Face Recognition from Multi Angled Images

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Abstract— The majority of modus operandi used face recognition method that shows better performance only when they are provided with front facing mug shot faces images. Hence with side angle image, face recognition is truly challenging issue with surveillance applications. Fetching of human face part from side-view image is a vital task for human face recognition. By enticing face feature, 2D face image can be generated from side view face images and in a manner it creating mirror image too. In this paper, authors discuss the frontal 2D face image construction method from a side face image with its boundaries.

Keywords—2D face, face detection, faces recognition, side view image, multi angle image

I. INTRODUCTION

Face recognition is a process with many applications for its nature of being non-intrusive, natural and passive. Especially, in applications such as surveillance systems, smart homes, or any application which is dealing with identifying people from images [1] or videos [2, 4]. However, it is very much challenging task to detect, identify and recognize faces from real-time scenarios [2, 3] where the environment is susceptible to expression, occlusion, or even pose variations [3, 4]. Among many applications, possible implementation areas for face recognition techniques are home safety applications [3], Security surveillance [4] etc. Face recognition and extraction of various face features without much error by using such system should be very accurate. But it is difficult task while dealing with face identification using side view or multi angled image [4, 5]. There might not be proper clarity or visibility of every facial component like eyes, nose mouth corners etc in a single side image of a person [6, 7]. If we use a system using only one side view image it is extremely difficult [8]. So in efficient face identification system angle of face in image play vital role [9, 10].

II. CHALLENGES IN FACE RECOGNITION

Face recognition is always challenging issue due to face expression and orientation that never predictable in scene [11-13]. Also if any external entity like optical, cap etc are worn while detection might difficult [4, 11] or faulty.

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- In face recognition, angle of face with side view image is most critical issue. As in back face view that might not possible to identify person. Also precise cross image with 45 angles produce best result but cannot assume kind of image [11]. Image may be around 40 to 50 angles assist for preeminent result [14]. So for good result image requires side face where at least some feature of face should be extracted [11, 15].
- On human face there may be some kind of defect in any face side, and by creating its mirror image based on that will make its identical copy. This results into generation of faulty frontal image [5]. Moreover if side view that is considered is not having any defect and the other side is having defect then again the same issue occurs that frontal image will not resemble the original one [11].
- Recognition can be performed on the foundation of extracting some face feature like nose, left eye, right eye, lips and mouth of human face which is base on human face orientation [12] and occlusion by other human or other object. Viola Jones Skin detection method is suitable method for feature extraction in side view [7]. It supports creation of 2D face creation successful. If these features are not visible due to face orientation [12] in image then it becomes an issue for both detection and followed by recognition [11] for recognition.

Side-view face recognition is a challenging problem due to various orientations of human faces. It is a highly important task in any real-world application where the surrounding is much crowded and uncertainty of various poses, expression with front and side view of faces [16-18]. *Equations*

III. FACE RECOGNITION METHODOLOGY

Human face is recorded in a dataset used for future attempts to determine or recognize once face is created and to be match with dataset images, that activity is face recognition. That used to identify people while they scan, store, and recognize their face.

The feature base, image angle base and biometric methods that dealing with side-view face recognition. Objective of these methods is to train input image after performing basic transformation and match with target image that previously kept in dataset. Major objective of this study is to recognize human face by the side view image given as input.

A. Feature Based Method

The feature based face recognition method performs on human face. Input image can be in different face orientation [19-21] where transformation of feature space is learned and applied on face for feature extraction [22-24]. Objective is human's various face features like left eye, right eye, nose, mouth are to be extracted [25-27]. Viola - Jones Skin detection method is best for feature extraction [7]. In multiview face recognition as shown in Figure 1 and 2, face image pass as an input then local feature of face to be extracted. In result it develops mirror image of any best side of human face as 2D mug shown in Figure 3.



Figure 1. Image with 40 angle



Figure 2. Side Image



Figure 3. 2D Face

B. Image-Based Method

The image-based face recognition techniques, match input image with dataset images. Dataset contain multiple pose images with specific angle [31, 32]. New image can be constructed by employing face reconstruction system. But target image may not match with dataset image angle. So it requires basic transformation like scaling and rotation about homogeneous coordinate. Here pose variation is handled by blend images that contain the same pose as the searched image and dataset [33, 34].

If we consider image in XY plane it require height and width of an image. The values of Y coordinate remain(Y = Y) same but value of X is changed (X = Width - X).



Figure 4. Input Image's Mirror Image

In Figure 4 we can perceive that on base of same person's one elevation another side is created. That will be match with dataset image. In Dataset it contains same human's multiple side face images [35] for purpose of recognition.

C. Biometric Methods

Biometrics is the science and technology of measuring and analyzing biological data. In Information Technology, biometrics refers to technologies that measure and analyzes human body particular eye retinas and irises [36-38] for authentication purposes of recognition.

This technique work with side view face images for face recognition task which will combine with such biometrics feature like detect retina from extracting eye [39-41]. It use grey image shown in Figure 5.



Figure 5. Image That Extract Face Feature

It requires high resolution image for face feature extraction and produce a resolution in best of manner [42, 43].

IV. PROPOSED APPROACH FOR FACE RECOGNITION

Our goal is to identify people even with their multi angled or side profile views. That requires efficient frameworks that construct the frontal face construction from side view single face image. In this approach the input image having a face without external accessories.



Figure 6. Block diagram of Face Recognition Process

A. Face Feature Extraction

In input image, face feature like nose, left eye, right eye, lips and mouth should be fully or partially visible. To extract these features we use Viola-Jones method. All human faces share some similar properties, so using "Haar features" obtain characteristic of human face based on subsequent constraint. The eyes region is darker than the upper-cheeks. The nose bridge region is brighter than the eyes. Size of eyes and nose seems bridge region. These features are applied onto a face for human any side.

B. Split Face

Using Viola-Jones method, it provide coordinate of nose and mouth. Taken center point of nose and mouth using "Haar feature" will mark virtual line that divides face in two parts. If face orientation is not very straight then virtual line's angle may be changed, that will not exactly 90. Choose finest part that contains clarification feature of human face as that facilitate to build 2D face.

C. Mirror Image Generation

It generates frontal face image that is constructed using side view and creating its mirror image. Here in XY plane value of Y coordinate remain same but X value gets change based on wideness of face that was splits on above phase. In merge image, there may be noise in nose, mouth and eye.

D. Feature Enhancement

Noticeably it's not always possible that angle of face is 45 angles. So during 2D face creation there can be some noise in final image and it require to have smoother face feature like nose mouth and eye. For that we have use Local Binary Patterns (LBP) and nearest neighbor pixel intensity method along with performing scaling or shifting transformation.

E. Face Comparision And Result

After Successful creation of 2D face image, will have to compare image with dataset image. Here we used featurebased (structural) method that compare face boundary along with local feature of human face.



Figure 7. 2 D Face



Figure 8. Dataset Front Face Image

Finally in result five images are listed which having highest performance of matching. That decide input image and dataset image is identical or not. Purpose of our method is to achieve higher success ate of face recognition to identify person. Here angle of face play vital role in good result.

V. CONCLUSION

In this paper, we presented a review of the side view of various face recognition techniques. As it is very important task to recognize human from single side view image, particularly images fetched by surveillance systems that deals with identification of humans. There should be proper mechanism to adjust appropriate angle and orientation while capturing side view image so that all the facial features like eyes, nose and lips are clearly and completely visible. An effective mechanism that generates frontal face images from side view but with prior detection of presence of any defect on the either side and thereby maximizing the resemblance of both views in comparison to original one. Our method is useful for 2D face creation that increase success rate to match with reference image for human recognition from human face side view.

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