An Unknown Signal Report

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Abstract

This report demonstrates my understanding of the methods I have used, the results results I have obtained and my understanding of issues such as overfitting for the 'An Unknown Signal' coursework.

1 Equations for linear regression

For a set of points that lie along a line with Gaussian noise $\mathbf{y} = \mathbf{X}\mathbf{w} + \epsilon$ where $\epsilon_i \sim \mathcal{N}(0, \sigma^2)$, the maximum likelihood esimation is equivalent to the least square error estimation and is given by the equation

$$\hat{\mathbf{w}} = (\mathbf{X^T X})^{-1}\mathbf{X^T y}.$$

I've implemented this equation in my code as the following to calculate the maximum likelihood estimation for my training data:

```
ws = np.linalg.inv(X.T @ X) @ X.T @ self.ysTraining.
```

2 Choice of polynomial order

3 Choice of unknown function

4 Procedure for determining function

5 Overfitting

Overfitting occurs when the noise displayed

6 Testing