dots \\ 1 & 2.8 \end{bmatrix} \quad y = \begin{bmatrix} 7.2 \\ 3.7 \\ \dots \\ \dots \\ \dots \end{bmatrix}$

Simple Polynomial Regression

- $y = \theta_0 x_0 + \theta_1 x_1 + \theta_2 x_2 + \theta_3 x_3$
- $X = \begin{bmatrix} x_0 & x_1 & x_1^2 & x_1^3 \\ 1 & 2.5 & 6.25 & 15.6 \\ 1 & 1.7 & 2.89 & 4.9 \\ \dots & \dots & & \\ \dots & \dots & & \\ 1 & 2.8 & 7.84 & 21.95 \end{bmatrix}$ $y = \begin{bmatrix} 7.2 \\ 3.7 \\ \dots \\ \dots \\ 11.2 \end{bmatrix}$