

## Dynamic Facial Expression Detection Using Eigen Face Algorithm

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### Abstract:

Human facial emotion recognition is one of the important topics of research nowadays to be used in human computer interface using facial recognition system. For recognising a human face, a facial expression system is dependent on some important variables such as orientation of face, colour of skin, posture, luminous intensity of environment etc. to detect a genuine facial expression. Recognition is basically done in following steps, firstly by sensing movement of eyes, nose, lips and head movement and after that it is followed by classifying the image using classifier by comparing the test image with the trained data with which is earlier fed into the system. Eigen face algorithm approach is used in this research for modeling human facial expression recognition system. This approach implements hue - saturation - value colour model to detect a face. PCA method is used for reducing high dimensionality eigen space. The test image is projected on eigenspace and a Euclidean distance is measured between the test images and mean value of trained image to get a final result. A set of greyscale images like surprise, sorrow, anger, happiness, fear etc is used to recognize by comparing to a test image and achieving a final result. The system used in this research is better in sense of precision and accuracy as compared to earlier ones. The rate of success of facial expression is higher than earlier method used in the following field.

**Keywords:** Detection, facial expression, recognition, eigenface.

### 1. INTRODUCTION:

It is very important for implementing the facial expression recognition system, it is also important to realize that there are many possible methods that exist to represent facial expression. These facial expressions can be represent using, pictures, video, cartoon, smiley, active action and facial characteristic points [1].

These images are showing the different types of facial expressions.



**Fig-1: 1.Happy, 2. Disgust, 3. Anger, 4. Sadness, 5. Neutral, 6. Surprise**

A human face carries a lot of important information while interacting to one another. In social interaction, the most

common communicative hint is given by one's facial expression. Mainly in psychology, the expressions of facial features have been largely considered. As per the study of Mehrabian, amongst the human communication, facial expressions comprises 55% of the message transmitted in comparison to the 7% of the communication information conveyed by linguistic language and 38% by paralanguage. This shows that the facial expression forms the major mode of interaction between the man and machine. Since for communicating the non-verbal messages the face forms the basis, the ability to read the facial emotions becomes an important part of emotional intelligence [2].

Automatic facial expression recognition (AFER) has essential real world applications. Its applications include, but are not limited to, human computer interaction (HCI), psychology and telecommunications. It remains a challenging problem and active research topic in computer vision, and many novel methods have been

proposed to tackle the automatic facial expression recognition problem. In recent years, dynamic facial expression recognition has become a new research topic and receives more and more attention. Different from the recognition problem in static images, the aim of dynamic facial expression recognition is to estimate facial expression type from an image sequence captured during physical facial expression process of a subject [5].

## 2. LITERATURE SURVEY:

### **Different Facial Expression Paper Based on PCA, Eigenface, Eigenvector and Atlas Construction**

D. Gautam et al. (2014)

Facial Expression Detection Using Implemented (PCA) Algorithm. The author implemented the facial expression recognition system using PCA (eigenfaces) analysis method. This method uses image database system for facilitating results by comparing it with prototype. Higher level of accuracy has been demonstrated in the experimental results of the following research paper.

Karen Das, Jeemoni Kalita et al.(2013)

Recognition of Facial Expression Using Eigenvector Based Distributed Features and Euclidean Distance Based Decision Making Technique. The previous work on Eigen face features considered the Eigen space of the whole face. In this paper, the objective was to amend the facial expression recognition system using the Eigenvector method, creating different Eigen subspace for a distinct expression. This method uses the trained images to compares with the test images and finding the euclidean distance between them to find the perfect result.

Vijay Kumar, Subham Sharma, Razz Verma, Manish Kumar Sharma et al. (2016)

Human Facial Expression Recognition using Principal Component Analysis. In this paper the authors are system implemented for the recognition of facial expression automatically. In this paper, first of all they extract the face region then extracted the features like lips, nose, eyes, and eye brow etc using PCA algorithm. Then the authors are calculate the Eigen vectors and compare with the real database as well as standard database. The experimental results show the accuracy of the system on different expressions using PCA(Eigenface) algorithm.

Saumil srivastava, et al. (2012)

Real time facial expression recognition using a novel method in this paper the author proposed Average frame processing time 120-150ms per 10 frames. It was observed that result was directly proportional to intensity of training provided. It was also observed that result was robust to pose variations; light intensity changes and is person independent model. Also the result was robust to background changes.

Anurag De, Ashim Saha, Dr. M.C Pal et al. (2015)

The authors made a approach towards the "Human Facial Expression Recognition Model based on Eigen Face Approach". This paper proposed to recognize various emotions are done by calculating the Euclidean distance between the input test image and the mean of the eigenfaces of the training dataset. The training dataset contains images of different people which gives good results but there exists a resemblance between some emotions some extent such as sorrow and fear which can be thought of as a future work for some improvisation through some more extensive training. The field of research in expression recognition is an area which can be further explored and improved.

Yimo Guo, Guoying Zhao et al. (2016)

The authors have used method named "Dynamic facial expression recognition with Atlas construction and Sparse representation". The authors have formulized a better way to tackle the problem of facial expression recognition. It is formulated as a longitudinal atlas construction and diffeomorphic image registration problem. In the paper, the author uses LDDMM registration algorithm. The LDDMM registration algorithm is used to design map, to manipulate and transfer information for providing a larger scope of results.

B.Fasel, Juergen Luetttin et al. (2002)

Automatic facial expression analysis. The author made a survey for their research and formulized a system that should work automatically to tackle changes human comes across periodic. The authors finds the great need to work on facial analysis system to work autonomously as well as it should be improved enough to tackle with natural and manual changes that comes across through human faces in daily life.

M.Pantic and I. Patras et al. (2006)

Dynamics of facial expression: Recognition of facial actions and their temporal segments form face profile image sequences. The authors try to make a new facial expression recognition method which depends on facial muscle action that produces expressions.

P. Viola and M.Jones et al. (2002)

Robust real-time object detection the authors in this method user rapid image processing to achieve high detection rate. This paper brings together new algorithms, representations, and insights which are quite generic and may well have broader application in computer vision and image processing.

M.Yeasin, B. Bullo and R. Sharma et al. (2004)

From facial expression to level of interests: A spatio-temporal approach. The authors in this paper performed a set of experiment with the proposed classification strategy and were tested on a number of data set with different lighting environments, subjects, and expressions. The authors are analysis of TV broadcast data. TV broadcast analysis and emotion elicitations were conducted. The main aim of the experiments was to understand the effects of a number of factors that are detrimental to the recognition of facial expression recognition using visual data. Emotion elicitation experiment was conducted on 21 subjects by showing the subjects six different clips of movies carefully chosen in a manner to arouse spontaneous emotional reactions that would produce natural facial expression.

S. Yang and B. Bhanu et al. (2011)

The concept proposed in this is Facial expression recognition using emotion avatar image. In this paper, the authors proposed a new concept of condensing a video sequence to be a single EAI representation. The authors adopted SIFT flow for aligning the face images which is able to compensate for large global motion and maintain facial feature motion detail. Then, an iterative algorithm is used to generate an Avatar reference face model onto which we align each face image. They feature extract the face from the raw data using the Viola and Jones face detector which achieved almost perfect results on GEMEP-FERA dataset.

T.Jeslin, R.Ravi et al. (2016)

Atlas construction and sparse representation method is used for the recognition of facial expression. The authors analyzed many experimental results and came to the conclusion that this system is capable of giving higher recognition rate which is enhanced by its 3D facial expression image recognizing feature. The SIFT and SURF algorithm can be used.

### 3. PROPOSED METHOD:

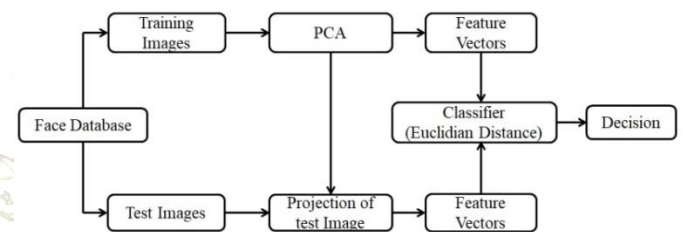


Fig-2: Block Diagram of Proposed System

### 5. CONCLUSION:

This system is automatically implemented for the recognition of the facial expression. In this method, first of all we extract the facial region in which some features are extracted such as lips, nose, eyes, and eyebrows etc using Eigenfaces algorithm. Then Eigen vectors are calculated and euclidean distance is compared with the trained images present in the real database as well as standard database. The experimental results show the higher accuracy of the system on different expressions using Eigenfaces algorithm as compared to other systems of research on the same field.

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