**ECE 395**

**Assignment 2.1**

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1. **Make the derivation for the closed solution** **w.**

= E [e2] + ||**w**||2

First, we need to create a sample average of the error which we define as

= yi - wt x)2+||w||2)

= yn2 + wT Rw − 2wT p)

Where R = xxT and p = xy. Once we have this, we can compute the gradient and set it equal to 0.

w= (R+I)w-p

0 = (R+I)w-p

w= (R+I)-1 p

1. **Work out an iterative solution using the same technique as the used in the Least Mean Squares algorithm.**

We can use ∆w L(x,w,y) derived in part 1 to develop a gradient descent method :

wk+1= wk-(R+I) wk-p

R = xxT and p = xy.

wk+1= wk-[x(xTwk-yn)+wk]

Where, e = xTwk-yn

wk+1= wk -ex +wk]

wk+1 = (1-) wk – xe

1. **Comment and compare both solutions in a short conclusion section.**

When we compute the gradient with respect to w, we see that the solution involves taking the inverse of (R+I *)* which are the estimates of the data autocorrelation matrix, so depending on how much data is stored in the matrix, this could be a very intensive calculation. Now for the iterative solution, we can see that we only need to multiply the scalars to the stored vector wk and subtract the value xe which should be negligible given we have a small error.