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3-D Face Recognition Under Masked Projection Using Occlusion

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ABSTRACT

The three-dimensional (3-D) face has become an emerging biometric modality, preferred especially in high security applications. However, dealing with occlusions covering the facial surface is a great challenge, which should be handled to enable applicability to fully automatic security systems. In this paper, we propose a fully automatic 3-D face recognition system which is robust to occlusions. We basically consider two problems: 1) occlusion handling for surface registration, and 2) missing data handling for classification based on subspace analysis techniques. For the alignment problem, we employ an adaptively-selected-model-based registration scheme, where a face model is selected for an occluded face such that only the valid nonoccluded patches are utilized. After registering to the model, occlusions are detected and removed. In the classification stage, a masking strategy, which we call masked projection, is proposed to enable the use of subspace analysis techniques with incomplete data. Furthermore, a regional scheme suitable for occlusion handling is incorporated in classification to improve the overall results.

Keywords
3D Face Recognition, Occlusion, 3D face database, Expression, Histogram, Cannyedge detection, Texture.

I. INTRODUCTION

In biometric systems, human beings are easily recognized by distinctive features of face which is a unique property, like physiological and behavioral characteristics. In biometric recognition, the human face is mostly preferred because of several advantages like its contactless acquisition and moreover it is well accepted amongst the users [13]. It is being widely used in many applications such as public records, authentication, security and safety. Without attention of users it can be easily acquired. This make it the most reliable and preferred technique amongst all other biometricmodalities.

This paper is organized as follows: in Section 2, a brief overview of face recognition is presented. 2D face recognition and 3D face recognition is presented. Section 3 describes the advantage of 3D face recognition over 2D face recognition and also depicts various short comings of face recognition systems like occlusion, ageing effect, illumination, changes in pose. Section 4 summarizes occlusion and its causes due to external objects and internal objects. In section 5, the overview of 3D face databases which addresses occlusion challenges are presented. Section 6 presents the different approaches of occlusion invariant 3D face recognition.

II .FACERECOGNITION

For face recognition, the acquisition, registration and feature matching can be based on acquired 3D or 2D data [13]. 3D Face Recognition has many advantages over 2D Face Recognition due to enhancement in dimensionality, using the parameters like shape and texture channels parallel. The texture channels include the 2D image information. Information about face in 3D analysis is registered with shape parameters like surface normal. Shape of the face or the probe is mostly affected by the variations like illumination [1],[22].

III.SHORTCOMINGS OF 3DFACE RECOGNITION

3D Face Recognition is widely preferred among all techniques of recognition. 3D face recognition have higher rate of accuracy than 2D face recognition. It is very robust to obstacles and variations coming across face detection while processing and acquiring face data like variations in pose, illumination factor, expression, ageing i.e. over time, the face will go through various changes. For example, from childhood to age hood also known as time dimension which can be due to age or intentionally made changes [1],[22].

It is also affected by occlusions and makeup variations. Recent research in 3D face recognition has shown that shape of face

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also plays important role while identifying one's identity. It is immune to spoofing and deception. At the same time, the data of shape helps to eliminate the effects of illumination and pose from the texture of 3d Face. If shape and texture of face processing done together then this could lead to high performance [1].

Another problem coming while processing the face is internal factors. As discussed, ageing is one more issue that changes the facial shape and appearance due to speech and expressions. Since humans take help of mouth and vocal track to produce speech. Due to movements in facial muscles will create new expressions like neutral, smiling, angry, happy, worried etc. Like Human vision, the automated system should recognize and process the face without taking in considerations of all hurdles. The concerned complication while recognizing the face is occlusion. Occlusions make problematic scenarios in identifying the original image of face. Handling of occlusion variations is still a challenging task[1]. [7] proposed a work, in this work, a framework of feature distribution scheme is proposed for object matching.

IV.OCCLUSION

The real world applications are forced to work in controlled scenarios (issues) which are nothing but presentation of other problematic issues [12]. In particular, subjects or persons providing information of face may have a non neutral facial expression and the face can be occluded due to hair, hands, phone , scarf , glasses , goggles , and other type of accessories [12], [22]. It can hide some part or whole part of face [8]. Maximum available approaches with 3D face recognition, does not deal with such kind of issues. The reason behind this is the lack of publically available databases, featuring a large number of acquisitions taken in presence of 3D facial information which can be affected due to internal and external objects [1] ,[22]. This can lead to missing information. Occlusion due to InternalObjects

a. Occlusion due to ExternalObjects

Occlusion Due to InternalObjects

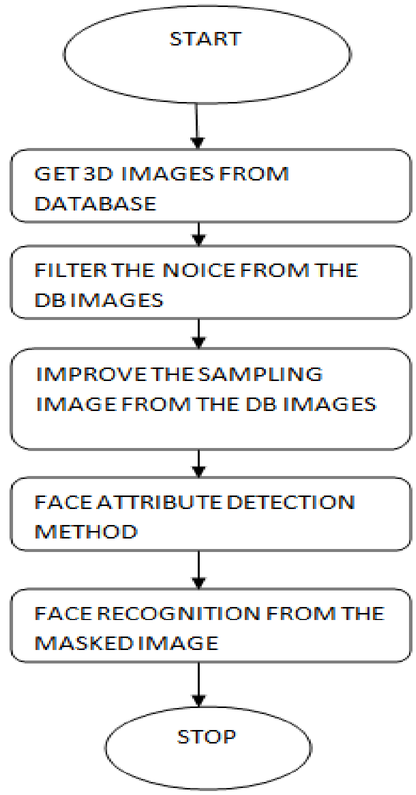
During acquisition changes in pose can lead to self occlusions where a part of facial surface hinders acquisition of another region. Thus presence of these occlusions causes missing of information of facial surface[15].

Occlusion Due to ExternalObjects

External objects are like hand, hair, scarf, eyeglasses, goggles and other objects [15]. Partial occlusion is a challenging problem and has found its implications in many areas of image processing as shown in Figure 1. The Real life examples of occlusion in face arelike

1. Iris Recognition: The Eyelashes occlude theiris.
2. Identification via Ear: The part of face occluded by Earrings.
3. Medical (Biomedical): Arteries may be occluded due to high cholesterollevel.
4. Hair, hands,Goggles.

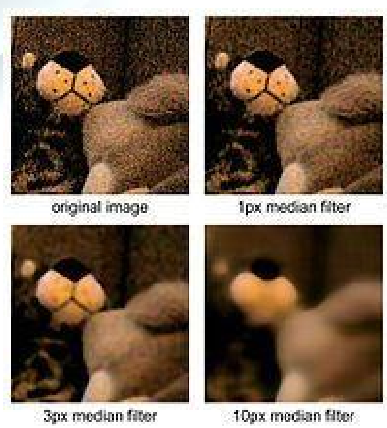
Emerging and developed technologies also lead to short comings like misuse of the developments for hacking and forgery. Intruders misbehave which subsequently in order to deceive the security system, the affects the performance of recognition system. In accordance with face recognition the spoofing and deception can degrade the quality of system leading to rise in failure rates of the realistic systems [8]. People may change their looks to trick the security system by covering the face with mask or some part of face with scarfor.



V. RESULT ANDDISCUSSION

FILTER THE NOICE FROM THE DBIMAGES

In signal processing, it is often desirable to be able to perform some kind of noise reduction on an image or signal. The median filter is a nonlinear digital filtering technique, often used to remove noise. Such noise reduction is a typical pre-processing step to improve the results of later processing (for example, edge detection on an image). Median filtering is very widely used in digital image processing because, under certain conditions, it preserves edges while removing noise (but see discussion below).



AverageFiltering

Average (or mean) filtering is a method of 'smoothing' images by reducing the amount of intensity variation between neighbouring pixels. The average filter works by moving

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through the image pixel by pixel, replacing each value withthe average value of neighbouring pixels, including itself. There are some potential problems: ¾ A single pixel with a very unrepresentative value can significantly affect the average value of all the pixels in its neighbourhood. 9 ¾ When the filter neighbourhood straddles an edge, the filter will interpolate new values for pixels on the edge and so will blur that edge. This may be a problem if sharp edges are requiredin theoutput.

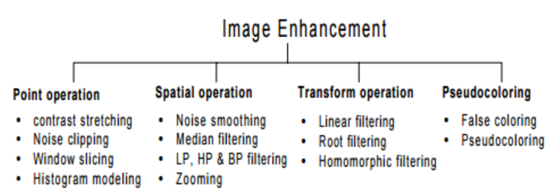
IMPROVE THE SAMPLING IMAGEQUALITY

The principal objective of image enhancement is to process a given image so that the result is more suitable than the original image for a specific application.

It accentuates or sharpens image features such as edges, boundaries, or contrast to make a graphic display more helpful for display and analysis.

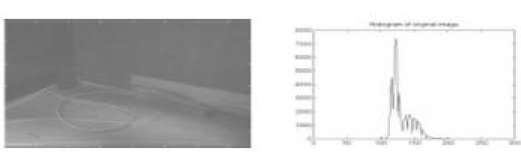
The enhancement doesn't increase the inherent information content of the data, but it increases the dynamic range of the chosen features so that they can be detected easily.

- Enhancement by pointprocessing
- Simple intensitytransformation
- Histogramprocessing
- Spatialfiltering
- Smoothingfilters
- Sharpeningfilters
- Enhancement in the frequencydomain
- Pseudo-color imageprocessing

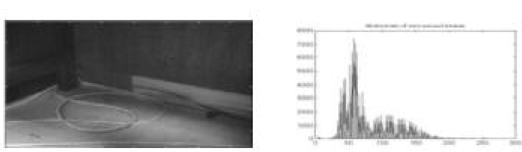


Contraststretching

- Low-contrast images can result from poor illumination, lack of dynamic range in the image sensor, or even wrong setting of a lens aperture during imageacquisition.
- The idea behind contrast stretching is to increase thedynamic range of the gray levels in the image beingprocessed.



Original



Processed image

FACE REGIONS DETECTION AND FACIAL FEATUREEXTRACTION

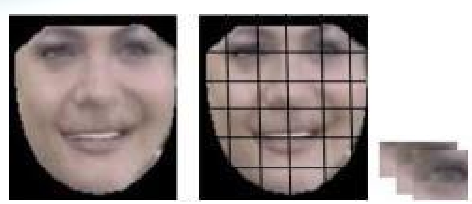
The possible face candidates with a highness value are passed on to the second stage. The functions of the second stage are to verify whether the candidates are human faces or not, and to extract the respective facial features in the face region. The verification process is based on the characteristics of the projected face images At this stage, the symmetry of a face candidate is measured. As every face region is normalized for the shirring select and the illumination select, the difference between the left half and the right half of a face region should be small due to its symmetry. In our method, the size of a face region is normalized to 2831, and the symmetrical measure is calculated as follows:

The bottom window, the mouth corner can be detected based on two assumptions; the mouth corners are close to the horizontal position of the corresponding iris and the gray-level intensity changes significantly at the mouth corner. Fig. (a) illustrates the x-projection and the determination of the detected mouth corners. The detection result for the respective facial features is shown in Fig. Similarly, if any horizontal position of the facial features cannot be located, the candidate is assumed to be a non-facial image. Otherwise, a true face region is declared, as are the different facial features being located.

(a)

FACE ATTRIBUTE DETECTIONMETHOD

Attribute Enhanced Sparse Coding: It describes the automatic detection of human attribute from the image and also creates the different sparse coding. These collections of sparse coding represent the original image. Attribute embedded inverted indexing: It collects the sparse code words from the attribute enhanced sparse coding and check the code words with the online feature database and retrieve the related images similar the query image.



For every image in the database face detector is used to detect the location of face region. 73 possible attributes can be taken. For example hair, color, race, gender etc. Active shape model is used to mark the facial landmarks and by using that land mark alignment of the face is done. For each face component 7*5 grid points are taken. Each grid will be a square patch.

These grid components include eyes, nose, mouth corners etc. LBP feature descriptor is used to extract features from those grids. After extracting the features we quantize it to code words known as sparse coding. All these code words are

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summed and generate a single pattern for the image. These steps are obtained by using attribute enhanced sparse coding. Before storing the image in database an index number will be provided to it and by using that index number we can identify the image. All these process will be performed in offline stage. Attribute embedded inverted indexing will be performed in online stage which compares the sparse codeword of query image and the database image and finally provide all the similar faces from the database.

VI CONCLUSION

The research work concentrates on different methods used for disruption invariant 3-D face identification technique. Disruption in 3-D face identification is a challenging task while processing. In this proposed work, 3-D face recognition with challenges of disruptions are reviewed. Additionally, disruptions due to internal objects and external objects are discussed. The maximum number of cramped datasets with large number of information is provided by UMB-DB database. All the approaches focused are effective for retaining the spatial domain information. In the future robustness of 3-D face identification can be improved to have high disruption invariant.

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