AI Assignment – 2 Report

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OUTLINE:

In this project, we are implementing a 3-layer artificial neural network using ANSI C. We are using only one hidden layer whose neurons we are varying between 5 to 8. We have fixed the learning rate at 0.001 and epsilon (another factor) at 0.001. We are using 2 error function namely:

1. SSD (Sum of Squared Deviation)
2. Cross-Entropy

We are using 2 stopping criteria:

1. Epoch
2. Norm

Implementation:

In this project, we are using a training set of 2216 observation, each observation consisting of 17 features and a test set consisting of 998 observations, each observation consisting of 17 features.

In both the training set and the test set, the first feature of each observation is class label, which we are storing in a different array (in case of training set the dimension of the array is 2216 and in case of test set the dimension is 998) and instead we are keeping bias (unity) in its place. The algorithms for training the perceptron are as follows (one for epoch as stopping criterion and the other for cross-entropy as stopping criterion).

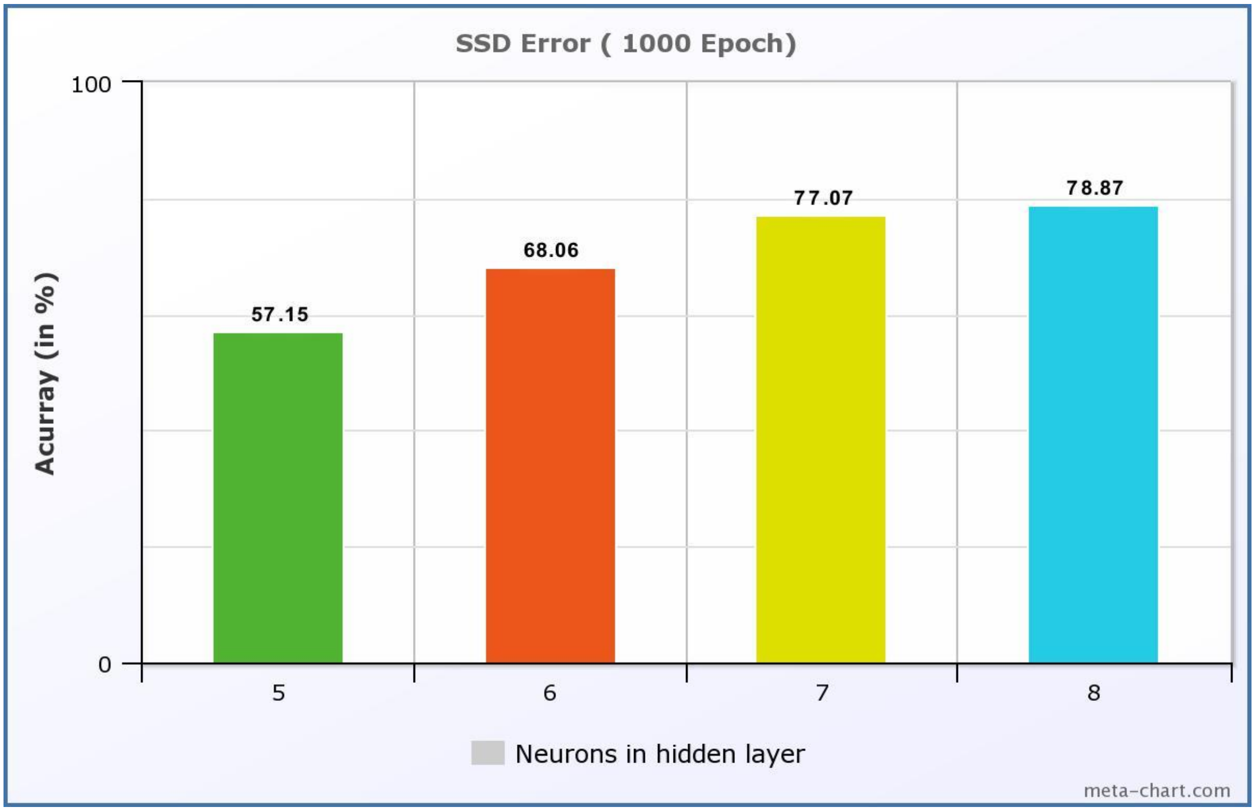
1. Using epoch as stopping criterion: In this case, we are doing forward propagation for each observation and after forward propagation we are calculating delta **W**kj for hidden to output layer and delta **W**ji for input to hidden layer. Using these values, we are updating the weights between input and hidden layer and between hidden and output layer. And then we are repeating this procedure for epoch number of iterations.
2. Using norm as a stopping criterion: In this case, we are doing forward propagation like in 1. After finding forward propagation corresponding to each observation in the training matrix, we are again calculating delta **W**kj and delta **W**ji but in this case instead of updating the weights between the input and the hidden layer and between the hidden and the output layer after, we are calculating the sum of delta **W**ji and delta **W**kj and storing the sum in 2 matrices. After one epoch, we are updating the weights between the layers based on the 2 sum matrices. We are stopping the training of the perceptron when the average of the norm of the 2 sum matrices is less than epsilon (which we have taken to be 0.001).

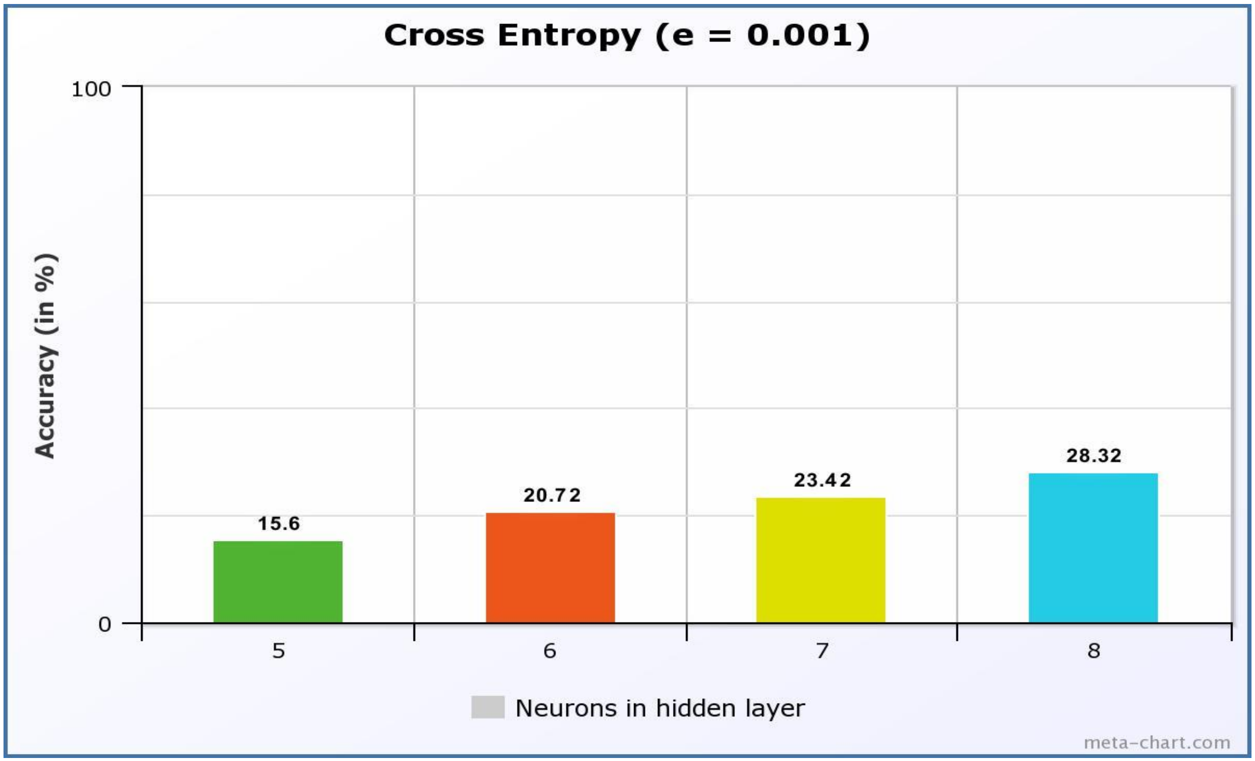
After training the perceptron using either of the 2 methods, we will get the optimal weights between the input and the hidden layer and between the hidden and the output layer. Using the optimal weights obtained, we are testing the perceptron on the test set (test matrix). We are plotting the results obtained on graphs in observation section.

OBSERVATION:

The accuracy obtained after training the perceptron using online method using 1000 epochs and using SSD as error is much higher than the accuracy obtained when training the perceptron using batch method using cross entropy as error and norm as the stopping criterion. The accuracy is also dependent on the initial weights taken between the input and the hidden layer and the hidden and the output layer.

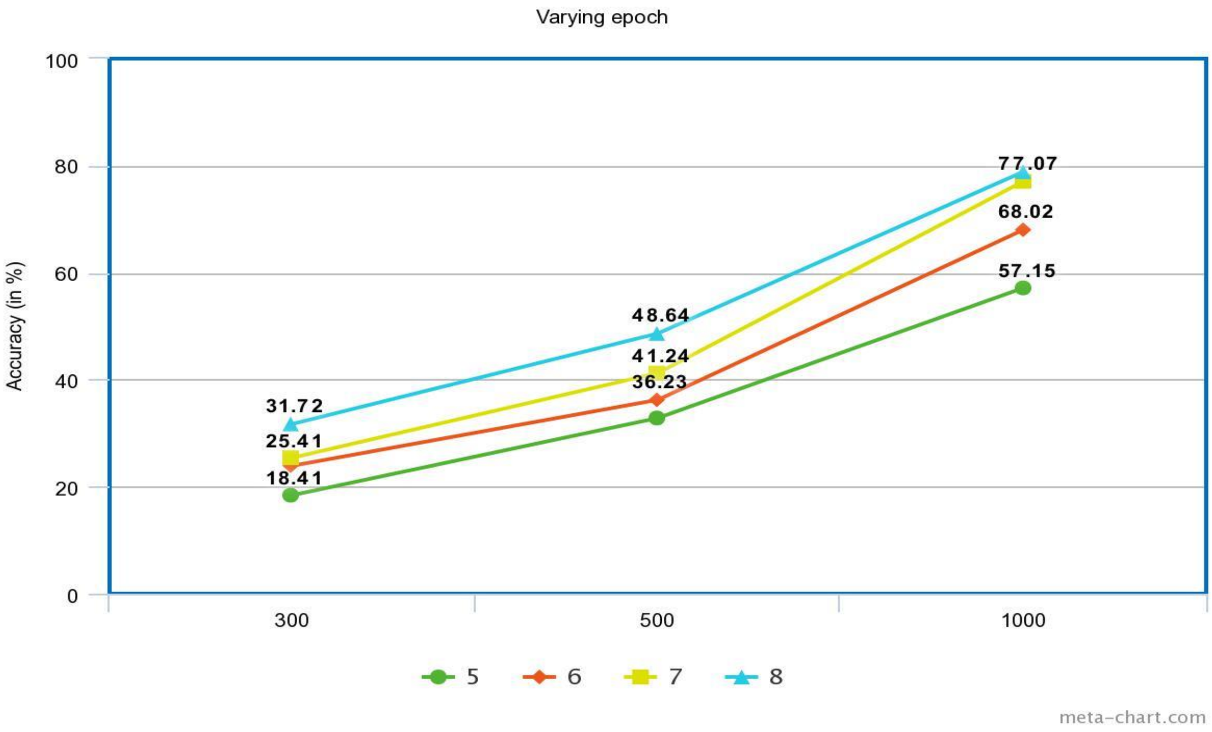
RESULT:





X-axis: Number of epochs

Y-axis: accuracy Different color represents neurons in hidden layer


Varying epoch
Accuracy (in %)
meta-chart.com