International Journal of Ethics in Engineering & Management Education
Website: www.ijeee.in (ISSN: 2348-4748, Volume 1, Issue 5, May2014)

FACE AND FACIAL EXPRESSION RECOGNITION IN 3-D USING MASKED PROJECTION UNDER OCCLUSION

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***Abstract*—with advances in sensor technology, the three-dimensional (3-D) face has become an emerging biometric modality, which is a particular technique, uses 3D sensors to capture the information about shape of the face preferred especially in high security applications. How means in a particular situation when occlusion occurring on face that time and in non cooperative scenarios identification of face is a challenging work. So for that purpose we should be handled to Identify distinctive feature of a face with fully automatic security systems. We use a 3-D face recognition system. We basically consider two problems: 1) Using a surface registration to handle an occlusion and 2) subspace analysis technique. Which is use for a to handle a missing data problem, we using another adaptively-selected-model-based registration technique, where it is use for an identify the occlusion occurred on the face model. After registering to the model, occlusions are detected and removed. In the classification stage, then after that we using a masking technique which we call masked projection technique are used to based on subspace analysis techniques with incomplete data. Then afterwards use a mapping technique such as masked projection technique to remove the occlusion from the face and turn the object on the face**

***Keywords:* - Masked projection, 3-D registration, Occlusion, Subspace analysis.**

I. INTRODUCTION

In Biometric systems, human beings are identified by different features of face, such as physiological and behavioral characteristics. As a biometric modality, the human face is widely preferred because of several advantages: Due to its contactless acquisition, sometimes its non cooperative and uncontrolled scenarios happened, then recognizing individuals from their faces is a challenging task. So that's why The particular factors that degrade the performance of a face recognizer in different ways such as include presence of illumination differences, in-depth pose variations, facial expression variations, and the presence of occlusions. In the three dimensional (3-D) domain, challenges caused by illumination, pose, and expression variations can be better handled. Occlusion variations still complicate the task of identification. For that purpose we propose a 3-D face recognition system that is robust under realistic occlusions. In our approach, occlusion handling is considered in the registration and the classification stages.For alignment of occluded surfaces, we use a registration scheme for which adaptively selects an alignment model, a model including the probable non occluded facial parts. By adaptively selecting a model, it is possible to discard the effect of occluding surfaces on registration. After alignment ,occluded regions are discarded. Occlusion-removed on facial surfaces contain missing data points, so for that perpose we propose a masked projection technique that can cope with missing data. Then finally we utilize a regional approach to improve the classification performance, where different regions serve as separate classifiers.

II. RELATED WORK

In this face recognition system. Developments in 3-D sensor technologies have increased interest in 3-D face recognition. In [31], it is shown that by using 3-D face, it is possible to obtain competitive results when compared with other modalities such as iris and high-resolution 2-D facial images. A thorough survey of previously proposed 3-D face recognition systems can be found in [1], [9], [35] and detailed fundamental analysis of concepts are given in [2], [21], [28]. In this section, we focus on the recent face recognition approaches dealing with realistic occlusion variations, both in 2-D and 3-D

A .*2-D TECHNIQUE*

In 2D Technique variations caused by pose and expression have attracted and increased research effort ,the problem of handling occlusions has not been discussed in the 2-D face recognition studies, there has been a few approaches considering occlusion variations. In most of these approaches,1) occlusion handling for recognition and 2) the registration problem is not considered: Experimental results are usually reported on databases where the faces are assumed to be accurately registered to recognition. Some studies are based on subspace analysis methods, where the aim is either occlusion-robust projection or missing data compensation. In [30], Park et al. consider occlusions caused only by eyeglasses and propose a method to compensate for the missing data. Initially, the glasses region is extracted using color and edge information. Occlusion variations are handled bye identifying the facial parts where occlusions are occur. Several subsets of images are created through masking facial regions both in training and test faces. Using masked training images, different face projection spaces are created through Principal Component Analysis (PCA), an approach for combining discriminative and reconstructive methods is proposed for better handling of images with outlier pixels. Other holistic approaches can be considered as model-based methods. In [16], De Smet et al. proposed an iterative approach for the parameter estimation of 3-D morph able model fitting procedure. Concurrently, a visibility map defining the occlusions are modeled by Markov Random Fields (MRF) accounts for spatial coherence of occlusions. Another approach for occlusion handling considers the facial surface as a combination of partitions. When local patches are considered separately, the areas where occlusions occur can be compensated for, in the classifier fusion phase. In [27], the facial surface is divided into local regions. Each region is modeled individually by a mixture of Gaussian distributions, and fusion is achieved by probabilistic evaluation of regional matches. In [23], Kim et al. propose a part-based local representation approach based on Independent Component Analysis (ICA). ICA representations are constructed for local regions corresponding to salient parts such as eye, nose, and lip areas. Conservation of discriminative feature is achieved by reordering of basis images. In[38],a face image is represented by applying multiscale and multiorientation Gabor filters and obtaining the Local Binary Pattern (LBP) map. Recognition is achieved by matching regional histograms. Recently, there has been increasing interest in the area of sparse representation techniques. For robust face recognition against occlusions and corruptions, Wright et al. [37] proposed an identification technique, where the occlusion robustness is obtained by sparsely representing corrupted pixels.

B. *3-D TECHNIQUE*

In 3-D technique using 3-D facial data, for occlusion detection, removal, restoration, and missing data handling. The occlusion detection shows the difference between the original face and occluded face, regions detected as occlusions are removed and the locations of the missing parts are employed in the restoration process, which is handled by Gappy PCA [17]. Identification was performed by the Fisherfaces approach. In [12], they have refined the occlusion detection method by including the difference of the input image from the mean face. In the experiments, it was reported that restoration does not offer improvement for faces occluded by more than 30%. In [13], the authors have employed the occlusion detection and restoration idea to the face detection problem. Occlusions are detected roughly by thresholding the difference from a mean face, and Gappy PCA is utilized to discriminate between face and no face images. The experimental results indicate performance improvement by the part-based system, both for expression and occlusion variations. In [6], the authors have proposed a nose-based registration scheme for better handling of occluded faces. Curvature information is utilized for automatic detection of the nose area, and an average nose model is used for fine alignment via Iterative Closest Point (ICP) algorithm. On the registered surfaces, occlusions are detected by analyzing the difference from the average face model, and the occlusion-removed surfaces are completed PCA method.

III. PROPOSED SYSTEM

This proposed system which consist of 3 different modules as shown in below figure(1), such as an.

1) Processing module
2) Training module
3) Classification module

The processing module includes the registration and occlusion removal process. For alignment, the adaptive registration module is utilized in processing module which registers the occluded surfaces. By adaptively selecting the model and identify the faces where occlusion occurred on a face then after know the occluded area it is possible to remove the effect of occluding surfaces on registration. The occlusions are detected on the registered surfaces by adaptively selecting model using ICP algorithm.

The training module introduces offline to learn the projection matrices. Uses with preliminary experiments on the UMB-DB database.

The classification module uses the occlusion mask of the probe image to compute the masked projection, and projects the probe image to the adaptive subspace. The identification is handled in the subspace by 1-nearest neighbor (1-NN) classifier. The proposed system is evaluated on two main 3-D face databases that contain realistic occlusions: (1) The Bosporus, and (2) the UMB-DB databases. the nose detection, registration and the subsequent occlusion detection phases are given. The proposed system introduces a new technique called masked projection for subspace analysis with incomplete data.

A. *REGISTRATION AND OCCLUSION REMOVAL*

In this approaches remove the occlusion from which occurs on face, means to register the occluded surface using adaptive register module.

B. *Automatic Nose Detection*

Iterative Closest Point (ICP) algorithm is used to remove the occlusion occurs on nose. Which is the most widely preferred methods for rigid registration of 3-D surfaces. The nose detection algorithm [6] is based curvature in formation ,which is advantageous due to its rotation and translation invariance. Initially, two curvature maps are computed for a given surface, namely the shape index map and the curvedness map. The shape index value at surface point can be computed from principal curvatures 1) $kmax(i)$ and 2) $kmin(i)$

$$1)\quad SI(i) = 1/2 - 1/\pi \tan^{-1} kmax(i)/ + kmin(i)/kmin(i) - kmax(i).$$

As the scale-dependent counterpart of shape index, curvedness measures the rate of curvature at each point:

$$C(i) = \sqrt{Kmin(i)} + \frac{\sqrt{kmax(i)}}{2}.$$

This is weighted with curvedness to integrate scale-dependent and scale-independent components are

$$WSI(i) = SI(i) * C(i)$$

Here, denotes the curvedness-weighted convex shape index

IV. EXPERIMENTAL RESULTS

A. Databases

Three databases are employed in this work: (1) FRGC v.2, (2) Bosporus, and (3) UMB-DB. The FRGC v.2 [32] neutral subset, containing a total of 2365 images of 466 subjects, serves as a separate training set for: (i) the construction of the average face & patch models, (ii) the training phase of the Fisher faces method, and (iii) the determination of threshold values

B. The Bosporus DB

Four occlusion types in the Bosporus database as shown in fig(2) occlusion of the eye area by eyeglasses, occlusion of the eye area by hand, occlusion of the mouth area by hand, and occlusion caused by hair

C. *UMB- DB Database*

The Bosporus and UMB-DB databases, containing occlusion variations, are utilized to evaluate the system performance as shown in figure (3) Sample faces from the UMB-DB.The Bosporus and UMB-DB databases, containing occlusion variations, are utilized to evaluate the system performance.Fig. 3. Sample faces from the UMB-DB. Bosporus database includes a total of 4666 scans collected from 105 subjects, including expression, pose, and occlusion variations. The database contains a total of 299 neutral scans. The first neutral scan of each subject is used to construct the gallery set (105 scans). The images with occlusion variations, consisting of 381 images, form the probe set 1) Standard Fisherfaces (FF) on restored images (blue squares), 2) masked Fisherfaces where regional projection matrices are obtained by regional training (green circles), and 3) masked Fisherfaces where regional projection matrices are also obtained by masking (red triangles)as shown in figure(4).

V. CONCLUSION

3-D face recognition which shows the emerging biometric technique. However, especially in non cooperative scenarios are occurs then it's a complicated task of identifying subjects from their face images. We present a fully automatic 3-D face recognizer, which is robust to facial occlusions. For the alignment of occluded surfaces, we utilized a model- based registration scheme, where the model is selected adaptively to the facial occlusion. The alignment model is formed by automatically checking patches for validity and including only non occluded facial patches. By registering the occluded surface to the adaptively selected model, a one-to-one correspondence is obtained between the model and the non occluded facial points. Hence, occlusion in sensitive facial registration can be achieved. From approach for both the Bosporus and the UMB-DB databases. Following the occlusion detection stage, the facial parts detected as occluded are removed to obtain occlusion-free surfaces. Classiffication is handled on these occlusion-free faces. In this work, we propose masked projection, which incorporates a masking scheme into a subspace analysis technique, namely the Fisher faces, to enable applicability to incomplete data. Sub- space training is handled offline and at the classification stage, the occlusion mask of the probe face is applied to the projection matrix. Then using a subspace analysis technique to removes the occlusion with missing data so that's why again we used a particular technique called as masked projection to removes complete occlusion from the face. So finally we conclude that using masked projection to express the facial expression under occlusion in 3-D.

VI. ACKNOWLEDGEMENT

I acknowledge the help, guidance and support receive from various quarters during the course of my project work. Hence, I hereby express my gratitude to one and all. My sincere thanks to my project guide because they are well supported to complete my project

VII. REFERENCES

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VIII. LIST OF FIGURES

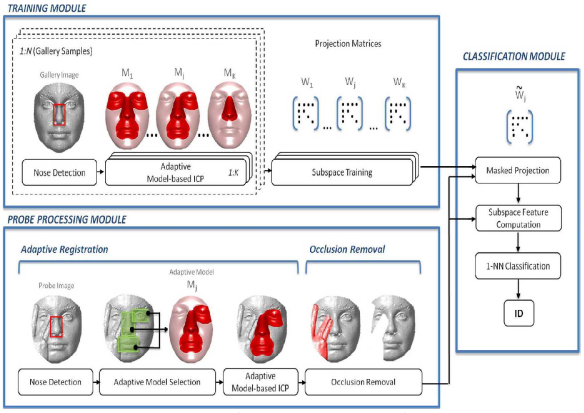


Fig1. Illustrative diagram of the proposed 3-D face recognition approach

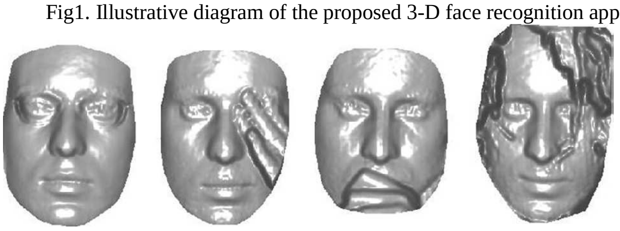
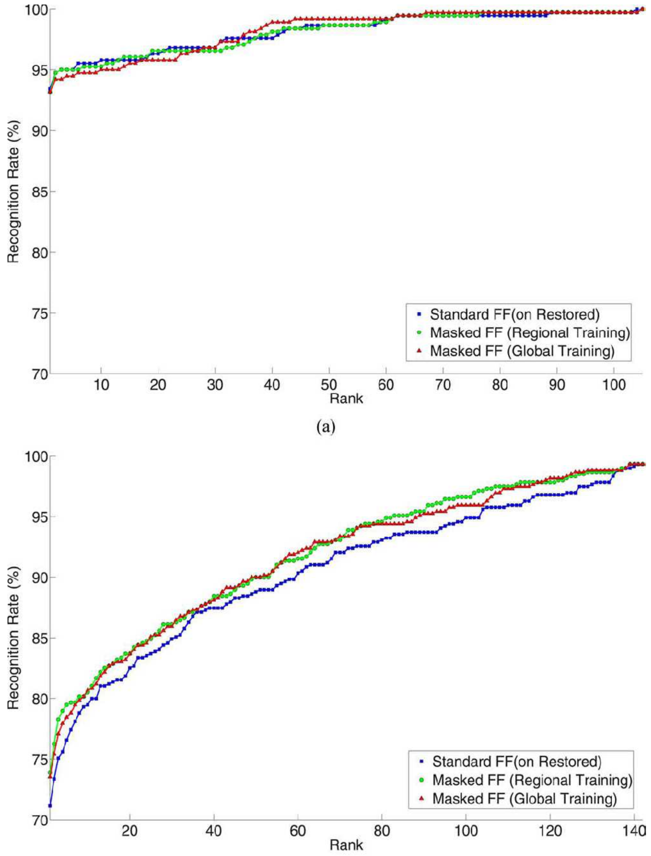


Fig2.Four Occlusion typesinthe Bosphorus database:

Fig3.Sample faces from the UMB-DB



(a)

(b)

Fig. 4. Cumulative match characteristics (CMCs) plots for (a) the Bosphorus and (b) the UMB-DB databases, via three different approach