CS4442 AI 2 Assignment 1 Report

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3b)

```
%test error values for various k values, for matrix X_train
% [err, _] = p2(p3(X_train, Y_train,X_test, 1), Y_test)
% k : err
% 1 : 0.0835
% 3 : 0.0790
% 5 : 0.0850
% 7 : 0.0885
%    it appears the best value for k is 3, as above 3 the error
increases
%    and below 3 it also increases
```

3c)

```
% Confusion matrix of k = 5
%    4 is being incorrectly classified as 9, it occured 12 times
%    this relationship is somewhat symetric as 9 is being classified by
%    9 is sometimes confused as 4, 9 times
%    7 is being classified incoorectly as 1
%    this relationship is not symetric since
%    1 is being classified as 7, 0 times
```

5b)

```
%discussion
%    the test error seems to decrease as we use more iterations. But
since
%    this is a random process, better classification is not certain with
%    more iterations. this makes this classifier not bery realiable.
%    It also appears that the training error is less than the test error
%    This could be due to us selecting the w that lowers the training
error
%    As expected the training error is reduced as the number of iters
%    increase
%
%100 iter
%err_train =
%    0.2901
%err =
%    0.3709
%1000 iter
%err_train =
%    0.2262
%err =
%    0.3083
%10000 iter
%err_train =
```

```
%      0.1455
%err =
%      0.2381
```

6b)

```
%Discussion
%err_train =
%      0.0356
%err =
%       0.0627
%    both the training error and test error are significantly lower than
%    in
%    the random weight calculations(p5), which is expected for since
%    randomly picking values is naïve compared to using a loss function
```

8b)

```
%Discussion
%training error =
%       0.0646
%test error =
%       0.1725
%
%       the test error is a liittle higher than in the KNN-classifier
%       looking at the confusion matrix it appears the two most confused
%       values
%       are: 9 being confused for an 7, but not vice versa
%       this is a bit different than our KNN classifier from 3b,
%       as 9 was being confused with 4 often in 3b
```

9b)

```
%Discussion
% training error =
%       0.098
% test error =
%       0.1230
%     the test error is lower than the perceptron loss function
%     looking at the confusion matrix it appears the two most confused values
%     are: 9 being confused for an 7, but not vice versa
%     this is a bit different than our KNN classifier from 3b,
%     as 9 was being confused with 4 often in 3b
%
```

10c)

```
%Discussion
%   valErr =
%        0.0547
%   err =
%        0.0915
%    test errors are less than both the perceptron and the softmax linear
%    classifiers, achieving better classification
```

10d)

```
%Discussion
%   Using the top program the best values of H and regularization weight
%   were found to be, the first layer has 180 nodes, while
%   the second layer has 70 nodes. The val error is less than the
%   unvalidated error for both the validation error and the test error
%        lowestH =
%            [140  70]
%        lowestReg =
%            0.9000
%        valErr =
%            0.0480
%        err =
%            0.0795
```

P12)

```
%     I submitted an essamble of 3 neural net classifiers with top 3 value
for hyper parameters H and regularizationWeights
%     weights as found with the p10d function on the full MNIST data set
  Net1
  H = [180, 70];
  regulizationWeights = 0.9;

  Net2
  H = [140, 70];
  regulizationWeights = 0.7;

  Net3
  H = [140, 80];
  regulizationWeights = 0.8;
```