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High Efficient and Better Robustness 3D Face Recognition with Expression Simulations

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ABSTRACT
Face Recognition is one of the popular biometric authentication system but the face recognition with the different illumination, pose and expression variations is a challenging issue so to improve the accuracy in such variations is addressed by an Analysis-By-Synthesis-Based scheme, where the expression simulations has been done for the 40 subjects of 400 images. The Fast Bounding Box Algorithm is used for face recognition. The use of fast bounding box algorithm has improved the accuracy and yields better robustness of face recognition.
Keywords:- Face recognition, Expression simulations, Fast bounding box algorithm.

I. INTRODUCTION

The security applications are growing continuously, the Recognition of humans has become the most popular topic today. Biometry extracts the physical and behavioural characteristics which are easy to access. Many biometric systems exist today like iris, voice, fingerprint, DNA. Each biometric has its own disadvantages. The system constraints and requirements should be taken into account as well as the purposes of use-context that include technical, social and ethical factors [1]. If you consider the fingerprint which is the biometric system most widely used for security purpose requires user collaboration [2]. Likewise face recognition problem can be identified and verified by extracting patterns from 2D or 3D still images which are previously stored in database.

In Face Recognition Vendor Test (FRVT) 2002, a recognition rate of a face was higher than 90% [3]. But with the introduction of various factors of real world scenarios like pose, illumination, expression the performance deteriorated, which led to the study of three-dimensional (3D) face model.

In FRVT 2006 [4], the good results are achieved with high resolution still images with False Rejection Rate (FRR) of 0.01 at a False Acceptance Rate (FAR) of 0.001. To achieve facial expression simulations, an automatic procedure MPEG-4 animatable face models is used. Facial animation engine is used to simulate the different expressions for each person.

II. LITERATURY SURVEY

A. *FRVT 2006 and ICE 2006 Large-Scale Experimental Results*

J. P. Phillips *et al.*, [4] experimented on Face Recognition Vendor Test (FRVT) 2006 and the Iris Challenge Evaluation (ICE) 2006. The FRVT 2006 measures performances for still frontal face images which are taken from controlled and uncontrolled illumination from high resolution still images and three-dimensional (3D) face images. The ICE 2006 performed for both left and right irises. The result of using FRVT 2006 and ICE 2006 which has been experimented by comparing human and algorithm leads to best performing algorithm and more accurate than humans on unfamiliar faces.

Advantages

- Face recognition performance on still frontal images taken under controlled illumination has improved by at least a factor of 20 (greater than an order of magnitude) since the FRVT 2002.
- Increase in the performance exhibited.

Disadvantages

- The FRGC was a technology development effort that preceded the FRVT 2006.

B. ***Automatic 3D Reconstruction for Face Recognition***

Yuxiao Hu, D. Jiang, S. Yan, L. Zhang, and H. Zhang, in their paper [7], they proposed the analysis-by-synthesis technique to recognize the facial image with variation of Pose, Illumination and Expression (PIE). First, frontal face detection and alignment are utilized to locate a frontal face and the facial feature points within an image, such as the contour points of the face, left and right eyes, mouth and nose. Then, the 3D face shape is reconstructed according to the feature points and a 3D face database. Based on this 3D face model, virtual samples with variant PIE are synthesized to represent the 2D face image space. Finally, face recognition is conducted in this enlarged face subspace after standard normalization of testing sample face images.

Advantages

- The proposed fully automatic system is efficient accurate and robust.
- The proposed algorithm significantly improved the performance in half-profile views, like pose 37 and 11.

Disadvantages

- For the profile views, the improvements are limited.
- Still need to explore new methods for realistic missing data reconstruction, like using the 3D texture models.

C. ***Matching 2.5D Face Scans to 3D Models***

Xiaoguang Lu and A. K. Jain, in their paper [15], developed a face recognition system that utilizes three-dimensional shape information to make the system more robust to pose and lighting. 3D face model is constructed for different views and is simplified has 3D (x,y,z). There exists two components for recognition surface matching and appearance based matching. The surface matching is based on the Iterative Closest Point (ICP) algorithm. Appearance matching uses the candidate list from the gallery which has been generated based on the output of the surface matching component. 3D models in the gallery are used to synthesize new appearance samples with pose and illumination variations using discriminant subspace analysis.

Advantage

- Integrates surface (shape) matching and a constrained appearance-based method for face matching that complement each other.
- The registered 3D model is utilized to synthesize training samples with facial appearance variations, which are used for discriminant subspace analysis.

Disadvantage

- Further the proposed system should destined so that is capable of recognizing faces with arbitrary pose.
- To make the entire matching system fully automatic, a more robust and accurate feature point locator is being developed.

D. ***Integration of 2D and 3D Images for Enhanced Face Authentication***

Filareti Tsalakanidou, Sotiris Malassiotis, Michael G. Strintzis, in their paper [16], they integrated 2D intensity and 3D range data based on less cost and real time structured light sensor to represent a face authentication system. They proposed the Novel algorithms which is robust for face detection and authentication under different background conditions. The depth maps are known using hidden markov model technique. The proposed system is efficient for identifying the face with different variations such as pose and illumination.

Advantage

- The proposed method simplifies the processing of 3D data by regarding it as a 2D image.
- Authentication may be performed using a simple 2D technique and conventional image sensor.

Disadvantage

- Improvement of the quality and resolution of depth maps is expected to lead to even lower EER.
- Use of more advanced surface features and investigation of illumination compensation techniques are among our future research plans.

III. PROBLEM STATEMENT

To increase the accuracy of identifying the face of a person in different pose, illumination and expression variations by using an analysis-by-Synthesis-based scheme.

IV. PROPOSED SYSTEM

The 2D and 3D image of a person has been scanned, 40 person facial images will be taken and 10 image expression simulations will be done for each person

image so 400 images will be obtained and stored in a database.

Out of 400 images, 200 odd images will be trained and histogram processing will be done. After scanning the image the obtained image will be noisy so the data pre-processing will be done to reduce spikes and holes.

The spikes will be removed by using Thresholding and holes will be filled by using Linear Thresholding. The noise will be reduced by applying Bilateral Smoothing Filtering.

The obtained clean and clear facial image will be used to extract the 17 feature points of interest from face region. The 17 points consists of 4 points for each eye, 5 points for nose and 4 points for lips. After obtaining 17 points, the 3D animatable model will be constructed using MPEG-4 and expression will be simulated using visage|lifeTM tool.

The face recognition will be done by using Fast Bounding Box Algorithm where the Query image of a person face has been taken and considered has Qobjects. The left eye, right eye, nose and lip regions are considered has Qpatch. Based on the Qpatch the database image Dobject and Dpatch region matching takes place. If the region has been matched then the face detected message will be displayed along with the detected face image of a person.

Advantages of proposed system

- A face recognition framework is proposed in which the widely-encountered single sample problem for identification of faces with expressions is targeted by augmenting the dataset with synthesized images.
- Improves the performance of the identification system.

V. CONCLUSIONS

The face recognition with various variations has been addressed by Analysis-By-Synthesis-Based scheme and the problem of identifying different pose, illumination, and expression has been resolved by this scheme, which has led to the better Robustness and accurate results. The use of fast bounding box algorithm has reduced the rejection rate and increased the acceptance rate.

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