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ECE 1395

Midterm Review

1. Introduction
   1. Differences between supervised and unsupervised learning
      1. Supervised learning trains a model on known input and output data so that it can predict future outputs
         1. clustering
      2. Unsupervised learning finds hidden patterns or intrinsic structures in input data
         1. Classification and regression
   2. Regression vs classification
      1. Classification predicts discrete responses
         1. Genuine or spam email, cancerous or benign tumor
      2. Regression predicts continuous responses
         1. Changes in temperature, fluctuations in power demand
   3. What makes good features?
      1. Linearly independent and non-redundant, statistically relevant to the variable of interest/output…etc.
   4. Basic MATLAB and linear algebra operations
      1. Yuh
2. Linear regression
   1. What is regression?
      1. Given some features **x**, predict a continuous variable y
      2. Involves fitting a function given training pairs (xi, yi)
   2. What is the objective of the optimization problem for linear regression?
      1. We can create a linear hypothesis of the form . From here, we design a mean-squared-error function . Minimizing this function will give us our optimal theta, which represents the best possible linear regression parameter vector.
   3. How to fit to nonlinear functions
      1. Create new features that are powers of existing features
   4. Derivation of the normal equation
      1. I really hope he doesn’t ask about this
   5. Normal equation vs gradient descent
      1. Gradient descent:
         1. Need to choose alpha
         2. Needs many iterations
         3. Works well when n is large
      2. Normal equation
         1. No need to choose alpha
         2. No need to iterate
         3. Needs to compute
         4. Slow if n is large
3. Gradient descent
   1. When is it guaranteed that gradient descent converges to local minima?