Assignment 1: Bias-Variance Tradeoff

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1. Plot the data point

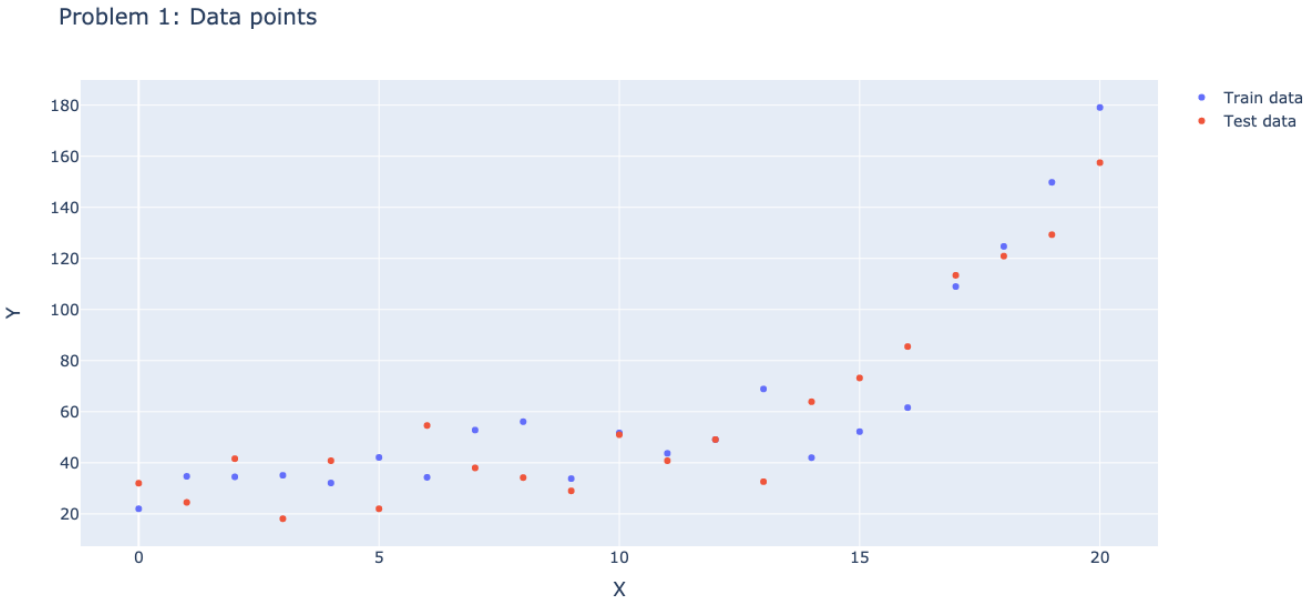

Figure 1: Traning and Test Data Points

2. Fit polynomial order n and plot the training data with best-fit polynomials

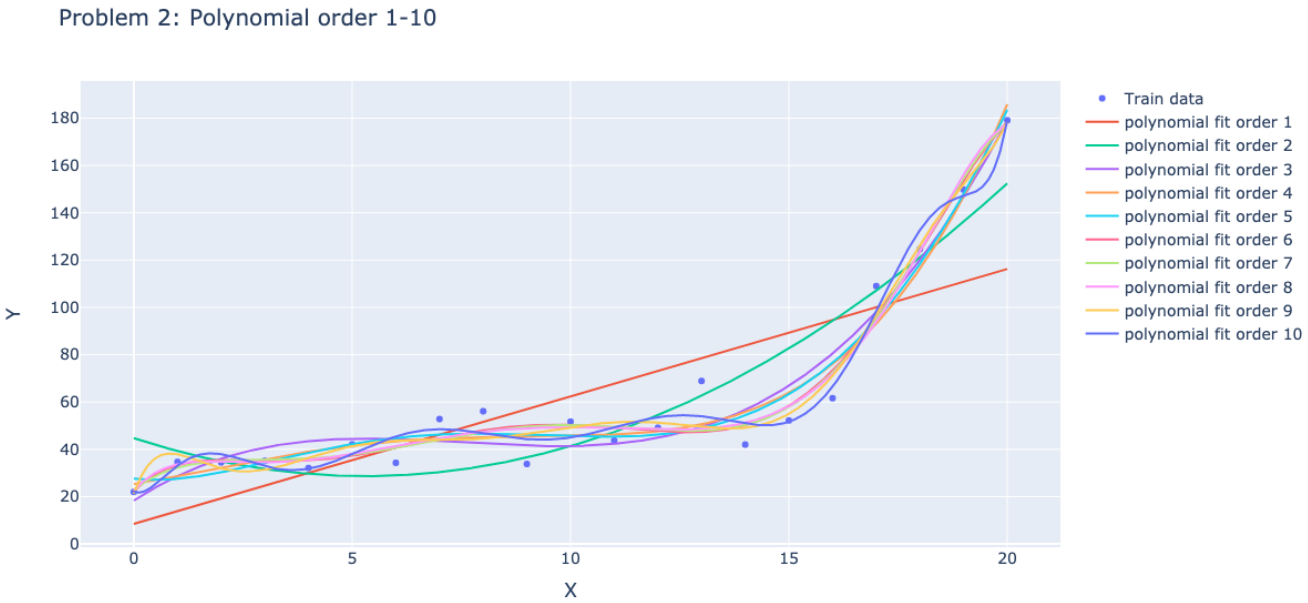

Figure 2: Training data with best-fit polynomial order 1-10

3. Calculate the Mean Squared Error for each best-fit polynomials with respect to training data and plot the MSE as a function of n

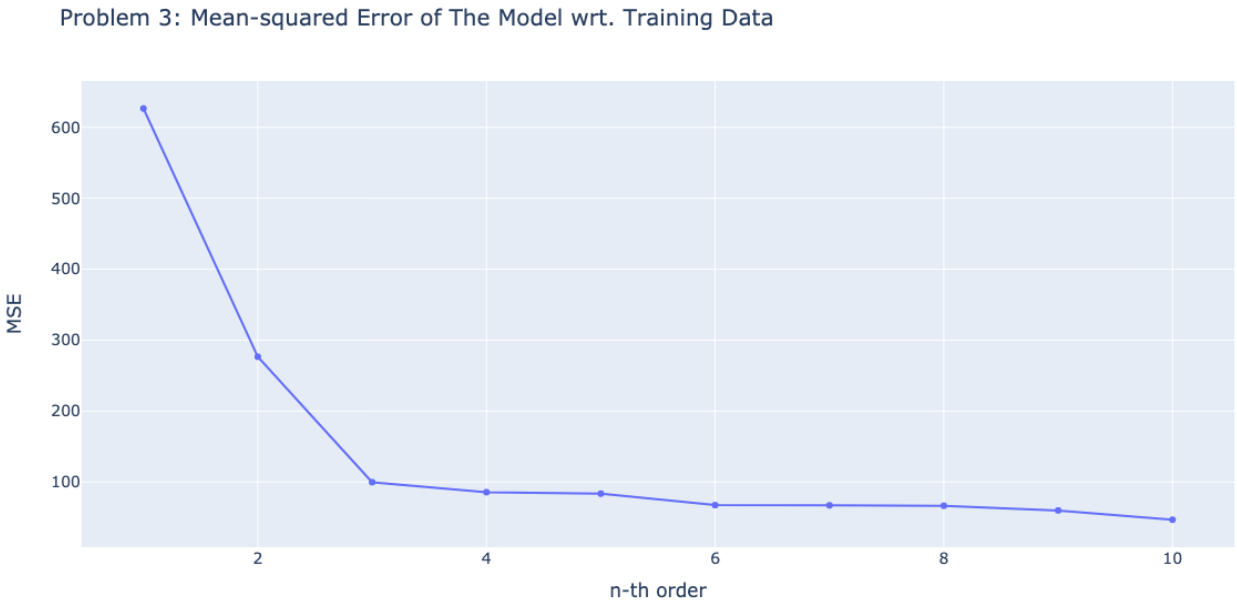

Figure 3: MSE wrt Training data

4. Calculate the MSE for each best-fit polynomials wrt test data and plot the MSE as a function of n

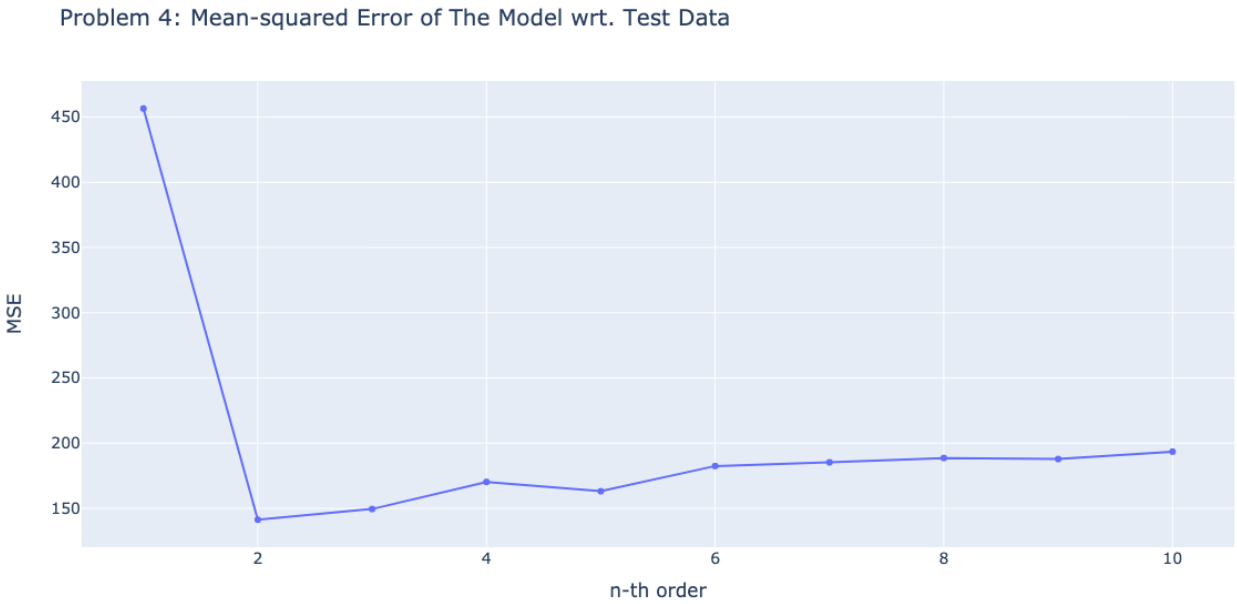

Figure 4: MSE wrt Test data

5. The fig.5 below is shown the combination of fig.3 and fig.4. The MSE determined wrt. the training data was decreased continuously when the order of the polynomial is increased. Oppositely, the MSE determined wrt. the test data was only decreased from order $n = 1$ to $n = 2$ and then increased from order $n = 3$ and so on. The crossover between MSE of the training and test data around order $n = 2$ to $n = 3$ illustrated that the model become over-fitted to the training data since the polynomial order $n = 3$, which can be indicated that the polynomial order $n = 2$ is best-fit polynomial for the system.

Figure 5: MSE of The Polynomial as A Function of n