Local Mapping Analysis to Determine Illumination and Pose Variation in Face Recognition

Ramji. R[#1], Barathi. N[#2], Kalaiselvi. N[#3], Sakthivel Punniakodi[#4]

[#1]*Bharathiyar College of Engineering and Technology, Karaikal.*

[#2]*Bharathiyar College of Engineering and Technology, Karaikal.*

[#3]*Bharathiyar College of Engineering and Technology, Karaikal.*

[#4]*Sri Manakula Vinayagar Engineering College,puducherry.*

Abstract

Face recognition is the latest biometric technology which based on identification or verifying the person/user by persons faces. The face recognition is done by various algorithms for computing and processing the face for the specific purpose. Here we propose new face recognition system, where automatically identifying a person from a video frame from the input video or video as live. In our model, we are using concept of neural network concept to develop the algorithm called as Local Mapping analysis algorithm and we use cluster information's (Neural Nets using statistical cluster information's). By using this algorithm we can leads to eliminate the various problems that occurs in recognizing the face with of some illumination variation etc. by extracting some of the unique feature like distance between eye, shape of cheekbones and the length between the jaw line etc..

1. Introduction

Face detection and face recognition is the most relevant application of the image analysis. Challenge thing to build an automatic system which somewhat, equals human ability to detect or recognize faces from a video/images. Face detection is the process of finding the face in a given image and face recognition is the process of comparing the faces and provide the result as match or mismatch.

Face recognition is one of the computer vision based application used for various application such as information security, personal security, access management, law enforcement, biometrics, entertainment leisure, etc. Face recognition process using input face to check the face that present in the database and provide any one result as "match" or "mismatch". Before face recognition we have to detect face in the given image with is called as face detection, and which result the face detected image or no face detected message.

A face recognition system is one of the computer applications which is used for automatically identifying or checking a person from the digital images or a sequence video. There are many ways to do this recognition, one of it is by comparing the selected features from the face (face portion of the image), compare to facial features already stored in the database and produce the result (match or miss match). As the years going we hear about various crimes of credit card, computer breakings by hackers, so security is decreasing day by day, to provide more security we move on to various biometric technologies only of it is face detection and recognition.

As the computational power and availability of various sensors, analysis and rendering equipments and latest technologies, computers are becoming intelligent. There are many commercial products and research projects have been demonstrated with the capability of computer to interact with the humans naturally through cameras, microphones, understanding inputs and reacting to the humans in a friendly manner.

The latest fundamental techniques that enables the human interaction using computer is called face detection. Face detection provide the step stone for all facial analysis algorithms, face alignment algorithms, face modelling algorithms, face relighting algorithms, face recognition algorithms, head pose tracking algorithms, and many more algorithms. Face Recognition was generally involves with two stages:

1. Face detection, it find any face from a given image or a frame of the video, then image processing is carried to extract the face.
2. Face recognition, the face extracted from the detection part, is feature extracted and

compared to the database and provide the result.

Basic method of face recognition is not easy one to perform correctly because of various problems such as age, illumination, variation, pose, occlusion, expressions, etc. General method of face recognition system includes two components, they are image processing (face detection, etc.) and face recognition algorithm. In our paper, we using the improved skin colour model algorithm for detecting faces in the image.

There are various types in skin colour model algorithms such as basic colour extraction, colour images using PCA, skin colour detection under changing lighting conditions, etc. in this paper we use, skin colour model using only

RGB model, which uses CYMK colour for detecting the face. So our method produce more accurate that older methods. Our next process is to perform novel algorithm analysis of the local features of the faces like length of eyes, width of nose etc. This is the neural network based algorithm called as Neural Nets using statistical cluster information.

In this project we convert the videos to frames, then face detection process is carried and the colour of the detected face is converted into black and white (gray scale) image for processing.

This Gray scale, image only used for the recognition process in any kind of system. The image is converted into matrix and get stored in data base for the security point of view, it's not matter in our project. Our algorithm is to extract the features from the inputted face and store them for the recognition process.

2. Proposed System

In this paper we implement and design automated face recognition system which can be divided into four modules,

1. Face detection,
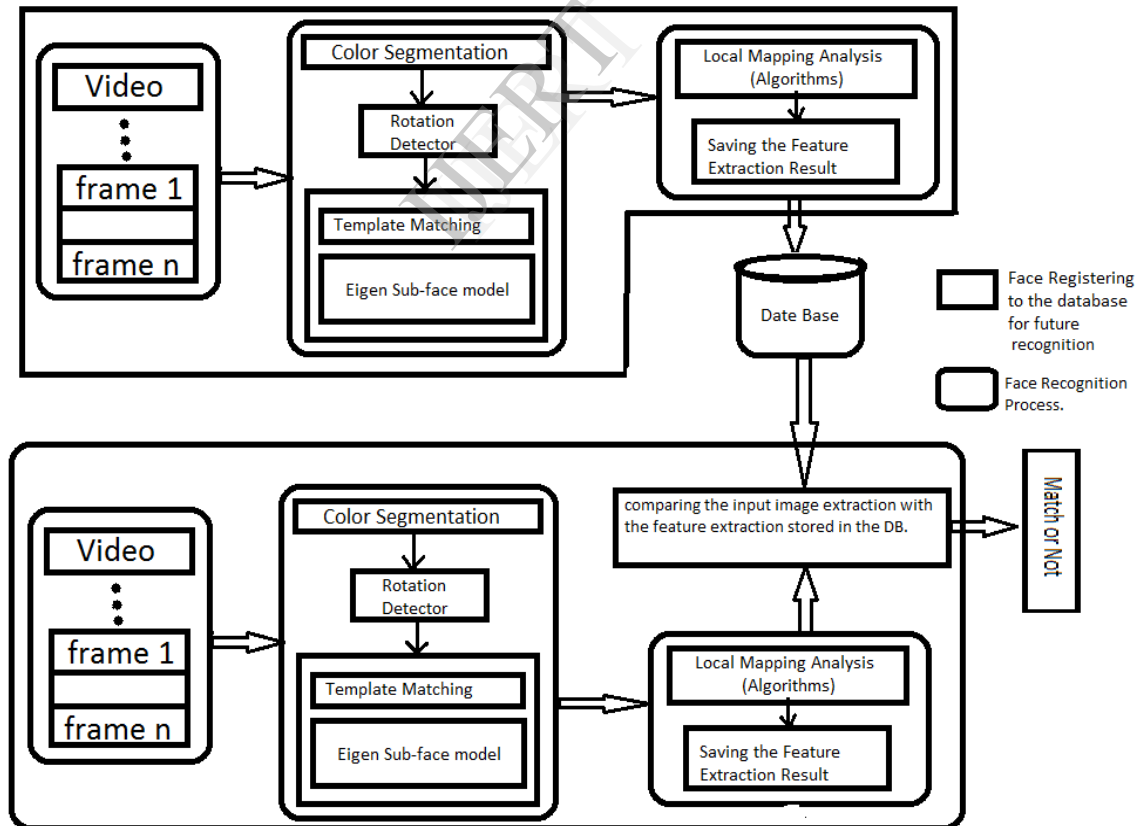2. Local mapping analysis algorithm
3. Create the database

Recognition

Figure 1: Overall System Model

3. Face Detection

In face detection module we perform 3 different steps. Firstly the skin colour model is performed to segment the face like regions from an image/frame. Secondly, the neural network computing are preformed to acquire rotation angle. And Finally, we provide upright face detector to find its face or not and produce the output. The following diagram explains clearly.
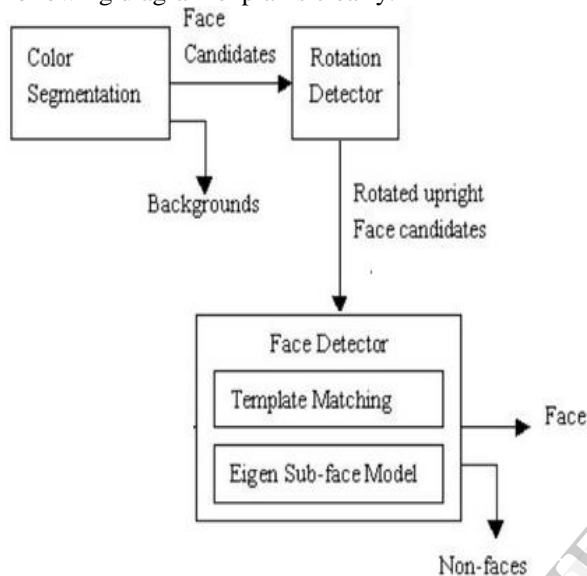

Figure 2: Face Detection.

4. Local Mapping Analysis and Creating The Database

It is a type of AI neural network that is used for trained images using unsupervised learning and in term it produce a low-dimensional and discredited representation of the input image of the training samples called as a map.
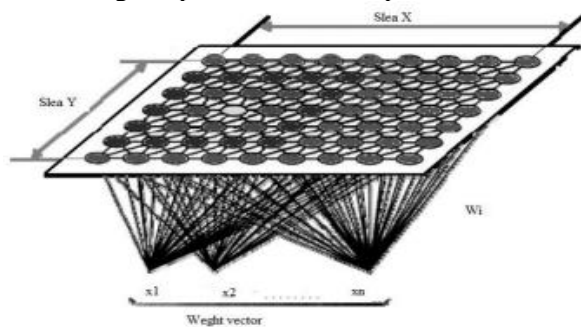

Figure 3: Local Mapping Analysis

The feature mapping for grouping the data with or without knowing the class of the input data. This extracted features can be used to detect face in the test image.

Input: training data means face image are taken as x vectors of various length n data

$$(x_{1,1}, x_{1,2}, ..., x_{1,i}, ..., x_{1,n})$$
$$(x_{2,1}, x_{2,2}, ..., x_{2,i}, ..., x_{2,n})$$
$$...$$
$$(x_{j,1}, x_{j,2}, ..., x_{j,i}, ..., x_{j,n})$$
$$...$$
$$(x_{p,1}, x_{p,2}, ..., x_{p,i}, ..., x_{p,n})$$

} P distinct training vector

Output: used to display the person is authenticated or unauthenticated depends on the result of the face recognition.
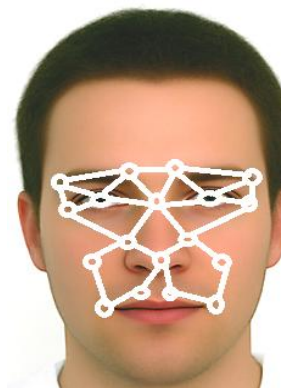

Figure 4: Extraction of feature points.

5. Face Recognition

The extracted feature extraction of the authorized person is saved in the database using that we perform the face recognition process. The input of the image is processed and extracted the feature extraction of that image and then compared the two value of the feature extraction if its matches then it decide a face as authorized else unauthorized.

Experiment: We tested by two dataset called ORL and Yale dataset.

ORL database: The ORL dataset contain many subjects and each subject has 10 different poses of the face. The all images are gray scale image and sizes of 64 X 64. We have experiment the FAR and FRR rate threshold value (versus threshold value) of our process is shown below,

YALE Database: YALE database is called as international database which contain more than 400 images for each individual person faces. Gray scale image and size of 128 X 128 dimensional. The FRR and FAR values are varies for each changing

in the threshold value of the algorithm. The YALE database threshold value is shown below,

6. Conclusion

This paper mainly focused on solving the problems in the existing system like illumination variation and pose variations using the concept of local mapping analysis. This method can be mostly applicable in road side application like traffic surveillance etc…, this process can be applicable in both windows as well as Linux based application for the security purpose. We hope this paper can be used to solve the security problem as well as reduce the problems in the conventional method.

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