Facial Expression Recognition using Gabor wavelet and neural network

Abstract

In this research, a new approach is proposed to extract facial features with a remarkable precision and performance. In the feature extraction step in the proposed system, the Gabor filter is used. The Gabor filter is one of the best descriptors that can be used in the feature extraction step. These functions are that some of the frequencies can be eliminated and the extraction of the feature in a less voluminous space, thus reducing the volume of the calculations. In this research, we apply the Gabor filter to 4 facial areas. We then apply the neural network cluster on the face feature vector to detect facial expressions. In this study, we use the PCA algorithm in order to select useful features and reduce the dimensions of the feature vector. In this thesis, six basic modes, including: angry, surprise, fear, happy, disgust and sadness, are selected for face recognition system. Experiments were performed on the JAFFE database. The results of the experiments show that the proposed system has a high facial recognition rate compared to the Gabor filter on the face. Also, in the testing section, two probable neural networks and the RBF neural network were used to categorize and detect facial expressions. The probable neural network compared to the RBF neural network has more acceptable results. Also, the results of the experiments show that the proposed method is more efficient and more accurate than other methods.

1- Proposed method

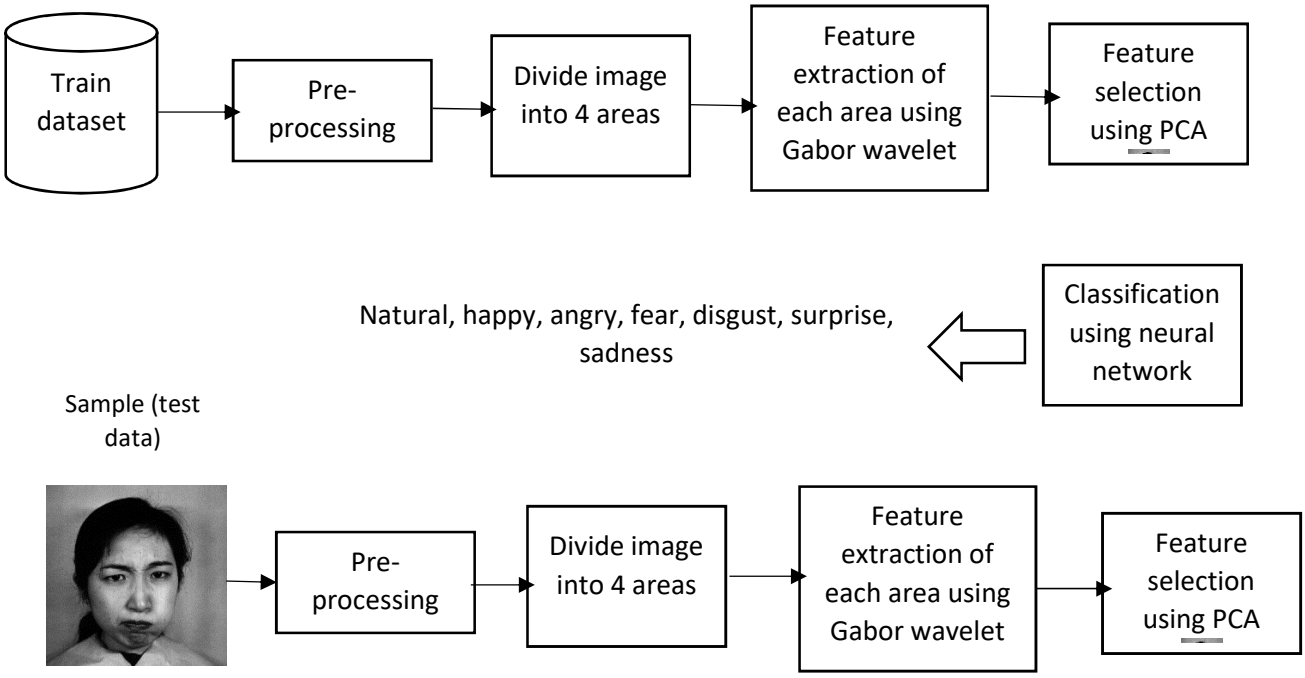


Figure 1. Diagram of proposed method

1-1-pre-processing

- Resizing to 250×250
- Convert image to gray scale
- Dividing image to 4 areas

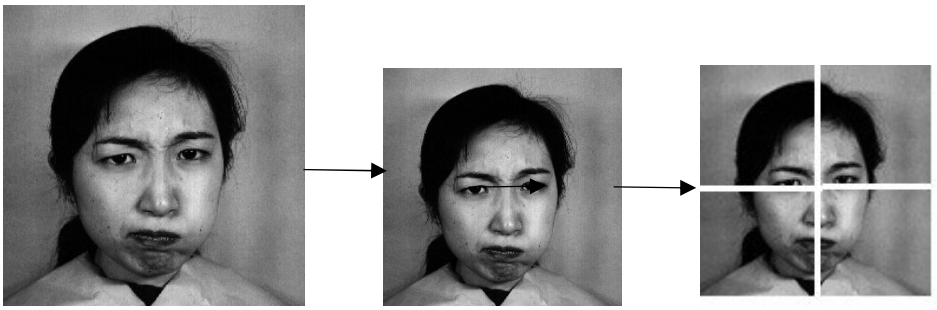


Figure 1. Pre-processing step

1-2-Feature extraction using Gabor Wavelet

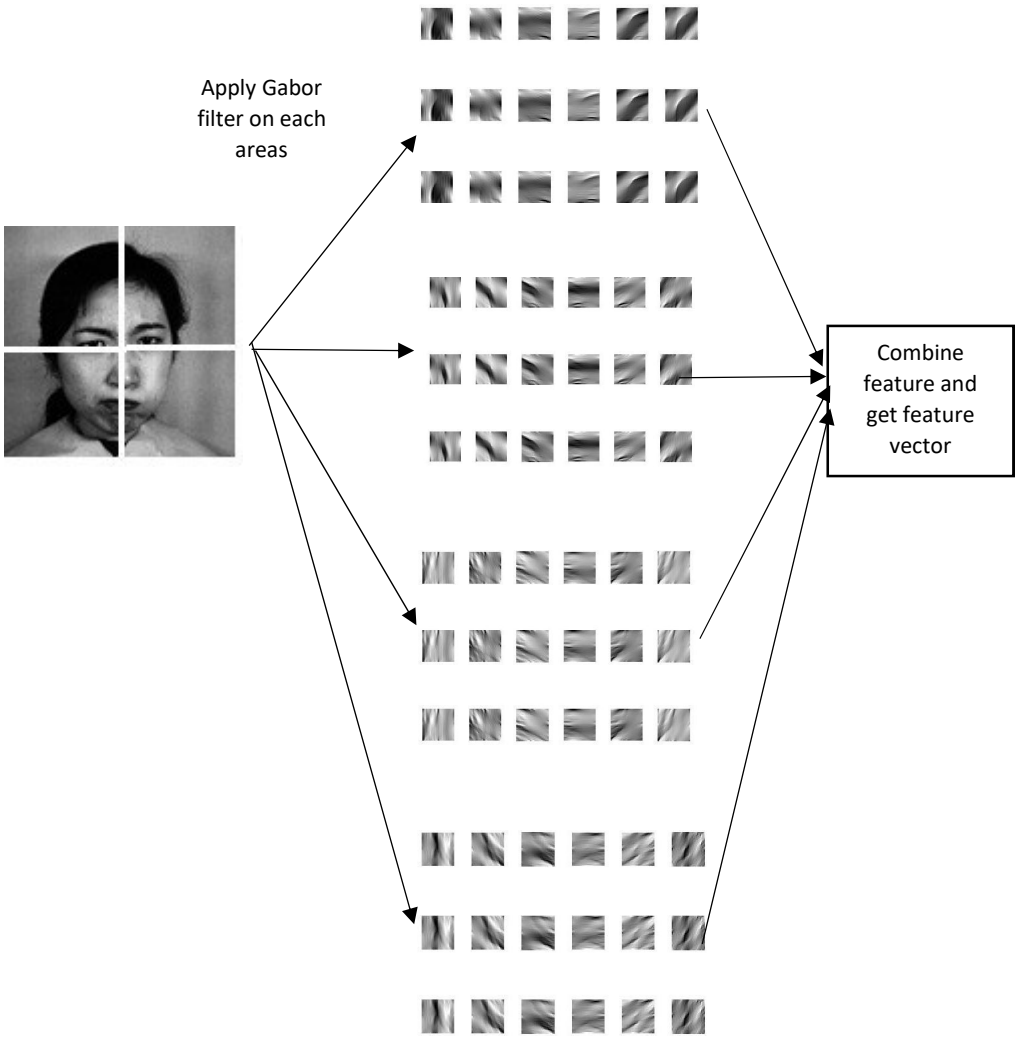


Figure 2. Apply Gabor filter on each 4 areas

1-3-Feature selection using principal component analysis (PCA)
1-4-Feature classification and expression recognition using Neural Network

2- Experimental Results

- Dataset: JAFFE (https://zenodo.org/records/3451524)

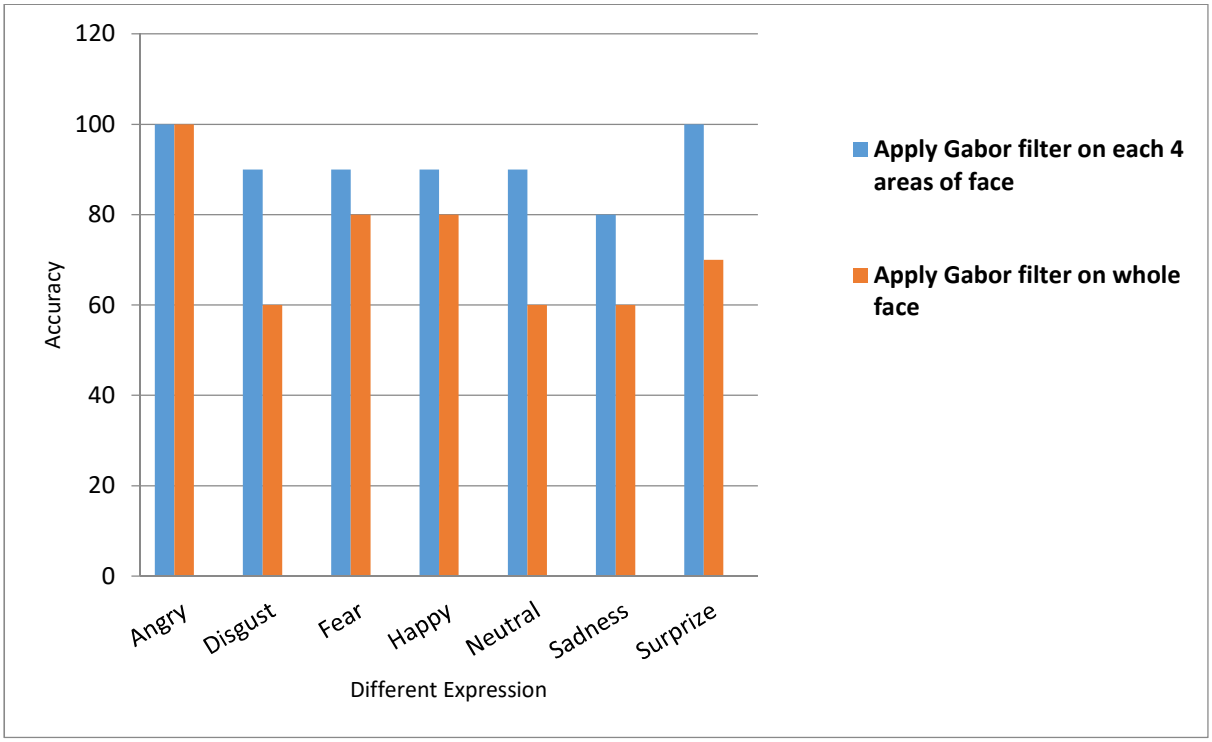


Figure 3. Comparison of the recognition accuracy of different facial expressions using probabilistic neural network classification and applying Gabor filter on the segmented areas and the whole face

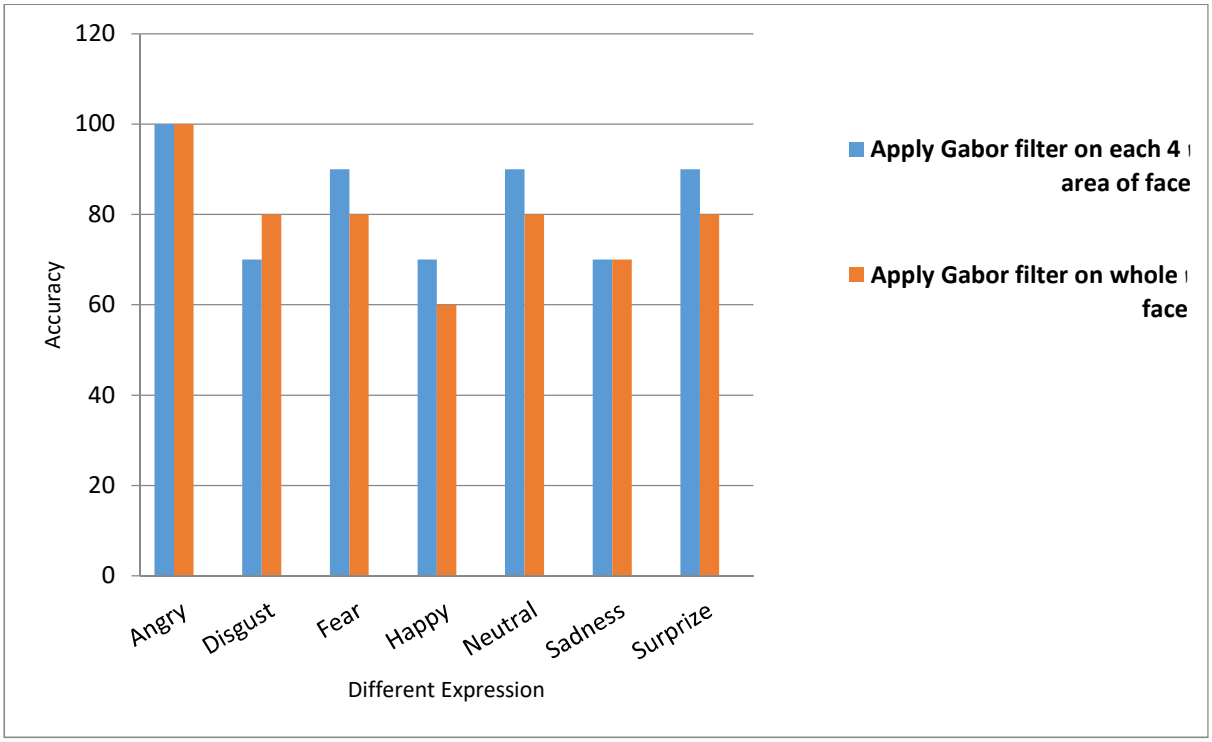


Figure 4. Comparison of the recognition accuracy of different facial expressions using RBF neural network classification and applying Gabor filter on the segmented areas and the whole face

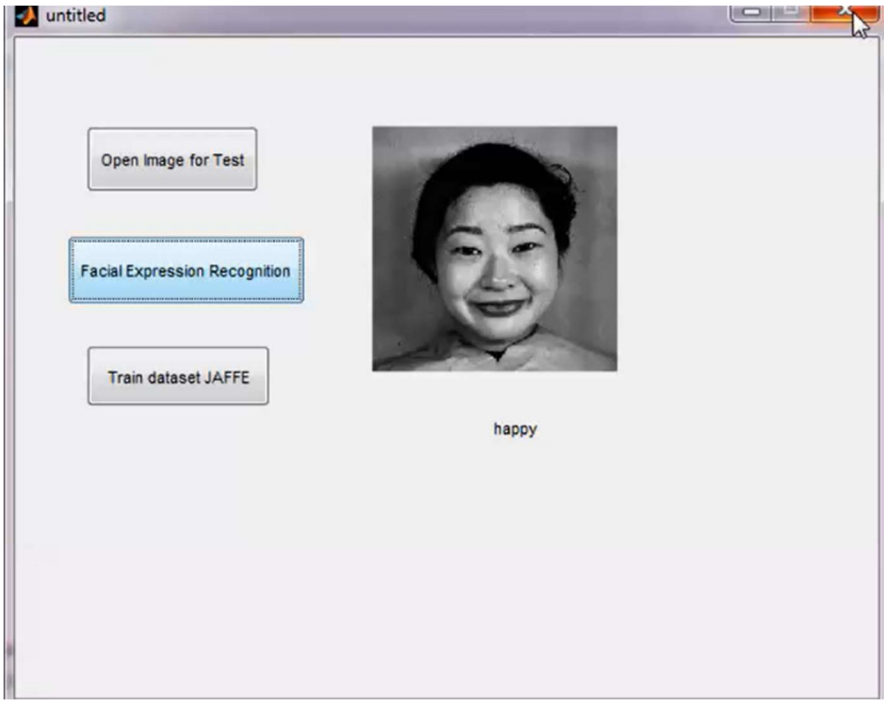
Table 1. Comparing the detection accuracy of applying Gabor filter on the whole face and on the divided areas of the face

(%) Test data accuracy	Apply Gabor filter on each 4 area of face	Apply Gabor filter on whole face
Probabilistic neural network	92.85	72.85
RBF neural network	82.85	78.57

3- How to run:

- Open run.m file and click run button
- First click train dataset JAFFE button
- Then click open image for test button
- Finally click facial expression recognition button

Finally, you can see expression of test data that you have selected.


untitled
Open Image for Test
Facial Expression Recognition
Train dataset JAFFE
happy