A Study on Facial Expression Recognition

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Abstract— In present, the automatic machine based face recognition has become significant due to its urgency in potential application and current scientific challenges of industries. The success rate or positive impact of face recognition systems depend on a variety of information imposed in images of human faces. Pose of face, facial expression, angle, occlusion and state of structural components are some of those. Emotions can be expressed in different ways that can be seen such as facial expression, speech, written text and gestures. This model propose an efficient approach for the recognition of expression or emotion variant faces since there are very few emotion recognition software tools to handle such problems and there is a significant importance to this research area in the field of face recognition. Especially an approach proposed here to face recognition where the facial expression in the training image set and in the testing image set diverge and only one sample image per class is existing in the system. The input to the system is a frontal neutral expression oriented face image with unique background. In this image the hair is tied away from the face and facial hair should be removed. Principal Component Analysis approach was used as a primary mechanism in the proposed model. This approach has been applied purely on a set of face images in order to extract a set of eigenface images as the output.

Key words: Face Acquisition, Facial Data Extraction, Facial Expression Recognition

I. INTRODUCTION

This paper is a study of the processing facial expression recognition which required image processing. The process studied in this paper is the most efficient, time saving and reliable. We have used the different algorithm for facial expression recognition. This process can be broken down into basically 3 parts:

1) Face Acquisitions: - The processing stage of finding automatically the face region for the input or sequence.
2) Facial data extraction: - Once the face is located, next step is to extract and represent the facial changes due to facial expression. There are two types of extraction approach firstly geometric feature based and other appearance based method.
3) Facial expression recognition: - It is the training part of the algorithm. We can train the algorithm to a lot appropriate ways to detect the expression of image.

II. FACE ACQUISITION

Face acquisition works in two steps face detection followed by head pose estimation

A. Face Detection

Face detection is a process being used in a variety of applications that identifies human faces in images. There is different algorithm for face detection and each algorithm has different advantage and disadvantages.

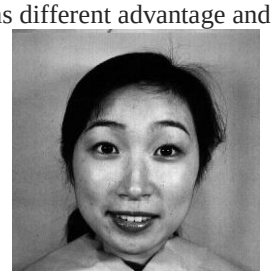

Fig. 1: Image (1)

B. Head Pose Estimation

After detection of face, head pose estimation has very

Fig. 2: Image (2)

Important role in process because knowing the head poses of a person provides important cues concerning visual focus of attention. Fast and reliable algorithms for estimating the head pose are essential for many applications and higher-level face analysis tasks.

III. FACIAL DATA EXTRACTION

In Facial data extraction the points are tracked from frame to frame to extraction the facial feature of face. While we can directly apply detection algorithm for every frame to know exactly where the face is but it is computationally expensive and it can sometimes even fail if face is tilted. This is because detection algorithm use trained classification model. So detection is done at the starting frame and then the detected face is tracked using tracking algorithm.

A. Geometric Feature-Based Methods

In the geometric feature based approach the primary step is to localize and track a dense set of facial points..The accuracy decreases when more emotions are needed to be recognized. Accuracy of geometric feature based emotion recognition still need to be improved. Research has developed systems for facial expression recognition, by utilizing the advantages of both geometric based and appearance based features.

This method uses the classical patterns of muscle actuation to generate the classical pattern of motion energy associated with each facial expression, thus resulting in a set of simple facial expression "detectors, "each of which looks for the particular space-time pattern of motion energy associated with each facial expression.

Fig. 3: Image (3)

B. Appearance Based Method

In appearance based object recognition, the pixel intensity values in an image of the object are chosen. The pixel intensities correspond directly to the radiance of light emitted from object along certain rays in space. A set of all such radiance values over all possible rays is known as preoptic function or light field. In this paper we develop a theory of appearance based object recognition from light fields. This theory leads directly to an algorithm for face recognition across pose that uses as many images of the face as are available, from one upwards. All of the pixels, whichever image they come from, are treated equally and used to estimate the light-field of the object. The Eigen light-field is then used as the set of features on which to base recognition, analogously to how the pixel intensities are used in appearance-based face and object recognition.

To reduce the computational complexity as well as the false detection rate, the coarse region of interest for eyes and nose were selected using geometrical position of face. After the detection we use following step

Select coarse lips ROI using face width and nose position.

1) Apply Gaussian blur to the lips ROIt
2) Apply horizontal sobel operator for edge detection.
3) Apply Otsu-thresholding.
4) Apply morphological dilation operation.
5) Find the connected components.
6) Remove the spurious connected components using threshold technique to the number of pixels.
7) Scan the image from the top and select the first connected components as upper lip position.
8) Locate the left and right most positions of connected component as lip corners**.**

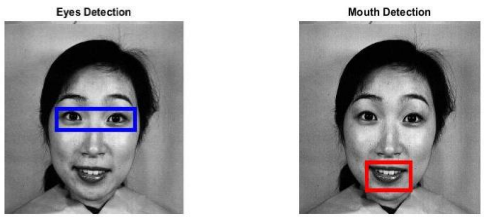

Fig. 4: Image (4)

IV. PROBLEM STATEMENT

Many face detection and facial data extraction were researched for facial expression recognition we settled on otus thresholding for facial data extraction. Some of the algorithms considered for the system are described below.

A. Gabor Wavelet.

A Gabor atom (or function) was proposed by Hungarian-born electrical engineer Dennis Gabor in 1946 . Nowadays, Gabor functions are frequently used for feature extraction, especially in texture-based image analysis (e.g., classification, segmentation or edge detection) and more practically in face recognition. Many of image processing tasks can be seen in terms of a wavelet transform. Informally speaking, the image can be seen under the lens with a magnification given by the scale of a wavelet. In doing so, we can only see just the information that is determined by the shape of the used wavelet. The Gabor atoms can also be seen in the words of a wavelet transform. Specifically, Gabor wavelets are created from one particular atom by dilation (and rotation in two-dimensional case). These Gabor wavelets provide a complete image representation.

In the one-dimensional case, the Gabor function consists of a complex exponential (a cosine or sine function, in real case) localized around x = 0 by the envelope with a Gaussian window shape

$$g_{\alpha,\xi}(x) = p\ \alpha/\pi e^{-\alpha x2}\ e^{-i\xi x}$$

B. Otus Thresholding

Otus Thresholding is used to automatically perform clustering-based image thresholding or the reduction of a gray level image to a binary image. The algorithm assumes that the image contains two classes of pixels following bi-modal histogram (foreground pixels and background pixels), it then calculates the optimum threshold separating the two classes so that their combined spread (intra-class variance) is minimal, or equivalently (because the sum of pair wise squared distances is constant), so that their inter-class variance is maximal Consequently.

Image Segmentation Based on Improved Otsu Algorithms author described 1D Otsu algorithm. This algorithm is widely used because of its simple calculation and stability. Here the algorithm works on only gray value of the image. The 1D Otsu algorithms only consider the pixelâTMsgray-level information without considering the pixelâTMs spatial neighborhood information, so it is difficult to obtain satisfactory segmentation result. This algorithm fails, when the global distribution of the target and background vary widely. Also it gives good segmentation effect but never work on image when the two classes is very unequal. In this paper authors proposed a new method based on Entropy which gives better result compare to 1D Otsu algorithm.

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