Emotion Recognition Of The Facial Expression Based On Key-Points Extract Features With Optimized Neural Network

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Abstract- Face is the main emphasis of consideration in social dealings, which also plays a more important role in transmission of personality and feelings. Although the capability to infer intellect or character from facial look is dubious, the human skill to identify face is astonishing. We can recognize thousands of faces learnt all through our lifespan and detect acquainted faces at a single glimpse even after so many years of separation. The main issues found that there are three main factors to construct a Facial Expression Recognition system, namely the face identification, facial feature extraction, and reaction or feeling cataloguing. In this paper work we will propose a computational model of face recognition, which is quick, sensibly simple, and accurate in constrained environments such as an office or a household using k-MEAN clustering for divide the data in the cluster form, SIFT and IGA in which feature divide into cluster form with the help of K-mean algorithm, feature extraction is done by SIFT, feature optimization is done by IGA and classification is done using Feed Forward Neural Network. Then finally measure the performance using the following metrics called False Acceptance Rate, False Rejection Rate, and Accuracy.

Keywords: Facial Emotions, SHIFT, FFNN, K-Mean, GA.

I. INTRODUCTION

Most communal exposition of an idea of emotion could be originated as "a natural instinctive state of mind deriving from one's situations, mood, or relationships with others". Which misses depicting the driving force behind all motivation which may positive, negative or neutral? This is very important information to understand emotion as an intelligent agent. It is very complicated to detect the emotions and distinguish among them. Before a decades or two emotion started to become a concern as an important addition towards the modern technology world [1]. Rises the hope of new dawn for intelligence apparatus. Imagine a world where machines do feel what humans need or want. With the special kind of calculation then that machine could predict the further consequences and by which mankind could avoid serious circumstances and lot more. Humans are far more strong and intelligent due to the addition of the emotion but less effective than machines. The facial expression recognition is to detect human emotion based on expression. Facial expression recognition follows the study framework of design recognition. This is composed of three steps: detection of face, feature (facial) extraction and expression classification. The amount of research carried out in each of these categories is quite sizable and noteworthy. These three categories are concerned with the central background pertaining to the issue of facial emotion recognition. Together from them, another core area is improvement of appropriate facial database for such studies[11].

The Categorizing facial expressions & its features:

Facial expression presents key mechanism to describe human emotion. From starting to end of the day human changes plenty of emotions, it may be because of their mental or physical circumstances. Although humans are filled with various emotions, modern psychology defines six basic facial expressions: Happiness, Sadness, Surprise, Fear, Disgust, and Anger as universal emotions [2]. Facial muscles movements help to identify human emotions. Basic facial features are eyebrow, mouth, nose & eyes[12].

Fig. 1: Basic Facial Expressions

Table -1: Universal Emotion Identification

Emotion	Definition	Motion of facial part
Anger	Anger is one of the most dangerous emotions. This emotion may be harmful so, humans are trying to avoid this emotion. Secondary emotions of anger are irritation, annoyance, frustration, hate and dislike.	Eyebrows pulled down, Open eye, teeth shut and lips tightened, upper and lower lids pulled up.
Fear	Fear is the emotion of danger. It may be because of danger of physical or psychological harm. Secondary emotions of fear are Horror, nervousness, panic, worry and dread.	Outer eyebrow down, inner eyebrow up, mouth open, jaw dropped[13]
Happiness	Happiness is most desired expression by human. Secondary emotions are cheerfulness, pride, relief, hope, pleasure, and thrill.	Open Eyes, mouth edge up, open mouth, lip corner pulled up, cheeks raised, and wrinkles around eyes.
Sadness	Sadness is opposite emotion of Happiness. Secondary emotions are suffering, hurt, despair, pitty and hopelessness.	Outer eyebrow down, inner corner of eyebrows raised, mouth edge down, closed eye, lip corner pulled down.
Surprise	This emotion comes when unexpected things happens. Secondary emotions of surprise are amazement, astonishment.	Eyebrows up, open eye, mouth open, jaw dropped
Disgust	Disgust is a feeling of dislike. Human may feel disgust from any taste, smell, sound or tough.	Lip corner depressor, nose wrinkle ,lower lip depressor, Eyebrows pulled down

A. Emotion recognition

The model system for feeling recognition is split into three stages: face detection, feature extraction and feeling classification. Once locating the face with the employment of a face detection rule, the information within the symmetry and formation of the face combined with image process techniques were accustomed method the improved face region to see the feature locations. These feature areas were any processed to extract the feature points needed for the feeling classification stage. From the feature points extracted, distances among the options area unit calculated and given as input to the neural network to classify the feeling contained. The neural network was trained to acknowledge the vi universal emotions[14].

B. Face Detection

The model system offers 2 ways for face detection. Although numerous information based mostly} and example based techniques will be developed for face location determination, we tend to opted for a feature invariant approach supported skin colour because the initial methodology thanks to its flexibility and ease. Once locating the face region with skin colour, many algorithms will be found for various color areas[15].

C. Feature Extraction

In the feature extraction stage, the face detected within the previous stage is any processed to spot eye, eyebrows and mouth regions. Initially, the probably Y coordinates of the eyes was known with the employment of the horizontal projection. Then the areas round the y coordinates were processed to spot the precise regions of the options. Finally, a corner purpose detection rule was accustomed get the desired corner points from the feature regions.

D. Feeling classification

The extracted feature points area unit processed to get the inputs for the neural network. The neural network has being trained in order that the emotions happiness, sadness, anger, disgust, surprise and concern area unit recognized. 525 pictures from Facial expressions and feeling info [3] area unit taken to coach the network. However, we tend to area unit unable to gift the results of classifications since the network continues to be being tested. Furthermore we tend to hope to classify emotions with the employment of the naïve bias classifier as Associate in Nursing analysis step.

The rest of the paper is organized as follows. connected work (literature survey) is conferred in section II. Methodology is explained in section III. Experimental results area unit conferred in section IV. last remarks area unit given in section V.

II. LITERATURE SURVEY

Dayana Mathew et al., 2015 [4] has planned a grip feature extraction technique victimisation neural threshold logic models to mechanically recognise the face expressions. The system is simulated at digital system level consisting of reading an image followed up with edge extraction system that may be enforced with hybrid CMOS memristive digital circuits. The results indicate sturdy boundaries of the countenance and it's helpful in development of period feeling recognizing digital chip. Salwa Said, Olfa Jemai et al., 2015 [5] Face feeling recognition is one among the most necessary and apace advanced active analysis areas of computing. a replacement methodology for countenance recognition depends on moving ridge network classifier is planned during this paper. It permits North American nation the detection of six basic feelings nonetheless the neutral one: (Joy, surprise, anger, sadness, concern and disgust) the method consists of 3 principle steps: face discovery, options extraction and classification. The effectiveness of our planned rule is through an experiment incontestable through victimisation well-known check info: the extended cohenkanade database

Mounira Hmayda, Ridha Ejbali et al.,2015 [6] This paper presents feeling recognition system supported Beta moving ridge network by the quick moving ridge rework so as to boost the performance of this network. The planned system will be summarized in 2 main steps: coaching stage & classification stage. Comparison with several algorithms that suffer from the low classification rates and also the long playacting time the rates given by our experimental results show the effectiveness of the FWT. Nattawat Chanthaphan et al., 2015 [7] the Facial feeling Recognition supported Facial Motion Stream generated through kindest using 2 sorts of face options. the primary one was simply a straightforward distance price every |of every} pair-wise coordinates packed into 153-dimensional feature vector each frame. The second was derived from the primary one supported Structured Streaming Skeleton technique and it became 765-dimensional feature vector per frame.

III. PROPOSED ALGORITHM

This thesis encompasses a set of objectives that is associated with milestone of this process. The objectives are mentioned below.

To study previous techniques based on face recognition system. Collect the database for implementation of proposed method. The implement K-mean for clustering purpose and SIFT algorithm for feature extraction. This algorithm creates features in the form of Key points. Also implement IGA (Improved Genetic Algorithm) Algorithm for feature reduction or optimization. And the implement Feed Forward Neural Network for classification and evaluate the performance parameters and comparison the previous parameters like; false acceptance error, false rejection rate and accuracy.

A. SIFT Algorithm

SIFT (Scale Invariant Feature Transform) algorithm suggested by Lowe in 2004 [8] to solve the picture rotation, scaling, and affine deformation, viewpoint change, sound, illumination changes, also has strong robustness.

The SIFT algorithm has four key steps: (1) Scale Space Extreme Detection, (2) Key point Localization, (3) Orientation Assignment (OA) and (4) Description Generation (DG).

The first phase is to identify location and scales of main points using scale space extrema in the DoG (Difference-of-Gaussian) tasks with dissimilar values of σ, the DoG function is convolved of picture in scale space separated by a constant factor k as in the following equation

$$D(x, y,\sigma) = (G(x, y, k\sigma) - G(x, y,\sigma) \times I(x, y)$$

Where, G is the Gaussian function and I is the picture. Now the Gaussian images are subtracted to produce a DoG, after that the Gaussian picture subsample through factor 2 and produce DoG for sampled picture. A pixel compared of 3×3 neighbourhood to detect the local maxima and minima of D(x, y, σ).

In the key point localization step, key point entrants are localized and refined by eliminating the key points where they rejected the little contrast points. In the orientation assignment step, the orientation of main point is obtained based on local picture gradient. In description generation stage is to compute the local picture descriptor for each main point based on image gradient magnitude and orientation at every image sample point in a region cantered at key point [9]

B. Feed Forward Neural System

A feed forward neural network is a biologically inspired classification algorithm. It consists of a (possibly big) quantity of simple neuron-like processing units, organized in layers. Each unit in a layer is linked with all the units in the previous layer. These connections are not all equal: every connection may have a dissimilar strength or weight. The weights on these connections encode the information of a network. Often the by in a neural network are also called knots.

Data enters at the inputs and passes through the net, layer by layer, till it arrives at the outputs. During normal operation, that is when it items as a classifier, there is no feedback amid layers. This is why they are called feed forward neural networks.

Feed-Forward Neural Networks is a collection of neurons linked together in a Network can be represented by a directed graph:

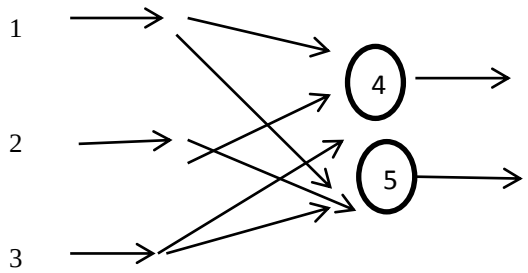

Fig. 2: Nodes represent the neurons, and arrows represent the links amid them.

- Every node has its number, and a link linking two nodes will have a pair of numbers (e.g. connecting nodes 1 and 4).
- Networks without sequences (feedback loops) are called a feed-forward net-works (or perceptron).

C. K-Means Clustering Algorithm

Simply speaking it is an algorithm to categorize or to group your objects based on attributes/features into K amount of group. K is positive integer no. The grouping is done by minimizing the sum of squares of distances amid data and the corresponding cluster centroid. Thus, the main purpose of K-mean clustering is to classify the data.

K-means is one of the humblest unsupervised learning algorithms that solve the well-known clustering problem. The process follows a simple way to categorize a given data set through a certain number of clusters (assume k clusters) static apriority. The main idea is to describe k clusters, one for each cluster. These canters should be located in a cunning way because of dissimilar location causes

changed result. So, the better choice is to place them as much as possible far away from each other.

D. Genetic Algorithm

Genetic system is computer programs that alike the processes of natural development in order to solve difficulties and to model evolutionary systems.

Different kinds of three operators [10]:

- The selection operator selects those chromosomes in the populace that will be allowed to replicate, with better chromosomes producing on average more spring than less ones.
- Crossover exchanges subparts of two chromosomes, roughly replicating biological re-combination between two single gene organisms ;
- Mutation casually changes the allele values of some positions in the chromosome; and transposable reverses the order of a connecting section of the chromosome, thus re-arranging the order in which genes are organized.

IV. SIMULATION RESULT EXPLANATION

In this section we present the experiments and their results along with their discussions. We recognize and classify the expression for the images in the testing dataset and the quality of the same was accessed using the quality metrics discussed below. The test set for this evaluation experiment image randomly selected from the trained dataset as the images to be tested needs to be trained first. Matlab 7.0 software platform is use to perform the experiment. The PC for experiment is equipped with an Intel P4 2.4GHz Personal laptop and 2GB memory as discussed above. The scheme is tested using ordinarily face emotion detection. From the simulation of the experiment results, we can draw to the conclusion that this method is robust to many kinds of FER systems.

Table no. 1 Performance Parameters False Acceptance rate, false rejection and Accuracy (Proposed Work)

Image Categories	Mean Square Error rate	False Acceptance rate	False rejection Rate	Accuracy
Happy	0.00724	0.0099	5.514	98
Sad	0.0075	0.001	5.623	98.2
Fear	0.0083	0.003	5.781	98.4
Surprise	0.0088	0.005	5.98	98.7
Neutral	0.0091	0.007	6.00	99

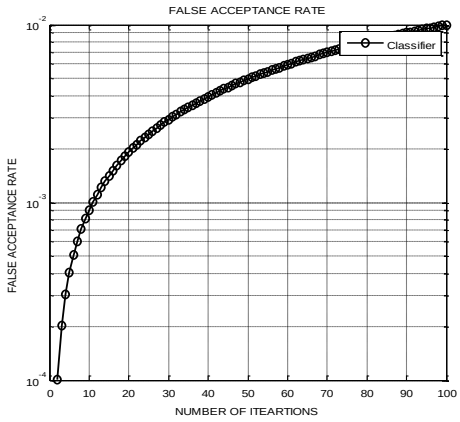

Fig. 3 False Acceptance rate (Proposed Work)

The above figure represents that the false acceptance rate means which wrong data will accept. The false acceptance rate, (FAR), is the calculate of the likelihood that the biometric safety structure will incorrectly accept an access attempt by an unauthorized user. A system's FAR typically is stated as the ratio of the number of false acceptances divided by the number of identification attempts.

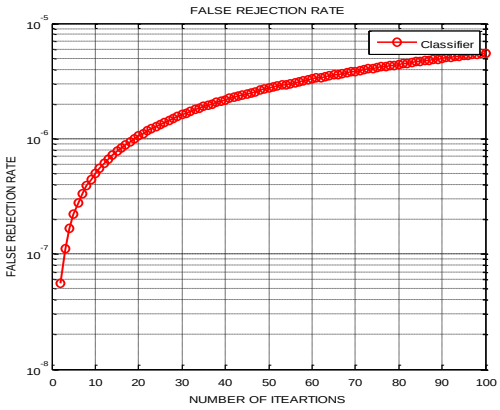

Fig. 4: false rejection Rate (Proposed Work)

The false rejection rate means wrong output is always wrong. The false rejection rate is the measure of the likelihood that the biometric security system will incorrectly reject an access attempt by an authorized user. A structure's FRR typically is specified as the ratio of the number of false rejections divided by the number of identification attempts.

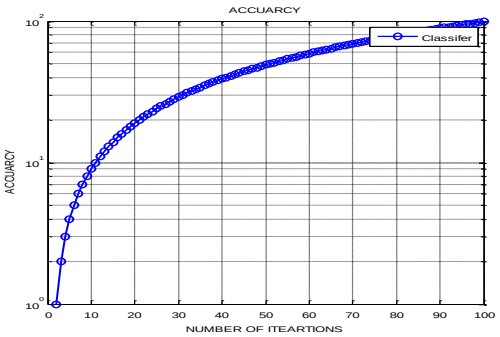

Fig. 5: Accuracy (Proposed Work)

The above figure represents that the accuracy means the false error is less then improve the performance of the detection of facial emotion category. Accuracy is not actually a dependable metric for the actual presentation of a classifier when the number of samples in different classes vary greatly (unbalanced target) because it will yield misleading results.

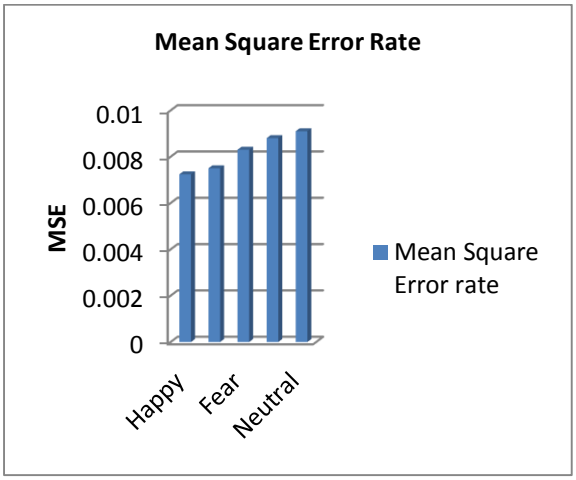

Fig. 6: Mean Square Error Rate

The above figure defined that the mean square error rate means training error and testing error sum is equal to the mean square error rate.

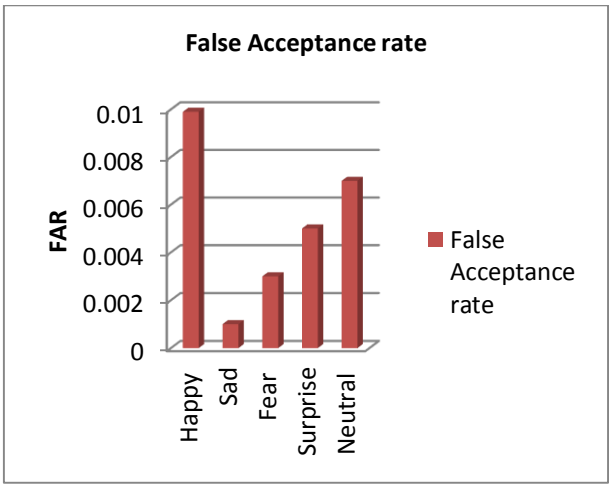

Fig. 7: False Acceptance Rate

The above figure define that the generate the test cases in facial emotion categories.

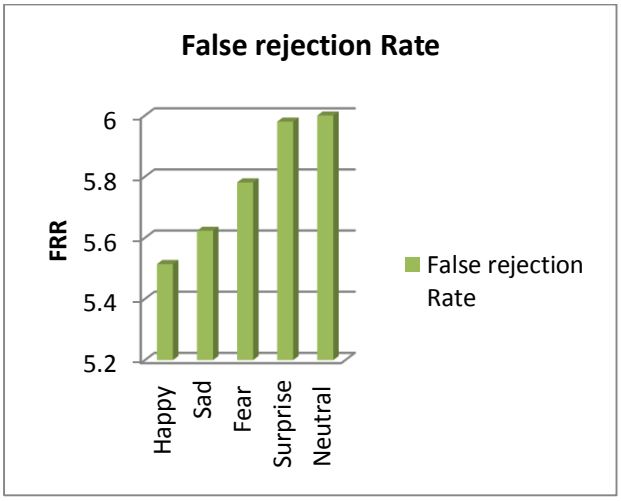

Fig 8 False Rejection Rate

The above figure shows that the test cases in facial emotion category detection emotions and evaluate the wrong data found.

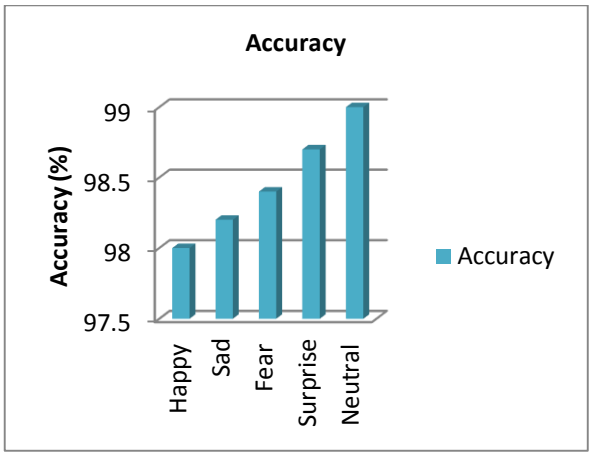

Fig. 9: Accuracy

The above figure deine the accuracy based on facial emotion detection in test cases.

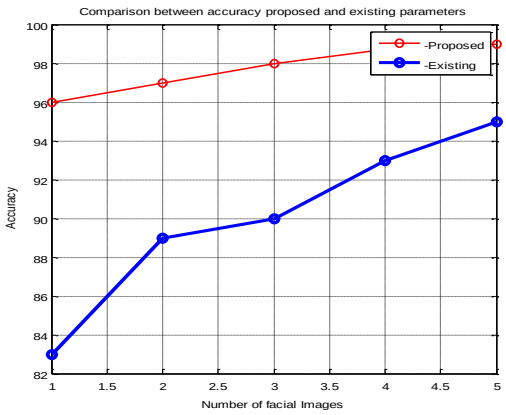

Fig. 10: Comparison between proposed and Existing Work

The above figure represents that the comparison between in facial emotion detection with proposed and existing work accuracy measure.

Tabel no. 2 Comparison Between Accuarcy with Proposed and existing work

Categories	Accuracy in proposed	Accuracy in Existing Work
Happy	96	83
Sad	97	89
Fear	98	90
Surprise	98.7	93
Neutral	99	95

V. CONCLUSION AND FUTURE SCOPE

In this conclusion, we improve the performance accuracy of the facial emotion detection and security maintained the Industrial area. The 5 emotions HAPPY, SAD, SURPRISE, NEUTRAL & ANGRY based on automatic facial expression recognition systems are over viewed. The neural network, Genetic algorithm approach is based on face acknowledgement, classification and feature extraction. The methodology of facial expression identification technique involves the optimization technique, Scale Invariant Feature Transformation (SIFT), clustering algorithm used to divide the facial emotion categories and neural network method. The methodology does make available a real-world clarification of the problem of facial expression recognition and it can work well in constrained environments. In future scope is as human facial expression recognition is a very elementary process, it is useful to evaluate the mood or emotional state of a subject under observation. As such, tremendous potential lies untapped in this domain. The basic idea of a machine being able to comprehend the human emotive state can be put to use in innumerable scenarios, a few of which we have mentioned here.

The ability to detect and track a user‘s state of mind has the potential to allow a computing system to offer relevant information when a user needs help – not just when the user requests help, for instance, the change in the Room Ambience by judging the mood of the person entering it. Help people in emotion-related research to improve the processing of emotion data. Applications in surveillance and security.

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