Face Recognition & Gender Determination Using LIPS.
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ABSTRACT
This paper presents a novel face detection and gender determination strategy in color images under non uniform background. This is done by detecting the human skin regions in image given and detecting facial features based on the measurements in pixels. The proposed converts the RGB image into the YCbCr color space to detect the skin regions in the facial image. But in order to detect facial features the color image is converted into to gray scale image. This method locates the lip region and the mouth region. Here feature extraction is carried out by using Principal component analysis (PCA) and Gabor wavelet. The gender classification method classifies almost all the images with different image sizes. The best classification rate is achieved by using the method given in this work i.e. Minimum distance classifier method. The whole idea is offering a simple, reliable and robust method for extracting features of lips for face recognition and gender identification. For recognition experiments we used face images of persons from different sets of the FERET and AR databases. The results using a training database of 15 male and 15 female images show an average performance of 88.6% correct gender determination on images from test set.

Index Terms : Face recognition, Gender determination, YCbCr, Principal Component Analysis, Gabor wavelet.

I. INTRODUCTION
Biometrics is the study of methods for measuring unique biological and psychological characteristics of an individual that can be used for uniquely recognizing or verifying his/her identity and it has various advantages than other. There are several biometric methods such as face and fingerprint recognition, iris location, palm-vein recognition, signature analysis, etc. But we need to investigate novel methods of authentication that find mass appeal. this brings us to identification and authentication using face recognition systems.

The proposed system proposes a new technique for Face Detection and Gender Determination by using the feature extraction of lips and extracted features are stored for the comparison in one matrix file. Lip detection is one of the biometric systems based on which a genuine system can be developed which holds an advantage of making the system secure. The Gender determination used for detecting whether the given face image belongs to the gender male or female. The face detection acts as a pre-processing step for the gender classifier that determines the gender of the individual. The most important factors are usually the detection and classification accuracies. The main issues of the face detection and gender classification are the selection of the color space to detect skin region, face detection and gender classification methods.

Face Detection is feature-based approach or holistic matching approach or combination of both and the apparent properties of the face such as skin color and face are calculated. In this system face detection method depends on feature derivation and analysis to gain the required knowledge about face.
threshold values (of intensity) are applied on the image to determine the skin region on the face. The face feature area is calculated. Here database is generated and images of the faces are stored for future verification. In our system Feature extraction is carried out by using two methods first one is PCA transform and second one is Gabor wavelet. After transformation feature extracted image is given for testing and identification of the gender is done by using Minimum distance classifier method which can identify the gender of input image.

The organization of this paper is: first literature review of different methods of face recognition and gender determination is given then next point is about system development, conclusion and references.

II. LITERATURE SURVEY

This section gives an overview on major human face detection and gender classification methods that apply mostly on frontal faces. The main issues of the face detection and gender classification are the selection of the color space to detect skin region, face detection and gender classification methods. The connection between face detection and gender classification are examined experimentally. Face Detection in feature-based approach, the apparent properties of the face such as skin colour and face geometry are exploited. Feature-based face detection method depends on feature derivation and analysis to gain the required knowledge about face. Facial features may be skin colour, face shape, or facial features like mouth, eyes, and nose. Among the face and skin detection algorithms, the 2-D image are used. The threshold values (of intensity) are applied on the image to determine the skin region on the face. The face feature area is calculated. The facial features such as mouth, eyes and nose are estimated through the lip point detection and applying the standard threshold values of measurements (in number of pixels) to get the entire portion of the features.

Evaluation of Gender Classification Methods with Automatically Detected and Aligned Faces [1]. This paper included study and comparison of four fundamentally different gender classification methods and four automatic alignment methods together with non-aligned faces and manually aligned faces. They also analyzed how the classification accuracy was affected when face image resizing occurred before or after alignment. Finally, they conducted a sensitivity analysis for the classifiers by varying rotation, scale, and translation of the face images.

Gender Classification with Support Vector Machines [2], the first automatic system for combined face detection and gender classification. They used maximum-likelihood estimation for face detection and for facial feature detection. For gender classification, they used several different classifiers. The experiments were carried out with a set of FERET images [3].

The most interesting findings in the context of this paper were that the Support Vector Machine (SVM) performed better than the other classifiers and resolution of the face did not affect the classification rate with the SVM. A Unified Learning Framework for Real Time Face Detection and Classification [4]. This paper combined the cascaded face detector by Viola and Jones with discrete Adaboost-based gender and ethnicity classification. The advantage of the system is that many pre-processing and book keeping calculations can be shared by the face detector and the gender classifier.

Boosting Sex Identification Performance [5] presented an Adaboost system for gender classification with manually aligned faces. They carried out a thorough experimental comparison between the Adaboost and an SVM classifier by varying face image scaling, translation, and rotation. Similar comparative analysis was conducted An Experimental Study on Automatic Face Gender Classification [6] reported a detailed
analysis of how different normalizations affect gender classification accuracy. They had three different
tools for alignment and three gender classifiers: an SVM, an FLD, and a two-layer Real Adaboost
classifier. Automatic Human Gender Identification System (Prinshul Jain, May 2008) In this thesis, a noble
gender identification algorithm has been proposed. It determines gender in near real time by utilizing all
possible characteristics of human face in terms of geometrical features, external features and textual
details.

III. SYSTEM DEVELOPMENT

Typical face recognition and gender verification system is illustrated in Figure 1. A Face Recognition and
Gender Verification System comprising of hardware and software elements is proposed. An Xpro 20
Mpixel webcam was used to capture face image. This is the main input device for data acquisition. The
software architecture of the system involves the use of MATLAB version11.0. MATLAB was used to
perform the pre-processing, feature extraction and verification processes. The whole system is composed
of following four subsystems:

- Image acquisition
- Pre-processing
- Feature extraction
- Face Recognition and Gender Verification

As stated in ‘Face Detection in color Images Using AdaBoost algorithm’ based on skin color information
[8](Yan-Wen Wu, Xue- Yi Ai et al, 2008)the apparent difference in skin color perceived is mainly due to
the darkness or fairness of the skin, characterized by the difference in the brightness of the color, which
is governed by Y but not Cb and Cr in YCbCr colour space. Y, luminance component is brightness
component, whereas Cb and Cr are chrominance components, which correspond to color scomponents.
In the color detection process, each pixel is classified as either skin or non-skin based on its color
components. The gamma corrected RGB value is determined through the formula as in "Digital Image
Processing"[9] (William K Pratt, WileyPublication,3rd edition) that uses the constant values. Then lip
detection is carried out by cropping lip part from the whole face region. After lip detection Otsu’s
thresholding is done for the segmented image acquisition. Lastly Canny edge detection is performed for
perfect shape analysis to be done in our system. Once the perfect shape analysis is done then we may
proceed for the feature extraction of lips and then to identify the gender of the particular individual. The
whole work is done by programming in MATLAB. In programming we initialize the waitbar for showing our progress of detection and identification. One training set is generated in which images of faces are stored for the verification and one testing set for the verification.

Feature extraction of ROI i.e. lip here. i.e. is done by the following two methods:

A. PCA Method

The purpose of PCA is to reduce the large dimensionality of the data space to the smaller intrinsic dimensionality of feature space (independent variables), which are needed to describe the data economically. This is the case when there is a strong correlation between observed variables. The jobs which PCA can do are prediction, redundancy removal, feature extraction, data compression, etc. Because PCA is a classical technique which can do something in the linear domain, applications having linear models are suitable, such as signal processing, image processing, communications, etc. Face recognition has many applicable areas, moreover, it can be categorized into face identification, face classification, or gender determination. Starting from the successful low dimensional reconstruction of faces using KL or PCA projections eigen pictures have been one of the major driving forces behind face representation, detection, and recognition. It is well known that there exist significant statistical redundancies in natural images. For a limited class of objects such as face images that are normalized with respect to scale, translation, and rotation, the redundancy is even greater. Computing the eigenvectors Performing PCA directly on the covariance matrix of the images is often computationally infeasible.

B. Gabor Wavelet Method

The Gabor transform is like the short time Fourier transforms. A set of gabor filters with different frequencies and orientations may be helpful for extracting useful features from an image. Gabor filters are examples of Wavelets having two bases for images. The Gabor transform can be explained as: Its impulse response is defined by a sinusoidal wave (a plane wave for 2D Gabor filters) multiplied by a Gaussian function. Because of the multiplication-convolution property the Fourier transform of a Gabor filter's impulse response is the convolution of the Fourier transform of the harmonic function and the Fourier transform of the Gaussian function. The filter has a real and an imaginary is more concentrated than the rectangular function in the frequency domain, the frequency resolution of the Gabor transform is much better than short time Fourier transform, Gabor transform.

C. Gender Identification

In this paper, face recognition and gender identification is carried out by feature extraction of lips and for extraction purpose PCA and Gabor filter are used. The extracted features of lips are then stored in the database known as training set and are then compared with the test image from test set. For the gender identification of particular individual the Minimum distance classifier method gives the best result with no extra efforts. Out of two techniques i.e. PCA and Gabor used for feature extraction the results of Gabor filter are more accurate and fast because it is having less leakage in time frequency domain.

IV. RESULT AND DISCUSSION

The performance of system is determined based on the accuracy of classification between the genuine and forged face image. Evaluation parameters for any fingerprint verification system are FAR and FRR. Standard definitions of performance evaluation parameters i.e. False Acceptance Rate, False Rejection Rate is as follows:
A. False Acceptance Rate (FAR)

The probability that a system will incorrectly identify an individual or will fail to reject an imposter. It is also called as type 2 error rate.

\[ \text{FAR} = \frac{\text{NFA}}{\text{NIIA}} \]

Where FAR = false acceptance rate
NFA = number of false acceptance
NIIA = number of imposter identification attempts

System identifies 7 persons correctly out of 10 person's database. Database containing 10 images of each person.

B. False Rejection Rates (FRR)

The probability that a system will fail to identify an enrollee. It is also called type 1 error rate

\[ \text{FRR} = \frac{\text{NFR}}{\text{NEIA}} \]

Where FRR = false rejection rates
NFR = number of false rejection rates
NEIA = number of enrollee identification attempts

![Figure 2: Real time output](image)

V. CONCLUSION

This paper proposes face recognition and gender verification system by extracting features of region of interest (ROI) i.e. lip here from the acquired image. Feature extraction of ROI is carried out by using pca and gabor method, proposed system is compared along with their FAR and FRR. The proposed algorithm can be used as an effective face recognition and gender verification system which is successfully made rotation invariant by the rotation of the image. The error rejection rate can further be improved by aligning the facial features horizontally and vertically and improving quality of images for training as well.
as testing. It uses a compact and memory efficient storage of feature points which reduces memory overhead and results in faster comparisons of the data to be verified from the experimental studies, we find that the choice of image spatial resolution is very important to keep invariant features.

VI. REFERENCES


