

A multiple facial emotion detection based on Back Propagation Neural Network and Principle Component Analysis (PCA)

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ABSTRACT

This paper presents the multiple facial emotion detection of human face with the help of principle component analysis (pca) and back propagation neural network. Face is a tough way in visual multidimensional and it raises a computational model for face detection is which quite difficult process. Principle component analysis (PCA) back propagation neural networks used for feature selections in emotion Recognition using facial expressions. PCA is one of the accepted techniques used, and know how to be show the optimal with different optimality criteria. In testing of all types of emotions such as sad, feeling, happy, revelation, anger, fear, disgust which are the basic six emotion is made in all existing but in our proposed we detect all types of emotion such as sound laugh, smile, loud crying, excitement, were an approximation were made for these all kind of emotion image data set is 85%.it shows that pca in neural network in emotion detection using facial expression is successful technique. We use back propagation for the Feature extraction which can be defined minimum subset of M features form process that is choose from the original set of N features, so to facilitate the feature space is optimally abridged according in the direction of a certain estimated condition.

Keyword:Pca, Neural Network, Face Expression, Feature extraction, back propagation.

1. INTRODUCTION

Facial expressions convey well heeled information regarding human emotion and cooperate vital responsibility in human communications [9]. In order to formulate simple a new intelligent and traditional human appliance boundary of new multimedia yields, regular facial expression detection [7] had been studied worldwide in the last ten years, which has become a very active research area in computer vision and pattern recognition. Certainly, present lives a number of requests which can advantage from standard facial appearance identification. Face recognition in real-life surroundings, for Example, such as airports, and banks, frequently occupy's a choice of different position and language of a person.

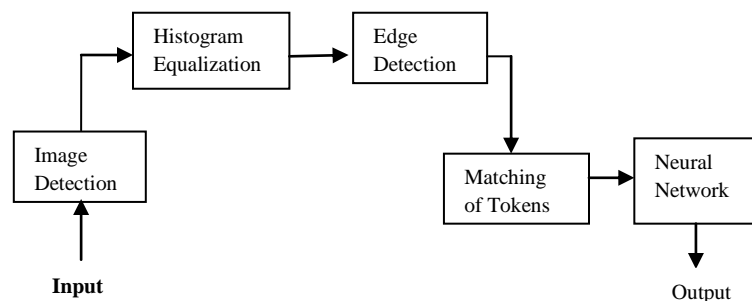


Fig. 1: Block Diagram for organization of Image



Image pre-processing building block is a mixture of three modules such as equalization of histogram, detection of edges from the input image and token matching. Their production is then supplied to the training module, it stores the information which comes from the image pre-processing block and then it guided the network which constructs the recognize0d product fig (1). Human face differs from one human being to another human being suitable to femininity, period, mature and some of the physical characteristics of human. Therefore the exposure of face is more difficult assignment in computer vision. The input of the image is may be choose one or taken from web cam.

Automatic detection might as well be wormed on video recording of collection relations, to trace and article modify in the terms of the Participant, or to recover quantity of a video based upon a demanding facial appearance of an issue. Elman and his colleagues have executed wide-ranging studies of Human facial lexis. They start six positions as "Universal facial expressions" namely those On behalf of cheerfulness, sorrow, fury, terror, shock, and repulsion. Facial expressions, and other motions, suggest non-verbal announcement cues in face-to face contacts.

Principal Component Analysis (PCA) [11] is a broadly worn knowledge about dimensional reduction. The PCA method contained a lengthy function for dimensional decrease. The new Vectors are orthogonal and uncorrelated by PCA. The process of PCA reduces the data dimensions, makes the data be processed in a lower dimensional space, and keeps the most information about data at the similar time. Donato and Bartlett evaluated different methods of feature extraction used for without human intervention recognizing facial expression, including PCA .pca request a projection that finest represents the unusual data in a least-squares sense, the application of PCA in facial appearance detection regards areas together with facial images as random vectors, and gets orthogonal foundation. Eigenvector corresponding to the large amount of Eigen value has the similar figure through human face [12].

A number of systems enclose previously agreement with facial terminology using different technical approaches such as the memory-based rule system, among others. One of our inspirations is to discover the potential that neural networks suggest for this kind of pattern recognition problem. An early neural network [10] which dealt with facial expressions was the single perceptron which could classic" snfiles from frowns, and which was tested on one person only. Neural Network concept is used because of its ability to learn ' from observed data. A neural network performs a complex Neural networks have been trained to perform complex functions in various fields of application including pattern recognition, identification, classification, speech, vision and control systems. Recently, there has been a high level of interest in applying artificial neural network for solving many problems. The application of neural network gives easier solution to complex problems such as in determining the facial expression. This paper clarifies a proposed approach to the dilemma of facial feature extraction from a tranquil advance posed image, classification and recognition of facial appearance and hence sensation and temper of a human being. Feed forward back propagation neural network is used as a classifier for categorizes the terminology of supplied face into more number of different categories like joyful, shock, irritated ,distress, miserable, surprise, revulsion, surprise, Irritated ,shocker,pleased,bolt from the blue, heartbreaking, impartial, bombshell, cheerful, astonish, revelation, disgust, surprise, sad, fear, disgust, fear, happy ,Aversion, horror, happy ,mad ,cheerless and happy.

2. RELATED WORK

The face emotional and recognition of expression [4]is made in the analysis of facial expression. This two are the basic thing in the analysis of facial emotion. The general facial reorganization involves face acquisition, facial data extraction and representation, and facial expression recognition [6].

In the first step, this step is made after to the input image, here the find the face area for the input images or Sequences. It just tracks the video sequence before that it made the detection of the face from the starting of the input video sequence. After identification of the face in the single frame tracking the video sequence is made. The pose estimation, head motion, head finding are handed in the face Emotion Identification system.

The second step facial expression, in facial expression the extraction and representing the facial changes is made. There are mainly two steps in facial feature extraction approaches for the work of analyses the expression, the one thing is that geometric feature based methods and also based on the appearance these are the two methods in the facial expression analysis .The geometric facial features at hand the shape and locations of all components in face including mouth, eyes, brows, and nose[7, 9]. The facial components or facial feature points be present removed to structure a feature vector that characterizes the face geometry. By way of appearance based methods, image filters, such as Gabor wavelets, are rational to furthermore the whole-face or thorough sections in a face image to take away in feature vector.

Depending on the different facial feature extraction methods[12], the effects of in-plane head rotation and different scales of the faces can be eliminated by face normalization before the feature extraction or by feature representation before the step of expression recognition. In the last step, the facial changes can be well-known as facial action units or prototypic emotional lexis. The recognition and giving out of facial phrase is achieved through various systems such as optical flow, hidden Markov model, and neural network processing or active appearance model. More than one modalities can be shared or fused multimodal detection, e.g. facial terminology and speech prosody or facial lexis and hand motion to supply an additional robust judgment of the subject's emotional state [4-7].



3. PROPOSED APPROACH

The steps which are followed in this paper are done by using following steps

- 1) Collect the set of images with different images
- 2) Keep this image to recognize the face emotion.
- 3) We are using PCA to extract the features of all images which plays a major role.
- 4) By using PCA features are well known for collected images
- 5) The neural network is big thing which made in this paper is that it checks all the image which we selected and with the help of PCA which extract and gives the feature of the selected image
- 6) Here in below we have shown the working condition of PCA and neural network in detail.

3.1 NEURAL NETWORK

Neural networks have been studied for more than four decades in view of the fact .The first single layer perceptron to pattern classification learning in late years which is applied by Rosenblatt. In neural network the number of nodes that are connected in directional links with all other nodes this is the network structure of neural network. Here in this network each node has individual processing unit and each node connection with other node is know and should be identified by every node in the network. The constructions of these nodes depend on changeable restrictions to pertaining to these nodes. A neural network has the substantial parallel distributed processor through the simple processing units. This network has the capacity to discover from experiential knowledge expressed through inter unit connection strengths, and can make such Knowledge obtainable for use.

A neural set of connections derives its computing power through its massive parallel distributed structure and its skill to learn and therefore to oversimplify. Generalization refers to the neural network manufacturing reasonable productions for new inputs not bumps into during a learning process. A primary to the operation in the neural network is a neuron as information only about processing unit. A neuron is made up of three basic elements: connecting links of each node, an adder and activation function. The first essential elements, connecting links from different enter x_i (or synapses), is characterized by a weight or strength. The negative as well as positive values are weights of a neuron may lie in this range. The neuron and weight of the input is referred by two indexes. The first index submits to the neuron in query and the second index pass on to the input of the synapse to which the weight refers. The second fundamental elements, an adder, integrating input signals x_i weighted by individual strengths of synaptic. An activation function f is a third basic element in neuron, which limits output amplitude of neuron.

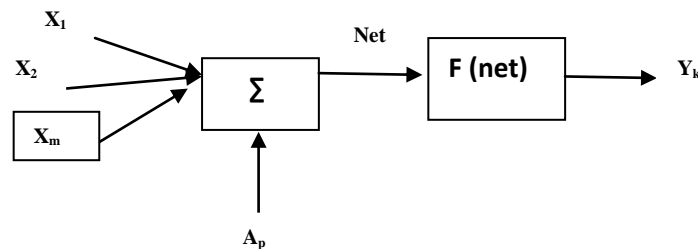


Fig 2: Model of Neural Method

An externally applied bias, denoted by A_p , is also included in the reproduction of the neuron shown in Figure 1. Bias is depend upon the input of activation function, The effect of bias is increasing or lowering the net input of the activation function, depending on whether it is positive or negative. The node characteristics and connectivity between node characteristics in the network is the architecture of the neural network. Network architecture is consist of the number of inputs to the network, the total number of elementary nodes, the number of outputs, which has a equal processing to all networks including in the organization and interconnections. Feedforward and recurrent are the two basic type of neural network which is generally classified in the neural networks.

The network is said to feedforward back propagation the input side is propagates in the direction to show the output commonly, without any loops or feedbacks .there are no links between nodes in the neural network in same direction, this layer is represented as feedforward networking the succeeding layer output of node in a specific layers is always connected as input to node. This representation is choosing because of modularity that is all nodes in this layer have same functionality or produces the common thing in the input vector. The set of connections is periodic if there is a feedback connection that forms a circular path in a network regularly in the holdup element as a component of synchronization. Many neural networks are proposed in both classes but the learning mechanism in back propagation is made in the multilayer feed forward which is most widely used in practical applications.



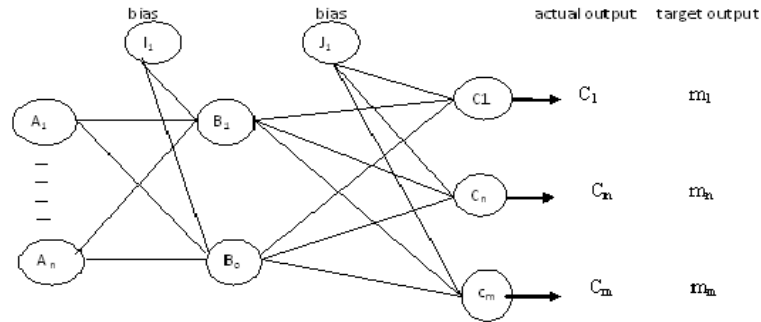


Fig: 3 Structural Design of Neural Network

The above figure is the complete figure of one hidden layer network with several neurons, where A is input, B represents hidden nodes, C represents output, m is the target value, and bias is usually set to 1.

3.2 PCA for Dimensionality Reduction

Consider a set of number (no) of sample images \$\{Z_1, Z_2, \dots, Z_m\}\$ which is represented by d dimensional features. Then applying mapping function from d dimensional feature space to s- dimensional feature sub-space. the new feature vector \$X_i \in G^f\$ is defined by

$$X_i = T_{pca}^f Z_i \quad (i = 1, 2, 3, \text{ and } 4 \dots m) \dots\dots (1)$$

\$T_{pca}\$ is the linear transformation matrix, where i is the sample image set.

The \$T_{pca}\$ Column is Eigen vector which is present in large Eigen values of scattered matrix. This is denoted as

$$\text{Scattered matrix} = \sum_{i=1}^N (Z - \mu)(Z - \mu)^T \dots\dots (2), \quad \mu \in G^f \text{ is the all sample mean images.}$$

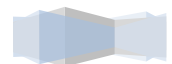
The most popular techniques for dimensionality reduction are PCA, which is known as Karhunen-Loeve transform. The data set reduced in the dimensionality by the standard statistical technique which is pca.pca is helpful tool to reduce the dimensionality of multivariate data set with image analysis, pattern recognition, pattern appearance with based visual recognition, data compression of data, prediction of time series, and analysis of biological data. The strength of PCA for data analysis move towards from its capable computational mechanism, the fact that it is finely understood, and from its general applicability.

For example, in computer vision a section of applications in consist of the demonstrating and face recognition, 3D objects recognition of under varying pose, following of deformable objects, and for illustration of 3D series data of heads. PCA is a technique of converting the original data set characterized by vector models into a fresh locate of vector Samples with resulting magnitudes.

So, we can decrease the data set to a lesser amount of magnitude with low in sequence loss. In accomplishment, the revolution from the creative characteristic to principal mechanism is carried out from side to side a development by original computing the covariance matrix of the innovative characteristic and afterward, by removing its eigenvectors to act as the principal components. The eigenvectors identify a linear drawing starting the novel attribute freedom of dimensionality N to an innovative space of size M in which features are uncorrelated. The follow-on eigenvectors can be statues according to the quantity of difference in the novel figures that they explanation for. Normally, the first few malformed characteristic description for the largest part of the dissimilarity in the data set and are preserved, while the residue are redundant.

PCA is an unproven technique which creates no exploit of in ordered in person surrounded by the class changeable. Because, the PCA precedes linear arrangements of the imaginative features, the significance of the unique features is not conserved. However, PCA illustrations have quite a lot of shortcoming. Solitary is that naive process for judgment the principal component instructions have dilemma with elevated dimensional data or bulky information of data points. Computational complexity and data scarcity are the two difficulties arise. Properly dealing incomplete data set in with missing of some of the points are another shortcoming of standard approaches to pca, to solve this drawbacks a grouping of method are proposed in the grassland of information, computer production, neural networks etc. above the living present comprise been many addition to predictable PCA.

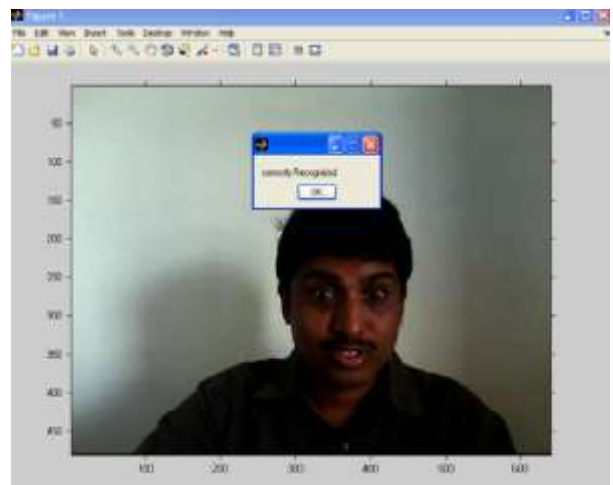
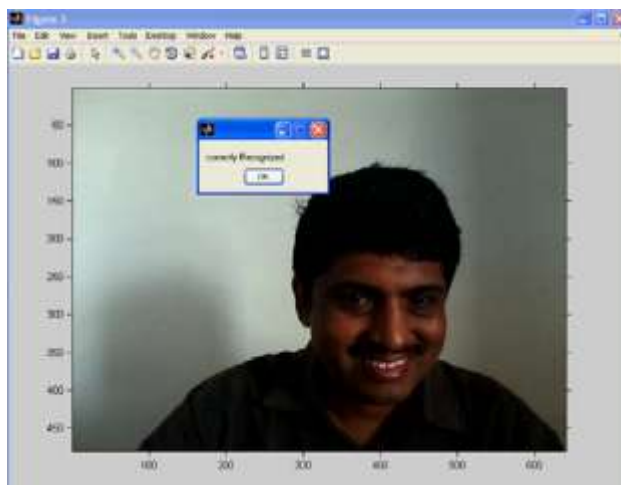
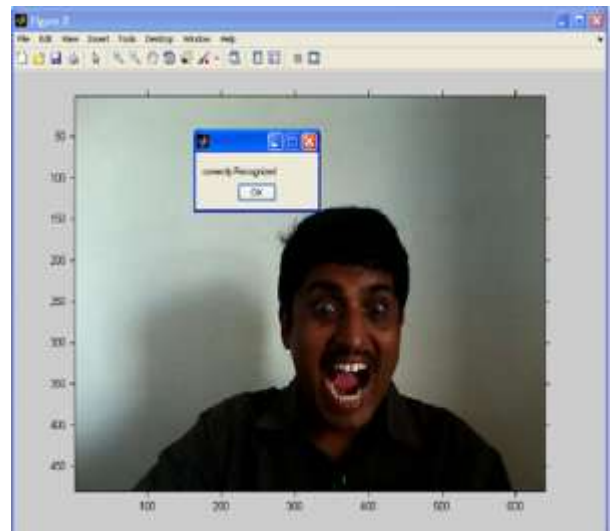
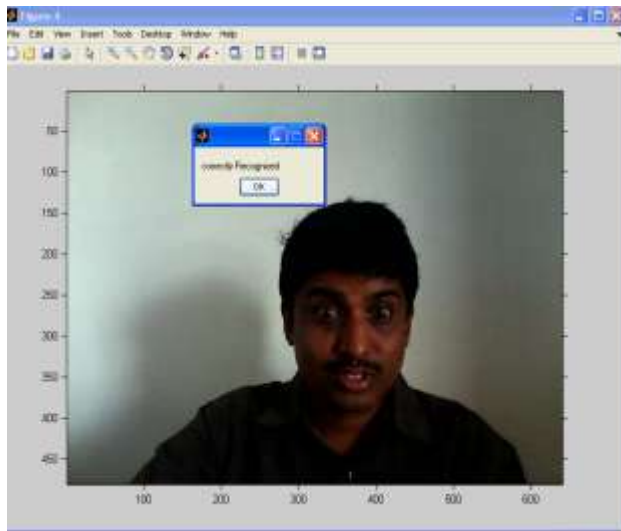
For example, in addition to pca to move forward with decor relation and to complete a dimension reduction in the feature space with information on individual variable this method is called Independent Component Analysis (ICA). extra addition address the location wherever the sample data live in a low-dimensional (non-linear) several in an exertion to preserve a larger measure of the dissimilarity by means of less important quantity apparatus and nevertheless further (related) calculation increase PCA from the point of view of density evaluation (which make possible representation non-linearity in the mock-up data) and the make use of Bayesian formulation for reproduction the density of the sample data multiple.

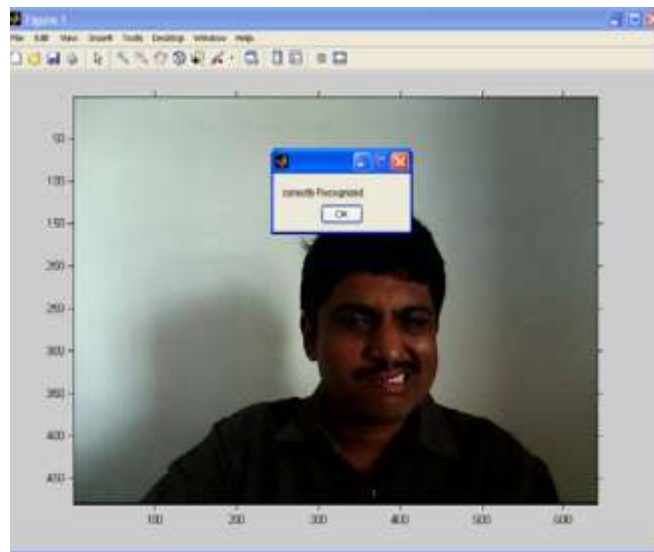


4. RESULT ANALYSIS

Only the facial appearances of images are used in face identification method. Many Japanese images were used for many of the facial expression particularly female expression. A numerous classifiers have been functional to phrase detection such as neural network, support vector machines (svm), linear discriminate analysis (LDA), k-nearest neighbor (K-nn), multinomial logistic ridge regression, hidden Markov models, tree Augmented naive Bayes, and others. Several systems use only a rule-based classification based on the characterization of the facial actions. There are mainly frame based and sequence based expression recognition method which is used to recognition of face [9]. The frame-based recognition technique make use of only the current frame with or devoid of a suggestion image principally it is a neutral face image to distinguish the language of the surround.

Below we have shown the output for this system which recognized all kind of face emotion .here with we have the output image except the universal output image. The different emotion output are listed below:





Ejaculation, emotional smile, loud shouting, joying face, irritating face are the corresponding output present in the above screens.

These all expression which presents in the sequence order with one or more frames are basically said to be the sequence-based recognition method [8]. Neural networks and PCA-based dimensionality reduction are used to identify the emotion reorganization. Algorithm for facial appearance acknowledgment classifies the specified image into one of the seven fundamental facial appearance grouping pleasure, depression, terror, disclosure, irritation, revulsion and neutral. PCA is worn for dimensionality diminution in participation information. It keeps the lower order principal components and ignoring higher order for components. The haul out feature vectors in the concentrated space is second-hand to educate the supervise neural network classifier. This press forward does not occupy the appreciation of quite a lot of location peak or node grids. The future system is swift and can be hand me losing for real-time reason.

Holding the value of characteristics of the collected information set which supply the more number of variance. The important data or information's are hold only in the lower order. The facial expression metaphors of each appearance of each subject were randomly selected as training samples [4, 6], while the remaining samples were used as test data. Not all terminology was equally well recognized by the system. Our reproduction experiment results explain that neural networks is successful in sensation identification using facial language, and we accomplish a detection rate of approximately 80% when difficult emotions. It is not so expedient to contrast classification presentation, because the problem that posed expressions is not always pure examples of a single expression category. It is important to realize that appearance is never pure terminology of one emotion, but for all time admixtures of dissimilar sentiment. Rows are the classified preferred by test subjects, columns the "true" categories performed in the incentive (so for pattern, of 50 metaphors depict angry, 39 were confidential acceptably, 1 exist as miss-classified by test subjects as fearful, while 1 images showing happy were miss-classified as annoyed). The above result analysis shows the result of different emotion identification of image which is classified as angry, fear, happy, sad, surprised, disgusted, loud laugh, shock, terror, and distress, neutral. We have achieved 82% of identification of all kinds of human image.

CONCLUSION

Experimentation outcome with identification rate of in the region when testing of all emotions on image data set, show that back propagation neural networks with PCA is successful in emotion revealing using facial lexis. This research might help out in future works, like imprison non-static imagery in real time and at the same time evaluating these images according to emotional calculating techniques. By manufacture these examination a quantity of the user's emotional position may possibly be seen like joy, fear, angry, and with these apparent results, subordinate and computer optimizers possibly will help users during the majority of special applications. There are many problem and problem that stay behind to be take in hand and that we be going to investigate in future work. Some enhancement of the choosing technique obtainable here are promising. Classify algorithms and several data sets where selected according to the selected algorithms and data sets will. In the future testing of large set of data using various classification algorithms.



Table:1 Matrix identification of Human Image with Different Emotions

F.E/F.E	smile	fear	disgust	happy	angry	sad	Loud laugh	neutral	surprised	shock	ejaculation
Smile	39	2	1	0	1	2	1	0	1	2	3
fear	1	42	1	0	0	1	0	0	1	1	2
disgust	0	1	44	2	1	0	0	0	2	0	1
happy	2	1	2	41	0	0	1	0	0	0	0
Angry	0	1	2	1	45	0	0	0	0	1	0
sad	1	0	0	2	0	43	0	1	1	2	2
Loud Laugh	1	0	0	1	1	1	47	1	0	1	1
neutral	0	1	1	0	1	1	0	46	1	1	0
surprised	0	1	0	2	1	0	1	0	44	1	0
shock	3	1	0	1	0	1	0	0	0	41	2
ejaculation	2	0	0	1	0	1	0	2	0	1	38

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