International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 3 Issue: 5 2630 - 2634

Fuzzy Model For Human Face Expression Recognition

Mr. Akshay A. Adsod[1], Prof. Dinesh Datar[2]
[1]M.E, CSE Department, G.H. Raisoni College of Engineering and Management, Amravati, SGBAU, *akshayadsod18@gmail.com*, India
[2]Head of Department, Information Technology, G.H. Raisoni College of Engineering and Management, Amravati, SGBAU, *dinesh.datar@raisoni.net*, India

Abstract:- Facial expression recognition plays a vital and effective role within the interaction between man and computer. In this project, brand new system supported the mathematical logic is projected for this purpose. Fuzzy is one helpful approach for fuzzy classification, which might verify the intrinsic division in an exceedingly set of untagged knowledge and notice representatives for undiversified teams. This method acknowledges seven basic facial expressions particularly concern, surprise, happy, sad, disgust, Neutral and anger. For description of detail face facial features, Face Action writing (FACS) was style. First, we tend to gift a unique methodology for facial region extraction from static image. For determination of face effective areas is employed from integral projection curves. This methodology has high ability in intelligent choice of areas in facial features recognition system. Extracted face expression fed to fuzzy rule based mostly system for facial features recognition. Results of tests indicate that the projected theme for facial features recognition is powerful, with smart accuracy and generating superior results as compared to different approaches.

Keywords- *facial expression recognition; face action coding system; integral projection; fuzzy logic.*

*****

1. Introduction

Facial expression analysis has been attracted goodly attention within the advancement of human machine interface since it provides natural and economical thanks to communicate between humans. Some application space associated with face and its expression includes personal identification and access management, video phone and group discussion, rhetorical application, human laptop application. Most of the countenance recognition strategies rumored thus far or specialize in expression class like happy, sad, fear, anger etc. For description of detail face countenance, Face Action writing (FACS) was style by Ekman. In FACS motion of muscles are divided into forty four action units and countenance are delineated by their combination. Synthesizing a facial image in model based mostly image secret writing and in MPEG-4 FAPs has vital clues in FACS. Victimizations MPEG-4 FAPs, totally different 3D face models will be animated. Moreover, MPEG-4 high level expression FAP permits invigorating numerous countenance intensities. However, the inverse drawback of extracting MPEG-4 low and high level FAPs from real pictures is far a lot of problematic attributable to the actual fact that the face could be an extremely deformable object.

2. Literature Survey

There are many approaches taken within the literature for learning classifiers for expression recognition. Within the static Approach, the classifier classifies every frame the video to at least one of the countenance classes supported the pursuit results of that frame. Bayesian network classifiers were unremarkably utilized in this approach. Naïve Bayes classifiers were conjointly used usually. Attributable to this unrealistic approach some used mathematician classifiers. Within the Dynamic Approach, these classifiers take into consideration the temporal pattern in displaying countenance. Hidden Markov Model (HMM) primarily based classifiers for facial Designer of FACS, Ekman himself as realized a number of these action units as unnatural sort facial movements.

2.1 The Facial Action Coding System

Designer of FACS, Ekman himself as discovered a number of these action units as unnatural sort facial movements. FACS provides AN objective and comprehensive thanks to analyze expressions into elementary elements, analogous to decomposition of speech into phonemes. Sleuthing a unit set of action units for specific expression isn't secure. One promising approach for recognizing up to facial expressions intensities is to contemplate whole facial image as single pattern. FACS has tried helpful for locating facial movements that square measure indicative of psychological feature and emotional states. See Ekman and Rosenberg (2005) for a review of face expression studies victimization FACS. The first limitation to the widespread use of FACS is that the time needed to code. FACS was developed for cryptography by hand, victimization human specialists. It takes over a hundred hours of coaching to become skillful in FACS, and it takes close to two hours for human specialists to code every minute of video. The authors are developing strategies for absolutely automating the facial action writing (e.g. Donato et al., 1999; Bartlett et al., 2006).

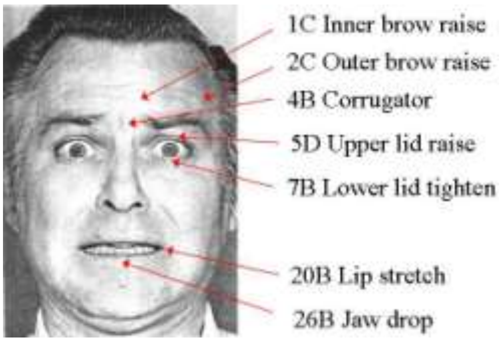


Figure 2.1.1.Example facial action decomposition from the facial action coding system. A prototypical expression of fear is decomposed into 7 component movements. Letters indicate intensity. A fear brow (1+2+4) is illustrated here.

2.2 Spontaneous Expressions

The machine learning system presented here was trained on spontaneous facial expressions. The importance of using spontaneous behavior for developing and testing computer vision systems becomes apparent when we examine the neurological substrate for facial expression. Volitional facial movements originate in the cortical motor strip, whereas spontaneous facial expressions originate in the sub cortical areas of the brain (see Rinn, 1984, for a review).Kimura and his colleagues have reported a method to construct emotional space using 2D elastic net model and K-L expansions for real images. Their model is user independent and gives some unsuccessful results for unknown persons. Later Ohba proposed facial expression space employing principle component analysis which is person dependent.

2.3 The Computer Expression Recognition Toolbox

Here we extend a system for fully automated facial action coding developed previously by the authors (Bartlett et. Al 2006; Littlemore et al., 2006). It is a user independent fully automatic system for real time recognition of facial actions from the Facial Action Coding System (FACS). The system automatically detects frontal faces in the video stream and codes each frame with respect to 20 Action units. In previous work, we conducted empirical investigations of machine learning methods applied to the related problem of classifying expressions of basic emotions. We compared image features (e.g. Donato et al., 1999), classifiers such as AdaBoost, support vector machines, and linear discriminate analysis, as well as feature selection techniques.

2.4 Real Time Face and Feature Detection

We used a time period face detection system that uses boosting techniques in a very generative framework (Fasel et al.) and extends work by Viola and Jones (2001). Enhancements to Viola and Jones embrace using mild boost rather than Ada Boost, sensible feature search, and a unique cascade coaching procedure, combined in a very generative framework. ASCII text file for the face detector is freely accessible at http://kolmogorov.sourceforge.net. Accuracy on the CMU-MIT dataset, a customary public knowledge set for benchmarking frontal face detection systems (Schneiderman & Kanade, 1998), is ninetieth detections and 1/million false alarms that is progressive accuracy. The CMU check set has free lighting and background. With the help of this, like the countenance knowledge used here, detection accuracy is way higher. All faces within the coaching datasets, for instance, were with success detected. The system presently operates at twenty four frames/second on a three gigahertz Pentium IV for 320x240 pictures. The mechanically settled faces were rescaled to 96x96 pixels. The everyday distance between the centers of the eyes was roughly forty eight pixels. Automatic eye detection (Fasel et al., 2005) was used to align the eyes in every image.

3. Problem Definition

A system that may automatically analyze the facial actions in real time has applications throughout a large choice of assorted fields. However, developing such a system is usually tough as a result of the richness, ambiguity, and dynamic nature of facial actions. Although, the type of analysis groups conceive to acknowledge facial action units (AUs) by either the facial feature extraction techniques or the AU classification techniques. The primary limitation to the widespread use of FACS is that the time required to code. FACS was developed for secret writing by hand, practice human specialists. It takes over 100 hours of employment to become skillful in FACS, and it takes additional or less a combine of hours for human specialists to code each minute of video.
To beat this, we've got a bent to unit getting to use fuzzy model for face recognition.

4. Proposed Method

This project consists of following phases:
1. Face detection based on skin color & features.

2. Face extraction and enhancement.
3. Face feature extraction.
4. Fuzzy patterns

4.1 Face Detection Based on Skin Color

Skin color plays an important role in differentiating human and non-human faces. From the study it's observe that color pixels have a decimal worth within the vary of a hundred and twenty to one hundred forty. During this project, we have a tendency to use an effort and error technique to find color and non-skin color pixels. However several of the days, system fails to observe whether or not a picture contains face or not (i.e. for those pictures wherever there's a color background).

4.2 Face Extraction and Enhancement

Literature review suggests that, FACS system technique is predicated on face options extractions like eye, nose, mouth, etc. during this project, we have a tendency to minimize the quantity of options (i.e. solely eyes and mouth) however given the a lot of weightage for fuzzy rules formations from these extracted options. Face extractions carries with it following steps:

1. Let W and H are the width and height of skin and non-pixel image as shown in fig

2. Read the pixel at position (0, H/2) which is a middle of i.e. left side of image.

3. Travers a distance D_1 = W/6 in horizontal direction to get the start boundary pixel of skin region.

4. Travers a distance D_2= H/6 from a pixel position (W/6, H/2) in upward directions. Same may do in downward direction and locate the points X_1, X_2.

5. Travers a distance D_3=W/3 from the point X_1 and locate the point X_3. Same do from the point x_2 and locate the point X_4.

6. Crop the square image as shown.

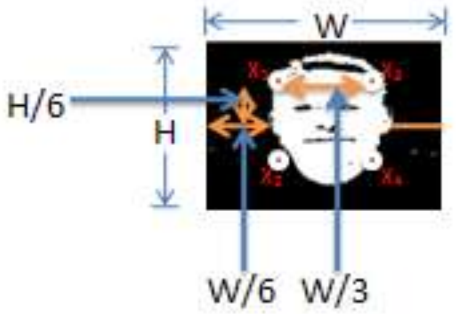


Fig 4.2.1 Face recognition

After face extraction white region pixels (i.e. skin pixels) are filled with skin color. A resultant image with skin color and after enhancement becomes as above.

4.3 Face Features Extraction

Human face is created from eyes; nose, mouth and chine etc. there are variations in form, size, and structure of those organs. That the faces are differs in thousands manner. One in every of the common strategies for facial expression recognition is to extract the form of eyes and mouth and so distinguish the faces by the gap and scale of those organs. The face feature extractions comprises following steps

1. Let W and H are width and height of an image shown in Fig 3.2.3

2. Mark pixel P_i (W/2, H/2) as Centre of image.

3. Travers a distance H/8 from the pixel P_i towards upward and mark a point K_1.

4. Travers a distance W/3 from the point K_1 towards leftward and mark a point K_2.

5. Travers a distance H/10 towards downward from the point K_2 and mark a point K_3

6. Travers a distance W/4 from the point K_3 towards right and mark the point K_4

7. Travers a distance H/10 from the point K_4 toward up and mark the point K_5.

8. Same steps are repeated for extracting the right eye and mark the point N_2, N_3, N_4, and N5.

9. Travers a distance H/8 from the point P_i towards downward and mark the point M_1.

10. Travers a distance W/6 towards left and right from the point M_1 and marks the point M_2 and M_3.

11. Start with the point M_2 traverse a distance H/10 towards downward and mark the point M_4.

12. Travers a distance W/6 from the point M_4 towards right and mark the point M_5. Same may do from point M_5 and mark the point M_6.

13. Travers the distance H/10 from M_6 towards up that meets to the point M_3.

4.4 Fuzzy Patterns

It is found that expression recognition from the still image ne'er provides an accurate output. An expression id can also false into over one expression domain. This project forms some fuzzy patterns for expressions. See the pure mathematics diagram below:

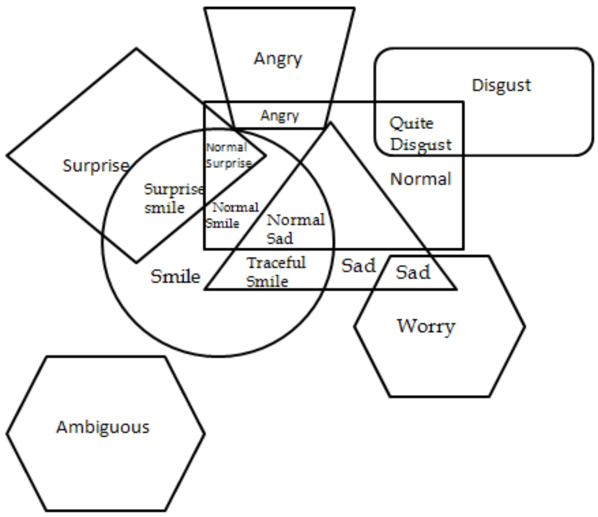
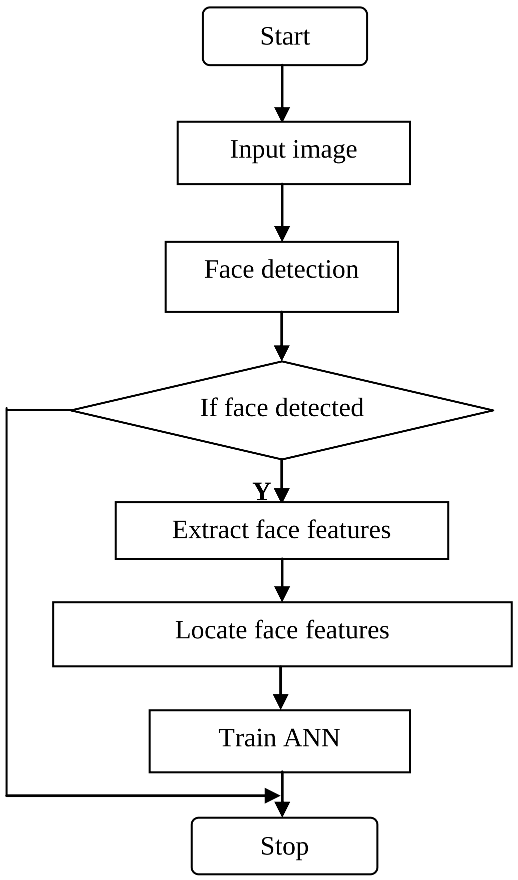


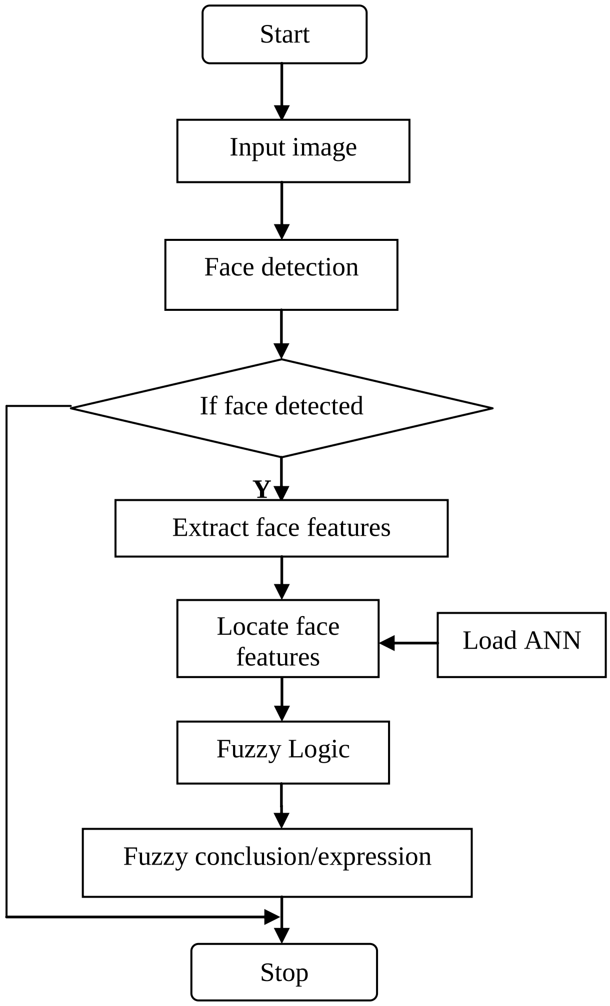
Fig 3.5.1 Fuzzy Expression Patterns

5. Data Flow Diagram

➢ **Training Phase**



➢ **Testing Phase**



6. EXPERIMENTAL RESULTS

In this section, we are recognizing the human facial expression by using the method mentioned above. This method basically recognizes seven human expressions like anger, happy, sad, disgust, neutral, surprise and trace. The method introduced in this article was tested with the help of fuzzy rules and by training the neural network.

We have design three experiments to check the effect of above method. The first experiment shown in table 6.1 is using different image format to show accuracy of the recognized expression. The second experiment showed in table 6.2 the overall comparison between proposed system with other methods. And the last experiment shows the recognition rate for different facial expressions. It could be seen that the recognition of proposed method performs better than other methods.

ISSN: 2321-8169
2630 - 2634

Table 6.1: Experimental Result (Accuracy Table)

Input Format	Dimension	No. Image Tested	Face Recognition	Face Extraction	Expression Accuracy
JPEG	50*50	20	20/20	18/20	92%
JPEG	100*100	20	20/20	19/20	97%
JPEG	200*200	20	20/20	20/20	100%
JPEG	500*500	20	20/20	20/20	100%
PNG	50*50	20	20/20	17/20	93%
PNG	100*100	20	20/20	18/20	97%
PNG	200*200	20	20/20	19/20	99%
PNG	500*500	20	20/20	20/20	100%
BMP	50*50	20	20/20	17/20	89%
BMP	100*100	20	20/20	19/20	98%

Table 6.2: Comparing the proposed method with other methods

Expression	LBP of Local Areas+SVM	Gabor Filter+GA	Fuzzy Kernel Clustering and SVM	Fuzzy Logic	Existing System	Proposed System
Anger	75	97.5	89.2	96	100	96
Happy	83	95.3	96	96.6	92	97
Sad	66	98.2	86.3	96	95	95.5
Disgust	80	95.5	87.7	96.2	97	97
Neutral	83	98.8	96	-	95	94.6
Surprise	92	100	95.4	96.5	98	100
Traceful	-	-	-	-	-	100
Overall	77.71	96.8	90.88	96.28	96.42	97.15

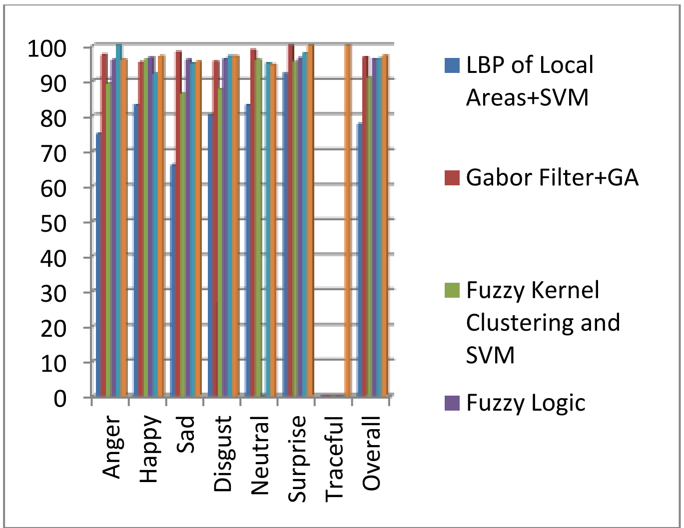


Fig 6.3: Recognition rate for different facial expression

7. CONCLUSION

The existing system is not sufficient for recognizing the accurate and more precise result. As we know, conclusion based on fuzzy patterns never been accurate but still our intension is to put more accurate results. The proposed Fuzzy Model for Human Face Expression Recognition system gives more accurate and precise result. It is going to be helpful in many aspects like; to find children who are lost by using the images received from the cameras fitted at some public places, and also to detect criminal at public place, etc. This approach relies on personal freelance average facial features victimization fuzzy model.

With the help of fuzzy rules and artificial neural network our system recognizes nearly accurate human face expression with minimum face detection and recognition time.

References

[1] Roja Ghasemi and Maryam Ahmady, "*Facial Expression Recognition Using Facial Effective Areas And Fuzzy Logic*", 978-1-4799-3351-8/14/$31.00 © 2014 IEEE.

[2] Y. Yacoob and L.S. Davis, "*Recognizing human facial expressions from long image sequences using optical flow*", IEEE Trans. Pattern Analysis & Machine Intelligence, Vol. 18, No 6, pp. 636-642, 2010.

[3] P. Ekman and W. Friesen, "*Facial Action Coding System*", Consulting Psychologists Press, 2009.

[4] K. Aizawa and T. S. Huang, "*Model-based image coding: Advanced video coding techniques for very low bit-rate applications*", Proc. IEEE, Vol. 83, No. 2, pp. 259-271, 2009.

[5] S. Kimura and M. Yachida, "*Facial expression recognition and its degree estimation*", Proc. Computer Vision and Pattern Recognition, pp.295-300, 2012.

[6] K. Ohba, G. Clary, T. Tsukada, T. Kotoku, and K. Tanie, "*Facial expression communication with FES*", Proc. International Conference on Pattern Recognition, pp. 1376-1378, 2010.

[7] M.A. Bhuiyan and H. Hama,"*Identification of Actors Drawn in Ukiyoe Pictures*", Pattern Recognition, Vol. 35, No. 1, pp. 93-102, 2012.

[8] M. B. Hmid and Y.B. Jemaa, *Fuzzy Classification, Image Segmentation and Shape Analysis for Human Face Detection*. Proc. Of ICSP, vol. 4, 2008.

[9] M. Wang, Y. Iwai, M. Yachida, "*Expression Recognition from Time-Sequential Facial Images by use of Expression Change Model*", Proc. Third IEEE International Conference on Automatic Face and Gesture Recognition, pp. 324 – 329, 2009.

[10] M. I. Khan and M. A. Bhuiyan, "*Facial Expression recognition for Human-Machine Interface*", ICCIT, 2010.

[11] Mr. Mayur S. Burange, and Prof. S. V. Dhopte "Neuro Fuzzy Model for Human Face Expression Recognition" IOSR Journal of Computer Engineering (IOSRJCE) ISSN: 2278-0661 Volume 1, Issue 2 (May-June 2012), PP 01-06

[12] Yan Tong , Wenhui Liao and QiangJi, "*Facial Action Unit Recognition by Exploiting Their Dynamic and Semantic Relationships,*IEEE transactions on pattern analysis and machine intelligence", vol. 29, no. 10, October 2007.

[13] M. Pantic and L. J. M. Rothkrantz, "Automatic analysis of facial expressions: the state of the art", *IEEE Trans. Pattern Anal. Mach. Intell.*, vol. 22, no. 12, pp. 1424–1445, Dec. 2000.

[14] T. Ahonen, A. Hadid, and M. Pietikainen, "Face Description with Local Binary Patterns: Application to Face Recognition", *IEEE Trans. Pattern Analysis and Machine Intelligence*, vol. 28, no. 12, pp. 2037-2041, Dec. 2006.