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# Analysis of Different Methods for Face Recognition

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**ABSTRACT**

Face recognition is an automatic assignment through which a digital image of a particular person can be analyzed using the features of the face in that image. Face recognition method first involves detecting a face from a scene and then extracting features from the face for identification. Computer learning is used in face detection to detect the location of any faces within an image. In this paper we have discussed algorithms for face detection and feature extraction.

**Keywords:** Feature extraction, Template based feature extraction, Face detection



## 1. INTRODUCTION

One of the most relevant applications of image processing is face recognition. It is a challenge to build an automated system that has capabilities similar to humans to recognize faces. Although humans are quite good in identifying known faces, but those skills are limited when it comes to dealing with a large amount of unknown faces. The computers, with an almost limitless memory and computational speed, should overcome human's limitations.

Face recognition finds its application in a wide variety of industry areas such video surveillance, human-machine interaction, photo cameras, virtual reality or law enforcement. Therefore, it's not a problem restricted to computer vision research. Face recognition is a relevant subject in pattern recognition, neural networks, computer graphics, image processing

Face recognition is the automatic assignment through which a digital image of a particular person can be analyzed using the features of the face in that image. Face recognition method consists of three components: face detection, image feature extraction and face identification.

The first phase of face recognition is face detection in which faces are detected from a scene, the second step feature extraction deals with identifying facial features points from a face such as eyes, nose, and mouth which are then used as input data to the application. In the face identification step the identity of the correct face is retrieved from the database.

In this paper we will have an overview of the face recognition system and the algorithms that are used at every stage of the system.

## 1. FACE RECOGNITION SYSTEM STRUCTURE

The input to a face recognition system is always an image or video stream. The output is an identification or verification of the subject or subjects that appear in the image or video. A face recognition system process can be analyzed as three step process as shown in Figure 1.

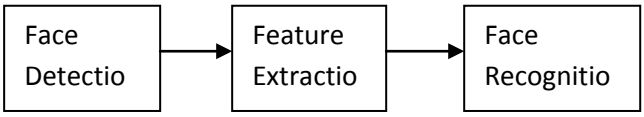


**Fig.1. Face Recognition System**

In the Face detection step faces are extracted from scenes. So, the system positively identifies a certain image region as a face. The next step feature extraction involves obtaining relevant facial features from the data. These features could be certain face regions,

variations, angles or measures, which can be human relevant (e.g. eyes spacing) or not. This phase has other applications like facial feature tracking or emotion recognition.

Finally, the system does recognize the face. In an identification task, the system would report an identity from a database. This phase involves a comparison method, a classification algorithm and an accuracy measure.

**2. FACE DETECTION**

The methods used for face detection can be classified in the following categories [1]

***A*. Knowledge Based Methods**- They are rule-based methods that encode our knowledge of human faces.

**B. Feature-Invariant Methods-** These methods are algorithms that find invariant features of face despite its angle or position.

**C. Template Matching Methods-** These algorithms compare input images with stored patterns of faces or features.

**D. Appearance-Based Methods**- A template matching method whose pattern database is learnt from a set of training images.

***A. KNOWLEDGE BASED METHODS***

These are rule-based methods. They try to capture our knowledge of faces, and translate them into a set of rules. It's easy to guess some simple rules. For example, a face usually has two symmetric eyes, and the eye area is darker than the cheeks. Facial features could be the distance between eyes or the color intensity difference between the eye area and the lower zone. The big problem with these methods is the difficulty in building an appropriate set of rules.

***B. FEATURE INVARIANT METHODS***

In this method we try to find some invariant features for face detection. The idea is to overcome the limits of our instinctive knowledge of faces. In this method we firstly, try to find eye-analogue pixels, so it removes unwanted pixels from the image. After performing the segmentation process, they consider each eye-analogue segment as a candidate of one of the eyes. Then, a set of rule is executed to determinate the potential pair of eyes. Once the eyes are selected, the algorithm calculates the face area as a rectangle. The four vertexes of the face are determined by a set of functions. So, the potential faces are normalized to a fixed size and orientation. Then, the face regions are verified using a back propagation neural network.

**C. TEMPLATE MATCHING METHODS**

Template matching methods try to define a face as a function. We try to find a standard template of all the faces. Different features can be defined independently.

For example, face can be divided into eyes, face contour, nose and mouth. Other templates use the relation between face regions in terms of brightness and darkness. These standard patterns are compared to the input images to detect faces. It cannot achieve good results with variations in pose, scale and shape.

**D. APPERANCE BASED METHODS**

The templates in appearance-based methods are learned from the examples in the images. In general, appearance-based methods rely on techniques from statistical analysis and machine learning to find the relevant characteristics of face images. These methods are also used in feature extraction for face recognition.

**2. FEATURE EXTRACTION FOR FACE RECOGNITION**

Some image processing techniques extract feature points such as nose, eyes, mouth and then the extracted points are used as input data to application. For some application this feature extraction is the central step. Various approaches have been proposed to extract these facial points from images or video sequences of faces. The four basic approaches are discussed here.

**A. GEOMETRY BASED TECHNIQUES**

In this technique features are extracted using the size and the relative position of important components of images. This technique in this group focuses on two broad directions. Firstly the direction and edges of important component is detected and then building feature vectors from these edges and direction. Canny filter and gradient analysis usually applied in this direction. Second, methods are based on grayscale difference of important components and unimportant components, by using feature blocks, set of Haar-like feature block in Adaboost method [2] to change the grayscales distribution into the feature.

In LBP [3] method, every face image divides into blocks and each block has its corresponding central pixel. Then this method examine its neighbor pixels, based on the grayscales value of central pixel it changes neighbor to 0 or 1. Therefore, every pixel will be represented in a binary string. After that a histograms is build for every region and then these histograms are combined to a feature vector for the face image. Gabor Wavelet Transformation methods are used for feature extraction [4].

***B. Template Based Techniques***

This technique will extract facial feature based on the previously designed templates using appropriate energy function and the best match of template in facial image yield the minimum energy. Methods have been proposed by Yuille *et al.* [5], detecting and describing features of faces using deformable templates. In deformable templates the feature of interest, an eye for example, is described by a Parameterized template. These parameterized templates enable a priori knowledge about the expected shape of the features to guide the detection process [5].

An energy function is defined to links peaks, edges, and valleys in the image intensity with corresponding

properties of the template. After that the template matching is done with the image, by altering its parameter values to minimize the energy function, thereby deforming itself to find the best fit. For the descriptor purpose final parameter value is used. In the Template based eye and mouth detection first an eye template is used to detect the eye from image. Then a correlation is found out between the eye templates with various overlapping regions of the face image. Eye region have a maximum correlation with the template.
This method can be given as algorithm which has the following steps [6].

**Step 1:** An eye template of size m × n is taken.

**Step 2:** The normalized 2-D auto-correlation of eye template is found out.

**Step 3:** the normalized 2-D cross-correlation of eye template with various overlapping regions of the face image is calculated.

**Step 4:** The mean squared error (MSE) of auto correlation and cross-correlation of different regions are found out. The minimum MSE is found out and stored.

**Step 5**: The region of the face corresponding to minimum MSE represents eye region.

**Step 6:** From eye region eyes points extracted.

**Step7:** From eye points mouth point can be detected

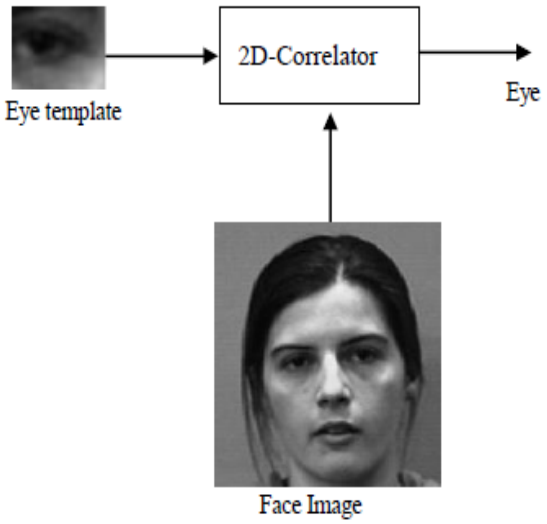


**Figure2: Template based feature detection**

### *C. APPEARANCE BASED TECHNIQUES*

The techniques of this group process the image as two dimensional patterns. The concept of "feature" in this approach is different from simple facial features such as eyes and mouth. Any extracted characteristic from the image is referred to a feature. This method group found best performer in facial feature extraction because it keep the important information of image and reject the redundant information. Method such as principal component analysis (PCA) and independent component analysis [7] are used to extract the feature vector. The main purpose of PCA is to reduce the large dimensionality of observed variable to the smaller dimension of feature space without losing much information. In PCA analysis high order dependencies exist and this is the disadvantage of this method because much of the information may contain higher order relationship. While the other method ICA uses the technique of independent component analysis which not only uses second-order statistic but also use high order statistic. It has been observed that many natural signals, including speech, natural images, are better described as linear combinations of sources with super-Gaussian distributions. In that case, ICA method better than PCA method because: I) ICA provides a better probabilistic model of the data. II) It uniquely identifies the mixing matrix. III) It finds an unnecessary orthogonal basic which may reconstruct the data better than PCA in the presence of noise such as variations lighting and expressions of face. IV) It is sensitive to high-order statistics in the data, not just the covariance matrix [8]. Some problems with this method like that it requires that image matrices must be transformed into vectors, which are usually of very high dimensionality and this causes high computational cost and complexity.

### *D. COLOR BASED TECHNIQUES*

This approach uses skin color to isolate the face area from the non face area in an image. Any non-skin color region within the face is viewed as a candidate for eyes or mouth [9].

#### 1. COLOR BASED FEATURE EXTRACTION

With the help of different color models like RGB skin region is detected [10] [11]. The image obtained after applying skin color statistics is subjected to binarization. Firstly it is transformed to gray-scale image and then to a binary image by applying suitable threshold. All this is done to eliminate the color and saturation values and consider only the luminance part. After this luminance part is transformed to binary image with some threshold because the features for face are darker than the background colors. After thresholding noise is removed by applying some opening and closing operation. Then eyes, ears, nose facial features can be extracted from the binary image by considering the threshold for areas which are darker in the mouth than a given threshold[u]. A triangle shape can be drawn considering the two eyes and nose as three points of triangle. After getting the triangle, it is easy to get the coordinates of the four corner points that form the potential facial region. Since the real facial region should cover the eyebrows, two eyes, mouth and some area below the mouth, this coordinates can be calculated [5]. The performance of such techniques on facial image databases is rather limited, due to the diversity of ethnical backgrounds.

## 5. CONCLUSION

This paper has discussed various face detection and feature extraction techniques. Feature extraction is an important part of face recognition because it forms the basis of classification of faces. This paper discusses various feature extraction technique. Every technique has its pros and cons such as appearance based technique represent optimal feature points which can represent global face structure but disadvantage is high computational cost. Template based methods are easy to implement but does not represent global face structure. Color segmentation based methods used color model for skin detection with morphology operation to detect features of face but different color model and illumination variation factors can affect performance.

## 6. REFERENCES


1. Ming-Hsuan Yang, David J. Kriegman, and Narendra Ahuja, “Detecting Faces in Images: A Survey”, IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE, VOL. 24, NO. 1, JANUARY 2002.
2. M. Jones and P. Viola, “Face Recognition Using Boosted Local Features”, IEEE International Conference on Computer Vision, 2003.
3. Shu Liao, Wei Fan, Albert C. S. Chung and Dit-Yan Yeung, “Facial Expression Recognition Using Advanced Local Binary Patterns, Tsallis Entropies And Global Appearance Features”, IEEE International Conference on Image Processing, pp. 665-668, 2006
4. T. S. Lee, ”Image representation using 2D Gabor wavelets,”PAMI, IEEE Trans. on, vol. 18, pp. 959-971, 1996.
5. Bhoi, M. N. Mohanty,” Template Matching based Eye Detection in Facial Image”, International Journal of Computer Applications (0975 – 8887) Volume 12– No.5, December 2010.
6. N.Bhoi, M. N. Mohanty,” Template Matching based Eye Detection in Facial Image”, International Journal of Computer Applications (0975 – 8887) Volume 12– No.5, December 2010.
7. Bruce A. Draper, Kyungim Baek, Marian Stewart Bartlett, J.Ross BeveRidge, “Recognizing Face with PCA and ICA”,Computer Vision and Image Understanding 91, pp. 115–137, 2003.
8. J.Lim, Y. Kim J. Paik” Comparative Analysis of Wavelet- Based Scale-Invariant Feature Extraction Using Different Wavelet Bases” International Journal of Signal Processing, Image Processing and Pattern Recognition Vol. 2, No. 4, December, 2009.
9. T. T. Do, T. H. Le,” Facial Feature Extraction Using Geometric Feature and Independent Component Analysis”, Department of Computer Sciences, University of Natural Sciences, HCMC, Vietnam.