APPENDIX 1

A.1.1 LINEAR DISCRIMINANT FUNCTION

LDF is a linear machine that divides the feature space into ‘n’ number of decision regions. It handles the case where the within-class parameters are obtained by performing the proposed procedure on different samples under test. This method maximizes the ratio of between-class variance to the within-class variance and thereby guaranteeing maximal separability. Adopted in this study is two-category classifier for which LDF is computed as stated below:

Step 1: Two data sets (normal and pathogenic cases) were formulated using the textual parameters obtained from image samples.

Step 2: Thirteen Haralick parameters are obtained from each of the image sample and its corresponding age together becomes fourteen features for each of image sample. Likewise, fourteen parameters are extracted from forty five image data in the age group between 8 and 80 years with no neuro-related problems. Similarly fourteen parameters are collected from four pathogenic cases. Hence the two data sets become the training data for LDF.

This results in two matrices of size $45 \times 14$ and $4 \times 14$ and they are called as ‘A_nor_training’ and A_path_training’ respectively.
Step 3: In the same way, fourteen features were obtained from forty five DTMRI brain slice with no neuro-related issues in the age group between 8 and 80 years and from five pathogenic cases. This becomes another set of data for LDF that is used to test its performance. This results in another two matrices of size \(45 \times 14\) and \(5 \times 14\) and they are called as ‘\(A_{nor\_testing}\)’ and ‘\(A_{path\_testing}\)’ respectively.

Step 4: Mean over feature values (mean over each column) is computed, and a column vector is formed which takes these mean values as its entry. This results in four numbers of column vector, two for training and two for testing. The size of all these vectors is \(14 \times 1\). These column vectors are called ‘\(\text{mean\_nor\_training}\), \(\text{mean\_path\_training}, \text{mean\_nor\_testing}\)’ and ‘\(\text{mean\_path\_testing}\)’ respectively.

Step 5: Covariance matrix for both the groups are computed that results in \(14 \times 14\) matrices and are named as \(\text{cov\_training}\) and \(\text{cov\_testing}\).

Step 6: Inverse matrices ‘\(\text{inv\_training}\) and \(\text{inv\_testing}\)’ for the two respective covariance matrices are computed and this again results in two numbers of \(14 \times 14\) matrices.

Step 7: LDF is solved using the following Equation (A.1.1)

\[
D(x) = b^T x - c
\]  
\text{(A.1.1)}

Where \(x\) = Set of feature parameters to be passed after obtaining from each of the image.

\[
c = (\text{mean\_nor\_training}^T \times \text{inv\_training} \times \text{mean\_nor\_training}) - (\text{mean\_path\_training}^T \times \text{inv\_training} \times \text{mean\_path\_training})
\]

\[
b = 2 \times \text{inv\_training} \times (\text{mean\_path\_training} - \text{mean\_nor\_training})
\]
Step 8: Boundary values is chosen as $-2\ln(\lambda) \times 10^3$, where $\lambda$ is the ratio between probability of pathological condition to the probability of being in normal state.

Step 9: The equation obtained on substituting the feature parameters as obtained through this study in the above said procedure (step 1 to step 8) is given below (Equation (A.1.2.))

$$D(x) = -1.6573 x_1 + 2.7204 x_2 + 0.9201 x_3 - 0.589 x_4 + 0.5946 x_5 - 0.964 x_6 + 28.5639 x_7 - 3.7711 x_8 + 5.3436 x_9 - 50.0645 x_{10} - 0.191 x_{11} - 20.069 x_{12} + 16.5243 x_{13} + 23.5417 x_{14} + 1474.7 \quad (A.1.2)$$

When the above equation is given the feature from the data set available for testing case (A-nor_testing and A_path_testing), and classified using the boundary value $-2\ln(\lambda) \times 10^3$, the following classification results are obtained as shown in Figure 5.27 (a) and Figure 5.27 (b).