A Robust Method for Face Detection based on Wavelet Transform and optimized feature selection using Ant Colony Optimization in Support Vector Machine

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***Abstract* - Face recognition method suffered from problem of feature selection process. The feature selection process in pattern recognition and recognition play an important role. The current method of face recognition system only focus on local, global and neural network process of feature extraction and process for recognition. The optimized feature selection process improves the recognition ratio of face recognition. In this dissertation we proposed a new method for face recognition based on wavelet transform function for feature extraction and for selection of feature of facial image used ant colony optimization technique for selection of feature for classification of support vector machine. The optimized feature selection process pass the data of most similar for classifier for classified data for recognition process. The optimized process of data reduces the unclassified region of support vector machine and improves the performance of face recognition..In this dissertation we modified the matching technique for face recognition using multi-class SVM and ant colony optimization. For the modification of pattern classification binary support vector classifier used.**

***Index Terms* - SVM, Face Detection, feature extraction**

I. INTRODUCTION

Importance of face detection systems have speeded up in the last few decades. A face detection system is one of the biometric information processing. Applicability is easier and working range is larger than other biometric information processing, i.e.; fingerprint, face scanning, signature, etc. The face detection is performed on live acquired images without any application field in mind. Face detection systems are part of facial image processing applications and their significance as a research area is increasing recently. They use biometric information of the humans and are applicable easily instead of fingerprint, face, signature etc., because these types of biometrics are not much suitable for non-collaborative people. Face detection systems are usually applied and preferred for people and security cameras in metropolitan life. These systems can be used for crime prevention, video surveillance, person verification, and similar security activities. Face detection system is a complex image-processing problem in real world applications with complex effects of illumination, occlusion, and imaging condition on the live images. It is a combination of face detection and detection techniques in image analyzes. Detection application is used to find position of the faces in a given image. Detection algorithm is used to classify given images with known structured properties, which are used commonly in most of the computer vision applications. These images have some known properties like; same resolution, including same facial feature components, and similar eye alignment. These images will be referred as "standard image" in the further sections. Detection applications uses standard images and detection algorithms detect the faces and extract face images which include eyes, eyebrows, nose, and mouth. That makes the algorithm more complicated than single detection or detection algorithm.

The first step for face detection system is to acquire an image from a camera. Second step is face detection from the acquired image. As a third step, face detection that takes the face images from output of detection part. Final step is person identity as a result of detection part. An illustration of the steps for the face detection system is given in Figure 1. Acquiring images to computer from camera and computational medium (environment) via frame grabber is the first step in face detection system applications. The input image, in the form of digital data, is sent to face detection algorithm part of software for extracting each face in the image. Many methods are available for detecting faces in the images. The available methods could be classified into two main groups as; knowledge-based and appearance-based methods. Briefly, knowledge-based methods are derived from human knowledge for features that makes a face. Appearance-based methods are derived from training and/or learning methods to find faces.

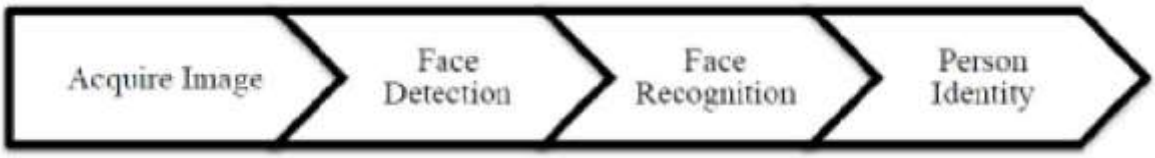

Figure 1 Step of Face Detection System Applications

Methods for face detection and detection systems can be affected by pose, presence or absence of structural components, facial expression, occlusion, image orientation, imaging conditions, and time delay (for detection). Available applications developed by researchers can usually handle one or two effects only; therefore they have limited capabilities with focus on some well-structured Acquire Image Face Detection Face Detection Person Identity application. A robust face detection system is difficult to develop which works under all conditions with a wide scope of effect.

II. FACE DETECTION PART

Face detection performs locating and extracting face image operations for face recognition system. Face detection part algorithm is given in Figure 2.

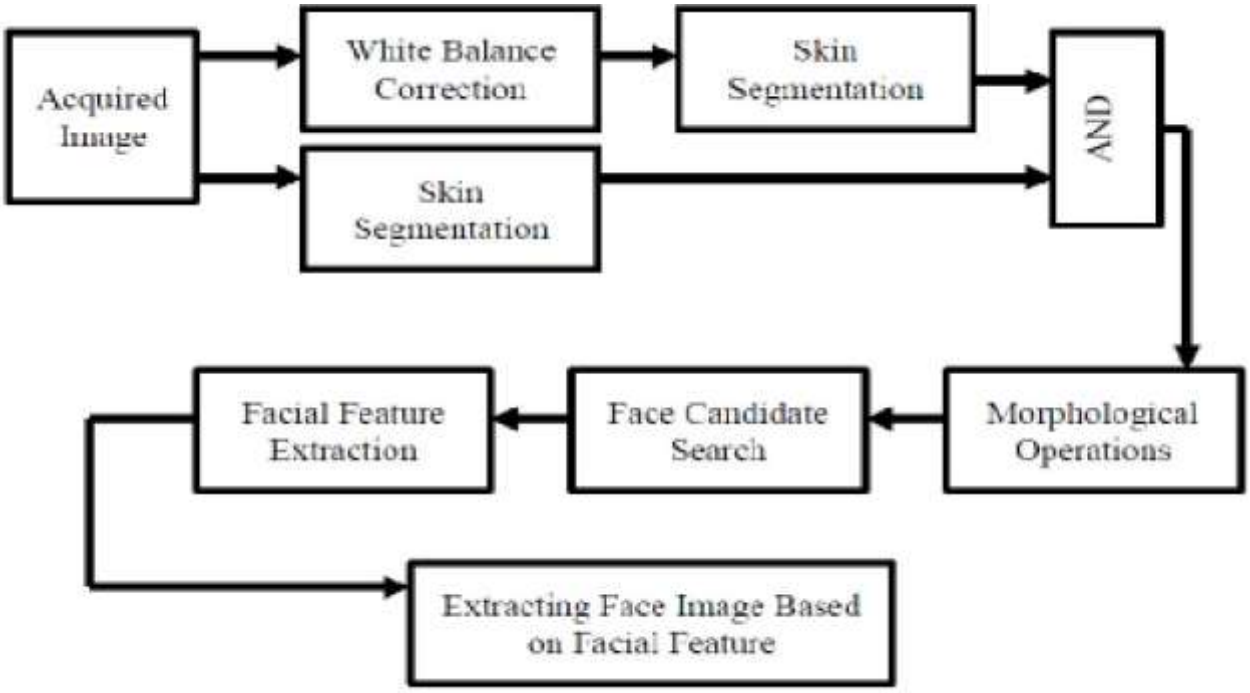

Figure 1 Step of Face Detection System Applications

For this reason, skin segmentation is applied as a first step of detection part. RGB color space is used to describe skin like color [1], and also other color spaces are examined for skin like colors, i.e. HSV&YCbCr [2], HSV [4], and RGB&YCbCr&HSV [2]. However, best results give RGB color space skin segmentation. White balance of images differs due to change in lighting conditions of the environment while acquiring image. This situation creates non-skin objects that belong to skin objects. Therefore, white balance of the acquired image should be corrected before segmenting it. White balance algorithm, as a brief, makes image hotter if image is cold, and

makes colder if image is hot. If image appears as blue, then image is called as cold. If image appears as red or orange, then image is called as hot. Lighting conditions in the capture area are always changing, due to change in sunlight direction, indoor lighting, and other light reflections. Generally, taken pictures are hotter than they should be. Figure 1 shows hotter image that is taken in capture area and skin color segmentation to hotter image, and white balance corrected image. If the image is not balanced, then some part of the wall will be taken as skin color. Under some lighting conditions, acquired image can be colder. Then, the colder image will be balanced to hotter image. On the contrary, this process will generate unwanted skin color like regions. To get rid of this problem and create final skin image, logical "and operation" is applied on both segmented original image and white balance corrected. This operation will eliminate change of color value due to change of lighting condition. Also, bad results of segmentation on uncorrected image and good results on corrected.

In uncorrected image, distinguishing of face part is hard and face part seems to be after "and operation" is applied on segmented images, some morphological operations are applied on final skin image to search face candidate. Noisy like small regions, that are less than 100 pixel square areas, are eliminated. Then, morphological closing operation is applied to merge gaps with 3-by-3 square structure. Applying dilation operation and then applying erosion operation are considered as closing operation. After these two morphological operations, face candidate regions can be determined. To select candidate, each 1's are labeled. On each label two conditions are concerned to be face candidate. First condition is ratio of bounding box, which covers the label. The ratio of

bounding box, width over height, should lie between 0.3 and 1.5.
The limits determined experimentally. Lower limit is taken to be as low as possible, to get facial part that includes neck or some part of chest. Other condition is to cover some gaps inside the region. This property will distinguish face from other body part, i.e. hand. Segmentation on hand will have no gap which make different from face.

III. RESULTS

Each of the three commercial face recognition algorithms performed significantly worse on the female cohort than the male
The agreement in relative accuracies of the COTS FRS and the no trainable LBP method on the gender demographic suggests that the female cohort is more difficult to recognize than the male cohort. That is, if the results in the COTS algorithms were due to imbalanced training sets (i.e., training on more males than females), then the LBP matcher should have yielded similar matching accuracies on males and females. Instead, the no trained LBP and Gabor matchers performed worse on the female cohort.

Figure 1 Gender detection

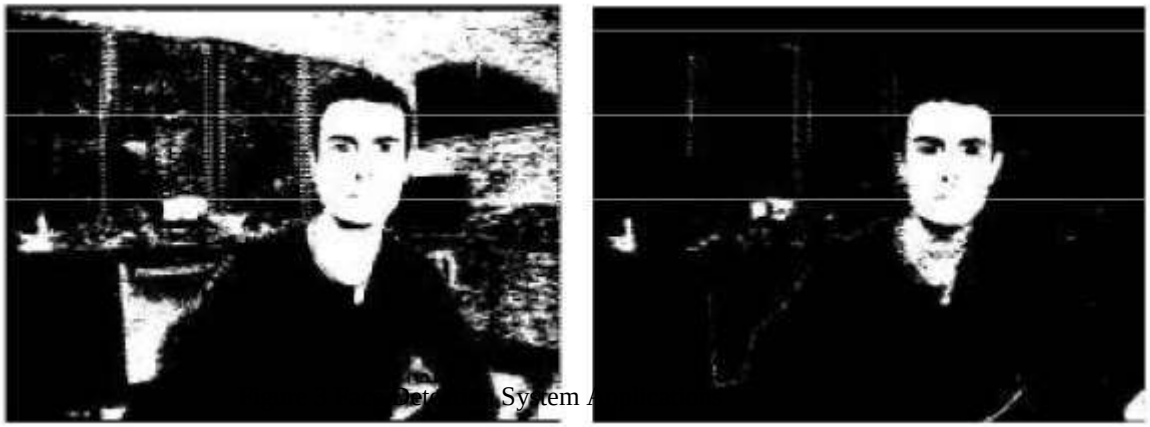

Figure 2 Face Detection System A

IV. CONCLUSION

The process of feature selection in face detection used wavelet and ant colony optimization process is very complex and takes more time for generation of template. In future we reduce the computational time and generate more reliable template for face detection.

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