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RECOGNIZE HAPPY AND SADNESS EMOTIONS USING MUTUAL INFORMATION AND SUPPORT VECTOR CLASSIFICATION METHODS

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Abstract

In the past decade, the field of facial expression recognition has attracted the attention of scientists who play an important role in enhancing interaction between human and computers. The issue of facial expression recognition is not a simple matter of machine learning, because expression of the individual differs from one person to another based on the various contexts, backgrounds and lighting. The goal of the current system was to achieve the highest rate for two facial expressions ("happy" and "sad") The objective of the current work was to attain the highest rate in classification with computer vision algorithms for two facial expressions ("happy" and "sad"). This was accomplished through several phases started from image pre-processing to the Gabor filter extraction, which was then used for the extraction of important characteristics with mutual information. The expression was finally recognized by a support vector classifier. Cohn-Kanade database and JAFFE data base have been trained and checked. The rates achieved by the qualified data package were 81.09% and 92.85% respectively.

Keywords: Facial Expressions, Mutual Information, Support Vector Classifier, Emotion Recognition.

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1. Introduction

The most obvious and common signs that show emotional case and intentions of human beings are facial expressions [1][2]. Various systems for facial recognition (FER) have been developed in the field of computer vision and machine learning, [3] Most facial expression systems (FES) were expressed across six categories: happiness, sadness, surprising, angry, disgusted and afraid [4].

In this present study, a facial classification scheme has been proposed ("happy" and "sad"). The paper was organized the following: Section 2: present the related work, Section 3: set out the databases and FER system parts, and Section 4: discussions of the results and the conclusions of the experiment.

2.Related Work

Several studies have examined developing emotional recognition systems using computer vision techniques, for instance:

In 2019, Issam Dagher and others proposed a three-stage facial expression support machine (SVM). The first move involves 21 SVMs, each with 7 binary mixes. If the expression is dominant, the first phase is sufficient; if two or more are present, the second phase is sufficient; and the third phase is sufficient if three are present.[5].

Ashamol Joseph, P. Ramamoorthy (2013) used Log-Gabor filters to extract the features, mutual information (MI) for features selection, then used Support Vector classifier (SVC) for classification [6].

Stochastic proximity embedding (SPE), Support vector machine (SVM) was introduced by Zilu Ying et al. in 2011 to classify Japanese Female Facial Expression (JAFFE) database. In that work, results were compared with other algorithms such as LDA, PCA, and etc. [7].

In 2007, Wang and Yin (2007) used quadratic discriminant classifiers (QDC), linear discriminant classifiers (LDA), support vector classifiers (SVC), and naive Bayes (NB) to express terrain context (TC) implemented on Cohn-Kanade and MMI. [8].

3.Databases and FER system

The method has been evaluated using two widely used databases (Cohn-Kanade database and the JAFFE data base) to assess the efficiency of the proposed system.

Cohn-Kanade database

The Cohn-Kanade (CK) database was launched in 2000 to support research into the automated detection of single facial expressions. Ninety seven students studied were examined as part of the database in an introductive psychology class. Students were ranged from 18 to 30 years-old, with 65% women, 15% African-American, and 3% Asian or Latina [9]. Photos of the database can be found in png and jpg, with resolution 640.

Japanese Female Facial Expression (JAFFE) Database

This database was previously prepared [10] with the use of images taken in the Department of Psychology at Kyushu University by a group of researchers including Miyuki kamachi, Michael Lyons and Jiro Gyoba Gyoba at Kyushu University. The JAFFE database consituted 213 facial images, including normal, happy, sad, surprising, anger, disgust and fear expressions using Japanese women's tough 256-to256-pixel models.

FER system

A general overview of the system proposed is shown in Fig. 1, the system consisted from 4 modules: starting with pre-processing of images, followed by the extraction of the feature, including a Gabor filter. Finally, the SVC approach was tested for the classified module.

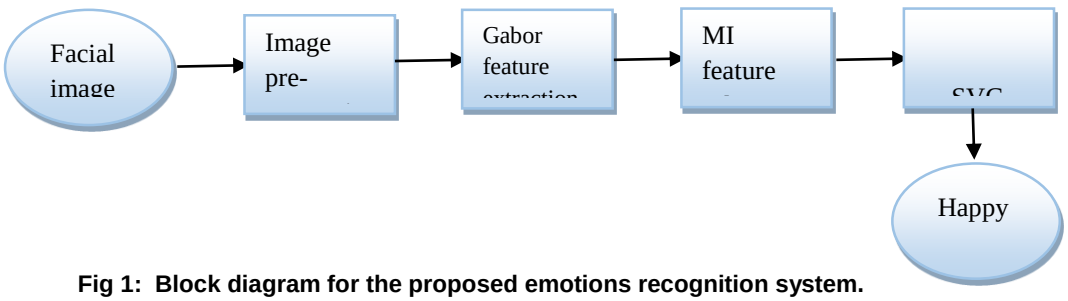

Fig 1: Block diagram for the proposed emotions recognition system.

Pre-Processing images

Prior to any processing, image pre-processing was indeed because the used images were taken from various databases sizes, resolutions, colors and backgrounds which must be standardized for the system. The processing was performed as: gray scale conversion, cropping and size standardization (Fig 2).

-a- -b-

Fig 2: Pre-processing image: a- original image, b- image after pre-processing.

Feature extraction

Dimensional reduction simplified image processing, and functionality extraction was an important component of this method. The Gabor filter was used to extract feature expressions from pre-processed images before features selection. (Fig 2)

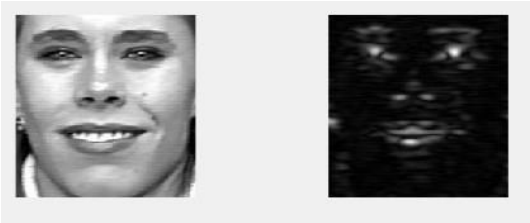

Fig 3. Gabor filter

Feature Selection

Data and features that have high-dimensional are the main issue in the classification of supervised and unsupervised learning, which has become much more relevant in terms of the number of data samples and the number of characteristics in the samples with the recent explosion of the available data sets. The rapid training time and the enhancement of classification accuracy can be obtained when dimension of data and features are decreased as low as possible. This issue was solved through the feature selection after extraction of features.

There are two major characteristics of mutual information exchange (MI). First of all, any type of connection between random variables, including the nonlinear relation [11] [12], can be calculated. Secondly, MI does not adjust in feature area transformations under reversible and identifiable transitions [13] [14].

This work was achieved using MI [15] to minimize the dimensions of the data from the preceding step prior to being used in the classification step.

Expression Recognition

SVC [16] [17] was used in this section of the work to classify and to test input expressions for happiness or sadness. The system was trained by random JAFFE and CK images of (32) and (34) databases respectively. The system proposed was subsequently tested with (38) JAFFE images and (41) CK images. The results obtained were compared with the accuracy ratio, which constituted the number of correctly classified samples over the total of samples tested samples.

4 . Results, Discussion and Conclusion

When the SVM classifying process is implemented in the existing work databases (Table 1). Longer average classification rates:

1. The database was CK (81.09). The findings of this database showed that the accuracy of classification of happy expressions (79.23%) was superior to sad expressions (68.33%).
2. Database JAFFE (92.85). The findings from this database showed that happy and sad expressions are equally correct in recognition (87.5%).

The results showed that happy emotions were easily recognized more than those for sadness. An explanation to this finding is that happy emotion is usually acknowledged with high percentage of correct responses (approximately 97%), whereas sadness has 75% correct responses [18] [19].

Table 1. Recognition rate for expression classification using SVC method used for classification after Gabor filter and MI method.

Expression	CK	JAFFE
Happy	79.23	87.5
Sad	68.33	87.5

The results of this work showed tremendous potential for the happy and sad representation of the extension recognition system. In order to improve the proposed process, different methods of recognition are required compared with the resulting SVC.

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