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Review Of Face Recognition And Face Emotion Detection System Using Open Source Computer Vision (Opencv)

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Abstract

In the last decade there has been rising interest in computer vision.Face recognition and emotion-recognition has transcended from abstruse to popular area of computer vision research and one of the best and most successful applications of image analysis.Especially due to the intrinsic nature of the issue, computer vision is not only an field of study in computer science, but also an focus of neuroscientific and psychological studies, primarily because of the general opinion that developments in computer image processing and comprehension study might provide deep insights into how our brain functions and vice versa. The proposed aThis research presents a framework based on facial features and their actions for real-time face recognition and facial emotion detection systems. OpenCV i.e Opensource Computer Vision is used to implement the face detection process, it serves as the input for the algorithm.

Keywords: *Python, OpenCV, Face Recognition, Face Detection, Emotion Recognition, Haar Cascades, Eigenface, Fisherface, Local Binary Pattern Histogram.*

2. INTRODUCTION:

A)Face Detection:

Face detection is used to check whether or not a face is present in a given image. Face detection is part of image processing, and image processing is nothing but a method for compressing and retrieving useful features from the source image.

Any face detection algorithm can classify the given image in the following two categories:

1) Face present
2) Face not present

The function of face detection is to locate a face in a given input image and also to remove the background from that image. There are two types of errors that can appear in a face detection process.

1)False Negative

2)False Positive

False Positive is an error that occurs when a face is identified in an image that does not contain an image where, as in False Negative Error, the algorithm does not recognize the face present in the image.

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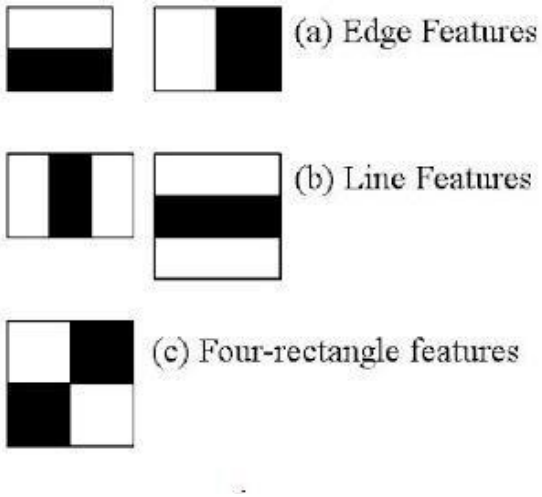
$$\text{Detection Rate} = \frac{\text{No of faces detected by human}}{\text{No of faces detected by algorithm}}$$

B)**Haar Cascades**



(Figure 1:Haar Cascades Features)

Haar Cascades uses The image Subtraction Morphological method to identify the face in the image. Cascades of photographs of the same person are taken and stored in the database. All pixels under the influence of the brighter region are subtracted from all pixels under the influence of the darker region. The above approach is implemented on each and every image which is present in the database, but some images may have some errors. At the end of the process, the images with the least amount of errors are chosen. The result is then applied and called a weak classifier. In the end, all weak classifiers are added to form a strong classifier.

This process works with the predefined set of trainers present in the OPENCV.

C)Face Recognition

Face recognition is a branch of computer technology that can identify various human faces from an image or a video clip. OPENCV (Open Source Computer Vision) is commonly used for the implementation of numerous face-recognition algorithms. The facial recognition algorithm evaluates the different features of the face from the given source image or a video clip. Eigenface, Fisherface and LBPH are some commonly used algorithms implemented using the OpenCV library.

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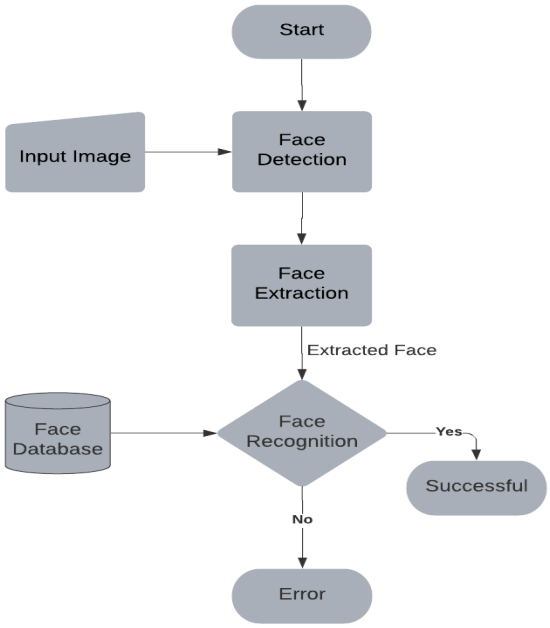
• **Eigenface** :- The EigenFace algorithm uses Principal Component Analysis which uses the same collection of images to classify the given input images and to extract features.

When implementing the EigenFace algorithm, it is important that the eyes of the individual match in each image and that the input images are taken under the same lighting conditions

• **Fisherface** :- FisherFace algorithm is based on Linear Discriminant Analysis (LDA) and is used to recognize patterns. It uses class labels as well as information regarding the datapoint. Different conditions of lighting have negligible effect on the process of classification.

• **Local Binary Pattern Histogram** :- The image is divided into 3x 3 pixel sized blocks in this algorithm. The luminosity strength of the neighboring pixels is compared to the core pixel and a value of 1 or 0 is assigned to each surrounding pixel depending on the difference. The result is an eight-bit number converted to a decimal number. The image's luminosity has no effect upon the algorithm.Histograms are used to track the frequency of values occurring, making the process more effective.



(Figure 2:Face recognition system)

• **Which Algorithm should we choose:**

1) Both Eigenface and FisherFace convert a high dimensional image model to a low dimensional image model which a CPU intensive process requiring a higher amount of computational power whereas LBPH uses matrix mathematics which compared to the other two requires less processing power

2) Eigenface algorithm requires the same lighting conditions between the input image and the images by which the system is going to be trained, which is not practical in terms of its uses

3) FisherFace algorithm causes the CPU to function at 100% capacity for long duration of time than that of a LBPH which increases the latency between the input and output, which is not a practical solution

D)Emotion Recognition

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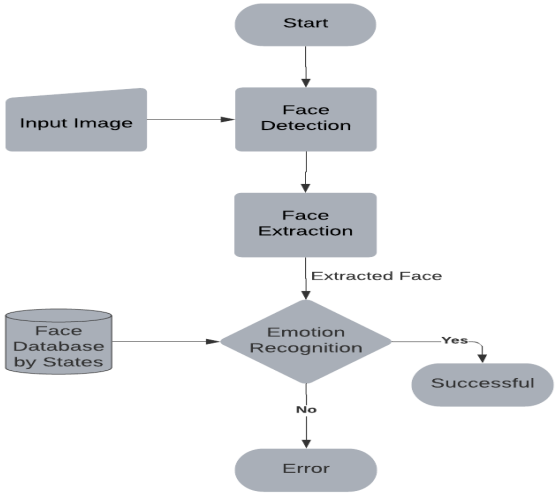
Detection of face-emotion is used to predict the person's emotional state based on their facial expressions. Following cross-cultural research in 1960, Paul Ekman proposed the concept that emotional facial expressions are not culturally determined, but universal, and identified six basic emotions: rage, disgust, fear, joy, sorrow, and excitement. Facial characteristics such as eyes, nose, lips and facial contour are known to be the facial action units and are responsible for developing facial expressions. Here facial features are known as the primary points used for training and testing.

Like the face recognition algorithm, emotion detection requires training of a machine by providing a number of images for each emotional state which are then processed to extract their common features, which are unique for each state, like for happiness, cheeks position changes.



(Figure 3:Emotion recognition system)

3.DISCUSSION

In recent years, face recognition has evolved rapidly for its various uses in the areas of law enforcement, biometrics, defense, and other commercial applications. Face recognition biometric technology has many benefits over other biometric systems. Biometric technologies provide recognition based on the biological and behavioral features.

Nearly almost all of these technologies require some voluntary action from users,
As in fingerprint or hand geometry authentication user has to place his hand on the device, in Iris or Retina recognition he or she has to stand in front of the camera(scanner)
The technologies often require expensive equipment and are prone to any body movement. Voice recognition in public places is more sensitive to background noise.There is a greater probability that signatures will be changed or copied, which may result in fraud. When many people use the same equipment to capture their biological features, there is a greater risk that the germs will spread from one person to another.Nonetheless, facial images can easily be collected with cheap fixed cameras. Effective face recognition algorithms and proper pre-processing of the images will account for noise and minor variations in orientation, size and illumination.

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facial expressions are the result of one's emotional state; it represents the psychology and personality of that person but also facial expressions that are part of nonverbal communications where they are used as a signal or clues. They are part of the communication they sometimes change the meaning of the conversation, so it's important for the listener to identify such clues to carry effective communication with the speaker

4.CONCLUSION

This paper concludes that face and emotion recognition are two important fields of image processing. Face recognition is simpler than emotion recognition as true emotions cannot be recognised by OPENCV alone. These errors in emotion recognition can be minimized to a certain extent by using a microphone to recognise the tone of the person, temperature reader to calculate temperature of body, Pulse rate sensor to identify physical condition of that person.

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