Design and Implement in Facial Emotion Detection using Key-point, Ant Colony Classification Approach

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Abstract:- Face recognition is an active area of research in recent years. This is most genuine type of biometric identification. The personal contact is not essential for facial recognition framework. Face recognition is one an approach that possesses low intrusiveness and high accuracy. Firstly, face detector locates human face from normal image despite of its background. Secondly, face patches are removed from pictures, such that face fix is normally mutilated into vector with settled measurement. Finally, face recognizer determines and identifies particular individual's face. Several advantages of Face recognition like: Contact free, perfect results, reliable matching, diverse applications, etc. Few applications of face recognition are: video games, driving licenses, voter Id, internet access, security, surveillance, etc., now accessing smart phones also. Presently K-nearest neighbour classification techniques are used to overcome accuracy degradation. KNN utilize a database in which the information focuses are isolated into a few separate classes to foresee the order of another example point. In this study, we proposed a combined approach for facial feature extraction and recognition using Deep Neural Network and ACO approach. DNN is artificial NN based on error deep algorithm, consists of lot of neurons that are efficient in a form of 3 layers: input, hidden and output. It's an extension of smallest mean square method that can be used to train multi-layer networks. ACO employs imitation ants that work together to find good solutions for discrete optimization difficulties. This approach is used to overcome time factor and error rate as well as to enhance the accuracy.

Keywords :- *Facial Emotion Recognition, KNN methods, Ant colony Optimization and Classification.*

I. INTRODUCTION

Emotional aspects have huge impact on Social intelligence like communication understanding, decision making and also helps in understanding behavioural aspect of human. Emotion play pivotal role during communication. Emotion recognition is carried out in diverse way, it may be verbal or non-verbal .Speech (Audible) is spoken form of communication & Facial expression,[1] act, body postures and sign is non-verbal form of communication. While communicating only 7% effect of communication is contributes by verbal amount as a whole, 38% by spoken part and 55% influence of the speaker's message is contributed by facial expression. For that aim automated and real time facial expression will play significant role in human and machine interaction. Facial expression recognition would be useful from human facilities to clinical practices. Analysis of facial expression plays important roles for applications which are depends on emotion recognition like Human Computer Interaction (HCI), Social Robot, Animation, Alert System & Pain monitoring for patients [2].

Capture - physical behavioural trial be capture with the structure through staffing.

Extraction - exclusive information is extract from the example and template is created.

Comparison - the template is then compared with a new sample.

Matching - the system then decides if the features extracted from the new sample are matching or not. For each representation type, a distance or similarity measure is defined that allows 'similar' faces to be determined. Much of the art in biometrics is in the design of a model of the biometric data and, given a scheme for extracting the model parameters as a representation of the data, in creating a similarity measure that correctly discriminates between samples from the same person and samples from different people. As with any biometric system, some threshold on similarity must be chosen above which two face images are deemed to be of the same person [3].

Performance-The Face Recognition Technology (FERET) tests provided an early benchmark of face recognition technologies. Phillips has continued the evaluation of face systems for US government agencies in the Face Recognition Vendor Test. This report provides an excellent independent evaluation of three state-of-the-art systems with concrete performance figures. The report highlights the limitations of current technology while under ideal conditions performance is excellent, under conditions of changing illumination, expression, resolution, distance or aging, performance falls off, in some cases dramatically. Current face recognition systems are not very robust yet against deviations from the ideal face image acquisition but there is continual performance improvement.

In this proposed work, implement an optimized classification method to enhance the performance and reduce the error rate in the face emotion recognition in the digital image processing.

II. LITERTURE REVIEW

Pooja Umesh Kulkarni et al., 2016 [14] described that the adaptive sub-layer compensation(ASLC) based facial emotions recognition method for human emotions recognition with various features extraction mechanism. We alter Marr-Hildreth algorithm by expending Adaptive sub-layer recompense and hysteresis analysis to minimize negative effects o Laplacian of Gaussian (LoG), such as image degradation, high reply to unwanted details in image, and detached edge details from given image. We have calculated four different features extraction techniques to identify the emotion. The four feature recognition mechanisms applied are Principal Component Examination, Local Tetra Pattern, Magnitude Pattern and Wavelet features. The emotion class is identified by using the extracted features and K nearest neighbour algorithm. We classify five different emotion categories i.e. Happy, Sad, Neutral, Surprise and Fear. We have used still image database for the experiments and the results gives verification of input into the five dissimilar emotion classes i.e. Happy, Sad, Neutral, Surprise and Fear. **Dayana Mathew et al., 2015 [15]** proposed that the edge feature extraction method using neuronal threshold logic models to repeatedly identify the facial expressions. The system is simulated at digital system level consisting of reading an image followed up with edge extraction scheme that can be applied with crossbreed CMO memristive digital circuits. The results specify robust edges of the facial features and it's useful in development of real-time emotion recognizing digital chip. **Salwa Said, Olfa Jemai et al.,2015 [16]**Face emotion recognition is one of the most important and rapidly advanced active research areas of computer science. A new technique for facial expression identification based on wavelet network classifier is proposed in this paper. It allows us the detection of six basic emotions other than the neutral one: (Joy, surprise, anger, sadness, fear and disgust) The process is composed of three principle steps : face detection, features extraction and classification. The effectiveness of our planned algorithm is experimentally established by using well-known experiment database: the extended cohen-kanade database. **Mounira Hmayda, Ridha Ejbali et al.,2015 [17]** presents feeling recognition scheme based on Beta wavelet network by the Fast Wavelet Transform in instruction to improve the performance of this network. The proposed system can be summarized in two main steps: training stage & classification stage. Comparing with many algorithms which suffer from the low classification rates and the long executing time the rates given by our experimental results show the effectiveness of the FWT . **Nattawat Chanthaphan et al.,2015, [18]** the Facial Emotion Recognition Based on Facial Motion Stream generated by kinect employing two kinds of facial features. The first one was just a simple space value of each pair-wise organizes packed into 153-dimensional feature vector per frame. The second one was derived from the first one based on Organized Streaming Skeleton method and it developed 765-dimensional feature vector per frame.

Table 1. Facial Detection methods and its related work

Methods	Related Works
Knowledge based	Multi resolve rule based technique[12]
Feature invariant	
Facial features	Grouping of edges
Texture	Space Gray-level Requirement matrix of face pattern
Skin colour	Mix of Gaussian[13]
Multiple Feature	Integration of skin colour, shape and size
Template Match	
Predefined face templates	Shape template
Deformable templates	Active Shape Model(ASM)
Appearance Based	
Eigen face	Eigenvector decomposition and clustering
Distribution based	Gaussian distribution & multilayer preceptron
Neural Network	Ensemble of neural networks and arbitration[5]
Support Vector Machine(SVM)	SVM by polynomial kernel
Naive Bayes classifier	Combined statics of local appearance & position
Hidden Markov Model(HMM)[4]	Higher order statistics with HMM

III. TECHNIQUES IN FACE EMOTION RECOGNITION

In order to detect emotion, we need to go through various steps. Firstly we need to enhance the given input in order to reduce complexity. After which we will detect the face and will perform feature extraction form which we will detect the facial emotion. This methodology is as given in Figure 1.

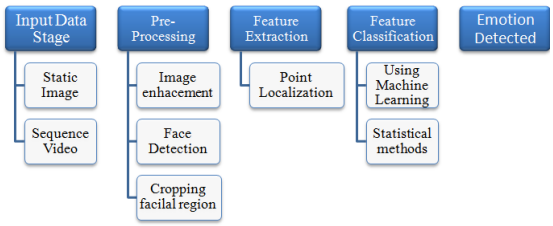

Fig.1: General Methodologies [4]

These steps are explained as below: [7]

- **Input Data Stage**

At this stage we load an image or video as an input to the emotion detection system. We may either load a static image that is a single image as input or a video consisting of number of faces with different emotions given by a person as the input. If we are loading a video then it needs to be converting into frames so as to detect and crop the face correctly.

• **Face localization** aims to decide the image position of a particular face; this is a simplified detection problematic with the assumption that an input picture contains only one face.[6]

• **Marr Hidreth Algorithm:** Marr-Hildreth (1980) procedure is technique for distinguishing edges in advanced pictures those persistent bends. Wherever there are well-fabricated and quick varieties in picture light. It is simple and capacities by convolving the picture with the LoG work, or, as quick guess by DoGs. Therefore the zero-intersections are found in the cleaned result to discover the cut off points. The LoG strategy is periodically too alluded to as the Mexican cap wavelet because of its picture shape while turned up-side-down. [8]

The main part of this paper is to minimalist the negative effects of the Marr-Hildreth advantage sensor, making it more suitable for the purpose of human emotion recognition. Marr-Hildreth edge detector is a two-step algorithm: LoG cleaning and zero-crossing recognition. Zero-crossing recognition is the key part of any Laplacian based edge detection algorithm. Unlike gradient-based edge detection, edge locations in Laplacian based sensor are indicated by the being zero-crossings since a ramp edge or step edge produces a dual response.

Algorithm for the Marr-Hildreth edge detector is

• Smooth the image by a Gaussian[7]

• Apply a two-dimensional Laplacian to the sharp image (frequently the first two steps are combined into a single operation)

• Loop through the result and look for sign deviations. If there is a sign variation plus the slope across the sign alteration is greater than some threshold, mark as an edge.

• To get better results it is possible to run the result of the Laplacian over a hysteresis alike to Cranny's edge recognition although this is not how the edge sensor was firstly implemented.[11]

• **Deep Neural Network*:*** Neural networks are a set of algorithms, modelled insecurely after the human intelligence, that are designed to know patterns. They interpret sensory data through a kind of machine perception, labelling or collecting raw idea. The patterns they identify are numerical, limited in vectors, into which all real-world information, be it images, sound, text or time sequence, must be transformed. Neural networks support us cluster and categorize. You can think of them as a collecting and classification layer on top of data you store and manage. They help to group unlabelled data according to similarities amongst the example inputs, and they categorize data when they have a labelled dataset to sequence on. Deep learning (also known as deep structured learning or hierarchical learning) is part of a broader family of machine learning methods based on learning data representations, as opposed to task-specific algorithms. Learning can be supervised, semi-supervised or unsupervised. [9]

• **Face detection:** recently some applications of Face Recognition don't need face detection. Within some cases, face images stored in the data bases are previously normalized. There is a standard image input format, so there is no need for a detection step. An example of this could be a criminal data base. There, the law enforcement agency stores faces of people with a criminal report. If there is new subject and the police has his or her passport photograph, face detection is not necessary. However, the conventional input image of computer vision systems is not that suitable. They can contain many items or faces. In these cases face detection is mandatory. It's also unavoidable if we want to develop an automated face tracking system. For example, video surveillance systems try to include face detection, tracking and recognizing. So, it's reasonable to assume face detection as part of the more ample face recognition problem. Face detection have to contract with some well known challenges. They are usually present in images captured in uncontrolled environments, such as surveillance video systems.

These challenges can be attributed to some factors:

Pose variation. The ideal scenario for face detection would be one in which only frontal images were involved. Affirmative is very unlikely in general uncontrolled conditions. Moreover, the performance of face detection algorithms drops severely when there are large pose

Variations. It's a major research issue. Pose variation can happen due to subject's movements or camera's angle.

Feature occlusion. The presence of elements like beards, glasses or hats introduces high variability. Face is able to also be incompletely covered by objects or other faces.

Facial expression. Facial type also varies greatly because of different facial gestures. Imaging conditions. Different cameras and ambient conditions can affect the quality of an image, affecting the appearance of a face.[10]

IV. IMPLEMENTATION WORK

By studying above different approached and attempt can be made to develop hybrid approach for facial feature extraction and recognition accuracy can be further improved using deep Neural Network approach and hybrid approach. Also there is scope in Automatic Facial Expression Recognition we can take more complex image such as very big size 2D image or 3D pictures and also for better results we might take colour images.

Photos of faces are extensively used in mug shot identification (e.g., for passports and driver's licenses), where the ownership authentication protocol is augmented with a photo for manual inspection purposes; there is wide public reception for this biometric identifiers. Face-recognition systems are tending to intrude from a biometric sampling viewpoint, needing no contact, nor even the mindfulness of the subject. The biometric everything, or at least works in theory, by old or no longer used picture data-bases, video film, or other photograph sources. Most Facial Expression Recognition and Analysis systems proposed in the literature focus on the binary occurrence of expressions, often either basic emotions or FACS Action Units (AUs). Expressions can vary greatly in strength, and this strength is often a strong cue for the interpretation of the meaning of expressions. In addition, despite efforts to evaluations standards (e.g. FERA 2011), there still is a need for more standardised evaluation procedures. They therefore suffer from low comparability. Yet at the same time, this is a rapidly growing field of research, due to the constantly increasing interest in applications for human behaviour analysis, and technologies for human-machine communication and multimedia retrieval. In these compliments, the FG 2015 Facial Expression Recognition and Analysis challenge (FERA2015) might help increase current standards for appearance acknowledgment by testing member to evaluate AU force, and it will keep on bridging the hole between phenomenal research on outward appearance acknowledgment and low similarity of results.

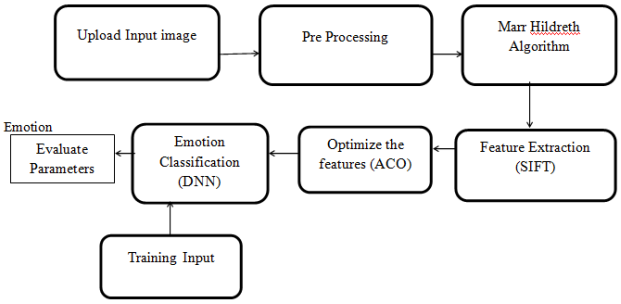

Fig.2: Proposed Flow Chart

V. RESULT AND DISCUSSIONS

In this section, we implement the facial emotion recognition in MATLAB simulation tool. Apply various algorithms in this topic. We create the Dataset in Happy, Fear, Neutral, Sad and Surprise. First, we create the database in the facial emotions i.e Happy, Fear, Neutral, Sad and Surprise. Secondly, we implement the edge detector technique. Apply Marr-Hildreth algorithm and Feature Extraction the unique features of the Face emotions using Scale Invariant Feature Transformation in the form of key points. After that feature extraction implement a ant colony optimization algorithm to select the features. Deep Neural network classification and evaluate the performance parameters i.e. accuracy.

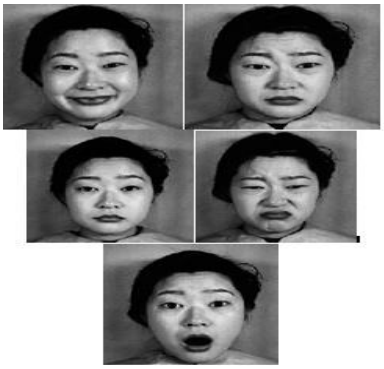

Fig.3: Facial Images

The above figure described that the upload the faces from the actual dataset in various emotion faces like

(1) Happy

(2) Sad

(3) Fear

(4)Surprise and

(5) Angry

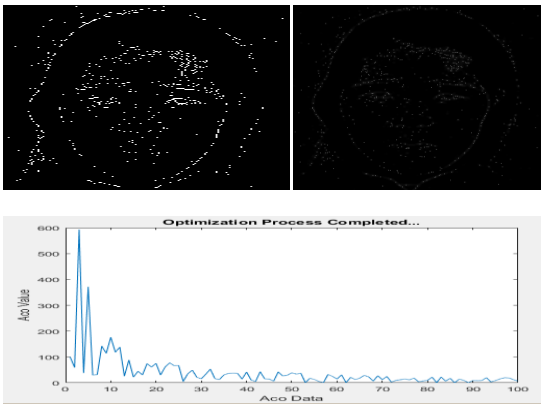

Fig.4: Feature Selection and Extraction

The above figure shows that the Marr-hidreth and ASLC algorithm. we perform the Laplacian of Gaussian (LoG) function on the obtained Wiener filtered image. It detects the edges by finding the zero crossings as per the intensity changes in the input image. First, we get the zero crossed edge detected LoG image without any threshold specified. we go for the ASLC analysis to minimize the negative effect of Marr Hildreth algorithm. First, we apply Sobel operator of 3x3 windows on the image with sensitivity parameter value as 0.05. The LoG image and Sobel image is used to calculate the ASLC output by comparing the pixel values and connected edge points. In this way, we can find out the ASLC High and ASLC Low images to perform double thresholding i.e. connectivity analysis. In this step, we obtain the disconnected image with more detailed output. The feature selection using ACO algorithm calculated the fitness function.

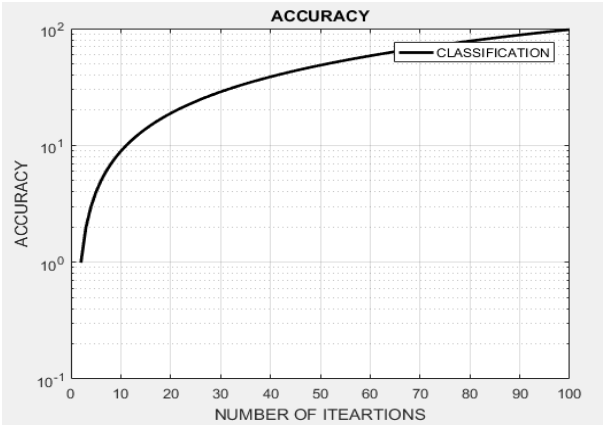

Fig.5 Accuracy

The above figure shown that the accuracy in the proposed work. It evaluates the organization, accuracy in the face emotion recognition images according to the category.

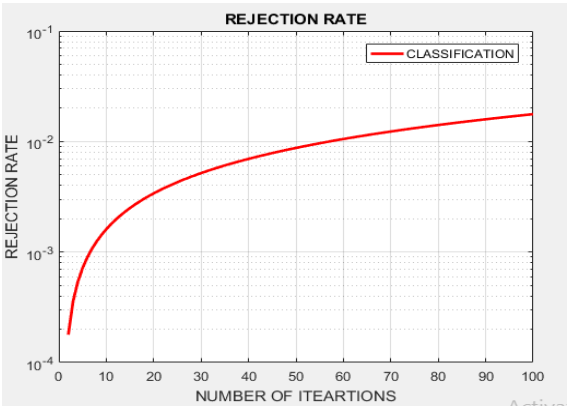

Fig.6: Rejection Rate

The above figure defined that the false rejection rate means false data reject able in the original form. We check the wrong data reject in the amount number of iterations in the face emotional recognition.

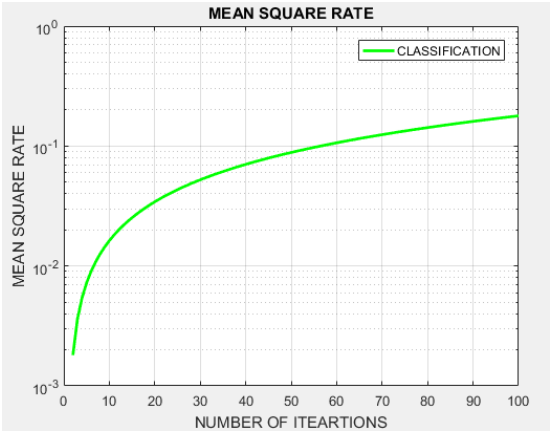

Fig.7: Means Square Error Rate

The above figure defined that the mean square error rate the original form. We check the average error rate data reject in the amount number of iterations in the face emotional recognition.

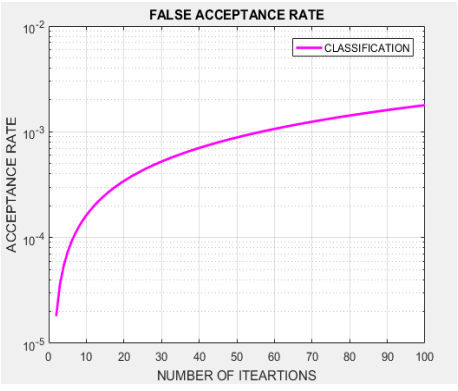

Fig.8: Acceptance Rate

The above figure defined that the false acceptance rate means false data acceptable in the original form. We check the wrong acceptance in the amount number of iterations in the face emotional recognition.

The above message box defined that the proposed performance parameters like accuracy rate, false acceptance rate, false rejection rate and mean square error rate .

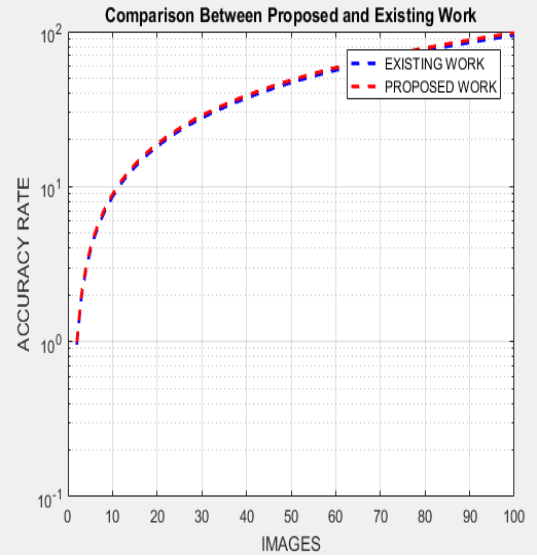

Fig.9: Comparison between proposed and existing in accuracy

The above figure showed that the comparison between K-NN and Deep neural Network in the proposed work. The Proposed Work with Deep Neural Network accuracy value is 98.3% and Existing work with KNN value is 94.5%.

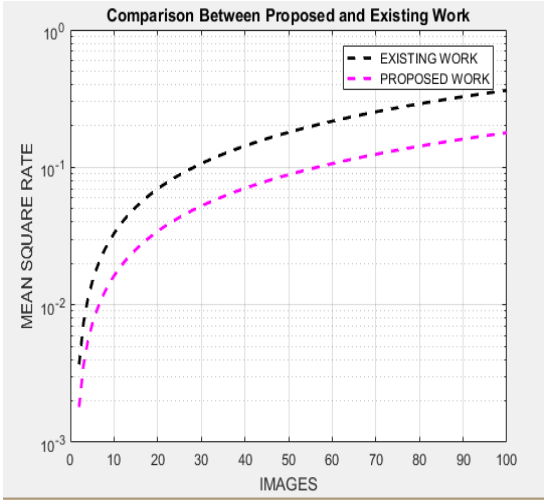

Fig.10: Comparison between proposed and existing in Error Rate

The above figure 10 comparison between the proposed and existing work in mean square error rate. The proposed work mean square error rate in the training case is 0.175 and existing work evaluate the error rate value is 0.77.

Table 2. Proposed Parameters

Parameters	Values
MSE	0.178
Acceptance Rate	0.00178
Rejection Rate	0.0176
Accuracy Rate	98.053

Table 3. Comparison

Parameters	Proposed Work	Existing Work
MSE	0.178	0.363
Accuarcy	98.053	94.6120

V. CONCLUSION AND FUTURE SCOPE

In this investigation, we proposed a joined approach for facial element extraction and acknowledgment utilizing Deep Neural Network and ACO approach. DNN is counterfeit NN in light of mistake profound calculation, comprises of parcel of neurons that are productive in a type of 3 layers: input, covered up and yield. It's an expansion of littlest mean square technique that can be utilized to prepare multi-layer systems. Ant Colony Optimization utilizes impersonation ants that cooperate to discover great answers for discrete advancement troubles. This approach is assists to conquer time factor and mistake rate and to upgrade the precision. By studying several approaches we attempt to develop hybrid approach for facial feature extraction and recognition accuracy can be further improved using deep Neural Network approach and hybrid approach. Also there is scope in Automatic Facial Expression Recognition we can take more complex image such as very big size 2D image or 3D pictures and also for better results we might take colour images. The objective of this research is to collect database with existing techniques for face recognition framework and implement feature extraction algorithm and SIFT algorithm to minimize the higher rate of data extraction. Deep Neural Network algorithm is utilized for classification to evaluate performance parameters like FAR, FRR, Accuracy. There are so many ways to make this system better in future. We can improve the face recognition system by using multi SVM with speed, memory and time. Emotion detection can be more efficient. Lesser the speed, time of system, emotion can be detected with more accuracy.

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