CMPE 302 - Machine Learning Problem Set

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1 Problem 1: Linear Regression using the Closed-Form Solution

Task: Compute the optimal parameters for a linear regression model using the normal equation.

Dataset:

$$X = \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{bmatrix}, \quad Y = \begin{bmatrix} 2.2 \\ 2.8 \\ 3.6 \\ 4.5 \\ 5.1 \end{bmatrix}$$

2 Problem 2: Implementing Gradient Descent for Linear Regression

Task: Train a linear regression model using gradient descent with learning rate $\alpha = 0.01$ and 1000 iterations.

3 Problem 3: Multivariate Linear Regression

Task: Train a multivariate linear regression model on the given dataset.

Dataset:

$$X = \begin{bmatrix} 1 & 2 \\ 2 & 3 \\ 3 & 4 \\ 4 & 5 \\ 5 & 6 \end{bmatrix}, \quad Y = \begin{bmatrix} 2.2 \\ 2.9 \\ 3.7 \\ 4.6 \\ 5.2 \end{bmatrix}$$

4 Problem 4: Comparing Gradient Descent and Closed-Form Solution

Task: Compare the weights obtained from gradient descent and the normal equation for the same dataset.

5 Problem 5: Effect of Outliers on Linear Regression

Task: Add an outlier to the dataset and visualize its impact on the model.