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Research Article

Face Recognition Based on Appearance Using Hybrid Methods

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Abstract

Face acknowledgment is a standout among the most difficult subjects in PC vision today. It has applications running from security and observation to amusement sites. Face acknowledgment programming are valuable in banks, airplane terminals, and different organizations for screening clients.Human face is a dynamic protest having high level of fluctuation in its appearance which makes confront acknowledgment a troublesome issue in PC vision.The power of the framework can be blocked by people who change their facial highlights through wearing hued contact focal points, growing a mustache, putting on serious makeup, and so on.The objective of this paper is to assess confront discovery and acknowledgment procedures and give a total answer for picture based face location and acknowledgment with higher exactness and better reaction rate. Arrangement is proposed in light of performed tests on different face rich databases as far as subjects, stance, feelings and light.

Keywords*: Face recognition, feature selection, OpenCV Haar, OpenCV DNN, DLib HOG and DLib MMOD.*

Introduction

Recently, with the development of hardware technologies and the expansion of software applications, technologies for various contents have emerged. In particular, the recent propagation of smart mobile devices facilitates the public interest in intelligent systems that exploit various machine learning techniques applicable to diverse image data. Among these technologies, face recognition is commonly used and can be applied in various fields including broadcast content, entertainment, access control, security, and surveillance.

The method used in the images of facial elements such as the eyes, nose and mouth as sub-images based on the results obtained from psycho-physical experiments that suggested the prominent facial components that would contain more discriminant information. In a discriminant-analysis-based method was proposed to select pixels for face recognition by quantitatively measuring the amount of the discriminant information of individual pixels constituting a face image. Hybrid methods using the whole image of faces as well as their sub-images have been presented. The methods in and used the holistic features extracted from the whole image of a face and their local features extracted from the sub-images such as features of the eyes, nose, or mouth, as well as sub-images equally divided from the image of a whole face.

Advanced digital cameras can provide features like autofocus, face detection, etc, for assisting users in capturing better photos, however, it can be challenging for an amateur user to find a good viewpoint in any tourist location. Face recognition is the task of identifying an already detected object as a known or unknown face. Often the problem of face recognition is confused with the problem of face detection. On the other hand is to decide if the “face” is someone known, or unknown, using for this purpose a database of faces in order to validate this input face.

Literature Survey

Many algorithms for face recognition have been proposed. Depending on the necessary information extracted from certain images, the algorithms can be divided into the holistic featuresbased method , the local-features based method, and the hybrid method.Such methods using holistic features such as Eigenface, Fisherface, Null space Linear Discriminant Analysis (LDA), Eigenfeature Regularization and Extraction (ERE), and Discriminant Discrete Cosine Transform (D-DCT) extract the necessary features from the whole image of a face using various linear transforms.

However, the recognition performance significantly fluctuate depending on the face image portion. The method used in the images of facial elements such as the eyes, nose, and mouth as sub-images based on the results obtained from psycho-physical experiments that suggested the prominent facial components would contain more discriminant information. In [4], a

discriminant-analysis-based method was proposed to select pixels for face recognition by quantitatively measuring the amount of the discriminant information of individual pixels constituting a face image.

Different tests are performed on the available online data-sets. The tests are carried out using different algorithms separately and making analysis on it. In this paper[1], geometrical approximated algorithm (PCA) is used for computing the eigenfaces on three different databases. With the emergence of machine learning, face recognition also leads to deep learning study on it [2].

Though the image is a single image or a set of multiple images, each image one or other expressions on the face. Each face consists of some facial expressions. Detecting and analyzing facial expressions results in understanding human emotions. In this paper [6], detection and classification of facial expressions is done. Analysis technique is also used for face recognition; in this , it is done by uses regression analysis. With the facial expressions the image consists of facial poses with different angles. The poses may be upside, downside, left side, right side, angular, etc. In this [10] paper, 2D-image based approach is made that can simultaneously handle illumination and pose variations to enhance face recognition rate using shadow method. A single image or a set of multiple images undergo the same process. A set of images is collected and are trained. Later the upcoming image is compared with the available data-set. The analysis is done by performing the methods used for that purpose. The methods include the different algorithms based on the required output from the overall process. The data-set of images are the images mostly taken from the online available data-sets of images. They are namely CMU_PIE, FERET or YALE database. Sometimes, the process is initially tested on the available database and then implemented on real images. Here, the real images defines the live capture of images and executing the whole process. In the [9] , the extraction of holistic and local features is per formed in parallel, there is no additional operation other than the module for evaluating individual features, which is performed close to real time.To extract holistic features for face recognition, the face images are cropped equally according to the coordinates of the two eyes, where the local features were extracted from the sub-images created from the divided images or those made by a feature selection method. In [12], the holistic and local features, used to construct the set of basic features, were extracted by employing the Null space LDA method.The power of class discrimination for each feature in the set of basic features was evaluated by using the input feature selection method based on discriminant analysis. The composite features for face recognition were then constructed by selecting the optimal features based on this evaluation. The approaches made by using different techniques of face recognition shows the advancement of the techniques. The images captured are trained by using different operations like cropping, highlighting features, emotions, colour of the skin, size and structure, etc. The process is executed by using different platforms like using shadow light effects, pose variations, etc.

Table.no.1 List of different appearance based face recognition technique

Approach	Representative Work	Strength	Weakness	Performance
Principle component analysis (PCA)	Fractional Eigen faces and dual supervised PCA	Recognition, implementation is simple and easier and No knowledge of geometry of faces is required.	Restriction on size and position of face and Learning is time consuming.	Recognition rate and performance decreases under varying pose but best recognition rate.
Linear discriminate analysis(LDA)	Encodes discriminating information	Solves illumination problem and Optimizes low dimensional representation of objects.	Singularity problem- fails when all scatter metrics are singular and Small sample size problem.	Good
Neural Network.	Convolution neural networks.	Reduces mis-classification among neighborhood classes and easy to implement and understand.	Implementation is expensive and result become quite low on increasing no. of classes.	very high performance
Naïve bayes classifiers	Intensity projection, profile and edges are combined.	Better estimation of conditional density function of sub-regions.	Don't work well for non frontal faces.	Quite low

Proposed Methodology

The proposed system uses four different methods. The applied methods are merged into each other for better enhancement. This defines any two methods are merged and tests are performed. The system firstly collects the different images of the face. Then, the collected images are trained for the training data-set. The images captured are up-to twenty two facial images with various expressions and poses. The upcoming new image is matched with the trained data-set to recognize the image to be matched or not matched. If matched, the proposed system recognizes the image and sends an alert message to the main server with its location. The proposed system mainly implies for searching faces from images. To overcome the drawbacks of the existing system, we develop a system that will be useful for the investigation department. Here the program keeps track of images from different sides of faces. Based on this record number the program retrieves the personal record of the suspect (comparing the face and getting results more than 90% accurate and matched, then show that person's information and its location also) on exercising the 'locate' option

A. Architecure

The following figure shows the flow of the proposed system:

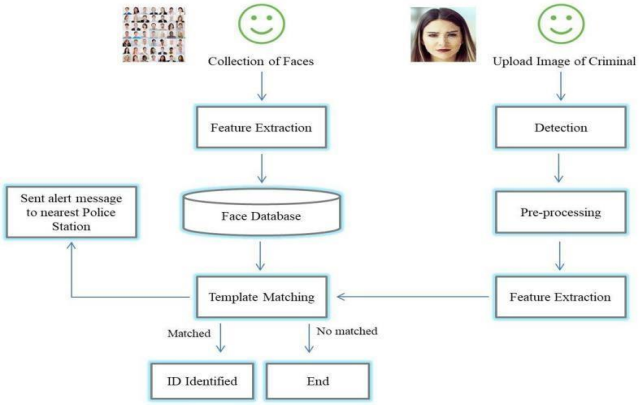

Fig.1 Architecture of the proposed system

B. Mathematical_Model

Let S be a system having Input(I), Functions(F) and Output(O). S={I, F, O} where, I is a set of images captured for the dataset. I={I1, I2, ..., In} O is the final image to be recognized. O={O1orO2} here, there are two outputs depending on the image, i.e. the image can be matched and recognized else the image

does not match and hence not recognized. O1 = image matched and recognized O2 = image not matched and hence not recognized F is the set of functions used for feature extraction and processing the data. F={F1, F2, F3, F4} where, F1 is a function for OpenCV Haar. F2 is a function for OpenCV DNN. F3 is a function for DLib HOG. F4 is a function for DLib MMOD.

C. Algorithms

λ OpenCv Haar: OpenCV is a C/C++ library of functions dealing with real-time computer vision. Haar Cascade is a machine learning object detection algorithm used to identify objects in an image or video based on the concept of features. The Haar cascade algorithm has four stages.They are namely; Haar feature selection, creating integral images, adaboost training and cascading features.OpenCV already has pre-trained classifiers for face. Using the OpenCV and the Haar features, the image can be detected using facial landmarks. It has a simple architecture. Its major drawback is, it doesnt work on non-frontal images. λ OpenCV DNN: OpenCV DNN is a set of library functions with the Deep Neural Network (DNN). This allows to load pretrained networks through different frameworks. Then, these images are used to classify the input images. This method is said to be one of the most accurate resulting method. It works on different facial orientations like up, down, left, right, etc. The DNN based detector overcomes almost all the drawbacks of Haar Cascade. λ DLib HOG: DLib is a modern toolkit containing machine learning algorithms. Histogram of Oriented gradients is abbreviated as HOG. A HOG is a feature descriptor used for object detection. The technique counts occurrences of gradient orientations of an image. DLib HOG is one of the fastest method executed on CPU. It works very well for frontal faces. It is said to be light weight model as compared to other models. The major drawback of this method is, it doesnt detect small faces as it is trained for minimum face of size 80X80.Also, it does not work for side face. λ DLib MMOD: DLib is mainly a general purpose cross-platform software library. It is written in C++. Maximum-Margin Object Detector is abbreviated as MMOD. This method uses CNN based measures. The training process of this method is very simple as it does not need a large amount of data to train a custom object detector. It works very fast on GPU. Its major drawback is, it works too slow on CPU as compared to GPU. Also, it does not work on small faces. D. System Requirements Software Requirements: Operating System: Microsoft Windows 7 and Above Programming Language: Python IDE: Python IDE Hardware Requirements: Processor: Intel Core I3 or Higher RAM: 4 GB or Higher Hard Disk: 100 GB (minimum) IV. RESULT AND DISCUSSIONS The existing proposed systems mainly use the common methods like Eigenfaces, Fisherfaces, SVM or HMM. These methods have their unique way of the whole process. Eigenface uses the co-variance matrix and Fisherface method is the extension of Eigen method. SVM uses the hyperplane concept. HMM uses the statistic models. Similarly, the other methods use different approach in face detection.

Fig.2 Face detection using existing proposed system

The requirements for the proposed system are very comfortable. The system requires the above mentioned setup.The proposed system uses the OpenCV and DLib together for face detection with the aim to obtain better accuracy and appropriate results. This approach is made for overcoming the drawbacks of all the four methods mentioned. The proposed system works on all kind ofimages respect to size, color and other features. The system will be a login system. The main user will be having a unique username and password to login into the system. The user will login to the system and run the application. Firstly, the images of a person will be captured. The captured images for the small instance will be to the count of twenty images at a time. The captured images will be stored in a folder. The

images consists of different poses and variations. It also includes facial expressions. The images will be seen in black and white color. They wont appear as the original colored image. Now, the captured are to be trained. The images are trained and are saved to the database. Training the images here is creating the trained data-set. The trained data-set will be used for recognizing the image. There is a new entry of a new image to the camera. The camera would capture the image. After capturing the image, at the back-end, the application will be running. It would check the trained data-set for the image. The system would check, whether the image matches to the image of the data-set or not. If the captured image matches, it would display a green color block over the face on the image captured. The process carried takes place due to the methods used for the face recognition. If the image matches the trained data-set it would recognize it immediately. The system will recognize the image of the same person in different outfits. Even in different looks, the image of that same person can be recognized. Along with it, an alert message will be sent to the main server. This accuracy is achieved by the use of hybrid methods in the system. If the image doesn't match with the trained dataset, then it would display a red block with no-match message.

Conclusion

The proper training of the data-set enhances the image and the accuracy of the system . Single-face recognition is possible. Single-side face recognition, that can be either left side or the right side of the face can be recognized through the proposed system. Multiple faces recognition is an advance advantage of this system. Higher accuracy allows avoiding false identification.

The system aims to find solutions for a robust method for face recognition from videos, reducing the time requirements for face recognition with introduction of four different algorithms. This system provides better approach to detection of criminal and recognizing a missing person.

The system demonstrates various concerns related to the face recognition process, such as the lighting and background condition in which the facial images are taken.

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