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A PAPER ON IMPLEMENTATION OF FACE RECOGNITION METHODS IN UNCONSTRAINED SCENARIOS FOR IDENTIFYING A PERSON OF INTEREST FROM A GALLERY

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Abstract— **It is always easy to recognize a person from the image of his face which is taken in constrained situations and with the cooperation of the subjects. For example from the photos of a person taken for his driving license or passport will immediately make him recognizable. But the problem comes when the subject is uncooperative and the scene is unconstrained as in the case of a criminal or a thief for whom there is a look out by the investigation agencies. Recognizing a face from video surveillance throws number of challenges like variation in illumination, resolution problems, back ground muddle, facial pose and expression on it. In order to identify a person the investigating agency has to utilize all known sources of the person as the quality of the images and videos will be poor. Sometimes the onlookers of the crime may capture the pictures or videos of the person responsible for the act on their mobile phones which will be a useful source for recognition. From the verbal description of the person of interest specific information can be gathered like the gender of the person, his probable age, how he looks like, color of the hair, body build, height and his race etc. Face sketches can be drawn by the experts from such description which will be of great helpIn traditional face matching techniques a single media is used. Generally it uses a still face image, a video track or a face sketch as input. In this paper utilizing entire gamut of data from multiple media is discussed for recognizing a person of interest. Due to this type of approach of utilizing different fusion schemes, 3D face models, incorporation of quality measures for fusion, and video selection the accuracy of identifying the person of interest will improve many folds.**

Index terms- **Face Recognition, Quality Based Fusion, Videos, Images, Pose corrections, Cots face Matcher**

I. INTRODUCTION

In this work we explore the issue of identifying a person with the help of various data sources in open set mode and also closed set mode. For law enforcing agencies the task of identifying a person from the unconstrained images is of prime importance. Generally one or more images taken from top 200 ranked lists from the gallery will be sufficient for the forensic analysts to identify the person. Many a times such identification is performed when multiple face images or a face track containing series of face images supposed to be of the same person from a video are available. Most challenging task for the intelligence agencies is to identify a person of interest from multiple face images contained in number of surveillance cameras or contents of a hard drive seized or from social networks or from the combination of all those sources by screening an initial clustering of visual images.

While investigating crimes like armed robbery, kidnapping or acts of violence, only a fraction of manual resources are available to identify the culprit. Hence it is imperative to understand the methods of utilizing multiple sources of face information which is known as face media to identify the offender.

Conventional methods adopted by investigating agencies mostly depend on human driven queries. But newly emerging techniques of face recognition do not allow high degree of human intervention which is called automatic face recognition techniques. Searching persons of interest from the videos of surveillance cameras is one such method which is open set recognition technique. These challenging applications will give better results in identifying a person. But such technique may also result in an empty candidate list as the person of interest may not be present there. In a closed set recognition methods the person of interest is supposed to be available in the vicinity of cameras and searching the videos of surveillance cameras will result in non empty candidates list. In this paper experimental protocols and resultant accuracies in recognition are discussed using COTS face recognition and 3D face modeling algorithms along with application of integration strategies in open set scenarios.

II. Literature Review

The Uncontrolled pictures from several videos and images are taken and then the poses are corrected into models of 3D [1]by the Cots recognition of face systems with large scale unrestrained face scenarios. The examiners of forensic use pictures of various faces generally in several stages. Firstly acquiring media of faces, data processing, mechanically matches the faces by the list, criminals verification report, analysis of investigators or humans by the report, finding the criminal or suspect. These are the six stages of forensic examiners. The face collection are from images, videos, models of 3D, estimations of several data types such as age, colour, height, and sketches are used to meet the tests associated with the subjects and improves the accuracy of recognition. The flaws are models of 3D images and video frames were to be improved. From 2D face images the poses are corrected in frontal view and by Cots face modeller of 3D the identification accuracy will be improved. Therefore the identification of more effective measures of quality faces is to increase the work of matching a fusion media data. A stable value of quality faces will avoid experts of forensic investigators from attempting all available solutions of matching a face media. The labelled videos[2] of faces are in conditions like unrestrained and are taken by the database YouTube faces which is used along with standard pair matching test are done. In videos the background matching of faces are shown to improve the work of standard tests. The test of matching with same background and same skin colour in videos [2] are used to derive the face videos. Hence in video appearance of faces are designed to use the data from various frames and remaining videos which are to posed in front view and have to check whether lighting of the video, colour of the face is matching or not and other ambiguous hints. The resemblance of background similarity is designed for differentiating the frames of different videos of faces, and must decide if the faces become visible in the one subject or not. While removing appearances of the face, room brightness is the conditions which have to be checked several times. The flaws are poses of the videos which are questionable are not effectively taken and the methods of algebraic don not work well because of the min distance method. So sometimes the methods are tricked or deceived by blurring the videos into motion and illuminations in variation. If blurred pictures are there then the output of frame images will not be able to identify the images. The variations of pictures will be taken and by finding out key points between the frames of videos by the methods of algebraic.

III. Implementation

A face media collection will have still images, video images, 3D model images, sketches prepared by forensic artists and demographic information. Now we discuss the methods of using face media to identify the person of interest and also about media fusion. Still image and video track: In face recognition methods still images and video images are the extensively used media sources. By using a COTS face matcher all still images and video frames of the suspect are matched to the gallery mug shot images. The resulting match scores are subsequently fused to get a single match score.3D face models: The biggest problem faced in face recognition under unconstrained scenario is the huge variation in facial pose. In particular, out of plane rotations drastically change appearance of a face in 2D model. In order to overcome the problems faced due to pose variations, 3D face models are prepared. This enables the viewer to see the 2D face images in the required poses. We use COTS 3D face modeling to build 3D models from 2D images. This modeling process is fully automatic. With the help of 3D face model frontal facing image of the person of interest will be rendered. Such image with pose correction then be matched against a frontal gallery. Pose correction will also be made of the images of frontal gallery before matching. Experiments showed that gallery images with pose correction enhanced the accuracy of face recognition.

Demographic attributes: It is always beneficial and compulsory to collect additional information about the suspect like age, gender, race which will be complementary to face images and videos in identifying him. Where ever demographic information is not available, it is challenging to estimate demographic data from the LFW data base

Forensic sketches: Even in olden days drawing sketches to identify the persons from the description given by the witnesses or audience was in practice. In recent times the law enforcing authorities are putting into use face sketches drawn by experts to identify the person of interest from mug shot data bases. Whenever either the photo or video of the suspect is not available, services of forensic sketch artists are utilized to draw sketches basing on the description of the suspect given by the eye witness or the victim. In some situations even if a photo or video of the suspect is available but due to its poor quality, forensic sketch artists are called to draw sketches basing on the photo or video. Hence it is included as one of the face media collections.

IV. Proposed Work

The Proposed methodology for unconstrained face recognitions is as represented in figure 1.Firstly the images and videos are taken in obtaining a face media. The unconstrained images and videos are then pre processed by correcting their poses. After pose corrections the images and videos were straightened and by automatic face matching techniques the images or videos will matched to the gallery and combine the scores by score level fusion. If the suspect is identified it is placed in suspect identification. The human will analysis the suspects face if it is not matched to the gallery then it comes back to the automatic face matching techniques. If the human analysis is true then suspect will be identified.

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Fig 1.Flow of Proposed Work

A. Obtain face media

From Labeled Faced in the Wild database the images are taken. In this database it is a collection of 13,233 face images, downloaded from the internet, of 5,749 different individuals such as celebrities etc.

Fig2. Examples of Unconstrained Images from the LFW Database

B. Pre processing

In Pre processing the poses are corrected from unconstrained images. By SIFT and RANSAC methods the poses are corrected. SIFT is known as Scale Invariant Feature Transform whereas RANSAC is known as Random Sample Consensus. The facial images are retrieved its local features from the gray and colour images.

Fig3. Pose Corrections using LFW database

In pre processing the videos from YTF database are taken and then the poses are corrected. If the key points are matched 100% then the poses are corrected in frontal view.

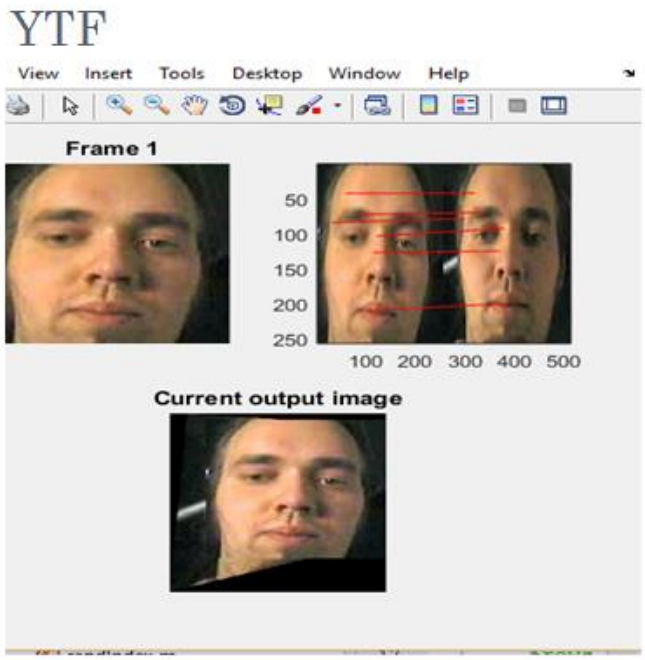

Fig4. Pose Corrections using YTF database

C. Automatic Face Matching

In Automatic Face Matching method the images are stored in a database by creating a database. Then by evaluating the database the images were taken and checks the other is matching with our gallery image or not. If the images were matched correctly then by the suspect is identified

D. Suspect List

In this suspect list the suspects which the images and videos are matched are placed in this suspects list.

E. Human Analysis

Human will analysis the suspect's list. If the suspect is identified then the images are sent to the suspect identification. If the images are appropriate then it sends again to the feedback from automatic face matching.

F. Suspect Identification

If the suspect is identified then it is placed in the suspect identifications list.

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VI. CONCLUSION

This paper contains study of face recognition of persons of interest who are non cooperative under unconstrained imaging scenarios. After obtaining face images and/ or video clips of a person 3D face models are prepared with the help of images,

video frames, face sketches and demographic information. It is demonstrated that there is specific improvement in the accuracy of a COTS face matching system. This gives a single ranked list of the person of interest rather than a ranked list for each face media sample. Face recognition techniques are implemented in closed set and open set scenarios.

- Combination of face media such as images, videos, 3D face models, face sketches and demographic information improves accuracy of face recognition when samples are of low quality.
- By correcting the pose of unconstrained 2D face images and video frames and subsequently matching the images enhances the accuracy of COTS face matcher
- When compared to the single consolidated 3D face model, matching all the frames of a video track with their pose corrected always gives better results.
- Fusion of match scores without incorporating quality will not yield better results and hence quality based fusion of match scores of various media types are used to get better performance.

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