24-787: Machine Learning and Artificial Intelligence for Engineers
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Homework 9
Due: Mar 30, 2024

Concept Questions:

Problem 1

Problem 1

Given: ground truth vector $y = [-4, 8, 7, -15, 12]$, $n = 5$

prediction vector $\hat{y} = [2, 9, -1, -16, 18]$

Find: MAE, MSE, MAPE

Equations: $MAE = \frac{1}{n}\sum_{i=1}^{n}|y_i - \hat{y}_i|$, $MSE = \frac{1}{n}\sum_{i=1}^{n}(y_i - \hat{y}_i)^2$, $MAPE = \frac{1}{n}\sum_{i=1}^{n}\left|\frac{y_i - \hat{y}_i}{y_i}\right|$

Solutions:

[MAE] $MAE = \frac{1}{5}[|2-(-4)| + |(9-8)| + |(-1-7)| + |(-16-(-15)| + |(18-12)|]$

$MAE = \frac{1}{5}(6+1+8+1+6) \rightarrow MAE = \frac{1}{5}(22) \rightarrow$ **MAE = 4.4 #**

[MSE] $MSE = \frac{1}{5}[(-4-2)^2 + (8-9)^2 + (7-(-1))^2 + (-15-(-16))^2 + (12-18)^2]$

$MSE = \frac{1}{5}(36+1+64+1+36) \rightarrow MSE = \frac{1}{5}(138) \rightarrow$ **MSE = 27.6 #**

[MAPE] $MAPE = \frac{1}{5}\left[\left|\left(\frac{-4-2}{-4}\right)\right| + \left|\left(\frac{8-9}{8}\right)\right| + \left|\left(\frac{7-(-1)}{7}\right)\right| + \left|\left(\frac{-15-(-16)}{-15}\right)\right| + \left|\left(\frac{12-18}{12}\right)\right|\right]$

$MAPE = \frac{1}{5}\left(\frac{3}{2} + \frac{1}{8} + \frac{8}{7} + \frac{1}{15} + \frac{1}{2}\right) \rightarrow$ **MAPE ≈ 0.6669 #**

Problem 2
Matrix 3.

Problem 3
4. (8, 10, 0, 2, 0.8, 1.0, 0.889)