Machine Learning

ECE 4332 / ECE 5332
Spring 2019

Project 3

1. Generate the data set $\mathcal{D}$ as follows:
   a. $D = 100$
   b. $N = 25$
   c. X contains samples from a uniform distribution $\mathcal{U}(0,1)$.
   d. $t = \sin(2\pi X) + \varepsilon$, where ε contains samples from a Gaussian distribution $\mathcal{N}(0, \sigma = 0.3)$.
2. Select a set of permissible values for the regularization parameter λ.
3. For each value of λ, use the method of "linear regression with non-linear models" to fit Gaussian basis functions to each of the datasets. Use $s = 0.1$.
4. Produce the plot as shown below, where

$$\bar{f}(x) = \frac{1}{D} \sum_{d=1}^{D} f^{(d)}(x)$$

$$(bias)^2 = \frac{1}{N} \sum_{n=1}^{N} \left[\bar{f}(x^{(n)}) - h(x^{(n)}) \right]^2$$

$$variance = \frac{1}{N} \sum_{n=1}^{N} \frac{1}{D} \sum_{d=1}^{D} \left[f^{(d)}(x^{(n)}) - \bar{f}(x^{(n)}) \right]^2$$

5. The test error curve is the average error for a test data set of 1000 points.

Upload your .m or .py file to Blackboard before midnight Friday, March 8.