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3-D Face Identification under Disruption Using Masked Projection

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Abstract:

Face has unique identity among all the human beings. Face identification is used to perform on 2-D and 3-D facial data.3-D provides higher accuracy than 2-D especially in high security applications. Considering the disruptions covering the facial surface is a great challenge and so enables the fully automatic security systems. In this proposed system handling two problems such as 1) disruption handling for surface registration, and 2) missing data handling for classification based on subspace analysis techniques. The adaptively-selected-model-based registration technique is implemented for alignment problem, where a face model is selected for an cramped face such that only the valid non-cramped patches are utilized. When the registration stage is completed, disruptions are detected and removed. In the classification stage, masked projection is proposed. It enables the use of subspace analysis scheme with incomplete data. Thedisruption handling is to improve the overall results. The two databasesnamely, the Bosphorus and the UMB-DB are reported in experimental results. The results confirm that registration based on the adaptively selected model together with the masked subspace analysis classification offer adisruption robust face identification system.

Keywords: Disruption, UMB-DB, Bosphorus, Face Identification.

1. INTRODUCTION

Identifying the features of human beings is easily done in biometric systems. The human face is mostly preferred in the biometric identifications. It has the advantage ofcontactless acquisition [13]. It is used in many applications such as public records, authentication, security and safety. In biometric system, the face identification technique is the most trusty and preferable.

This paper is presented as follows: in Section 2, face identification (2-D and 3-D) is discussed. Section 3 describes the advantages of 3-D face identification systems like disruption, ageing effect, gleam and changes in pose. Section 4 gives short description about external and internal objects. In section 5, the review of databases and challenges are summarized.

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Section 6 addresses the different approaches of disruption invariant.

2. FACE IDENTIFICATION

A face identification system is used to verify a particular person from a digital image or video source. The human face is used to identify in the society and provides security among the biometric face identification system. In this system, they can capture a face without touching the person and identified. The proposed system is used to control the crime deterrent.Face is classified into many dimensions. Here 2-D and 3-D face is discussed. The surface reflectance is presented by 2-D intensity and the face shape data is given by 3-D depth values.

Based on 3-D or 2-D data, the acquisition, registration and characteristic matching is done for face identification. Identification is enhanced dimensionally by using the parameters like shape and texture channels parallel. 2-D image information is included in texture channel. 3-D has more advantages than 2-D. The variation like gleam [1] [22] affects the shape of the face or the probe. [9] proposed a system in which an automatic anatomy segmentation method is proposed which effectively combines the Active Appearance Model, Live Wire and Graph Cut (ALG) ideas to exploit their complementary strengths. It consists of three main parts: model building, initialization, and delineation. For the initialization (recognition) part, a pseudo strategy is employed and the organs are segmented slice by slice via the OAAM (Oriented Active Appearance method). The purpose of initialization is to provide rough object localization and shape constraints for a latter GC method, which will produce refined delineation. It is better to have a fast and robust method than a slow and more accurate technique for initialization.

3. 3-D FACE IDENTIFICATION

When comparing to 2-D face identification, 3-D is the most preferable because it has higher accuracy rate. In addition, it is robust to obstacles and variations. Example for identification is time dimension[1] [22]. Shape of face plays a major role in 3-D face identification in one's identity. It is resistant to deceit and deception. The effect of gleam and pose from 3-D texture face is eliminated by the shape data. The combination of shape and texture of face processing leads to high performance [1].

During the processing of face, internal factors occur. The appearance and shape of the face is the major problem when ageing occurs. The facial muscles will produce new expressions like smiling, happy, sad, angry etc. Disruption makes problems for identifying the original image of face. Still the disruption variation is a challenging part[1].

4. DISRUPTION

The real-time applications are constrained to work in controlled issues[12]. The information of face provides non neutral facial expressions. The face can be cramped due to hair, hands, phone, scarf, glasses, goggles etc[12] [22]. It hides some part in face[8]. The internal and the external objects[1] [22] are affected due to the presence of 3-D facial information in a large number of acquisitions. Sometimes it loses the

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information. There are two types of disruptions. They are 1) disruption due to internal objects and 2) disruption due to external objects.

4.1 DISRUPTION DUE TO INTERNAL OBJECTS

Changes in pose lead to self disruptions. Due to that a part of facial surface hinders acquisition of another region. These disruptions cause missing of information of facial surface [15].

4.2 DISRUPTION DUE TO EXTERNAL OBJECTS

Examples of external objects are hair, hands, phone, scarf, glasses, goggles etc[15]. The problems occurred in partial disruption has found the solution is implications for image processing. The real life examples are iris recognition, identification via ear, medical, hair, hands and goggles. The developed technologies used for hacking and forgery. The disruption system are used to control the intruders misbehave. The people are used tricks to forgery the security systems by covering the face with mask or scarf. The deceiting and deception leads toraising failure rates of the realistic systems in accordance with face identification[8].

5. REVIEW OF DATABASES

The complexity in database is used to recognize the different faces are a realistic challenge. The UMB-DB database and the Bosphorus database are addressed in 3-D face. The large disruption faces are contained in UMB-DB 3-D database. When the face is affected by disruption, the UMB-DB database is used to test the algorithms and systems. In face identification, the disruption is present due to external and internal objects. The UMB-DB consists of 1473 2-D color images and 143 contents of 3-D depth images. The contents include 98 Males and 45 Females. The majority of the people age ranging from 19 to 50. A pair of twins and a child of 4years old age have been additionally included. The contents are included from Caucasian race. The database has captured9 acquisitions which include 1) Three with a neutral expression 2) Three contents with non-neutral facial expressions mainly, Smiling, Angry and Bored 3) Three contents their face cramped by different objects like scarf, hair and hands having random positions.

The UMB-DB database has captured the contents like eyeglasses, holding phones, partially cramped by hair and other objects. The aggregate number of cramped faces is 578. During the time of acquisitions the persons were allowed to cover the some part of face. The UMB-DB database provides an average of 42% and maximum of about 84%. Minolta vivid-900 laser scanner is used to create the dataset. When acquisition occurs every time, seven feature points are noted manually [12].

6. APPROACHES

Alyuz et al [13] have presented a paper about masked projection having face identification with disruption. They illustrates mainly two problems i) Disruption handling for surface registration ii) Based on subspace analysis method handling missing data for

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classification. To recover the alignment problem they addressed an adaptively selected model based registration method. This method includes the preliminary handling of 3-D face identification method which consists of registration and removal of disruption steps. Adaptive registration pipeline is classified into conflict techniques. Some of the techniques are nose detection, adaptive model selection and Bosphorus database. The important non-cramped patches are utilized with ICP based approach in adaptive modeling. Disruptions are detected and removed during registration stage. In classification stage masked projection is presented. In the presence of defective data the use of subspace analysis method is enabled in the proposed technique. To improve the performance disruption handling is added in the classification stage.

7. MODELING OF FACIAL SURFACE

With the help of pixel level Gaussian Mixture Model (GMM) facial surface complex model is designed in the proposed technique. Comparing the pixels with the respective mixture model for their fitness. Through the training phase pixels are passed. The pre-aligned faces are obtained by the adaptive registration technique. To give depth images, the facial surfaces are re-sampled after alignment. Comparing to baseline approach our proposed technique delivers best performance. Using UMB-DB database and Bosphorus database, these approaches are tested for detecting disruption[15].

8. RELATED WORKS

The binary segmentation problem from the challenge of face detection with disruption is considered in this approach. It includes the data residing in the neighborhood relations in the form of pixel. The graph is modeled from the regional cues of depth values included with neighborhood cues and acquired surface. The surface pixels are separated into face or disruption with graph cut technique. Comparing to GMM, GC gives outstanding results. The research field is now on encapsulating regional anddetecting neighborhoodinformation [15].

Alyuz et al. [14] have presented the method to disruption handling at the classification stage, known as masking projection. Enabling the use of subspace analysis technique with insufficient data is focused in this paper. They have augmented with regional approach suitable for disruption handling in classification stage. It leads to recognition rate by the use of UMB-DB and Bosphorus Database.

A. Colombo et al. [3] have proposed the tolerant technique against partially cramped faces. The detection algorithm reviews the features on the face. The acquired face of the person is registered. The method which is used to avoid samples including cramping objects is Iterative Closest Point (ICP).The Gappy Principal Component Analysis (PCA) classifier is used to isolate between face and non face. The face detection can be done using UND database. It shows 90.4%accuracy for face identification.

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Agrawala et al. [5] have analyzed a framework for detecting 3D faces by comparing, matching and averaging their shapes. Representing facial surfaces with radial curves starting from nose tips is analyzed using elastic shapeto develop a Riemannian frame work. The framework is normal for measuring facial disruption and it is a challenging task for variations in large pose. This approach is experimented from both exact and hypothetical perspectives using three databases FRGC2, GavabDB andBosphorus. They proposed a local representation by utilizing a curved representation of a 3D face and a quality filter for selecting the curves in unrestricted situation.

Bagchi et al. [6]analyzed a robust face recognition system.The system is resistant to pose changes and to disruptions from real time. TheIterative Closest Point (ICP) algorithm is used with the residual distances between aInput Face and gallery model. Theperformance of ICP depends on initial conditions.By considering the threshold of depth map value of the 3-D image, disruptions are removed. Using Bosphorus database, thisdisruption invariant method provides 91.30% accuracy.

9.RESULTS AND DISCUSSION

After analyzing many papers presented by researchers, it is summarized as most of the process done on the basis of masking projection at the classification stage. The techniques which are used in common are ICP, GPCA and PCA. These methods are used to solve the problems like gleam, disruption, variation in pose [4] and expressions. The below table represents the analysis related to the proposed system.

10. 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 disruptionsarereviewed. Additionally, disruptions due to internal objectsand external objectsare discussed. The maximum number of cramped datasets with large number of information is provided by UMB-DB database.All the approachesfocused 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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