CMSC 409: Artificial Intelligence

Fall 2018, Instructor: Dr. Milos Manic, http://www.people.vcu.edu/~mmanic

Project 3

CMSC 409: Artificial Intelligence
Project No. 3
Due Nov. 20, 2018, noon

Pr.3.
You are given hourly energy consumption data from 5:00AM to 8:00PM in 1 hour interval, for 3 days. Using this data, predict the energy consumption of the 4th day using a single decision unit (neuron) (hint: you can use your code from project 2 as a starting point).
The data is given in 1 hour increments in four text files (please download "Pr3_data.zip"). The training data for the first 3 days are named "*train_data_X.txt*" where "*X*" is the date. Use this data for training. In this example, time units are hours and consumption in kW.

Once the decision unit is trained, predict the energy consumption for the 4th date in 1 hour increments from 5:00AM to 8:00PM. Use the testing data to calculate the error of the prediction. The testing data is in the file "*test_data_4.txt*". (Note: do not use this data for training, the testing data is only for testing.)

Consider the following single-neuron architectures:

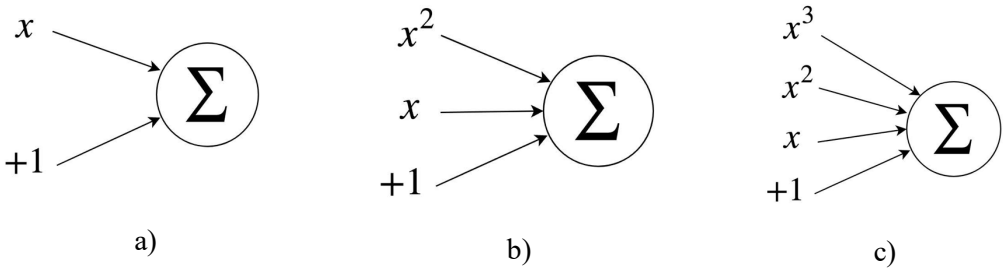

Figure 1: Architectures

1) What are the inputs and outputs for this problem? (Hint: see Session 6).
2) What should be the activation function of your decision unit? Why did you choose it? (Hint: it should output continuous real values **linearly** from –INF to +INF, not asymptotically ending in 0 and 1)
3) Compare the training and testing errors obtained using the architectures on Figure 1:
    a. Train the decision unit on the data from the first 3 days. Report training error for each of the three days. Present a graph (original data vs. trained model), similar to the Figure 2.
    b. Predict the energy consumption of the 4th date. Calculate the error of your prediction using the data for the 4th date. Report testing error. Present a graph (original data vs. trained model), similar to the Figure 2.
4) Report the number of iterations, the learning rate, data pre-processing steps you have chosen (such as normalization of input data). Clearly explain why you selected these values.
5) Could the error be further reduced using a neural network (opposed to a single decision unit)? If so, discuss how and why these methods would reduce the error.

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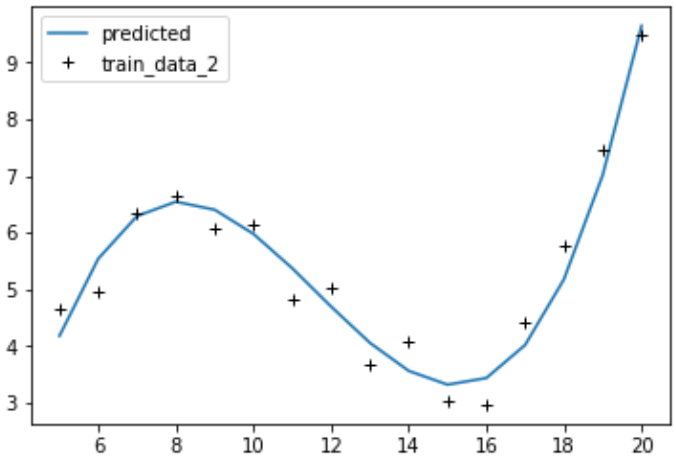

Figure 2: An example of the plot showing training data vs. model predictions

Compile your answers into a single PDF file and submit along with your code.

Note:

1. Your software must be user friendly. The TA must be able to test it simply by executing the code.
2. Hint: you can consider normalization of input data.
3. Project deliverable should be a zip file containing:
    a. Written report with answers to the questions above in word, pdf, ps, or txt format.
    b. The source code.
4. Submit your zip file to Blackboard. Please name the zip file as name it FamilyName_Project3.zip.