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**“HUMAN FACE EXPRESSION RECOGNITION USING FACIAL FEATURES DETECTION  
ALGORITHM”**

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**ABSTRACT:** *Human Face Detection & Expression Recognition is one of the challenging tasks, because of the variations in the illumination, pose and occlusion. Human skin color is an effective feature used to detect, whereas human eyes, nose, eyebrow, chick, forehead are detect faces using facial features detection algorithm as well as recognizing the expression using fuzzy rules . However different person have different skin color and face features. This paper introduced a face detection and expression recognition system to detect faces in images from galleries of known people and recognize the expression from the human face. There are seven basic facial expressions namely fear, surprise, happy, sad, disgust, normal and anger one additional expression is added i.e. “Trace”. To detect the face before trying to recognize the expression saves a lot of facial expression features. This system is fuzzy based expression recognition producing exact facial expression. The first step is to classify each pixel in the given image as a skin pixel or a non-skin pixel. The second step is to identify different facial expression features in detected image. The last step is to decide whether each of the expression identify in the face or not. Finally recognition is done by using fuzzy logic.*

**.Keywords:** Face Expression Recognition, Facial Action control system (FACS), Facial features Detection Algorithm (FFDA), Fuzzy Logic.

## 1. INTRODUCTION

Facial expression delivers wealthy data concerning human feeling and plays a crucial role in human communications. For intelligent and natural human laptop interaction, it's essential to acknowledge face expression mechanically [1]. varied techniques are developed for automatic face expression recognition, that dissent in knowledge used (still pictures vs. video sequences), options extraction ways, and classifiers used. For face expression recognition from image sequences, optical flow estimation is often wont to extract options.

Face expression recognition from static pictures could be a harder downside than from image sequences thanks to the actual fact that less data throughout expression actions is available[3]. several psychologists used single image for expression recognition thanks to the issue to get well-controlled video sequences of normal facial expressions [2]. A lot of the first work on laptop vision applied to facial expressions targeted on recognizing many archetypical expressions of feeling created on command[5]. These examples were collected underneath controlled imaging conditions with subject's deliberately facing the camera. Extending these systems to spontaneous facial behavior could be a essential leap forward for applications of this technology. Spontaneous facial expressions dissent considerably from posed expressions, like however continuous, spontaneous speech differs from isolated words created on command. Spontaneous facial expressions ar mediate by a definite neural pathway from posed expressions[15]. The paramedical motor system, originating within the animal tissue motor strip, drives voluntary facial actions, whereas involuntary,

emotional facial expressions seem to originate in a very sub animal tissue motor circuit involving the basal ganglia, visceral brain, and therefore the cingulated cortical region Psychophysics- cal work has shown that spontaneous facial expressions dissent from posed expressions in a very variety of the way 161. Subjects usually contract completely different facial muscles once asked to create Associate in Nursing feeling admire concern versus once they are literally experiencing concern. additionally, the dynamics ar different[17].

FACS [1] is that the leading technique for menstruations facial movement in behavioral science. it's an individual's judgment system that's presently performed while not aid from laptop vision.

## 2. FUZZY LOGIC

Fuzzy logic is associate extension of logical system supported the mathematical theory of fuzzy sets, that will be a generalization of the classical mathematics. By introducing the notion of degree inside the verification of a condition, thus sanctionative a condition to be in passing state but true or false, system of logic provides a very valuable flexibility for reasoning that produces it potential to want into consideration inaccuracies and uncertainties. a kind of data illustration applicable for notions that cannot be printed precisely, but that depend on their contexts. Fuzzy “not clear, distinct, or precise; blurred”. system of logic can true out concerning any proposition expressed in language.

Fuzzy systems can be used for estimating, decision-making, and mechanical control systems such as air conditioning, automobile controls, and even “smart” houses, as well as industrial process controllers and a host of other applications.

Fuzzy logic provides an alternative way to represent linguistic and subjective attributes of the real world in computing. It is able to be applied to control systems and other applications in order to improve the efficiency and simplicity of the design process.

### 3. PROBLEM STATEMENT

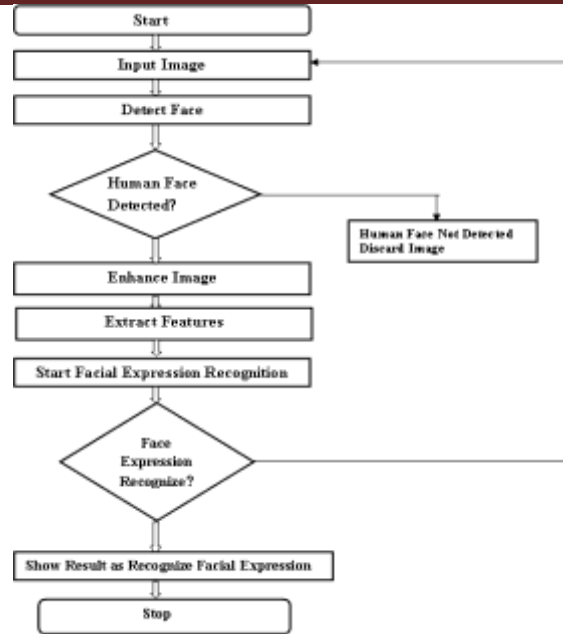
Human face expression recognition has attracted abundant attention, it's a lively space of analysis spanning many disciplines reminiscent of laptop vision and automatic access system. To find the facial expression before attempting to acknowledge it saves plenty of labor, as solely a restricted region of the image is analyzed. In fact, police work human faces, extracting the facial expression and recognizing expression in a picture could be a difficult method. it's terribly troublesome to find the positions of faces and options expression in a picture accurately. Human expressions are drastically changed within a second, it is very difficult to identify such a person what is in his mind. Personal security is very important therefore this system is effectively work than the previous one. The high sensitive area use surveillance camera to identification of face but it is difficult to recognize what is the aim of that person, it would be required a strong system for identifying human face as well as its expression.

### 4. PROPOSED METHODOLOGY

The proposed system includes Face Detection, Image Enhancement using filters, Feature Extraction & Expression Recognition using Fuzzy rule. All steps of proposed system are described as follows.

#### • Flowchart of Proposed Methodology

The flowchart includes two phase i.e. training and testing. Training Phase include face detection, image enhancement and collection of features. And Testing phase include addition steps to find out the expression on the face.



**Figure1** : Flowchart of Proposed System

#### • Face Detection

Human face detected as per the effective options offered on face like eye, eyebrow, mouth and nose. The face expression detection algorithmic rule [FFDA] used for locating the features on the face and determine it. Coloring plays a necessary role in distinctive human and non-human faces. From the study it is observe that coloring pixels have a decimal price within the vary of a hundred and twenty to one hundred eighty. during this project, we tend to used an endeavor and error technique to find colorings and non colorings pixels. However several of the days, system fails to discover whether or not a picture contains face or not .an image is segmental into skin color and non-skin color pixels.

#### Facial Features Detection Algorithm [FFDA]:

##### Steps :

- 1 : Start
- 2 : Read Image I
- 3 : For i=1 to height (I)  $\geq 120$  &&  $P(I) \leq 180$   
 add to skin pixel  
 End  
 //If pixel value range in between 120 to 180 it skin pixel
- 4: For j=1 to Area ( $I_{sk}$ )  
 Locate Black Circle  
 If found  
 \* Locate  $V(x+20, y)$  ,  $V(x-20, y)$   
 \* Locate point  $V(x+10, y)$  ,  $V(x-10, y)$   
 //for eye location on face

```

* Locate point from
  V(x+10, y+20) && V(x-10, y+20)
  //for finding nose
*Locate point from
  V(x+10, y+30) to V(x+10, y+40) &&
  V(x-10,y+30) to V(x-10, y+40)
  //distance from eye to lip
End
End If
End
End of For
    
```

- 3 : Crop face area
- 4 : Save face
- 5 : Stop



Figure2: Detected Face with Detection Time

It refers to accentuation or sharpening of image options cherish boundaries or distinction to form a graphic show a lot of helpful for show analysis. This method does not increase the inherent info content in knowledge.. Image process techniques utilized in this paper for image improvement i.e. Dennis Gabor filter that is employed to denoising the image, Haar Wavelet, Daubechies Wavelet that measure used for image improvement quality.

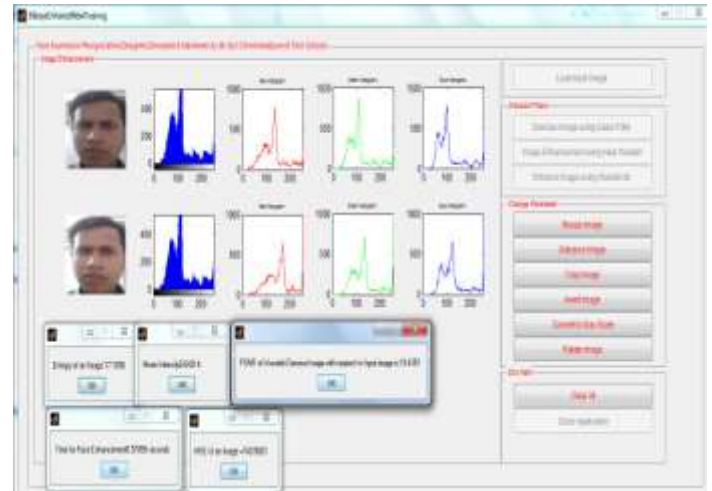


Figure 4 : Enhance Image using Gabor Filter

• Features Extraction

Human face is made up of eyes, nose, mouth and chine etc. there are differences in shape, size, and structure of these organs. So the faces are differs in thousands way. One of the common methods for face expression recognition is to extract the shape of eyes and mouth and then distinguish the faces by the distance and scale of these organs.



Figure 3: Crop Face with Detection Time

The input image, then detect face image with calculating mean intensity and entropy. The figure gives human face area with red square, and time for face detection is calculated i.e. 4.2988 seconds.

• Image Enhancement

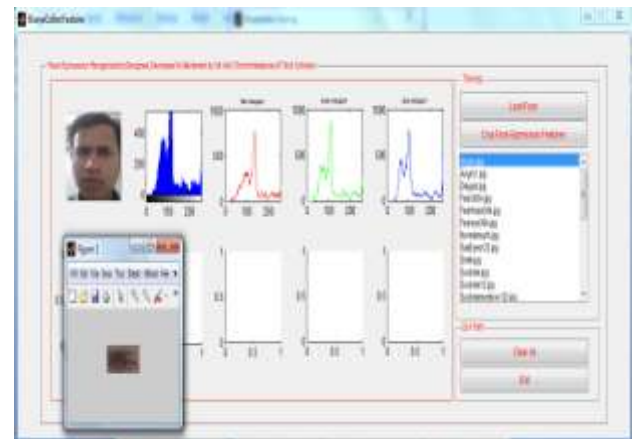


Figure 5: Facial expression crop features image

• Expression Recognition using Fuzzy Rule

Human face expressions are fear, trace, sad, happy, disgust, surprise, normal & angry. The system finds the expression from the face whichever the crop features stored into the Database Dictionary. This Dictionary holding the cropped features which is available in training section. The fuzzy rules are created according to the availability of expression.



Figure 6: Face Expression Located Features with Facial Expression Recognition Result

5. EXPERIMENTAL RESULT & ANALYSIS

The results have been demonstrated in the form of comparison tables 1. After the comparison tables, a graphical representation has also been done for a fast analysis of experimental results. All the techniques have been tested for all the assumed standard test images. Different types of results are extracted from Face Expression Recognition Process.

Sr. No.	Input face Image name	Input face Image	Time for face Detection	Expression Recognized	Time for Expression Recognition	Recognition Rate %
01	0AAC. Jpg		4.2103sec	Normal	15.5015 sec	100%
02	Ats1. Jpg		4.2988 sec	Trace	22.2042 sec	100%
03	ABC. Jpg		3.5237sec	Fear	10.7971 sec	100%
04	ANC. Jpg		3.9258 sec	Happy	12.6785 sec	100%
05	KA.AN2.40		4.477 sec	Angry	18.2059 sec	100%
06	KA.DI3.44		4.445 sec	Disgust	18.427 sec	100%
07	KA.SA2.34		4.434 sec	Sad	19.2518 sec	100%
08	KA.SU2.37		4.5857 sec	Surprise	19.388 sec	100%

Table 1: Face Expression Recognition Result on Simple and Standard Database (JAFPE)

There are eight types of expressions recognized by this system using various parameters like image is resize, crop, invert, grayscale and rotate. After that we got recognition rate i.e. 100%.

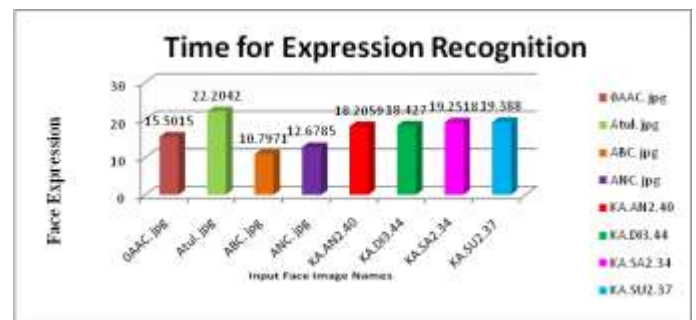


Figure 7 : Face Expression Recognition Time graph

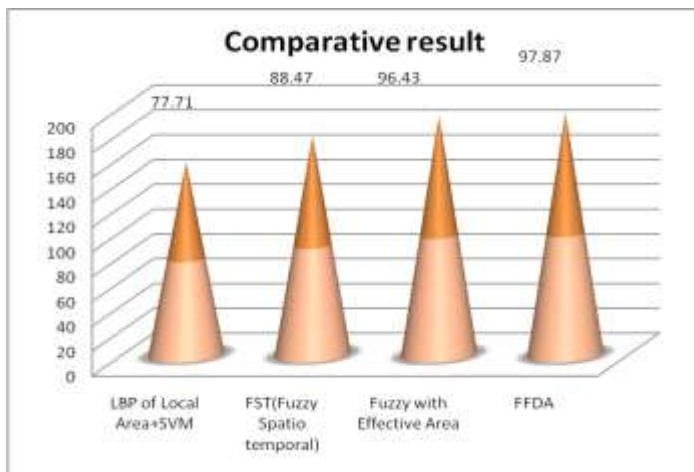
• Result Analysis

The table shows the comparative study of proposed work with other work. The method introduced in this system was tested on the simple and standard JAFFE database. Result tested from 10 images of each Expression which is mention in following table it is clear that proposed method is accurate and recognition rate is higher than the previous work.



Expressions	LBP of Local Area+SVM	FST(Fuzzy Spatio temporal)	Fuzzy with Effective Area	FFDA
Fear	65	90.7	98	100
Trace	-	-	-	96
Happy	83	95.7	92	98
Sad	66	77.8	95	97
Disgust	80	84.8	97	98
Normal	83	-	95	96
Angry	75	92	100	99
Surprise	92	89.8	98	99
Overall	77.71	88.47	96.43	97.87

**Table 2 :** Comparative study with previous work



**Figure 8:** Face Expression Recognition Comparative Result graph

The graph shows diagrammatic analysis of table 6.9 for comparative study of four different methods of expression recognition. The FFDA is given more accuracy and precise result. Hence it is observed that FFDA is more accurate as compare with previous work.

**6. CONCLUSION**

This paper has demonstrated the effectiveness of detecting faces using FFDA and recognizing facial expression using a fuzzy logic. The fuzzy logic is a powerful tool to solve complex expression recognition problems, and can potentially be applied at each stage of a face recognition system. Firstly the preprocessing of face image is gone through the various steps like detecting face and enhancement of image.. In testing process, tests the input images with the given or template images which are trained by fuzzy logic. This paper summarizes that after testing with all techniques of previous work, this

implemented method using FFDA & fuzzy gives accurate 95-98% recognition rate.

**7. REFERENCES**

[1] P. Ekman and. Friesen, "Facial Action Coding System", Consulting Psychologists Press, 1977.

[2] Nidhi N. Khatri , Zankhana H. Shah, and Samip A. Patel, "Facial Expression Recognition: A Survey / (Vol. 5 (1) , 2014, 149-152

[3] Maja Pantic, Leon J.m. Rothkrantz,"Automatics Analysis of Facial Expressions: The State of the Art", IEEE transactions on pattern analysis and machine intelligence, Vol. 22, No. 12, December 2000.

[4] Cătălin-Daniel Căleanu, "Face Expression Recognition: a Brief Overview of the Last Decade," 8th IEEE International Symposium on Applied Computational Intelligence and Informatics May 23–25, 2013, Timisoara, Romania.

[5] Shuai-Shi Liu, Yan-Tao Tian, Dong Li ,"New Research Advances Of Facial Expression Recognition", IEEE Proceedings of the Eighth International Conference on Machine Learning and Cybernetics, Baoding, 12-15 July 2009

[6] Aruna Bhadu, Rajbala Tokas, Dr. Vijay Kumar," Facial Expression Recognition Using DCT, Gabor and Wavelet Feature Extraction Techniques", International Journal of Engineering and Innovative Technology, Volume 2, Issue 1, July 2012

[7] Senthil Ragavan Valayapalayam Kittusamy and Venkatesh Chakrapani," Facial Expressions Recognition Using Eigenspaces", Journal of Computer Science 8, 2012

[8] Jung-Wei Hong and Kai-Tai Song,"Facial Expression Recognition Under Illumination Variation",IEEE 2007

[9] B. J. Matuszewski, W. Quan, L-K Shark, "Facial Expression Recognition" in "Biometrics – Unique and Diverse Applications in Nature, Science, and Technology", M. Albert (Ed.). InTech, 2011.

[10] Roja Gasemi and Maryam Ahmady, " Facial Expression Recognition Using Face Effective Areas and Fuzzy Logic", 978-1-4799-3351-8/14/@2014 IEEE.

[11] V. Gomathi, Dr. K. Ramar, and A. Santhiyaku Jeevakumar, "Human Facial Expression using MANFIS Model", International Journal of Electrical and Electronics Engineering 3:6 2009.

[12] Mr. Sachin More & Prof. Sachin Deshpande, "Fuzzy Model for Human Face Expression Recognition". International Journal

of advance Technology & Engineering Reserch, ISSN No. 2250-356 Volume 2, Issue 2 May 2012.

[13] Jeemoni Kalita and Karen Das, "Recognition of Facial Expression Using Eigenvector Based Distributed Features and Euclidean Distance Based Decision Making Technique", IJCSA, Vol. 5 No. 2 2013.

[14] C. Shan, S. Gong, and P. W. McOwan, "Robust Facial Expression Recognition Using Local Binary Patterns," Proc. IEEE International Conference on Image Processing (ICIP'05), Genova, Italy, September 2005.

[15] Z. Zeng, Y. Fu, G. I. Roisman, Z. Wen, Y. Hu, and T. S. Huang, "Spontaneous Emotional Facial Expression Detection," Journal of Multimedia, vol. 1, no. 5, pp. 1-8, 2006.

[16] J. Wang, L. Yin, X. Wei, and Y. Sun, "3D facial expression recognition based on primitive surface feature distribution," in Proc. Conf. Computer Vision and Pattern Recognition, 2006, pp. 1399–1406.

[17] Shilpa Choudhary, Kamlesh Lakhwani, Shubhlakshmi Agrwal, "An Efficient Hybrid Technique Of Feature Extraction For Facial Expression Recognition Using Adaboost Classifier", International Journal of Engineering Research & Technology, Vol. 1 Issue 8, October - 2012

[18] I. Kotsia, I. Pitas, "Facial Expression Recognition in Image Sequences Using Geometric Deformation Features and Support Vector Machines," Image Processing, IEEE Transactions on, vol. 16, Issue 1, pp. 172–187, Jan. 2007.

[19] J. Ahlberg, "CANDIDE-3 an updated parameterized face," Report No. LiTH-ISY-R-2326, Dept. of Electrical Engineering, Linköping University, Sweden, 2001.

[20] F. Dornaika and B. Raducanu, "Inferring facial expressions from videos: Tool and application," Image Commun., vol. 22, pp. 769–784, October 2007.

[21] Bogdan J. Matuszewski, Wei Quan and Lik-Kwan Shark, "Facial Expression Recognition", www.intechopen.com.

[22] Patil Archana, Nemade Vivek, "An Overview of Human Face Expression Recognition", Volume 2, Issue 12, ISSN NO: 2394-5036, IJRCEMAS Dec-2015.

[23] Genyuan n Zhang, "Face Recognition Based on Fuzzy Linear Discriminant Analysis" IERI Procedia 2 (2012) 873 – 879.

[24] Everardo Santiago-Ramirez, J.A. Gonzalez-Fragaa, Sixto Lazaro-Martinez "Face recognition and tracking using unconstrained non-linear correlation filters" Procedia Engineering 35 (2012) 192–201.

[25] Alla Kovalenko, Maryna Surudzhi, "Cross-race Effect: the Role of Social and Individual Factors in Face Recognition Process" Procedia - Social and Behavioral Sciences 114 (2014) 136 – 140.

[26] Sushma Jaiswal, Sarita Singh Bhadauria, Rakesh Singh Jadon, Tarun Kumar Divakar, "Brief Description of Image Based 3D Face Recognition Methods", 10.1007/3DRes.04(2010)02.

[27] Anisha Halder, Amit Konar, Rajshree Mandal, Aruna Chakraborty, Pavel Bhowmik, Nikhil R. Pal and Atulya K. Nagar, "General and Interval Type-2 Fuzzy Face-Space Approach to Emotion Recognition", IEEE transactions on systems, man, and cybernetics: systems, vol. 43, no. 3, may 2013.

[28] Zisheng LI, Jun-ichi IMAI, and Masahide KANEKO, "Facial-component-based Bag of Words and PHOG Descriptor for Facial Expression