An Algorithm based on SURF and LBP approach for Facial Expression Recognition

Neha Sahu[1*], Chhavi Sharma[2], Hitesh Yadav[3]

[1]Assistant Professor, CSE/IT, The North Cap University, Gurgaon, India
[*]Corresponding Author E-mail: *nehasahu@ncuindia.edu*

[2]Assistant Professor, IT, The North Cap University, Gurgaon, India
E-mail: *nehasahu@ncuindia.edu*

[3]Assistant Professor, CSE/IT, The North Cap University, Gurgaon, India
E-mail: *hiteshyadav@ncuindia.edu*

Abstract: Facial Expression Recognition is an advancement made in the area of facial recognition process. Face recognition is a vital area of research in human computer interaction, ML and image processing [1]. There may be overlapping in facial expressions classification. To classify the facial expressions accurately an algorithm based on SURF and LBP approach is proposed in this paper. An effective algorithm is presented to improve the accuracy and recognition rate of existing facial expression recognition algorithms.

Keywords: Facial Expression Recognition, Face Recognition, Image Processing, Pattern Matching

I. INTRODUCTION

There exists similarity in various facial expressions. This existing similarity can lead to inaccurate classification of facial expressions in various classes. It can also lead to misclassification and reduced accuracy of classification. Paul said that the emotions are mostly often confused with each other [2]. To improve the classification rate distance metric learning can be used to learn the distance between input data. The concept of metric learning was given initially by Xing et al [3].

Table 1: Comparison of various algorithms

Algorithm	*Features*	*Disadvantage*
Distance metric learning	Distance metric is an optimization problem	In case of high dimensional data, the time taken by algorithm is very high
Relevant component analysis	Division of similar data into chunklets and reducing irrelevant variability to amplify relevant variability.	Reduced performance in high dimensional data. the informative data is ignored [4].
Discriminative component analysis	Better than metric learning algorithm to have better classification results in image processing	Incapable of capturing complex non-linear relationships between data instances with the contextual information [4]
ERDCA	Chunklets are formed based on informative samples.	Chunklets are formed based on some random selection. Unable to organize the expression information effectively

II. PROPOSED WORK

Face recognition can be further extended to recognize various facial expressions. A three staged model is defined to improve the accuracy of facial expression recognition. Face recognition can be used as an authentication application and to identify the gender of a person, emotions and expressions of a person. The work in this paper aims to recognize face and facial expressions. The three staged model is defined for face recognition in Fig 1. LBP features are mainly used to perform facial recognition whereas SURF features are used to perform facial expression recognition. Weighted score fusion based distance analysis approach is used to perform final expression recognition.

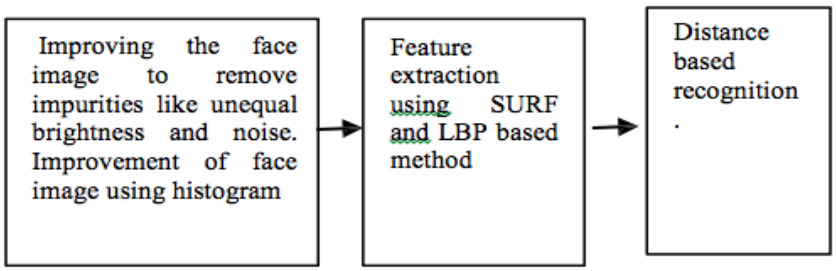

Fig. 1. Three staged model for Face Recognition

After the loading of the image from dataset, the improvement of the image is performed using histogram equalization approach. Once the improved facial dataset is obtained, the SURF method is applied on the dataset to perform feature extraction. Then LBP method is applied on the SURF feature set. Finally, a fusion feature is obtained from LBP and SURF features. The fusion feature is based on AND fusion [1-20].

II. EXPERIMENT

In this experiment, the algorithm is evaluated on Japan Female Facial Expression Database (JAFFE [9]). JAFFE database is used by researchers all over the world, which contains 213 images acquired from ten females. There are seven facial expressions. The various facial expressions are happy, neutral, angry, disgust, fear, sad and surprise [1]. All the images are in tiff format, the resolution of the image is 256×256. Fig.2 clearly shows the various facial expressions.

Fig. 2. Sample Expressions

The input face image is in tiff format and in grayscale format in fig 3. Gaussian noise is added to the input image. The image after the addition of Gaussian noise becomes noisy image. The noisy image is shown in fig 4.

Then a fuzzy based effective approach is defined to convert the noisy image into noise free image fig 5. The fuzzy based approach is effective in performing the de-noising operation. [5]. An analysis of fuzzy based approach is done with median filtered approach based on PSNR value. Fuzzy based approach outperforms median filtered approach by giving higher PSNR value. The comparison of both the approaches shows that fuzzy based noise removal method having higher PSNR value is much more effective than median filtered approach [5]. Histogram equalization is then applied to noise free input image to improve the image fig 6. Histogram equalization leads to enhancement in the features of the image. After the improvement of the image using Histogram equalization, the SURF operation is applied. SURF operation is the feature analysis approach to enhance the image features fig 7. The enhanced image features are used in expression identification. Then LBP feature extraction operation is applied, the extracted features helps to perform facial expression recognition fig.8. In fig.9.Shows the result of fusion operation applied on feature images.

Fig. 3. Input Image

Fig. 4. Image with noise added

Fig. 5. Noise removed using fuzzy logic based approach

Fig. 6. Improved image using histogram equalization

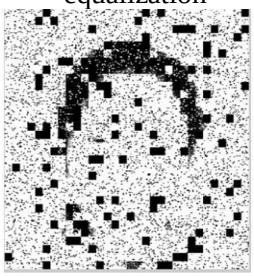

Fig. 7. Feature extraction using LBP approach

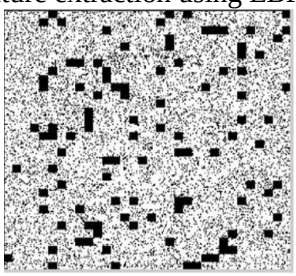

Fig. 8. Result of Fusion Image

III. EXPERIMENTAL RESULTS

When the Performance of proposed algorithm is evaluated and compared with the existing algorithms it is observed that the proposed algorithm gives the improved recognition rate by recognizing the face and facial expression with the accuracy of 98%. To recognize facial expressions different sets of training and testing images are used.

IV. CONCLUSION

The proposed algorithm gives high accuracy of 98%. The accuracy is very good as compared to other facial expressions recognition algorithms. The algorithm gives high accuracy. The recognition of facial expression is done effectively. Facial expression recognition can be a very important effort in the research area of face recognition system and will successfully help in solving the problem of face recognition and identification of a person.

V. FUTURE DIRECTIONS

The prime concern of face recognition system is to provide cost effective solution to identify individuals accurately and quickly. The currently used recognition systems face various challenges. In expression recognition, the main challenge is the error in classification as the facial expressions can be misclassified because of overlapping in expressions. Facial expression recognition is adding detailing to the system of face recognition. In face recognition system the aim is to identify the correct identity of the person but facial expression recognition can predict the various moods of the same person where the moods can be happy, neutral, angry, disgust, fear, sad and surprise [1].

Conflict of interest: The authors declare that they have no conflict of interest.

Ethical statement: The authors declare that they have followed ethical responsibilities

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