EE 660 # Homework 1 Posted: Friday, 8/28/2015

Due: Friday, 9/4/2015, 3:00 PM

1. Curve fitting as an example of regression, using PMTK.
   1) Download and install PMTK from the following address:
      https://github.com/probml/pmtk3
      Follow its Readme to download and setup.
   2) Run the demo script /demos/linregPolyVsDegree.m
      (a) Attach Figure 1 in your answer.
      (b) Describe how curve shape and MSE change as degree of polynomial increases, and explain why.
   3) Run the demo script /demos/linregPolyVsRegDemo.m
      (a) Attach Figure 1 in your answer.
      (b) What is degree of polynomial? Is it changing during the demo?
      (c) Which variable controls the effect of regularization? Describe how curve shape and MSE change as regularizer increases and why. **Hint:** regularization is introduced in Murphy 7.5.1 (part of Reading Assignment 1), and in Lecture 3.

2. Implement a simple curve fitting problem.
   1) [code] Generate a set of data points with the following lines of Matlab code:

```
% a simple curve fitting script
x = [0:0.5:10]';
y = 0.03 * x.^3 - 0.4 * x.^2 + x + 0.2 + normrnd(0, 0.3, size(x));
```

      We can see that y is a set of points drawn from a polynomial corrupted by Gaussian noise. Plot y as discrete points.
   2) [math] Assume that we know the curve to be fit, $f(x)$, is a 3rd order polynomial. Write down the mean-squared error objective function (criterion function, or function to be minimized) for curve fitting. This is the function that enables the algorithm to learn from the data points.
   3) [math] Represent the objective function in matrix form.
   4) [code] Solve for the curve parameters using pseudo-inverse. Plot the resulting polynomial (as a continuous curve) along with y (as discrete points).
   5) [code] what does your resulting fitted curve give for x=3.25? x=9.75?
   6) [math] How do these values compare with the original expression for y, except without corrupting noise, at those points?

      Attach your Matlab or Python code in your answers.