Assignment: Perceptron and Shallow Neural Network

Problem 1 (20 points)

An online rental video company is interested in creating a model to make movie recommendations to one of its customers, Ms. X. As a consultant to this company, you are provided with the history of the movies that she accepted or rejected to watch. She makes her selections solely based on the movie's level of violence and critic ratings. The data is in *movieData.csv* on Canvas.

1. Train a perceptron that will create a linear boundary decision that will help the company to make future recommendations to Ms. X. After how many iterations does the algorithm converge?

2. Upon creating a model, plot the boundary line along with all the data points and axes clearly marked.

Problem 2 (40 points)

In this problem you will use the data in *siCoData.csv* file to train a neural network. Use the backpropagation algorithm to train a 3-layer (input, hidden, output) neural network. Use stochastic gradient decent (SGD) technique and assume that the activation function for the hidden layer and output layer are tanh and linear, respectively. (You must write *your own code* for BP and SGD).

1. The stopping criteria for training in this problem should be a combination of achieving a minimum in-sample error

$$E_{in} = \frac{1}{N} \sum_{n=1}^{N} e_n$$

   and reaching a maximum number of epochs (In this expression N is the number of observations in the data set and e_n is the error corresponding to each individual training point). Report the minimum E_{in} that you could achieve along with the related weights and number of iterations.

2. Graph the original data (y vs. x) and the predicted values ($\hat{y}$ vs. x) on two separate scatter plots.