

Machine Learning Foundations

Tutorial-Week 4

Instructor:
Abhinandan Pandey
IIT Madras Online Degree



Polynomial Regression

Let us understand polynomial regression by fitting following data points to a second degree polynomial

x	y
1	3
2	1.5
3	2.5

$$y = \theta_0 + \theta_1 x + \theta_2 x^2 \quad \text{--- (1)}$$

$(x_1, y_1), (x_2, y_2) \text{ and } (x_3, y_3)$

$$y_1 = \theta_0 + \theta_1 x_1 + \theta_2 x_1^2 \quad \text{--- (2)}$$

$$y_2 = \theta_0 + \theta_1 x_2 + \theta_2 x_2^2 \quad \text{--- (3)}$$

$$y_3 = \theta_0 + \theta_1 x_3 + \theta_2 x_3^2 \quad \text{--- (4)}$$



$$\begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \begin{bmatrix} \theta_0 \\ \theta_1 \\ \theta_2 \end{bmatrix}$$

$$\begin{bmatrix} \theta_0 \\ \theta_1 \\ \theta_2 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}^{-1} \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix}$$

$$\begin{aligned} x_1 &= 1 & y_1 &= 3 \\ x_2 &= 2 & y_2 &= 1.5 \\ x_3 &= 3 & y_3 &= 2.5 \end{aligned}$$

$$\begin{bmatrix} \theta_0 \\ \theta_1 \\ \theta_2 \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 3 & 9 \end{bmatrix}^{-1} \begin{bmatrix} 3 \\ 1.5 \\ 2.5 \end{bmatrix}$$



$$\begin{aligned}\theta_0 &= 7 \\ \theta_1 &= -5.25 \\ \theta_2 &= 1.25\end{aligned}$$

$$\begin{aligned}y &= 7 + (-5.25)x + 1.25x^2 \\ y &= 7 - 5.25x + 1.25x^2\end{aligned}$$

