Diagnosis of Brain Tumor based on Combination of Texture Features and Fuzzy Segmentation

Abstract

The steps of performing proposed method can be divided into three categories: tumor segmentation, feature extraction, and classification. In this study, Zernike moments combination and discrete wavelet transform have been used to extract the feature, which is a powerful method for extracting image texture. The ACO algorithm is used to select useful features. Finally, the SVM cluster was used to classify the extracted features and tumor diagnosis. Fuzzy logic is also used to segment the tumor area. The results of our experiments on the clinical database show that the proposed method is more efficient and accurate than previous methods. Also the proposed method has been tested with two categories SVM and K-NN and we have shown that SVM category has about 88% accuracy and it has higher accuracy than K-NN category.
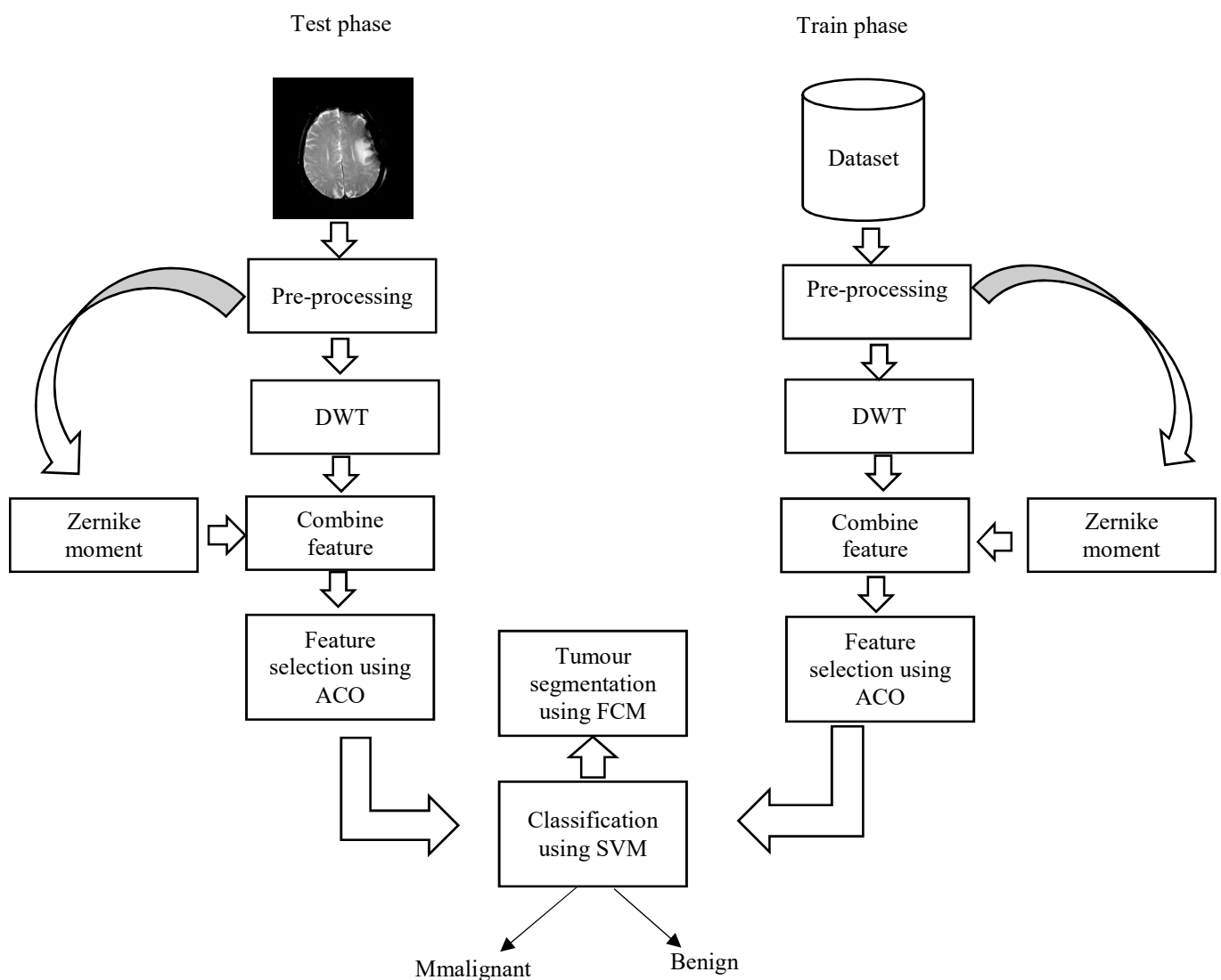
1- Proposed method

Figure1. Proposed method

1-1-   Pre-processing
- Convert image to grayscale
- Denoising using medial filter
- Resizing to 300×300

1-2-   Feature extraction using DWT (discrete wavelet transform) and Zernike moment

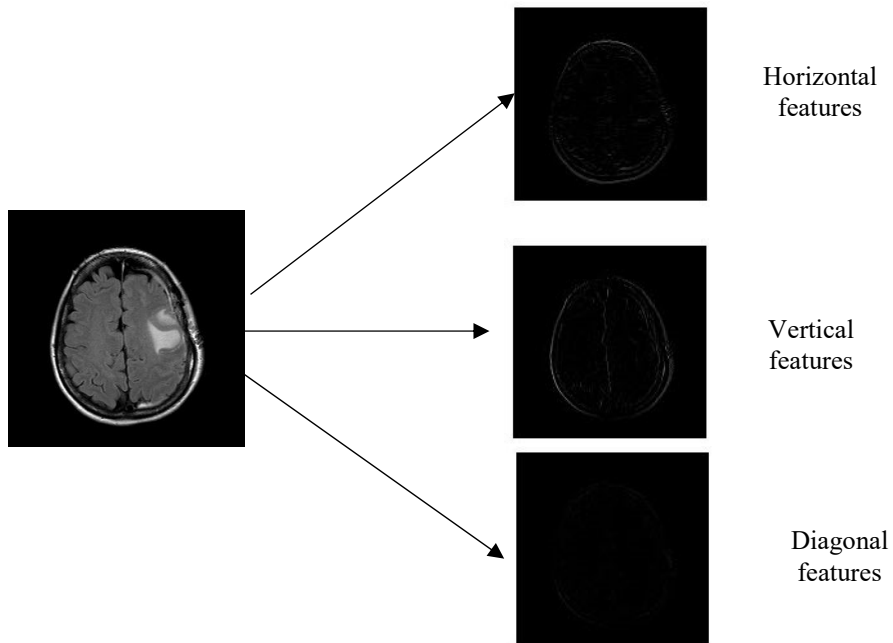Horizontal features

Vertical features
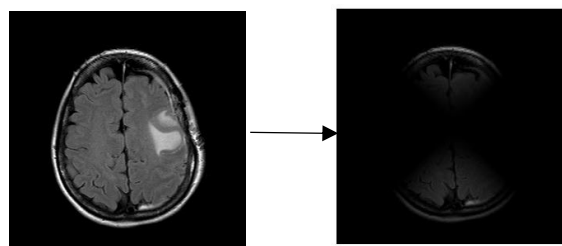
Diagonal features

Figure 2. DWT output

Figure 3. Zernike moment output

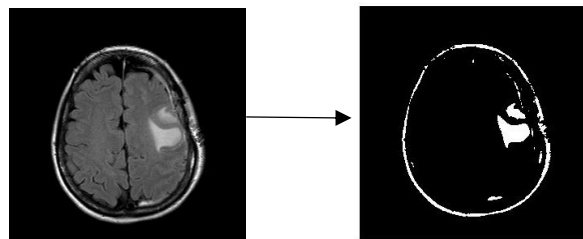

Figure 3. Segmentation (FCM) output

1-3-   Feature selection using ACO (Ant Colony Optimization)
1-4-   Classification using SVM (support vector machine)

2- Experimental Results
  - Clinical dataset (2500 MRI normal images, 2500 MRI abnormal images, 70% for training, 30% for testing)

Table 1. Evaluation metrics of the proposed method

	Abnormal brain	Normal brain
Abnormal brain	TP=2202	FN=298
Normal brain	FP=330	TN=2170

Table 2. Evaluation metrics of the proposed method

	Sensitivity	Specificity	Accuracy
Test %30-Train %70	88.08%	86.08%	87.44%

Table 3. Evaluation metrics of the proposed method

	Sensitivity	Specificity	Accuracy
Proposed method	88.08%	86.08%	87.44%
DWT+PCA+K-NN	%89	%87	86%
PCA+SVM	%80	82.45	81%
Gabor +statistical features	%83.67	84%	83.56%

Table 4. Compare proposed method with different classification

Different classification	Accuracy (%)
SVM Proposed method+ RBF	87.44
Proposed method +SVM Linear	84.34
Proposed method+ K-NN	79

3- How to run it:
  - First click on run.m ftle and then run it
  - Secondly click on 'train database'
  - Then after train, click on 'select image for test' button
  - Click on 'tashkhis' button
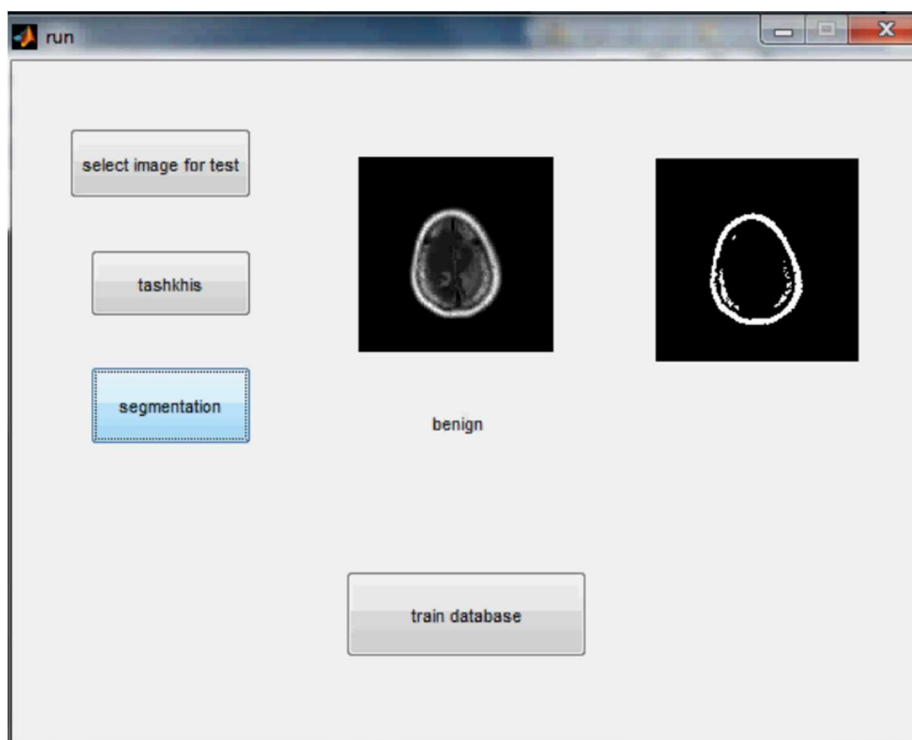 - Finally click on 'segmentation' button, you can see 'Mmalignant' or 'Benign'

Figure 4. Output of application