Diagnosis of Brain Tumor based on Moments of Local Binary Patterns and Discrete Wavelet Transform

Abstract

In the field of automatic tumor detection, numerous works have been conducted with varying results. The steps involved in these algorithms can be divided into three categories: pre-processing, feature extraction, and feature classification. In this research, various image processing methods were applied to improve MRI images and prepare them for feature extraction. We used a fuzzy algorithm for tumor area segmentation. Image features were extracted using local binary pattern moments and discrete wavelet transform. In the last stage, the final feature vector is fed into the SVM classifier to determine whether the brain tumor is normal or abnormal (benign or malignant). The experimental results show that the proposed method has an accuracy of over 86% on clinical dataset. This method is fast and effective in classification.

1- Proposed method

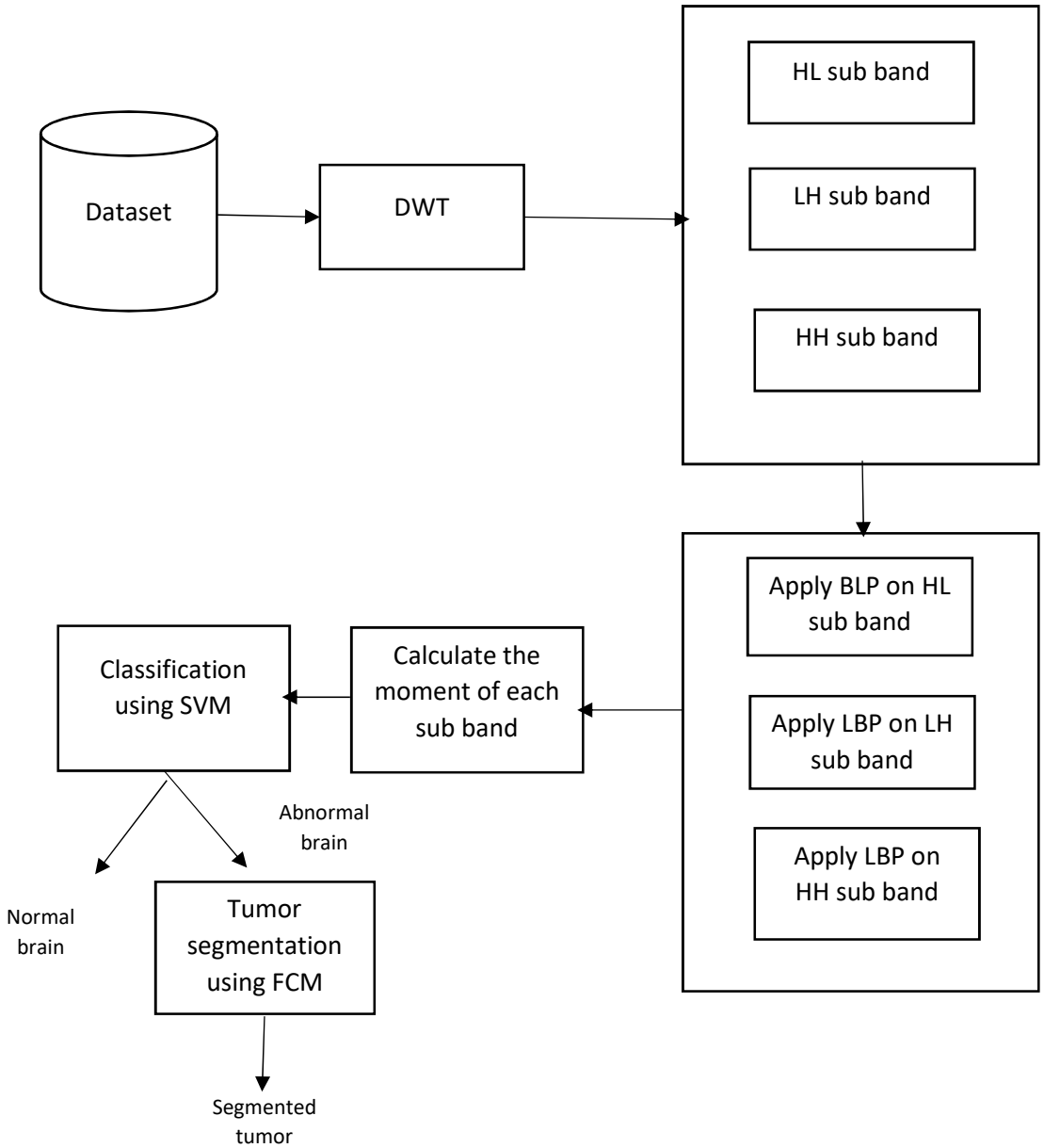


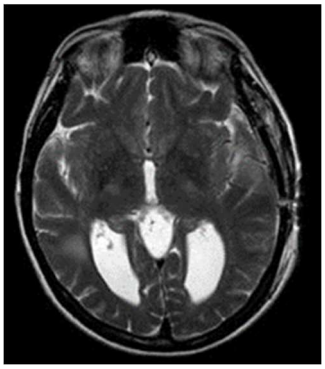
Figure1. Proposed method

1-1- Pre-processing (de-noising and resizing to 300×300)

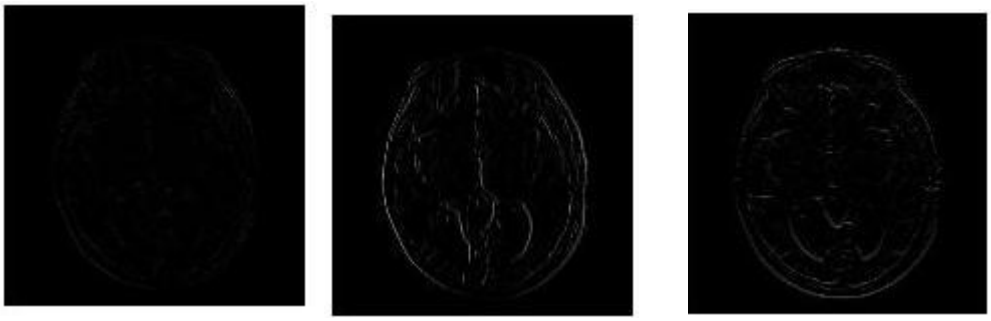
1-2- Feature extraction

- Apply DWT on pre-processed image
- Apply LBP on each sub band of DWT
- Apply moment on each sub band of previous step

1-3- Feature Classification (Normal or Abnormal)



Pre-processed image



Vertical Detail (HL) Diagonal Detail (HH) Horizontal Detail (LH)

Figure2. Output of DWT

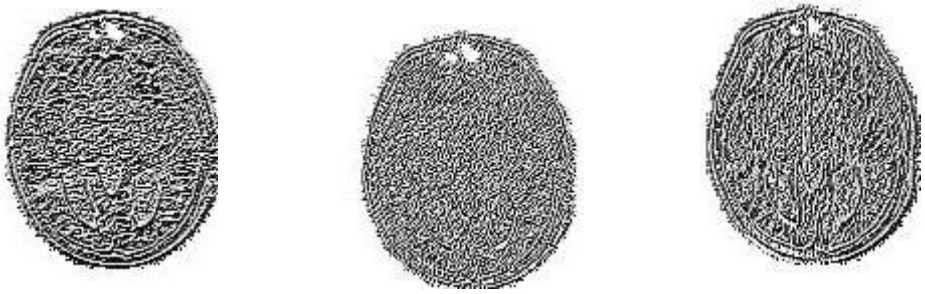


Figure2. Output of LBP on each sub band of DWT

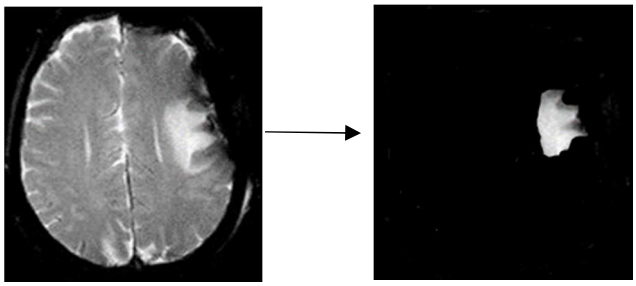


Figure 3. Tumor segmentation using FCM (Fuzzy c means)

2- Experimental results

2-1- Clinical dataset (1000 MRI normal images, 1000 MRI abnormal images, 70% for training, 30% for testing)

Table 1. Evaluation metrics of the proposed method

	Abnormal brain	Normal brain
Abnormal brain	TP=867	FN=133
Normal brain	FP=138	TN=862

Table 2. Evaluation metrics of the proposed method

	Sensitivity	Specificity	Accuracy
Test %30-Train %70	86.70%	86.20%	86.45%

Table 3. Evaluation metrics of the proposed method

	Sensitivity	Specificity	Accuracy
Proposed method	86.70%	86.20%	86.45%
DWT+PCA+K-NN	%89	%87	86%
DWT+PCA+NN	%82	84	81
PCA+SVM	89%	84%	85%

How to run:

1. Press train dataset button
2. Then click open image for test
3. Click feature extraction button
4. Then click recognition button
5. If tumor image is abnormal (malignant and benign) Click tumor segmentation button

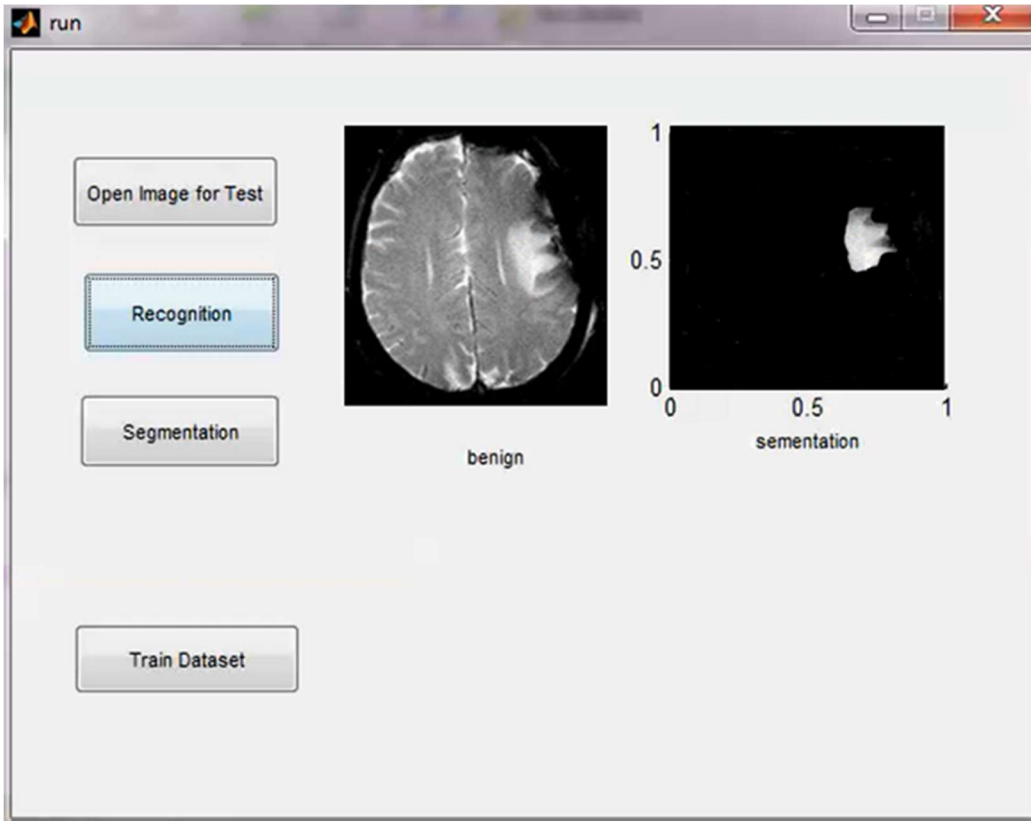


Figure 4. Output of proposed method