EE 550
Artificial Neural Networks
Homework 1

Due: 06/03/2020

Least Mean Square (LMS)

This project requires the computation of LMS solution of a multivariate linear model. Consider the following model

$$y(i) = \theta_1 x_1(i) + \theta_2 x_2(i) + \theta_3 x_3(i) + \theta_4 x_4(i)$$

where $\theta_1 = 2.5, \theta_2 = 1, \theta_3 = 4, \theta_4 = 3.5$.

1) Generate 15 data points ($i = 1, 2, \ldots, 15$) where each variable $x_j(i)$ is randomly chosen between 0 and 10.

2) Add zero mean Gaussian noise with standard deviations **Case a)** $\sigma = 0.2$ and **Case b)** $\sigma = 0.4$ to each data points (i.e., $y(i) = \theta_1 x_1(i) + \theta_2 x_2(i) + \theta_3 x_3(i) + \theta_4 x_4(i) + e(i),\ \ e(i) \sim \mathcal{N}(0, \sigma^2)$).

3) For these 15 noise added data points, implement the LMS algorithm (as given in the class) to calculate the estimated model parameters $(\hat{\theta}_1, \hat{\theta}_2, \hat{\theta}_3, \hat{\theta}_4)$ for both cases.

4) For both cases, calculate the LMS error for the estimated model by

$$J = \sum_{i=1}^{15} [y(i) - \hat{y}(i)]^2$$

where

$$\hat{y}(i) = \hat{\theta}_1 x_1(i) + \hat{\theta}_2 x_2(i) + \hat{\theta}_3 x_3(i) + \hat{\theta}_4 x_4(i)$$

NOTES:

1) Please upload all your files (codes and report) to Moodle with the file convention LASTNAME_FIRSTNAME_project1.rar.

2) There will be a demo after due date. During demo, you will asked to download your code from Moodle and run it.

3) Plagiarism will not be tolerated.

4) Late submissions will not be accepted.