Date

HOMEWORK

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Mean square Error $= \frac{1}{N} \sum_{i=1}^{N} (y_i - \hat{y}_i)^2$

$\varepsilon = \frac{1}{N} \sum_{i=1}^{n} (y_i - (ax_i + b))^2$

$\frac{d\varepsilon}{da} = \frac{\partial \frac{1}{N} \sum_{i=1}^{n} (y_i - (ax_i + b))^2}{\partial a}$

$= \frac{1}{N} \sum_{i=1}^{N} \frac{\partial (y_i - ax_i - b)^2}{\partial a}$

$= \frac{1}{N} \sum_{i=1}^{N} 2(y_i - ax_i - b) \cdot -x_i$

$0 = \frac{1}{N} \sum_{i=1}^{N} \{-2x_i y_i + 2ax_i - 2bx_i\}$

$a = \frac{\sum_{i=1}^{N} x_i y_i - b \sum_{i=1}^{N} x_i}{\sum_{i=1}^{N} x_i^2}$

$\frac{\partial \varepsilon}{\partial b} = \frac{1}{N} \sum_{i=1}^{N} \frac{\partial (y_i - ax_i - b)^2}{\partial b}$

$= \frac{1}{N} \sum_{i=1}^{N} 2(y_i - ax_i - b) \cdot -1$

$0 = \frac{1}{N} \sum_{i=1}^{N} [-2y_i + 2ax_i + 2b]$

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$$= \sum_{i=1}^{N} [-y_i + ax_i + b]$$

$$= -\sum_{i=1}^{N} y_i + a\sum_{i=1}^{N} x_i + b \rightarrow b = \sum_{i=1}^{N} y_i - a\sum_{i=1}^{N}$$

SUBSTITUTING A IN ABOVE EQUATION

$$b = \sum_{i=1}^{N} y_i - a\sum_{i=1}^{N} x_i$$

$$b = \sum_{i=1}^{N} y_i - \left(\frac{\sum_{i=1}^{N} x_i y_i - b\sum_{i=1}^{N} x_i}{\sum_{i=1}^{N} (x_i)^2} \right) \sum_{i=1}^{N} x_i$$

$$\sum_{i=1}^{N} x_i^2 b = \sum_{i=1}^{N} y_i \sum_{i=1}^{N} (x_i)^2 - \sum_{i=1}^{N} x_i y_i \sum_{i=1}^{N} x_i + b\sum_{i=1}^{N} x_i \sum_{i=1}^{N} x_i$$

$$b\sum_{i=1}^{N} (x_i)^2 - b\sum_{i=1}^{N} x_i \sum_{i=1}^{N} x_i = \sum_{i=1}^{N} y_i \sum_{i=1}^{N} (x_i)^2 - \sum x_i y_i \sum$$

$$b\left(\sum_{i=1}^{N} x_i^2 - \sum_{i=1}^{N} x_i \sum_{i=1}^{N} x_i\right)$$

$$b = \frac{\sum_{i=1}^{N} y_i \sum_{i=1}^{N} x_i^2 - \sum_{i=1}^{N} x_i y_i \sum_{i=1}^{N} x_i}{\sum_{i=1}^{N} x_i^2 - \sum_{i=1}^{N} x_i \sum_{i=1}^{N} x_i}$$

$$b = \frac{\sum_{i=1}^{N} y_i \sum_{i=1}^{N} x_i^2 - \sum_{i=1}^{N} x_i y_i \sum_{i=1}^{N} x_i}{\sum_{i=1}^{N} x_i^2 - \left(\sum_{i=1}^{N} x_i\right)^2}$$

$$a = \frac{\sum_{i=1}^{N} x_i y_i - b\sum_{i=1}^{N} x_i}{\sum_{i=1}^{N} x_i^2}$$