Scientific Journal Impact Factor (SJIF) : 1.711
International Journal of Modern Trends in Engineering and Research
ISSN (ONLINE) : 2349 - 9745 ISSN (PRINT) : 2393 - 8161

REAL TIME READING OF FACIAL EXPRESSION & PLAYING SONG BY FACIAL ACTION CODING SYSTEM (FACS)

Makwana Samir (student)[1], Ass.Prof- Janak D Trivedi[2], Kalsara Jaydip (student)[3]

[1, 2, 3] GEC Bhavnagar, GUJARAT,INDIA

Abstract— Face expression analysis and recognition has been one of the fast developing areas due to its wide range of application areas such as emotion analysis, biometrics, image retrieval and is one of the subjects on which lots of research has been done through solving the problems occurring in recognition of the face expressions under different illuminations, orientations and numerous other variations.

Keywords*:* Facial Expression Detection (FED*)*, FACS, Histogram, Viola-jones algorithm.

I. INTRODUCTION

Facial expression analysis has been attracting considerable attention in the advancement of human machine interface since it provides a natural and efficient way to communicate between humans. Some application areas related to face and its expressions include personal identification and access control, video phone and teleconferencing, forensic applications, human-computer interaction, automated surveillance, cosmetology, and so on. But the performance of the face detection certainly affects the performance of all the applications. Many methods have been proposed to detect human face in images, they can be classified into four categories: knowledge-based methods, feature-based methods, template based methods and appearance-based methods. When used separately, these methods cannot solve all the problems of face detection like pose, expression, orientation, and occlusion. Hence it is better to operate with several successive or parallel methods. For a description of detailed facial expressions, the Facial Action Coding System (FACS) was designed by **Ekman and Friensen [1]** in the mid-70s. In FACS, motions of the muscles of the face are divided into 44 action units and any facial expressions are described by their combinations.

1.1 Problem Statement

There is an inaccurate location and tracking of facial points. Also Pose, movement and rotation of the test person are limited. Glasses may hinder classification, especially thick and dark frames in detecting emotions. Face Reader can analyze one face at a time. Face Reader cannot classify facial expressions in test persons with a partial facial paralysis.

1.2 Detailed Description

Automatic facial expression recognition has been used in various real life applications such as security systems, interactive computer simulations/designs, computer graphics, and psychology and computer vision. In this project, the aim is to implement binary and multi-class face expression analysis algorithms based primarily on 'Facial Action Coding System' by evaluating features such as Haar-like, Gabor, Haar wavelet coefficients; and making use of classifiers like Support Vector Machines and Error Correcting Output Codes (ECOC) combined with feature selection methods such as Ad boost to be used in automated systems in real-life applications based on learning from examples.

1.3 Expected outcome

Here after detecting various facial expression of face according to that different song will play, song that we read into matlab,likewise for smiling face one song will play which is differ from diff expressions.

II. STATE-OF-THE-ART

2.1 Introduction

In the literature, when facial expression analysis is considered; two main different approaches, both of which include two different methodologies, exist. Dividing the face into separate action units or keeping it as a whole for further processing appears to be the first and the primary distinction between the main approaches. In both of these approaches, two different methodologies, namely the 'Geometric-based' and the 'Appearance-based' parameterizations, can be used. In the following subtitles, details of the two approaches and the two methodologies have been further discussed.

2.2 Two Main Approaches for Facial Expression Analysis on Still Images

The two main approaches can be summarized as follows:

1.Making use of the *whole* frontal face image and processing it in order to end up with the classifications of 6 universal facial expression prototypes: disgust, fear, joy, surprise, sadness and anger; outlines the first approach. Here, it is assumed that each of the above mentioned emotions have characteristic expressions on face and that's why recognition of them is necessary and sufficient. Ekman, Friesen [1] and Izard [1] have proposed these facts in their related work and Bartlett, Littlewort et al [4] have used the method for fully automatic recognition systems.

2. Instead of using the face images as a whole, dividing them into some sub-sections for further processing forms up the main idea of the second approach for facial expression analysis. As expression is more related with subtle changes of some discrete features such as eyes, eyebrows and lip corners; these fine-grained changes are used for analysing automated recognition. This approach has been presented to be the 'Facial Action Coding System', which is first developed by Ekman and Friesen [3], for describing facial expressions by 44 different Action Units (AU's) existing on face. The advantage here is that, this decomposition widens the range of applications of face expression recognition. This is due To ending up with individual features to be used in/with different processing areas/methods other than just having the 6 universal facial expression prototypes.
Most of the current work done on facial expression analysis makes use of these action units.

It should be mentioned that, there are also some other methods in which neither the frontal face image as a whole nor the all of 44 action units themselves, but some other criterion such as the manually selected regions on face [6] or surface regions of facial features [7] are used for the recognition of the facial expression.

III. FACIAL ACTION CODING SYSTEM (FACS)

This system (FACS), which was first developed by Ekman and Friesen [5] for describing facial expressions by 44 Action units, is a strong and useful method for facial expression recognition. This is because it decomposes the facial expression into individual action units by supplying flexibility, objectivity; and can be used in various applications which measure fine-grained changes in facial expressions in a comprehensive way.

3.1 Action Units

There are 44 AU's in total and we see that 30 of them are obtained by contractions of the specific facial muscles. Out of these 30, 12 are for the upper face and 18 are for the lower [7]. Figure 1 and Figure 2 shows some upper and lower face action units together with some combinations.

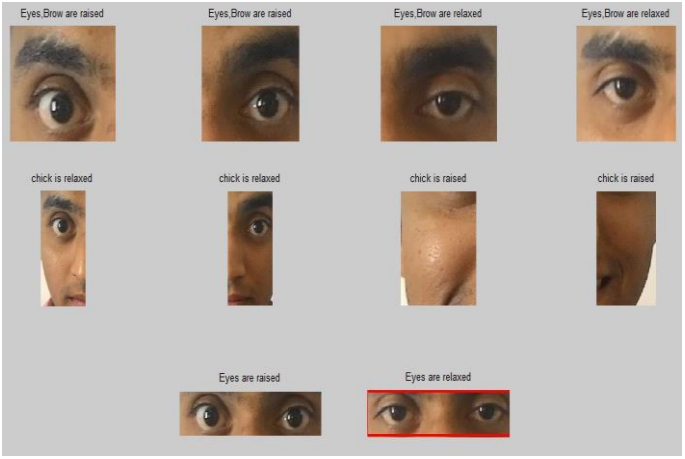


Figure1. Upper face Action Units and some combinations [13]

This is the upper face expressions of original image of left chick, right chick, left and right eyes.

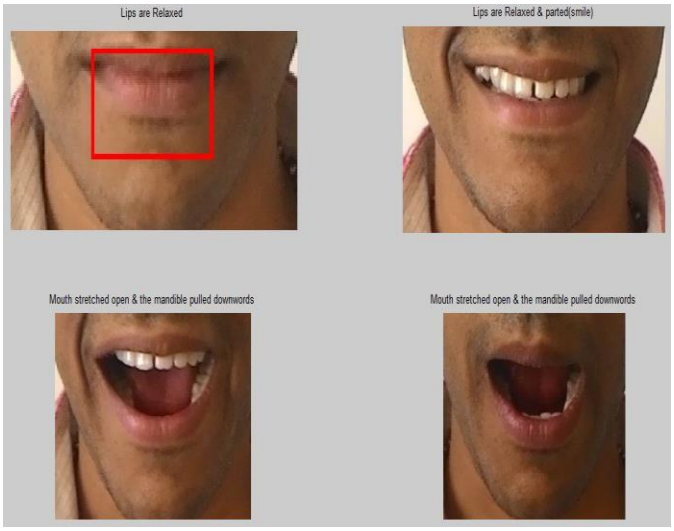


Figure2. Some lower face Action Units and some combinations [13]

This is image of the mouth detection when smile detect and only mouth detect for difference expression.

IV. DIFFERENCE BETWEEN TWO IMAGES

Here we need to find out difference between two images so that we can do it thresholding on specific part of a face. Two different thresholding to be done on two difference image and after that converting into BW format we can find out it's area and by calculating area and setting range for it we can able to play song according to our wish.

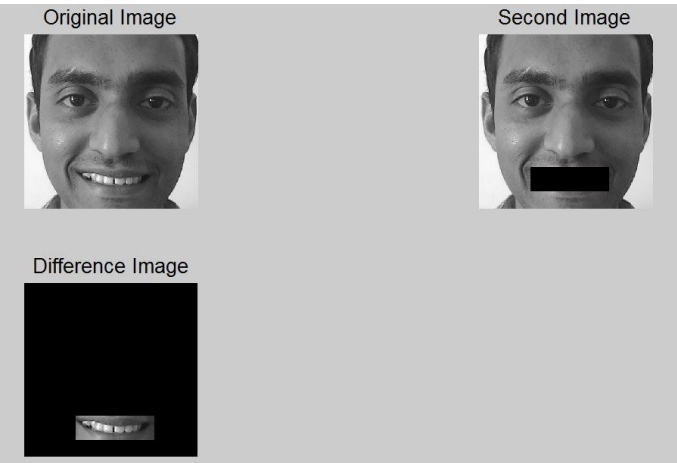
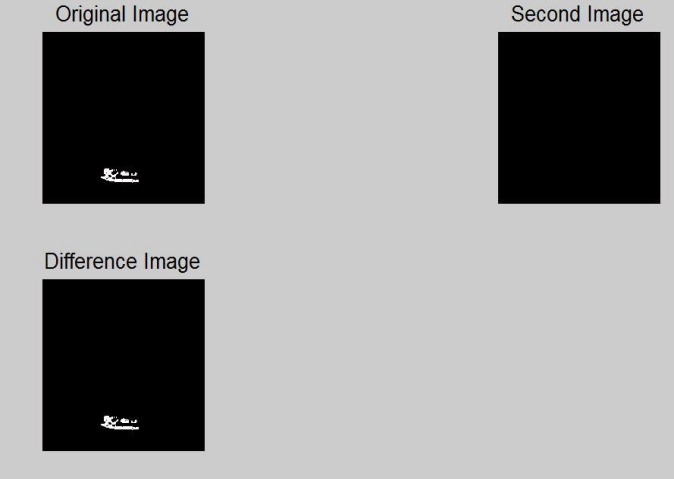


Figure4.Difference between images(grey level)

This is a image of the difference between original image and second image and we detect the smile.



5). Detection of tooth

This is two image difference, in which one image in smile and second image has no smile. So, taking difference between two image we got only smile.

V. HSV FORMAT

In some of the image we need to convert RGB image to HSV image Red as Hue, Green as Saturation, and Blue as Value. Now in RGB image format if we wants to detect human teeth which is white so it's value near to 255,Now in RGB format value of R, G and B must be near to 255 for brighter portion, now have to apply threshloding on that white portion and on that song have to play but it also detect some other white portion having value near to 255 that comes due to reflection of light on our face hence it detect more than one portion on face at a time[6].

So if we use HSV format that problem can be completely overcomed.in HSV format Value represents Blue Portion so we have to threshold only that portion so only teeth will detect any song will play on basis of that .One detection one song [6]

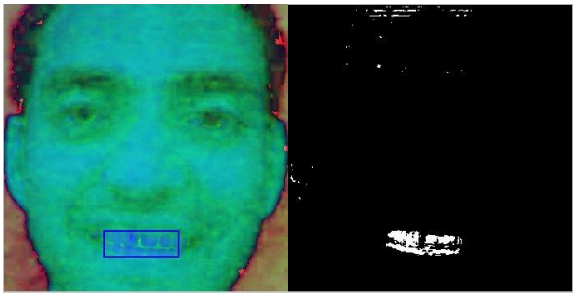


Fig8_HSV format detection

HSV image is a image in which smile is detected as a blue portion other face portion is detected as a orange and blue.

VI. DETECTION OF FACE

6.1 Viola Jones method:

Face detection is the process that determines the locations and sizes of human faces in digital images. It detects facial features and ignores anything else. Computer vision is the science and technology of machines that see, and seeing in this case means that the machine is able to extract from an image some information that is necessary for solving some task[1]. As a scientific discipline, computer vision is concerned with the theory behind artificial systems that extract information from images. The face area is highlighted by red color box with some features of the face .The cascade object detector uses the Viola-Jones algorithm to detect people's faces, noses, eyes, mouth, or upper body. The feature employed by the detection framework universally involve the sums of image pixels within rectangular areas [1]. As such, they bear some resemblance to ***Haar basis functions***, which have been used previously in the realm of image-based object detection. However, since the features used by Viola and Jones all rely on more than one rectangular area, they are generally more complex.[1] The figure at right illustrates the four different types of features used in the framework. The value of any given feature is always simply the sum of the pixels within clear rectangles subtracted from the sum of the pixels within shaded rectangles. As is to be expected, rectangular features of this sort are rather primitive when compared to alternatives such as steerable filters. Although they are sensitive to vertical and horizontal features, their feedback is considerably coarser. However, with the use of an image representation called the integral image, rectangular features can be evaluated in *constant* time, which gives them a considerable speed advantage over their more sophisticated relatives [8]. Because each rectangular area in a feature is always adjacent to at least one other rectangle, it follows that any two-rectangle feature can be computed in six array references, any three-rectangle feature in eight, and any four-rectangle feature in just nine. The speed with which features may be evaluated does not adequately compensate for their number, however. For example, in a standard 24x24 pixel sub-window, there are a total of 162,336 possible features, and it would be prohibitively expensive to evaluate them all. Thus, the object detection framework employs a variant of the learning algorithm Ada Boost to both select the best features and to train classifiers that use them [8].

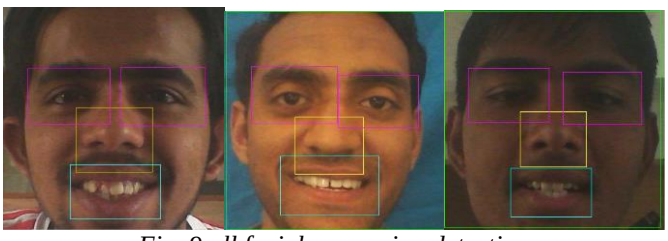


Fig_9 all facial expression detection

This all faces are detected by FACS method.

Equations:

Precision = correct/(correct + false position) ..... (A)

Recall = correct/(correct + Missed) .....(B)

F1 = (2 * Recall * Precision)/ (Recall + Precision) .....(C)

Person	Range of Frame	Teeth detection	Teeth detection	correct	Missed	False position	Recall	precision	Fl
1	1-10	1	1(FACS)	8	1	1	0.8	0.8	0.8
1	1-10	1	1(FACS)	8	1	1	0.8	0.8	0.8
1	1-10	1	1(FACS)	8	1	1	0.8	0.8	0.8

We have got all this expressions from VIOLA JONES algorithm. And then implemented table made using FACS method.

This is a table of the teeth detection using FACS method .we have take difference difference images ,and take its FACS value for the comparision. And here we have taking range f the frame between 1-10.

Fig.10 no smile detection in BW image

There is a no expression in this image so, no smile detection in image. So, image is black**.**

Fig.11 smile detection in BW image

There is smile detection in this image because it is smiley face. there is a song will play as per facial expression .we have got the final result of the sad and happy songs with the help of the WEBCAM.

Here not only mouth is responsible for this expression. But, our eyes and chicks are also responsible for the facial expressions.

VII. RESULTS

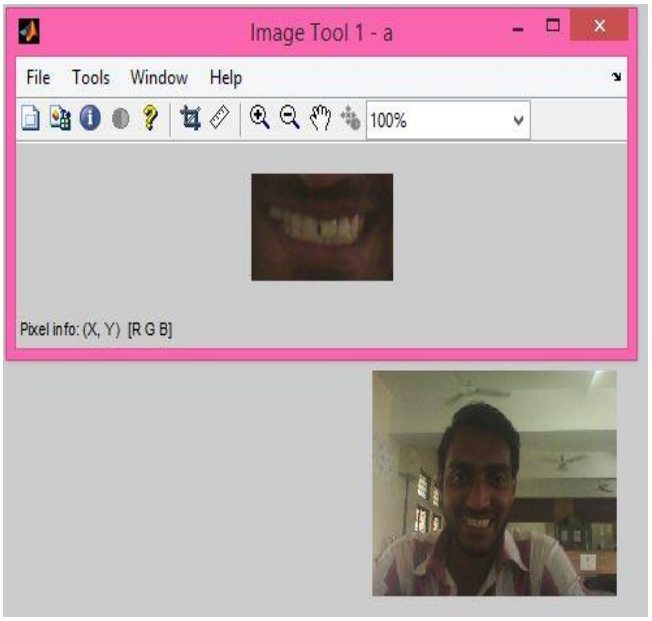


Fig11_smile portion cropped

Here online face detection by WEBCAM. Here only smile portion is detecting with the help of thresholding.and find the area of mouth.

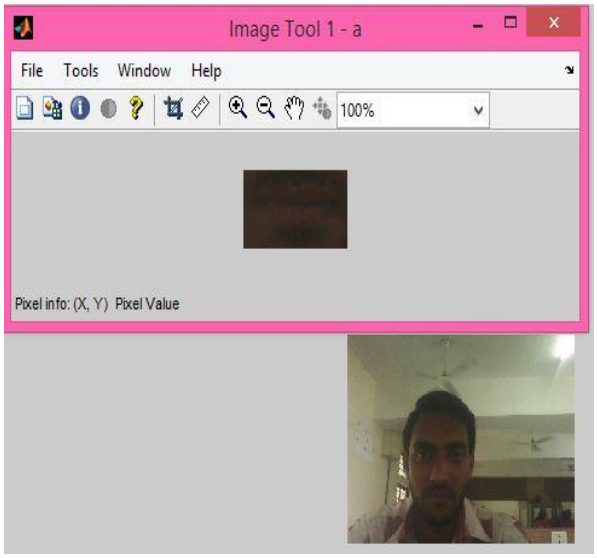


Fig12_sad portion cropped

Here, sad portion is detected in online WEBCAM. This is also detection with help of thresholding.

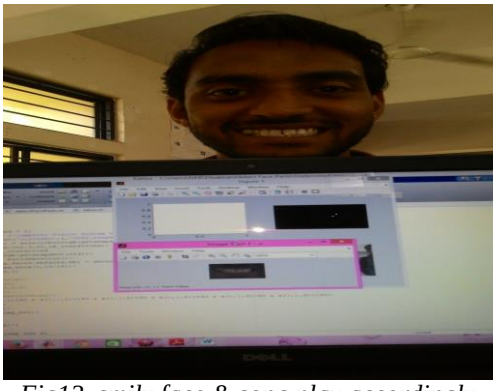


Fig13_smily face & song play accordingly

Here happy song is playing as per detection of smile online.

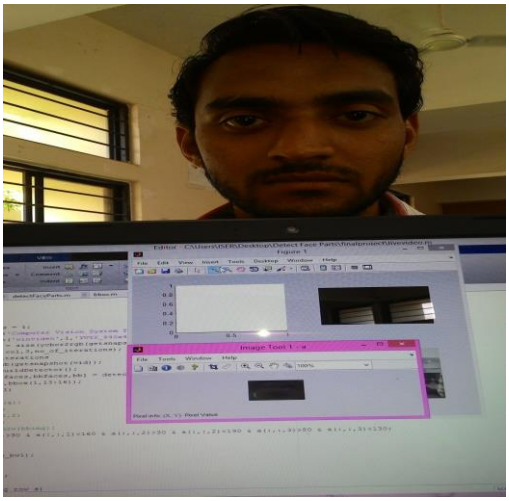


Fig14_sad face & song play accordingly

Here sad song is playing as per the no detection of smile.

VIII. CONCLUSION

From all the above experiment we have conclude that, using FACS method we have playing a song as per sad and smiley facial expressions.

IX. ACKNOWLEDGMENT

On successful completion of this Project on "**Real Time Reading of Facial Expression & Playing Song by Facial Action Coding System (FACS)"** we are very much thankful to our guide **Prof. J .D. Trivedi** for providing us adequate facilities, ways and means by which we were able to complete this project.

REFERENCES

[1] Ekman, P. and Friesen, W.V. *The Facial Action Coding System: A Technique for the measurement Of Facial Movement*, San Francisco: Consulting Psychologists Press, 1978

[2]Viola, Paul and Michael J. Jones, *"Rapid Object Detection using a Boosted Cascade of Simple Features*", Proceedings of the 2001 IEEE Computer Society Conference on Computer Vision and Pattern Recognition, 2001. Volume: 1, pp.511–518.

[3] Facial Expression detection Report PDF File By Kaustubh dewoolkor, Gaurav Bhole, Arjun Mehta, University of Mumbai. Rizvi College of Engineering New Rizvi Educational Complex, Off-Carter Road,Bandra (w), Mumbai – 400050

[4] Bartlett, M.S; Littlewort, G.; Lainscsek, C.; Fasel, I. and Movellan, J. *Machine Learnin Methods for Fully Automatic Recognition of Facial Expressions and Facial Actions*, IEEE International Conference on Systems, Men and Cybernetics, pages 592-597, 2004.

[5]. "Generating Music Based on Facial Expression" US 8094891 B2 Jan 10, 2012.

[6] Digital image processing by Gonzalez, Rafael Digital Image Processing / Richard E.Woods

[7] Tian, Y.; Kanade, T. and Cohn, Jeffrey. *Recognizing Action Units for Facial Expression Analysis*, IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 23, no. 2, February
2001.

[8] Automatic Facial Expression Analysis A Survey. C.P. Sumathi1, T. Santhanam2 and M.Mahadevi3, International Journal of Computer Science & Engineering Survey (IJCSES) Vol.3, No.6, December 2012

