

A Review on Face Part Detection and Eye Recognition

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Abstract- *The detection of human face under complex condition is a complex task. Face detection can be extensively used in wide range of applications such as human computer interaction, identity authentication and surveillance. In this paper we present a survey on face detection, recognition and eye detection. Several researchers present various algorithms to detect and recognize face using different algorithm. The proposed face detection and eye recognition algorithms based on skin color model in YCbCr chrominance space.*

Keywords- Face detection, Face Recognition, Eye Detection

I. INTRODUCTION

Face detection research gaining wide popularity in last few decades. Face detection can be extensively used in wide range of applications such as human computer interface, identity authentication and surveillance. Several heuristic and pattern recognition based methods have been given to achieve accurate solutions. With feature based face detection technique, classify the pixels in accordance of skin and non-skin finding probably existed face using skin color segmentation. For face detection applying skin color model is best idea for both task properties and common sense [1]. Skin color has turned out to be a helpful and robust prompt for face detection, localization and tracking. Face detection procedures based on the use of color information have been proposed [2-4]. Face recognition system is convenient method to authenticate user's identity than other system that use password and others. The problem related to face recognition systems are:

- (i) Detection of a pattern as a face (in the crowd) and its pose
- (ii) Detection official landmarks and
- (iii) Analysis of facial expressions

The face recognition systems can be broadly classified in two different ways, such as holistic [5] and feature-based approaches. Face detection research have increased significantly for the several past decades. This technology can be used in a wide range of application such as identity authentication, human-computer interaction and surveillance. The core of technology for such applications is first of all to detect human faces in an image. Various methods

for doing this have been suggested and they can normally be classed according to the type of data they access on. Various methods by classifying pixels into skin or non-skin in the image and finding probably existing face by skin color segmentation [6, 7, and 8]. Such methods are sensitive to background clutter and object presenting in the scene with skin-color. A different approach is to match input image with template learned from large numbers of gray-scale face samples [9, 10, 11], performance of approaches closely rely on quality and diversity of sample. Inevitably, changing illumination condition can disrupt sample data. A different access to get different features in the face, e.g. nose, eyes, cheeks, mouth, hair-line, etc. and design a classifier based on their relationships structure [12, 13]. Such ways are indeed background is affected in between clutter, therefore process good as an accessible tool purpose of generally face person [14]. Whereas they tend to access better on frontal right-up face images and can be quite heavy computational-wise. Under face detection with in or out plane rotation, methods in above literatures are powerless.

Face Detection is to determine whether there is someone in a given image, if exist, then figure out the position, size and pose of the human's face. As an important part of face information processing system, face detection has turned into a hot exploration topic in computer vision and pattern recognition and has been concerned by a large number of researchers. In recent years, the research on face detection has made rapid progress. According to the differences of color properties of facial features, the methods of face detection can be divided into two categories [15]: one is based on skin color of color images, which is fast and not sensitive to the gesture while it is difficult to distinguish between similar color of non-face region and face region. The other is based on the template from the gray distribution information of face. This method is general and robust, but has the disadvantages such as large calculation amount and slow speed. Therefore, focusing on many different color spaces, researchers have proposed many face detection algorithms based on skin color [16]-[18]. Meanwhile, with the development of statistical theory, statistical learning method is gradually applied to the field of pattern recognition.

Rowley [19] used the neural network in face detection system. Viola and Jones [20] have proposed a AdaBoost classifier based on cascade structure, and multiple classifiers make up a cascade structure. The classifiers at every level are trained by Adaboost algorithm. To solve the degradation and sample distortions in training process, Xiong [21] adjusts the weight updating rule of Adaboost algorithm. Kim [22] uses Gaussian distribution to improve the performance of Adaboost algorithm by modifying the binary model of weak classifiers into Gaussian model to optimize the system structure. On this basis, according to different applications, a variety of improved algorithms have been proposed [23]. Inspired by the above, if skin color information and gray-scale texture information are combined together, it is possible to obtain better robustness and higher speed.

II. APPLICATIONS

The application of face recognition used for two purposes:

a) Verification (one-to-one matching):

When presented with a face image of an unknown individual along with a claim of identity, ascertaining whether the individual is who he/she claims to be.

b) Identification (one-to-many matching):

Certain an image of an unknown individual, determining that person's identity by comparing (possibly after encoding) that image with a database of (possibly encoded) images of known individuals. There are various application regions in which face recognition can be changed for these two purposes, a couple of which are outline below.

- Protection (access control to structures, airplane terminals/seaports, ATM machines and boundary checkpoints [24]; computer network security [25]; email validation on s and multimedia and workstations).
- Observation (an extensive number of CCTVs can be checked to search for known criminals, drug offenders parties, and so on and authorities can be notified when one is situated; for instance, this technique was used at the Super Bowl 2001 diversion at Tampa, Florida [26]; in another instance, as per a CNN report a CNN report, two cameras associated with state and national databases of sex offenders, missing kids and asserted abductors have been presented as of late at Royal Palm Middle School in Phoenix, Arizona [27]).
- General identify confirmation (discretionary enlistment, managing an account, electronic business, recognizing

infants, national IDs, identifications, drivers' licenses, representative IDs).

- Criminal equity system (mug-shot/booking system, post-event examination, lawful sciences).
- Picture database investigation (looking picture databases of approved drivers, advantage recipients, missing children, foreigners and police bookings).
- Picture database investigation (searching picture databases of authorized drivers, advantage beneficiaries, missing children, workers and police bookings).
- "Smart Card" applications (in lieu of maintain a database of facial pictures, the face-print can be store in a smart card, barcode or megetic stripe, authentication of which is performed by coordinating the live picture and the stored format) [28].
- Multi-media environment with adaptable human computer interfaces (a portion of universal or context aware systems, conduct observing at childcare or old people' focuses, recognizing a client and surveying his needs) [29].
- Video indexing (labeling face in video)[30].
- Witness faces reconstruction [31].

III. THE TECHNOLOGY OF FACE RECOGNITION

In this section we briefly review some of the technologies that have been used for face recognition. Face recognition systems developed by finding the face with in an image, the effect of estimating and normalizing for scaling, translation and in- plane rotation.

Face Detection

Naturally, before recognizing a face, it must be located in the image. In some cooperative systems, face detection is obviated by constraining the user. Mainly system uses a combination of skin-tone and face composition to decide the area of a face and use a picture pyramid to permit appearances of varying sizes to be detected. Progressively, systems are being produced to identify faces that are not full-frontal. For example, movement and person detection can be used to localize faces for recognition. Commonly translation, scale and in-plane revolution for the face are evaluated all the while, along with rotation-in-depth when this is considered

Face Recognition

There is a great diversity in the way facial appearance is interpreted for recognition by an automatic system. Currently a number of different systems are under development, and which is most appropriate may depend on the application domain. A major difference in approaches is

whether to represent the appearance of the face, or the geometry. Brunelli and Poggio have compared these two approaches, but ultimately most systems today use a combination of both appearance and geometry. Geometry is difficult to measure with any accuracy, particularly from a single still image, but provides more robustness against disguises and aging. Appearance information is promptly acquired from a face picture, but is more subject to superficial variation, especially from pose and expression changes. Basically for most purposes, even appearance-based system must estimate some geometrical parameters so as to determine a 'shape free' representation that is autonomous of expression and posture artifacts. This is accomplished by discovering facial landmarks and warping the face to a canonical neutral pose and expression. Facial features are also important for geometric approaches and for anchoring local representations.

Matching

Having processed a face and extracted the feature, these are stored or transmitted as a facial code (face template), which can be as slight as 84 bytes (Visionics). For every representation sort, a separation or comparability measure is characterized that permits "similar" face to be determined. Much of the art in biometrics is in the design of a model of the biometric information and, given a scheme for extracting the model parameters as a representation of the information, in creating a similarity measure that effectively discriminates between sample from the same person and samples from different people. Likewise with any biometric system, some threshold on similarity must be picked above which two face pictures are regarded to be of the same person. Changing the threshold gives different False Accept and False Rejection Rates—trading the one off against other depending on the security level required. This is a trade-off between convenience and security: easy to use matchers have a low false reject rate, while secure matchers have a low false recognize rate [32].

IV. METHODOLOGY

Face Recognition Algorithms:

In the previous section we have shown that the task of face recognition encounters complex variations. To deal with such problems of true invariant for face recognition, many researchers present various algorithms to validate the user's identity, a face recognition system. In this section, we will describe two representative ones. The Eigen face approach applies the Karhunen-Loeve (KL) feature extraction transform. It manages discriminating power and also less the feature dimension of facial. The approach of neural network,

by few variants of the algorithm which is work on the feature extraction, mostly provides sophisticated modeling idea for estimating likelihood densities in the recognition phase pattern.

Eigen face:

It is an efficient method used in face recognition due to its speed, simplicity and learning capability. Those methods that are computationally expensive require more storage for this reduction scheme is required. A technique mostly used for dimensionality reduction in computer vision, is the use of Principal component analysis. The Eigen faces are the principal components of a distribution of faces, the Eigen vectors of the covariance matrix of the set of the face images, where an image with N by N pixels is considered a point in N 2 dimensional space.

Neural Network

Neural Network on a basic level, the famous back propagation neural system may be trained to recognize face pictures directly. even a picture with moderate size, the network can be very complex and therefore difficult to train. For instance, if the picture is 128x128 pixels, the quantity of inputs of the network would be 16,384. Neural network is applied on pattern recognition in compare to feature extraction, because it reduced the complexity.

Sung and Poggio's face detection algorithm (Sung, 1995) down-samples a face image into a 19x19 facial feature vector before they apply the elliptical kmean clustering to model the distributions of the "face samples" and the "non-face samples". Rowley et al. (Rowley, 1998) also reduce the dimension of the facial image to 20x20 by down sampling before the facial image is fed into their multi-layer neural network face detector.

Predominant Approaches

There are two predominant approaches to the face recognition problem: first is the Feature based (Geometric) and second is the View based (Photometric). In face recognition many different algorithms were developed include:

Principal Components Analysis (PCA)

This is generally referred to as Karhunen-Loeve (KL) transformation make use of Eigen Faces. This technique is used in image compression, image recognition and classification. The recognition technique, also known as eigen

method explains the feature space that decrease the original data space dimensionality. In recognition, this decreased data space is used. Reduction in dimensions removes knowledge which is not workup and decomposes the structure of face into uncorrelated (orthogonal) components known as Eigen faces. All face images may be presented as a feature vector (weighted sum) of the Eigen faces, which are collected in a 1D array. The advantage of this technique is that decrease or eliminate the require data to unique identifying individual to 1/1000th of the data is present.

Linear Discriminant Analysis (LDA)

It is one of the well known methods for face recognition. This method also reduces the dimensionality. LDA is an approach for samples classifying to classes of unknown which is based on training samples with well-defined classes. This advantage of this method is to maximize between-class (i.e., across users) variance and minimize within-class (i.e., within user) variance block represents a class; there are little variances within classes, but huge variance between classes. When dealing with large dimensional of face data, this technique faces the little problem of sample size where there are a little no. of provide samples space compared to the dimensionality of the training sample.

Elastic Bunch Graph Matching (EBGM)

In this technique real face images have number of nonlinear characteristics; whereas linear analysis technique doesn't addressed such variations in illumination, pose and expression. Dynamic link architecture is created by Gabor wavelet transform. In Gabor Jet a node in elastic grid, which explain the behavior of image around a given pixels. It is the final result of an image convolution with a Gabor filter, which is used to shape detection and to features extract using processing of image. A convolution explains the amount of functions overlap, blending together the function. The problem with this method is the accurate landmark localization requirement, which can few times be achieved by combining LDA and PCA techniques [33].

V. EYE RECOGNITION SYSTEM

Iris recognition is a technique in biometric authentication that uses pattern recognition rely on high resolution images of the iries of an individual eye. In eye recognition system any subject is identified on the basis of his/her eye. For this first a photograph of his/her eye is taken and then a template (code) is generated for iris region. This generated template (code) is compared with other code that

stored in database and wait until a matched code is found, if code is unidentified the process stop. Various methods for accomplishing task are edge detection, Prewitt Operator, Sobel Operator, Canny Edge detection, Roberts's method and so on.

VI. LITERATURE REVIEW

Aisha Azeem (2014) et al presents a survey on various techniques that overcome the drawbacks of partial occlusion. In this paper classify different methods that depends on fractals based methods, feature based methods, and parts based methods particularly related to partial occlusion. In this paper main work is on parts based methods. [33].

Muhammad Sharif (2012) et al present the face recognition existing techniques and their pros and cons related to techniques in their survey. The methods includes Eigen face (Eigen elements), Hidden Markov Model, geometric based and layout matching methodologies. In first part of survey perform analysis on the methodologies for face representations which will be discussed as under. In the second phase of the survey, factors influencing the recognition rates and procedures are also discussed along with the solutions provided by different authors [34].

Rizoan Toufiq (2014) et al shows that Biometric technology expects a fundamental part to provide the security which is basic part in secure system. Human face recognition is a sensible technique for biometric verification. This paper introduces a technique for face recognition system using principle component analysis with Back propagation neural network where components of face picture has been joined by applying face detection and edge detection technique. In this system, the execution has been execution has been analyzed based on the feature fusion technique. At in the first place, the fussed feature has been moved and the dimension of the feature vector has been decreased using Principal Component Analysis method. The decreased vector has been grouped by back propagation neural network based classifier. In recognition phase, a Nemours step is required. Finally, we analyzed the performance of different size the system for different size of the train database. The implementation analysis demonstrates that the effectiveness has been enhanced when the feature extraction operation performed successfully. The performance of the system has been come to more than 92% for the adverse conditions [35]

Ms. Jaishree Tawaniya (2014) et al presents the detection of human face that rely on computer technology, that tells the locations and sizes of human face in arbitrary images. It only detect facial feature. In this paper present efficient

systems that recognize faces from images with some near real-time variations. The main focus is to apply and check the algorithm. The training set is a classes of face images from which the mean face is calculated [36]

WAN Li (2010) et al presents human face detection in complex background for color images. In this combination YCgCr and Adaboost algorithm is used for skin color model. In first step use of YCgCr color space that detect face region of candidate in tested image and in next step verify face region using Adaboost algorithm with new features. From the experiments it showed algorithm works well and has high accuracy detection and lower false detection rate, and also has better face detection effect in complex background [37].

VII. CONCLUSION

In this paper, face detection and eye recognition method along with factors affecting face detection technique in special aspects as accuracy, performance etc are discussed. It is experimental that to undertake unlike factors as pose variation, lighting conditions, facial aging etc. different methods are used independently. A limited occlusion has been found in many areas of image processing. The exact face detection on the basis of high performance rotation face detecting scheme could also identify faces with high dependability in real-time. We will work on Face and eye recognition; it provides an almost seamless form of interaction with the modern graphical user interface, representing the best non-invasive method of measuring user importance and attention.

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