

## Quiz/Lab/Homework Math 350

Friday April 11

1. On a separate sheet of paper, compare the three clustering algorithms we have (LBG, SOM, Neural Gas), and in particular, compare how the centers are updated/modified to represent the data.
2. Download the appropriate files and modify the Neural Gas algorithm appropriately to get a clustering of the obstacle course. Publish the results to HTML, print and attach.
3. Download the script file `Quiz8Prob3.m`, along with `lag.m` and `LinearNet.m`. Modify the script to predict the time series. Most of the work is already done- Your job will be to try to understand what is going on!
4. Download the script file `Quiz8Prob4.m`. Modify the script so that the network is adaptively learning the time signal. The setups are below.

### Third and Fourth Exercises

For the third problem, we are training a linear network to predict the current value of a time series by using its previous 5 values. That is, given the scalars (ordering them in time makes them a time series):

$$\{x_1, \quad x_2, \quad x_3, \quad \dots \quad x_p\}$$

We will try to model:

$$\begin{aligned} x_6 &= f(x_5, x_4, x_3, x_2, x_1) \\ x_7 &= f(x_6, x_5, x_4, x_3, x_2) \\ x_8 &= f(x_7, x_6, x_5, x_4, x_3) \\ &\vdots \\ x_p &= f(x_{p-1}, x_{p-2}, x_{p-3}, x_{p-4}, x_{p-5}) \end{aligned}$$

where  $f$  is a linear neural network,

$$f(x_{p-1}, x_{p-2}, x_{p-3}, x_{p-4}, x_{p-5}) = W\mathbf{x} + b$$

The sample points for the training of  $f$  are constructed using the `lag.m` function (already coded for you). The only thing you need to do is to figure out how to call the `LinearNet` function with the right parameters, and show how you can visualize how well the network performed.

The fourth problem is similar to the third, except that we will be training the network **adaptively**, using the Widrow-Hoff learning algorithm. In this case, the underlying data changes periods suddenly during training- How quickly will our network re-learn the predictions?