

Regression: Types, Evaluation Metrics & Formulae

STATISTICS & MACHINE LEARNING OVERVIEW

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What is Regression?

Regression is a supervised learning technique to model the relationship between dependent variable (Y) and independent variable(s) (X).

Used for prediction, identifying relationships, and understanding trends.

Types of Regression - Part 1

Linear Regression: Models relationship as a straight line.

$$\text{Equation: } Y = \beta_0 + \beta_1 X + \varepsilon$$

Multiple Linear Regression: Uses multiple predictors.

$$\text{Equation: } Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \varepsilon$$

Polynomial Regression: Fits a curve instead of a line.

$$\text{Equation: } Y = \beta_0 + \beta_1 X + \beta_2 X^2 + \dots + \beta_n X^n + \varepsilon$$

Types of Regression - Part 3

Logistic Regression: Used when dependent variable is binary or categorical.

$$\text{Equation: } P(Y=1 | X) = 1 / (1 + e^{-(\beta_0 + \beta_1 X)})$$

Nonlinear Regression: Models nonlinear relationships.

Evaluation Metrics

Mean Absolute Error (MAE): $MAE = (1/n) \sum |y_i - \hat{y}_i|$

Mean Squared Error (MSE): $MSE = (1/n) \sum (y_i - \hat{y}_i)^2$

Root Mean Squared Error (RMSE): $RMSE = \sqrt{(1/n) \sum (y_i - \hat{y}_i)^2}$

R-Squared (R^2): $R^2 = 1 - (SS_{res} / SS_{tot})$

Adjusted R^2 : $1 - (1 - R^2)(n-1)/(n - p - 1)$

Mean Absolute Percentage Error (MAPE): $MAPE = (100/n) \sum |(y_i - \hat{y}_i)/y_i|$

Summary

Regression models continuous outcomes and relationships.

Types include Linear, Multiple, Polynomial, Logistic, and others.

Evaluation metrics include MAE, MSE, RMSE, R^2 , Adjusted R^2 , and MAPE.