

Assignment 4
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In this assignment, we have evaluated 3 classification algorithms i.e. neural network, K-nearest neighbor and Adaboost.

K-Nearest Neighbour

We train the model by using the command:

```
./orient.py train train-data.txt knn_file.txt nearest
```

We test the model using following command:

```
./orient.py test test-data.txt knn_file.txt nearest
```

We analyze the accuracy for different values of k and found out the best performance for k=11

K	Accuracy
1	67.23
2	65.21
3	68.71
5	69.141
7	69.56
9	70.73
11	71.04
15	70.2
20	70.5

Neural Network

1)We have used batch gradient descent for training our neural network.

2)We have designed the neural network with 1 hidden layer ,1 input layer with 192 input nodes and 1 output layer with 4 nodes.

3)We have finalized softplus function as activation function after trying tanh and sigmoid as softplus gave better accuracy for our case.

We train the model by using the command:

```
./orient.py train train-data.txt nnet_file.txt nnet
```

We test the model using following command:

```
./orient.py test test-data.txt nnet_file.txt nnet
```

We analyzed the accuracy of neural network with respect to the learning rate and running time taken to train the model and found results as below:

accuracy	learning rate	running time
0.731707317	0.1	44m33.347s
0.702014846	0.6	43m14.233s
0.716861082	0.2	43m3.027s
0.721102863	0.05	44m53.984s
0.721102863	0.01	45m19.073s

We get the best accuracy of 73.17 for learning rate 0.1 with 32 hidden nodes.

Adaboost

We have 192×192 stumps in total, out of which fixed number of stumps are selected randomly for reducing the running time of the algorithm.

Each classifier predicts the orientation of an image according to the count of label corresponding to that classifier in training data.

We have added an extra stump which classifies the image using color blue in the image.

This classifier predicts the orientation of image by counting max of blue shade in part of image. E.g.: blue in left half of image predicts that orientation is 270 degrees.

This classifier helps the algorithm as it is one of the strongest classifiers in most of the cases.

We tried for different stumps and got the best accuracy for $n=3$ as stump count after this it starts decreasing with increase in stump count.

Stump count	Accuracy
1	69.03
2	69.04
3	69.047

Best Classifier:

We are getting the best classification accuracy for neural network and hence it is our best classifier. Thus we would suggest this classifier to our potential client

Analysis on small dataset

We tried with small datasets and found aberrant behavior for our classifiers as some correctly classified images on general dataset were getting misclassified and some misclassified ones getting classified correctly.

We observed that neural network was able to give better accuracy and generalize better than other two classifiers.