IJCAT - International Journal of Computing and Technology, Volume 1, Issue 8, September 2014
ISSN: 2348 - 6090
www.IJCAT.org

Real Time Facial Feature Point Extraction

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Abstract - Extract of facial feature points has become an important issue in many applications, such as face recognition, expression recognition, and face detection. A method of facial feature extraction-based and corner detection is presented in this paper. In this method develop a technique for extracting the facial features from a color image captured by the online webcam, under normal lighting condition; And saving the time during the feature extracting by the goal of detecting the features in different expression and orientations.

***Keywords* - Feature Extraction, Facial Recognition, Corner Based.**

1. Introduction

Face recognition is influenced by many complications, such as the differences of facial expression, the light directions of imaging, and the variety of posture, size and angle. Even to the same people, the images taken in different surroundings may be unlike. The problem is so complicated that the achievement in the field of automatic face recognition by computer is not as satisfied as the finger prints. Facial feature extraction has become an important issue in automatic recognition of human faces. Detecting the basic feature as eyes, nose and mouth exactly is necessary for most face recognition methods.

In the past, many systems have ignored this step and relied upon manual marking [1], [2], [3] in order to focus better on the overall system. However, in most cases, it is necessary (or at least highly desirable) to achieve automated detection quickly, or even in real-time. In other words, good detection performance is not the only concern a system capable of flawless feature point classification may be of little practical use if it cannot meet real-time requirements. So, when choosing our approach, I will try to identify methods that minimize computational complexity wherever possible.

It is interesting to note that most of the existing methods attempt to locate facial feature points from images/video captured in a highly controlled laboratory environment and with high spatial resolution. Furthermore, the face regions are always larger than 160×160 pixels. This resolution is equivalent to a person sitting only 30cm away from a webcam with focal length of 3cm and image capture resolution at 320 × 240. It is obvious that many applications require a much wider range of working distances than this, especially when wireless input devices and lower resolution cameras are used. In addition, most existing methods extract facial landmarks from expressionless face images which are unsuitable for facial expression recognition, in particular, when the recognition is based on local features. Finally, computational cost of the methods involving multiple classifications cannot be afforded by most real-time applications with limited computing resources.

The extraction of facial feature point, for example, eyes, nose, mouth corners and others, is an important stage in many facial image interpretation tasks such as face verification, face expression recognition, model based image coding and head pose determination.

2. Related Work

In Facial feature extraction, local features on face such as nose, and then eyes are extracted and then used as input data. And it has been the central step for several applications. Various approaches have been proposed in this chapter to extract these facial points from images or video sequences of faces. The basically of approaches are come as follow:

2.1 Geometry-Based

Generally geometry-based approaches extracted features using geometric information such as relative positions and sizes of the face components. Technique proposed by Kanade [4], localized eyes, mouth and the nose using vertical edge map. Nevertheless these techniques require threshold, which, given the prevailing sensitivity, may adversely affect the achieved performance.

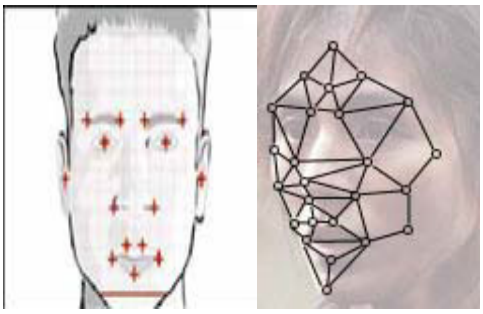

Figure 1 – Geometry Based

2.2 Template-Based

This approach, matched facial components to previously designed templates using appropriate energy functional. The best match of a template in the facial image will yield the minimum energy. Proposed by Yuille et al [5] these algorithms require a priori template modeling, in addition to their computational costs, which clearly affect their performance. Genetic algorithms can be proposed for more efficient searching times in template matching.

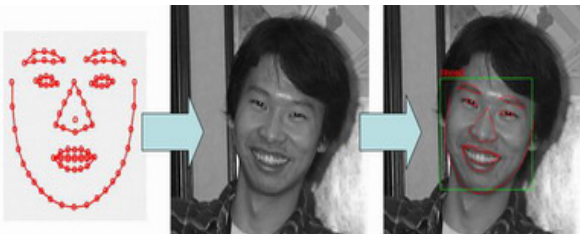

Figure 2 – Template Based

2.3 Color Segmentation Techniques

This approach makes use of skin color to isolate the face. Any non-skin color region within the face is viewed as a candidate for eyes and/or mouth. The performance of such techniques on facial image databases is rather limited, due to the diversity of ethnical backgrounds [6].

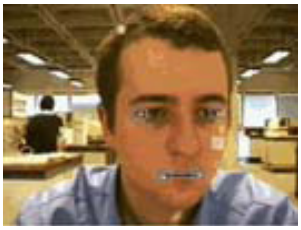

Figure 3 – Color Segmentation

2.4 Appearance-Based Approaches

The concept of "feature" in these approaches differs from simple facial features such as eyes and mouth. Any extracted characteristic from the image is referred to a feature. Methods such as principal component analysis (PCA), independent component analysis, and Gaborwavelets [7] are used to extract the feature vector. These approaches are commonly used for face recognition rather than person identification. Most of techniques except of the hybrid one which are not included here, are using still images as an input and the user's images are frontal so I don't use the template-based. As mentioned in introduction, it is so time consuming to using the appearance-based approaches cause of training part which is take the long time.

Also couldn't use the color-based approaches, because just working when the eyes are visible; it means that it doesn't give good results in different expression. The geometry-based technique works on the frontal one but I used that plus the corner detection which will be introduced in methodology.

3. Methodology

Extract of facial feature points has become an important issue in many applications, such as face recognition, expression recognition, and face detection. A method of facial feature extraction-based and corner detection. In this method I develop a technique for extracting the facial features from a color image captured by the online webcam, under normal lighting condition; And saving the time during the feature extracting by the goal of detecting the features in different expression and orientations.

The eyes, nose, and mouth are the most significant facial features on a human face. In order to detect facial feature candidates properly, the unnecessary information in a face image must be removed in advance. The first stage is cropping the face area as soon as the picture is taken from the webcam; the second part of preprocessing is prepared by resizing that cropped image.

To adjust the contrast and brightness of the image in order to remove noises built-in MATLAB function are used then it is converted to the gray scale image, because the corner detector can only be applied on gray level.

Facial features in the face model are corresponded to the dark portion on a more light for face region, that is, eyes, nose, and mouth is darker for- skin region. A Gaussian derivatives filter is an effective filter that is the good response to such patterns of intensity variation. This filter is composed of a second derivative of a Gaussian in a direction, and the other filter is a Gaussian in the orthogonal direction for finding the corner point applying

the corner detection algorithm which is started by Auto-correlation:

Step1. Constructing the auto-correlation matrix, also called (weighted)

Step2. Strength assignment

Step3. Non-maximum suppression

Auto-correlation matrix captures the structure of the local neighbourhood and measure based on Eigen values of this matrix. If finding two strong Eigen values, it means that point is the interest point, if finding one strong Eigen value it means, the selected part is the contour and if no Eigen value it means, that is a uniform region. Interest point detection find after Threshold on the Eigen values and Local maximum for localization.

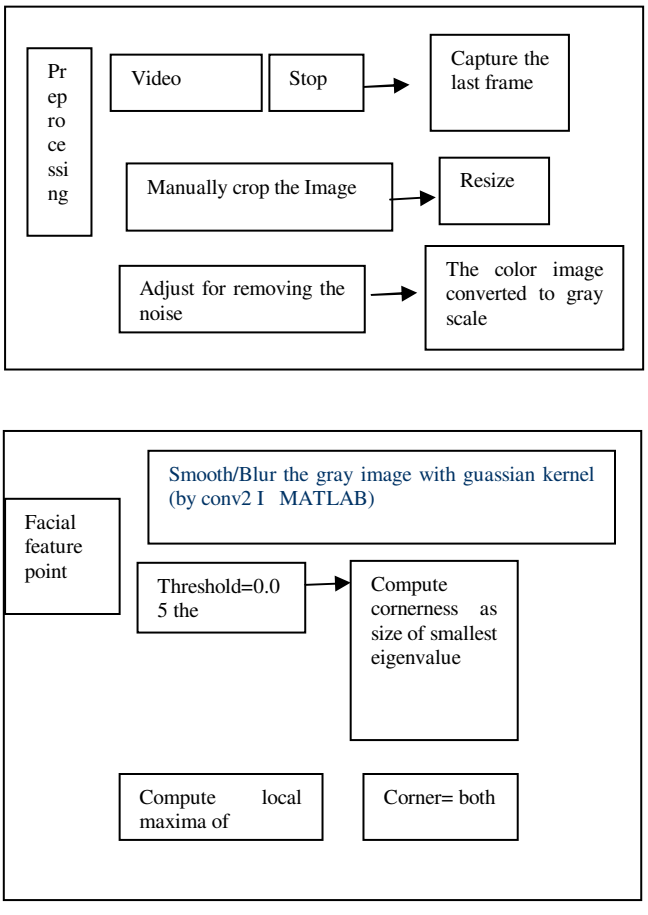

Fig. 1 Block Diagram of the System Process

4. Result

The Facial feature extraction method was implemented in MATLAB and examines in four different expressions are Sad, Happy, Surprise, Neutral, also in five orientations as follow; Left side, Frontal, right side, Up and Down.

For example capture the user's face from the left side in the sadness expression, so the corners is marked and the value is calculated by the average of four more pictures results in the same position, moreover this testing continued for other expressions and orientations, I do not have any result for the left eye in the right side face picture, because the left eye doesn't appear in the right side picture also for the right eye in the case of left side photo. Finally the average detection rate for all of the expression and orientation is 89.15, as see in

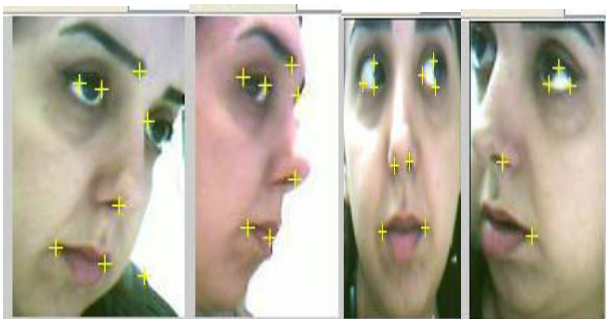

Fig. 2 Test results

5. Conclusion and Future Works

In this paper, it's been tried to review the works done in facial feature extraction, and proposed the geometry based technique by the corner detection for extracting the facial feature points and also present the preprocessing approach. The experiment result shows the system can works in the different orientation and expression. In the future I will improve the detection by the higher accuracy and also it will be work in the real-time video.

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Kusuma Kumari B.M completed her M.C.A, M. Phil and pursuing Ph. D from Tumkur University. Currently working as an Assistant Professor at Tumkur University. 8 years of teaching experience and attended and presented number of national and international conferences and published 13 papers in international journals. Interested in image processing, pattern recognition etc.