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Extraction and Recognition of Facial Expression

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Abstract: ***Face recognition from image or video is popular topic in biometric research. It has many practical applications like video surveillance, access control, personal identification, forensic and law enforcement. Facial expression is a central element in human interactions. Facial expression recognition is the process of identifying a person emotion in image or video. This paper proposes an efficient face recognition method based on Scale Invariant Feature Transform (SIFT) for feature extraction and use support vector machine (SVM) as a classifier. In this proposed method, we assign the extracted SIFT features of the face images video as input. Face data base show that the facial images can be recognized by the proposed face identification method efficiently.***
Keywords: Face recognition; SIFT, key point , SVM, Euclidian distance, face extraction.

I. INTRODUCTION

The project states the technique of recognizing emotion using facial expressions is a central element in human interactions. A human face does not only identify an individual but also communicates useful information about a person's emotional state. Facial expressions of a person are happy, angry, sad, surprise etc. Expressions can provide either intended or unintended feedback from listener to speaker to indicate understanding. It is one type of non-verbal communication. Facial motion plays a major role in expressing emotion of person. By using SIFT algorithm that can detect and understand emotion. Face recognition has attracted much attention in the last decade because of its wide range of applications. However, face recognition is still an unsolved problem as the human face is not a rigid object and can be transformed easily under different situations. The recognition of faces is thus, a challenging problem due to the wide variety of illuminations, facial expressions and pose variations. Therefore, representing the intrinsic attributes of a human face effectively becomes a very important factor in increasing the accuracy of facial recognition systems. Over the past years, many algorithms have been proposed for facial recognition systems.Face has always been a fascinating part to work on. But the main problem every researcher faces is how to diagnose the key features of image under consideration. As there are many algorithms that can be used for feature extraction. Based on what algorithm used decides the result of outcome. Moravec (1981) worked on the development of image matching using corner detector. This work was further enhanced by Harris and Stephens (1988). They are able to make more efficient work for image variation and edge detection than Moravec. They (1992) also worked for motion feature tracking and 3d structure of motion. The two researchers (1995) showed and developed same concept of matching corners by using correlation windows around each corner. The two more researchers (1997) found that this concept of feature extraction can be applied to general image recognition. In David Lowe (1999) extended this work with a new approach for stable key points. This is not a full history of the SIFT algorithm. Some of the earlier work also identified the peaks and ridges in scale space and linked it into tree structure. After the feature extraction the classifier is another important module for facial emotion recognition system. Researchers are nowadays trying to recognizing the emotion in multiple patterns. Mainly the emotions being worked mainly on six types of them: anger, disgust, happy, fear, sad and surprise. But there lot more emotions combined for the same emotion appearing at a particular emotion. SVM is the best option to use as a classifier for multiple emotion identification. It is based on statistical learning theory and is being used mostly by researchers nowadays.

II. SIFT ALGORITHM OVERVIEW

SIFT is elaborated as Scale Invariant Feature Transform algorithm. The SIFT method detects the local key points from the set of reference images and stored in database. The new face video is taken and then we compare each feature from our database and then we find that the candidate matching features based on Euclidean distance of their feature vectors. From the all set of matches, subsets of key points that agree on the object and its scale, location, and orientation in the new images are identified to refine good matches. In SIFT algorithm images is convert into the large collection of feature vectors, each feature vector is invariant to image translation, scaling, and rotation, partially invariant to illumination changes and robust to local geometric distortion. The steps include in algorithm are as

A. Scale-space extreme detection

B. Key point localization
C. Orientation assignment
D. Key point descriptor

The first step is used to detect key points of image. These key points are basically the interest points which are important for us. To detect key points image I(x, y) is convolved with Gaussian blurs G(x, y, σ) at different scale to get Gaussian images. This function is given in eq. 1.

$$L(x, y, \sigma)=G(x, y, \sigma)*I(x, y) \quad (1)$$

These zoomed images of original image by a factor of σ, kσ…etc are subtracted from each other to get the key points of the image. This difference of zoomed images by series of factor is called difference of Gaussian images (DOG). These key points which are extracted from series of image are maxima and minima that occur at multiple scales. Thus it is a feature improving procedure where the subtraction of one blurred image from another more blurred image occurs. The formula used on above concept is eq. 2 and the difference of Gaussian as shown in fig. 1.

$$D(x,y,\sigma)=L(x,y,k\sigma) - L(x,y,\sigma) \quad (2)$$

In second step key points obtained from scale space extrema detection consists of key points – stable and unstable. This step detects unstable key points and removes it to obtain stable and reliable key point features. Unstable key points are removed due to low contrast, poor edges and below threshold value.

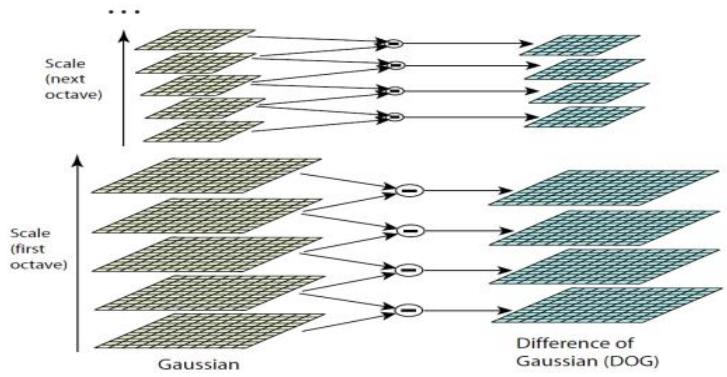

Fig.1 Difference of Gaussian

The third step aim to assign orientation to the key points based on local image properties, achieving invariance to rotation. Neighbor is taken around the key point location depending on this key point and gradient magnitude and direction is calculated in that region. The approach taken to find orientation is
Compute gradient magnitude

$$m(x,y) = \sqrt{L(x+1,y) - L(x-1,y))^2 + (L(x,y+1) - L(x,y-1))^2} \quad (3)$$

Compute orientation

$$\theta(x,y) = \tan^{-1}((L(x,y+1) - L(x,y-1)) / (L(x+1,y) - L(x-1,y)) \quad (4)$$

The final stage of SIFT algorithm build a descriptor for each key point location which depends upon the image gradients in its local hborhood around a pixel. The SIFT bring out the key points from the database images. Then given an altered image SIFT extracts the key point for that image and compares that key point to the dataset.

III. SVM CLASSIFIER

Support vector machine is used as classifier, which is basically used to classify the input data when compared with database and clarifies the category of input data.

IV. PROPOSED APPROACH

In the previous work, many algorithms have been proposed for facial recognition like PCA (Principal Component Analysis and LDA (Linear Discriminant Analysis). This approaches use the entire face region for the task of feature extraction and, therefore to

overcome difficulties in the detection of specific facial landmarks generally, this approaches obtain better result on images captured in controlled conditions, but less efficient in case of invariance to scale and rotation or orientation. This propose system based on SIFT features for face recognition. The SIFT features are bring out from all the faces in the database. Hence, take a new face video and the features are extracted from the face are compared with the database images. The face in the database with the largest number of matching points is considered the nearest face, and is used for the classification of the new face. A feature is considered matched with another feature when the Euclidian distance to that feature is less than a specific fraction of the distance to the next nearest feature. This guarantees that we reduce the number of false matches. Sometimes in case of a false match, then there will be a multiple number of other near features with the close distances, because of the high dimensionality of the features. On the other hand, in case of a correct match, it is unlikely to find another feature that is too close due to the highly distinctive nature of SIFT features.

V. METHODOLOGY

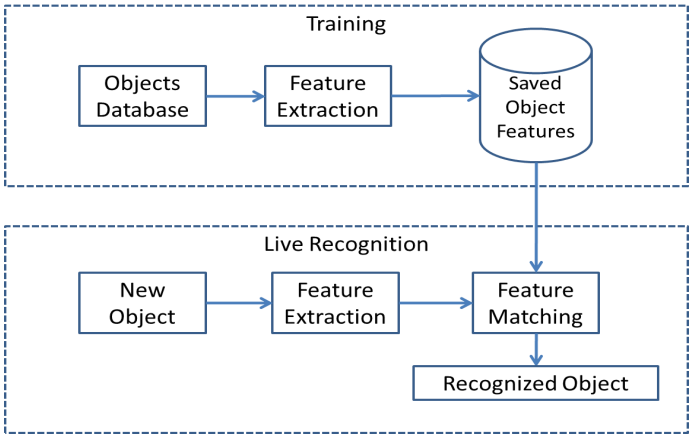

Fig. 2 Extraction of facial expression

Database- It contain the images of female database consist of five emotion such as anger, sad, normal, surprise, happy. When input image is given it is compared with database images every time and detects output as emotion.

Feature extraction- SIFT algorithm is used for feature extraction. It extracts the reliable key points as feature descriptor of image. Features of all images are stored in database and it compared with input images.

Comparison-Emotion of input images are detected and comparing with database then SVM is used to classify the emotions. Finally facial emotion is detected.

Working- We propose a system based on SIFT features for face recognition. The SIFT features are extracted from all the faces in the database. Then, given a new face image or video the features extracted from that face are compared against the features from each face in the database. The face in the database with the largest number of matching points is considered the nearest face, and is used for the classification of the new face. A feature is considered matched with another feature when the Euclidian distance to that feature is less than a specific fraction of the distance to the next nearest feature. This guarantees that we reduce the number of false matches. This is because in case of a false match, there will be a number of other near features with close distances, due to the high dimensionality of the features. On the other hand, in case of a correct match, it is unlikely to find another feature that is too close due to the highly distinctive nature of SIFT features.

VI. CONCLUSION

Facial expression recognition is challenging problem. Many algorithms have been proposed to correctly identify the facial expression. Facial expression recognition has many applications in recent advance system. This propose system is based on SIFT algorithm for face recognition and extraction to provide the superior performance and greater accuracy with consistency.

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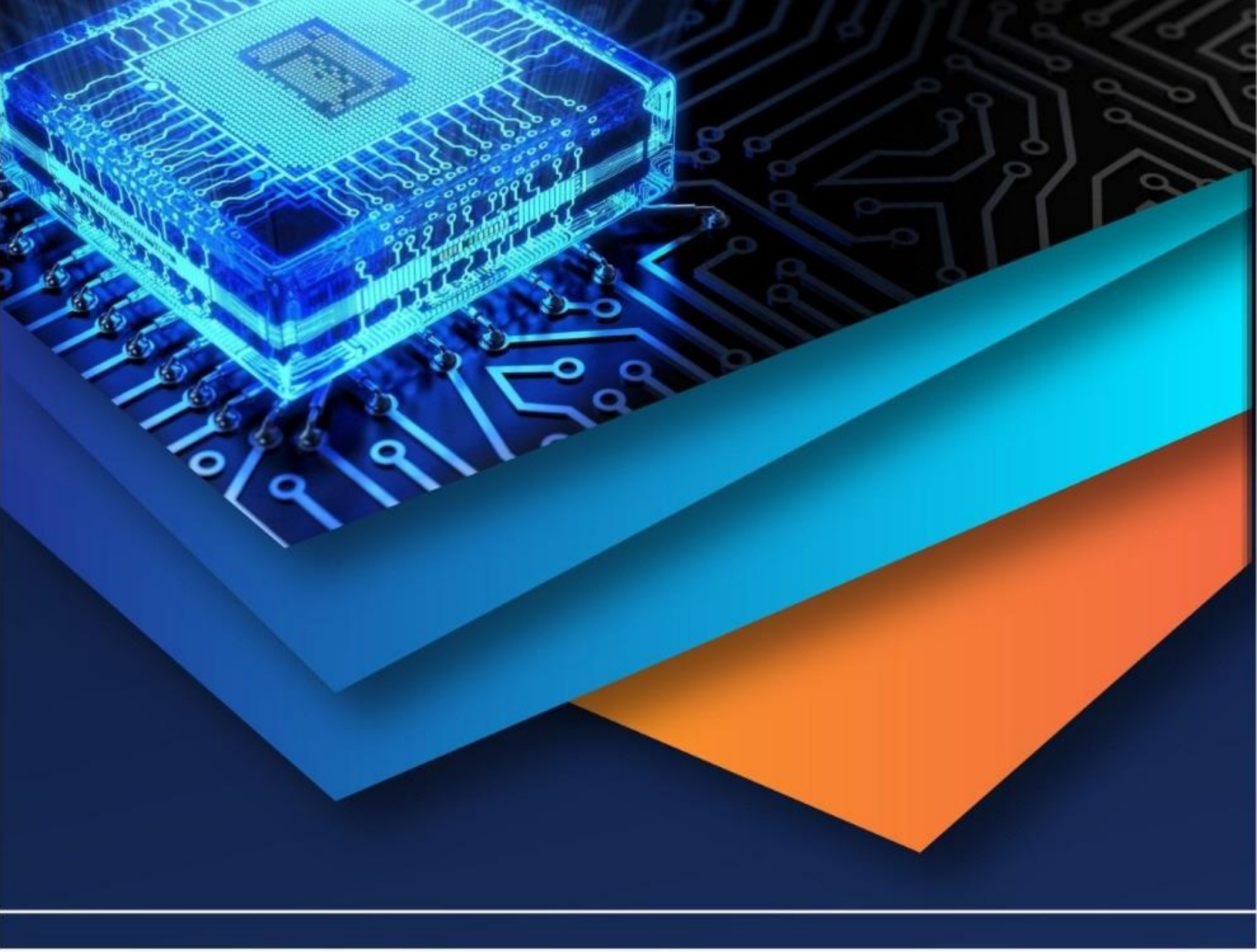

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