$f(x) = w_0 + w_1 x + w_2 x^2 = \sum_{i=0}^{2} w_i x^i$ $\quad f(x) = \sum_{i=0}^{N} w_i x^i$ $\quad w$ = vector of coefficients

Task 4

1 Identify the knowns and unknowns in the polynomial

w_0, w_1, w_2, x (unless provided)

2. Linear or non in w

Linear in w because w_0, w_1, w_2 involve x^i

this means Linear Regression

3 Linear or non in X

non

4. outline Algorithm using Least squres

$$X = \begin{bmatrix} 1 & x_1 & x_1^2 \\ 1 & x_2 & x_2^2 \\ 1 & x_3 & x_3^2 \end{bmatrix} \quad Y = \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} \quad W = [w_0, w_1 w_1]^T$$

$$\downarrow$$

$$W = (X^T @ X)^{-1} X^T @ Y$$

5 just extend X to NxN size

y to N size

w to transpose all w_i

Task 5

The projection matrix $P = A(A^TA)^{-1}A^T$

is equal to identity sometimes

1 Example of a design matrix $P = I$

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

2. Why usually not for projection?

Because a projection with identity does absolutely nothing

3 prove a condition $P = I$

$$\alpha = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$P = \alpha(\alpha^T\alpha)^{-1}\alpha^T = I$$