International Journal of Emerging Trends & Technology in Computer Science (IJETTCS)
Web Site: www.ijettcs.org Email: editor@ijettcs.org
Volume 4, Issue 6, November - December 2015 ISSN 2278-6856

An Edge based 3D Facial Expressions Detection System

[1]A.N.V.Susmitha, [2] Mr. K.Srinivas

[1]PG Scholar, Dept of CSE, Gudlavalleru Engineering College, Gudlavalleru, Krishna (Dt), AP, India.

[2]Assoc.Professor, Dept of CSE, Gudlavalleru Engineering College, Gudlavalleru, Krishna (Dt), AP, India

Abstract

Facial expression identification is a process of generating new facial features from a given face and still retain the facial characteristics of the face. Traditioanl 2D based facial expression evaluation encounter difficulties with large variations in facial features in terms of illumination, pose and expression evaluation. By using 3D model the information of human faces head pose and lighting changes are used to find the large set of expressions. In most of the 3D models,face data are projected on to 2D and finds the expression in the 3D. In this model, a novel method is used to find the 3D expression using edge based model for complex pose datasets. Experimental results show that proposed model has high accuracy compare to traditional 3D expression evaluation models.

Keywords-3D faces, Ridges, Edge based facial evaluations.

I. INTRODUCTION

Biometrics is generally used in two different ways: subject authentication, and subject identification. In the authentication scenario, users present themselves to the biometric system and the biometric system confirms their identity. Additionally, there are generally three ways to authenticate a user. The first relies on the user's knowledge for subject identification. The problem with this method of authentication is that knowledge is easily stolen. The problem with this method is that the device could be easily lost, stolen, or broken. The last method is based on a measurement of who or what the user is. The authentication scenario described above is one of the typical applications for biometrics. The other is subject identification. There is a growing need for an accurate and automatic human recognition procedure. Biometrics is a science that could assist in this recognition process[1-4].

The word biometrics comes from the Greek work ***bios,*** meaning **life**, and ***metron,*** meaning **measure.** Biometrics uses distinguishing human anatomy or traits to determine or verify the identity of an individual. It is believed that demographics (or "soft-biometrics") was first used in ancient Egypt during the construction of the great pyramids. Administrators providing food and supplies to the workforce kept records of every worker's name, age, place of origin, work unit, occupation, and when the worker received their last allowance. This process ensured that no one received more than their share of benefits. Today, thousands of individuals are victims of identity theft, and biometrics is sometimes touted as a possible solution.

The method based on global deformation is to extract all the permanent and temporary information. Most of the time, it is required to do background substraction to remove the effect of the background. The method based on local deformation is to decompose the face into several sub areas and find the local feature information.

Feature extraction is done in each individual sub areas independently. The local features can be represented using Principal Components Analysis(PCA) and described using the intensity profiles or gradient analysis.

The method based on the image feature extraction does not depend on the priority knowledge. It extracts the features only based on the image information. It is fast and simple, but lack robustness and reliability. The method need to model the face features first according to priority knowledge. It is more complex and time consuming, but more reliable. Face movement detection method attempted to extract the displacement relative information from two adjacent temporal frames. These information is obtained by comparing the current facial expression and the neutral face. The neutral face is necessary for extracting the alteration information, but not always needed in the feature movement detection method. Most of the reference face used in this method is the previous frame. The classical optical flow method is to use the correlation of two adjacent frames for estimation [9]. The movement detection method can be only used in the video sequence while the deformation extraction can be adopted in either a single image or a video sequence. But the deformation extraction method could not get the detailed information such as each pixel's displacement information while the method based on facial movement can extract these information much easier.

II. RELATED WORK

The PCA algorithm [8] identifies the maximum amount of variance from a group of data points scattered in a space to obtain a projection along the axis where the variance is maximized. A new coordinate system such that the greatest amount of variance is represented by the first coordinate, the second greatest variance with the second coordinate, etc. is created to represent the data. This process is used to transform correlated variables into uncorrelated variables. This technique can also be used to reduce the dimensionality of a data set for simplified analysis. In face recognition, this technique is used to determine the level of similarity between images. First, a set of 2D gallery images are decomposed into vectors where their values are represented by the grayscale color pixels in the image. These vectors are analyzed and a new coordinate system is created. Next, probe images are decomposed and projected into the new coordinate system. Using a nearest neighbor technique, the gallery image most similar to the probe image will be closest in the new coordinate system.

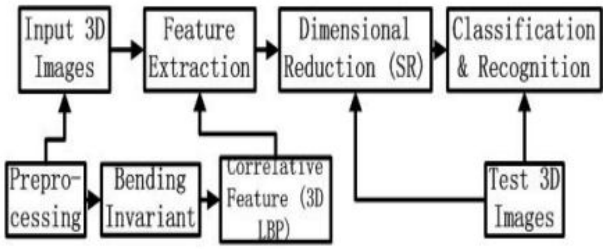
[3] propose an expression invariant approach to 3D face recognition that reports results on the FRGC v2.0 data set [4]. They perform automatic nose detection by slicing the 3D image horizontally, smoothing uniformly, and filling holes using linear interpolation. A circle centered at the maximum value of the slice is used to find the triangle with the largest area. The three triangle points consist of the circle center and the locations where the circle intersects the slice. A line is fit to the candidate nose tips (which should follow the nose bridge) and the point with the maximum confidence level (based on the triangle altitude) is selected as the final nose tip. Because this method relies heavily on the triangle, altitude for nose tip determination, it may perform poorly in the presence of large changes in the pitch or roll of an image. 3D system that uses multiple regions of the facial surface to improve recognition performance. Their algorithm uses linear discriminant analysis (LDA) to fuse the results from each of the 10 regions and to provide a weighted combination of the similarity scores. The authors found that using a combination of regions outperforms the results when using any single region. In addition, they found that using LDA to determine the fusion weighting parameters provided higher results than the standard sum rule.

These "soft biometrics" are unable to uniquely identify the subject. However, they are able to eliminate potential flaws in other matching engines. First, a primary biometric system is used to determine the probability of a match. Next, the soft biometrics are extracted and used to generate a second probability. The results from these two systems are combined using decision fusion and the user is either accepted or rejected. The authors conducted experiments on 263 users of a fingerprint system and show that by using soft biometrics for post-screening, recognition performance can be increased roughly 5%. create a method to search for 3D models using global shape descriptors based on spherical harmonics to index into a database of shapes. They are able to return query results in under one second based on a repository of over 20,000 3D models. The harmonic descriptor is created by decomposing a 3D model into functions based on concentric spheres. This descriptor allows for fast, accurate, orientation-invariant indexing and retrieval of 3D shape information[7-10].

Facial expression classification mainly deals with the task of categorizing active and spontaneous facial expressions to extract information of the underlying human emotional states. Based on the face detection and feature extraction results, the analysis of the emotional expression can be carried out. A large number of methods have been developed for facial expression analysis.

The optical flow approach is widely adopted using the dense motion fields computed frame by frame. It falls into two classes: global optical flow and local optical flow methods. The global method can extract information of the whole facial region's movements. However, it is computationally intensive and sensitive to the continuum of the movements. The local optical flow method can improve the speed by only computing the motion fields in selected regions and directions.

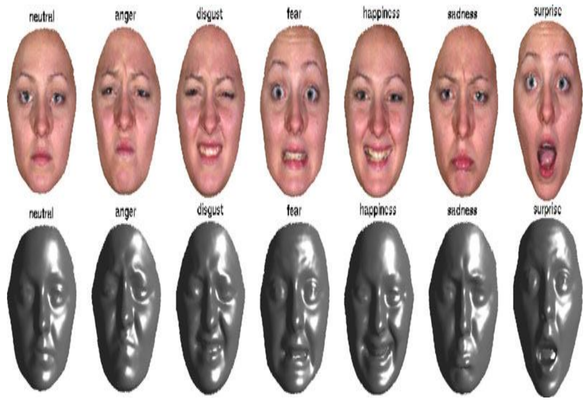
III. PROPOSED APPROACH



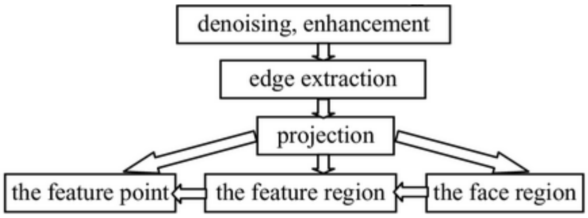
The Framework of 3D Face Recognition

Three dimensional (3D) face recognition technologies is now emerging, in part, due to the availability of improved 3D imaging devices and processing algorithms. For such techniques, 3D images of the facial surface are acquired using 3D acquisition devices and are used for recognition purposes. Three dimensional facial images have some advantages over 2D facial images. Their pose can be easily corrected by rigid rotations in 3D space. The shape of a 3D facial surface depends on its underlying anatomical structure.

Future 3-D face-recognition algorithms should be evaluated on the basis of all these factors. As the second contribution, a survey of published 3-D face-recognition methods that deal with expression variations is given. These methods are subdivided into three classes depending on the way the expressions are handled. Region-based methods use expression-stable regions only, while other methods model the expressions either using an isometric or a statistical model.



Proposed Algorithm



Input: 3D model, 3D Training data.
Output: 3d-Edge Image.
Begin
Initializing 3D image features set and Edge set E.
Filter the 3d image by 2D Gaussian approach in each three dimensions.

$$G(x,y)=\frac{1}{2\pi\sigma^2}\exp\left(-\frac{1}{2\sigma^2}(x^2+y^2)\right)$$

For each pixel p in the filtered 3d image do
For each feature in the features set do
Fit the edge block set on the window with center p
Calculate the local estimation accurate point using

$$P=\left[255\left(\frac{g-\min(g)}{\max(g)-\min(g)}\right)^{r}\right], 0<r<1$$

$$f(R_1,R_2)=\max(R_1/R_2, R_2/R_1)/3$$

$$S_1=\frac{I(i-1,j-1)+I(i,j-1)+I(i+1,j-1)}{3}$$

$$S_2=\frac{I(i-1,j+1)+I(i,j+1)+I(i+1,j+1)}{3}$$

$$R_1=\sqrt{(I(i-1,j-1)-S_1)^2+(I(i,j-1)-S_1)^2+(I(i+1,j-1)-S_1)^2}$$

$$R_2=\sqrt{(I(i-1,j+1)-S_2)^2+(I(i,j+1)-S_2)^2+(I(i+1,j+1)-S_2)^2}$$

End for
Compute Accurate edge pixel position using a double threshold model
For each pixel p1 in the adjacent 3d image D
If D(p1) >thres1
Then
E(p1)=1;
Else
E(p1)=0;
End if
If D(p1) >thres2
Then
E'(p1)=1;
Else
E'(p1)=0;
End if
End for
Mark edge in both E' and E
Contour the edge set .
END
Results:
Facial expression features are extracted from 3D facial images which as happy fear, anger etc. Each class of expression has different samples obtained from Bosporus database.

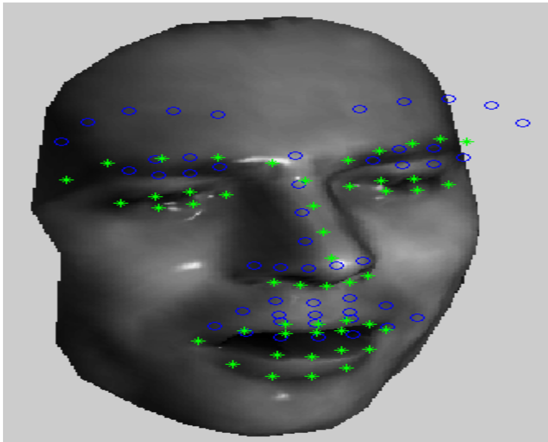


Fig 2: Traditional Facial expression Model

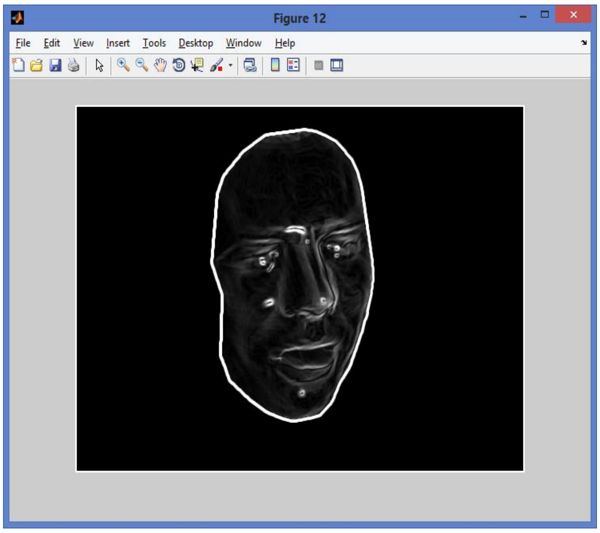


Fig 3: Proposed Edge based 3D Facial expression evaluation

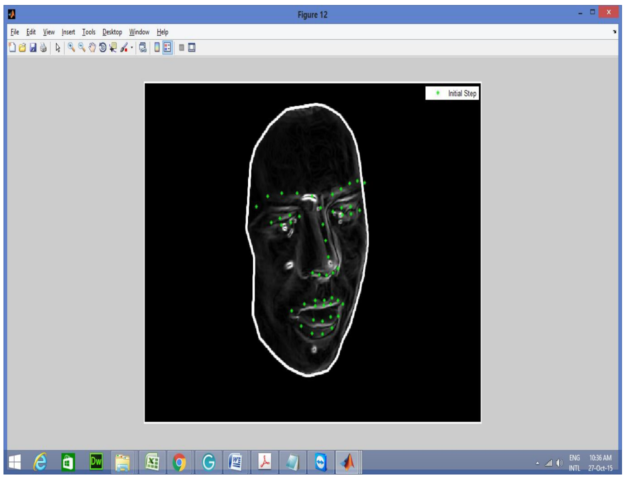


Fig 4: Facial expression based edge model in the proposed system

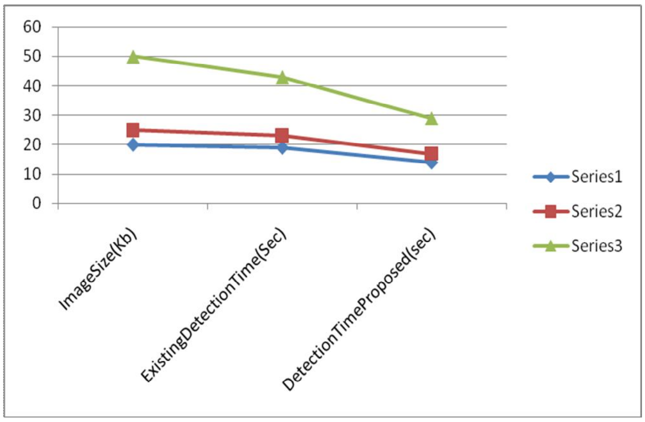
IV. PERFORMANCE MEASURES

Verification is a binary (1:1) classification problem with two possible types of errors: False acceptance where two samples from two different persons are classified as a match and false rejection where two samples from the

same person are classified as a non-match. The percentages of occurrences for these errors are referred as False Acceptance Rate (FAR) and False Rejection Rate (FRR), respectively. These two rates are inversely related and can be adjusted by changing the verification score threshold.
Verification rate (VR) at τ1: Percentage of correctly accepted clients (1-FRR) at 0.1% FAR. Equal error rate (EER) at τ2: Error rate at which FAR and FRR are equal.

Execution Time Measures

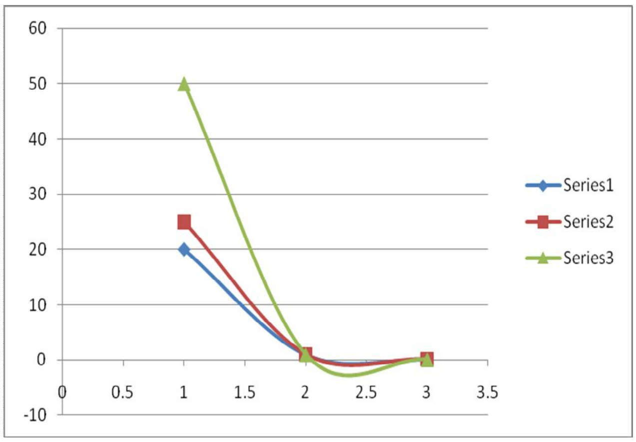
ImageSize (Kb)	Existing Detection Time(Sec)	Detection Time Proposed(sec)
20	19	14
25	23	17
50	43	29



Graphical representation of Proposed and Execution Time

Proposed Accuracy Measures

ImageSize(Kb)	Accuracy	Error
20	0.978	0.023
25	0.989	0.087
50	0.993	0.078



Graphical representation of Proposed Accuracy Measures

V. CONCLUSION

A performance driven 3D expression model is proposed based on facial expressions. Most of the traditional models are using manual selection of landmarks on 3D data, such manual selection of landmarks result poor results due to variations and noise in the pose databases. By using 3D model the information of human faces head pose and lighting changes are used to find the large set of expressions.These shows the main difference in expressions. In most of the 3D models,face data are projected on to 2D and finds the expression in the 3D. Work is to be done on 2D to obtain 3D.
In this model, a novel method is used to find the 3D expression using edge based model for complex pose datasets.This edge based model uses the previous work done on the facial model and generates an edge image.So the output image along with automatic corrections is obtained with more accuracy than the past frame. Experimental results show that proposed model has high accuracy compare to traditional 3D expression evaluation models since edges are identified and changes are corrected..

REFERENCES

[1]. Otsuka, K., Sawada, H., Yamato, J., C.: Automatic inference of cross-modal non- verbal interactions in multiparty conversations: "who responds to whom, when, and how?" from gaze, head gestures, and utterances. In: ICMI, pp. 255{262, ACM Press, New York, (2007).
[2]. Ekman, P., C.: Universals and cultural di erences in facial expressions of emotion. In: In Nebraska Symposium on Motivation, pp. 207 {283, Lincoln, NE, (1972).
[3]. Fasel, B., Luettin.J., C.: Automatic facial expression analysis: a survey. Pattern Recognition, 259{275,(2003)
[4]. L. Yin, X. Wei, Y. Sun, J. Wang, and M. Rosato. C.: A 3D Facial Expression Database For Facial Behavior Research. In: The 7th International Conference on Automatic Face and Gesture Recognition (FG). pp. 211{216, IEEE Computer So-ciety TC PAMI, (2006)
[5]. J. Wang, L.Yin, X. Wei, and Y. Sun, C.: 3d facial expression recognition based on primitive surface feature distribution, In: CVPR, pp. 1399{1406, (2006).
[6]. H. Soyel and H. Demirel. C.: Facial expression recognition using 3d facial feature distances. In: In Int. Conf. on Image Analysis and Recognition, pp. 831{838, (2007).
[7]. I. Mpiperis, S. Malassiotis, and M. G. Strintzis. S.: Bilinear models for 3-d face and facial expression recognition. IEEE Transactions on Information Forensics and Security,3(3): 498{511,(2008).
[8]. H. Tang and T. S. Huang. C.: 3d facial expression recognition based on automatically selected features. In: In Int. Conf. on Computer Vision and Pattern Recognition, pp. 1{8, (2008).

[9]. B. Gong, Y. Wang, J. Liu, and X. Tang. C.: Automatic facial expression recognition on a single 3d face by exploring shape deformation. In: In Int. Conf. on Multimedia, pp. 569{572, (2009).

[10]. A. Maalej, B. Ben Amor, M. Daoudi, A. Srivastava, S. Berretti. C.: Local 3D Shape Analysis for Facial Expression Recognition. In: ICPR, pp. 4129{4132, IEEE, (2010).