Soft Computing

Assignment 3: Pattern Classification

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Given a dataset of 200k class labelled processed audio samples. The labels given are -1, 0 and 1. Where -1 indicates DJI phantom that is not carrying a payload, 0 indicates No DJI phantom in the area and 1 indicates DJI phantom that is carrying a payload of 1kg.

I had rewritten the 0 labels as -1 and this made my dataset with two labels that is 1 and -1. I have created a neural network with one output neuron which classifies the data into 1 or -1. Where 1 indicates loaded DJI phantom and -1 which corresponds to nothing in the area or an unloaded DJI phantom.

In the pre-processing step, I have normalized the data points by using zero centering where the mean is subtracted from the data and then I have performed the decorrelation technique. The Principle Component Analysis gave me some important features where I have taken four features which has the highest rank.

In the Neural Network I have designed, there is no need for hidden layer. I have designed a neural network with one output layer without any hidden layers. I have given four best ranked features as inputs to my neural network.

The given data is split into training, validation and testing data. For different proportions of training, validation and testing data, I have got different accuracy values. Different proportions of data in training, validation and testing are taken to ensure the network is trained.

I have used the confusion matrix to evaluate the quality of the trained networks.

True Positives: correctly identified

False Positives: incorrectly identified

True Negatives: correctly rejected

False Negatives: incorrectly rejected

Yes, we should care about the false positives and false negatives. If the correctly classified instances are more, that means that our neural network is trained well and if the false positives and false negatives are more we have many incorrectly classified instances and our network is not well trained. So, in real world problems, we should consider the true positives and true negatives to be more and false positives and false negatives to be less.

For the first neural network given, the output 1 indicates loaded DJI phantom and -1 which includes Unloaded or nothing in the area. Given 90 features for the network where I have implemented PCA to get the best four features for my neural network. I have used the sigmoid activation function for the output neuron. I have used the N-fold cross validation where I have taken different proportions for the training, validation and testing data sets and calculated their accuracy for different proportions.

Pre-processing includes Normalization of data and as I have mentioned earlier about the PCA and decorrelation techniques. Performing the pre-processing techniques, the accuracy is increased as I have compared it with the accuracy of the network without applying any of the pre-processing techniques. The main feature of feature reduction is to remove the unnecessary features which causes noise in the dataset and by using only the important features to deal the network. The architecture chosen is simple with an output layer with one neuron which gives two values.

The termination condition used is I have set an error value which is very minimum and when it reaches the error value set, it gets terminated.

The performance is measured using the confusion matrix.

Results:

Confusion Matrix for 10 folds

Actual/predicted	0	1
0	129190	9274
1	11102	50434

Accuracy: 89.812%

Confusion Matrix for 20 folds

Actual/predicted	0	1
0	129072	9392
1	11493	50043

Accuracy: 89.557%

Confusion Matrix for 30 folds

Actual/predicted	0	1
0	129774	8690
1	12170	49366

Accuracy: 89.57%

So, the best cross fold validation is for 10 folds where the accuracy is 89.812%