

Quiz#2 of ESE 417 FL2024: (09/19, 12:35PM~12:50PM)

Consider a regression problem with the data set in the table, where  $x_1, x_2$  and  $x_3$  are the input features, and  $y$  is the target value. Assuming a linear model is used, i.e.,  $\hat{y} = h_w(\mathbf{x}) = \mathbf{x}^T \mathbf{w}$ , where,  $\mathbf{x} = [1 \ x_1 \ x_2 \ x_3]^T$  is the expended feature vector,  $\mathbf{w} = [w_0 \ w_1 \ w_2 \ w_3]^T$  is the weight vector. Calculate the **sum of squared error (SSE)** over the given data set with  $\mathbf{w} = [1 \ 1 \ 1 \ 1]^T$ .

#	$x_1$	$x_2$	$x_3$	$y$
1	-1.5	0.4	0.1	-1.2
2	-1.2	0.3	0.1	-0.6
3	0	0.2	0.2	0.4
4	1.1	0.1	0.2	1.0
5	1.2	0	0.4	1.5

$$\begin{aligned}
 SSE &= \sum_{i=1}^5 (y_i - \hat{y}_i)^2 \\
 &= \sum_{i=1}^5 (y_i - \vec{x}_i^T \vec{w})^2 \\
 &= \sum_{i=1}^5 \left[ y_i - (1 + x_{i1} + x_{i2} + x_{i3}) \right]^2 \\
 &= [-1.2 - (1 - 1.5 + 0.4 + 0.1)]^2 + [-0.6 - (1 - 1.2 + 0.3 + 0.1)]^2 \\
 &\quad + [0.4 - (1 + 0 + 0.2 + 0.2)]^2 + [1 - (1 + 1.1 + 0.1 + 0.2)]^2 \\
 &\quad + [1.5 - (1 + 1.2 + 0 + 0.4)]^2 \\
 &= (-1.2)^2 + (-0.8)^2 + (-1)^2 + (-1.4)^2 + (-1.1)^2 \\
 &= 6.25
 \end{aligned}$$