Theory

POLYNOMIAL REGRESSION

Polynomial Regression is an extension of linear regression used to model the relationship between an independent variable (x) and a dependent variable (y) when the relationship is non-linear. Instead of fitting a straight line, polynomial regression fits a curve by using polynomial terms of x.It is commonly used when data shows curvature and cannot be accurately represented by a straight line.The general form of a polynomial regression equation is**: $y = a_0 + a_1x + a_2x^2 + a_3x^3 + ... + a_nx^n$ where $a_0, a_1, a_2, ..., a_n$** are regression coefficients n is the degree of the polynomial

MATHEMATICAL FOUNDATION:

Polynomial regression is based on the Least Squares Method, where the sum of squared differences between observed and predicted values is minimized. Error for each data point: $e_i = y_i - \hat{y}_i$

ALGORITHM STEPS:

1.Read number of data points (n) 2.Read degree of polynomial (d) 3.Read n pairs of x and y values 4.Generate polynomial terms**: $x, x^2, x^3, ..., x^d$** 5.Construct normal equations using least squares method 6.Form matrix equations **AX = B** 7.Solve the system using Gaussian elimination or matrix inversion 8.Obtain coefficients **$a_0, a_1, a_2, ..., a_n$** 9.Display polynomial regression equation

ADVANTAGES:

Can model non-linear relationships Flexible curve fitting Simple extension of linear regression Widely used in data analysis and prediction Does not require non-linear optimization

DISADVANTAGES:

Sensitive to outliers Overfitting for high-degree polynomials Poor extrapolation outside data range Increased computational complexity Requires careful degree selection