Facial Emotion Recognition of Human Facial Expression Classification

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ABSTRACT

Facial expression recognition has various prospective applications which have attracted the concentration of researchers in the last decade. Feature extraction is one of the most important steps in expression recognition which contributes toward fast and accurate expression recognition. Happy, surprise, normal, sad, anger facial expressions are of facial recognition. Facial expressions are most generally used for interpretation of human emotion. There is a range of different emotions in two categories: positive emotion and non-positive emotion. There are four types of generally using system: Facial detection, Facial extraction, Facial Classification and Facial recognition. Many methods have been used in the past to classify emotional facial expressions, such as Artificial Neural Networks, Bayesian Networks, Support Vector machines etc. In Existing system, facial features were extracted using higher order Zernike moments and the features were classified by an ANN based classifier. The facial expressions were classified into groups that represented either positive or non-positive emotion. The images in training section were not repeated in the testing section. It is not so much required to know the exact emotion of a person but a general explanation of the state of mind of the person is sufficient. In our proposed system, we will use PCA and geometric method for facial feature extraction and ANN classification. We will try to improve accuracy of facial expression.

Keyword – *Facial Recognition system, Viola-jones detector , PCA, Geometric Feature*

1. INTRODUCTION

Facial expressions are the facial changes in effect to a person's internal emotion states, intention, or social interactions. Facial expression investigation has been an active research topic for behavioral scientists. Facial expression investigation refers to computer systems that try to automatically investigate and identify facial movement and facial feature change from visual information. Occasionally the facial expression investigation has been confused with emotion investigation in the computer vision domain. For emotion investigation, higher level information is required. Computer facial expression analysis systems need to investigate the facial actions regardless of context, culture, gender, and so on [2].

Automatic facial expression investigation can be applied in many areas such as emotion and paralinguistic interactions, medical psychology, psychotherapy, neurology, lie detection, intelligent environments, and multi modal human computer communication. The computer-based identification of facial expression has received a lot of concentration in recent years because the investigation of facial expression or behaviour would be beneficial for different fields such as lawyers, the police, and security agents, who are interested in issues concerning dishonesty and attitude [2].

Facial expression is one of the most powerful, natural criteria for human beings to communicate their emotion and intention. To recognize facial expression author extract facial features of facial organs such eyes, and mouth and recognize the particular expressions From changes in their shape or their geometrical features. Different classifier

for classify the expression of supplied face into 7 basic categorized like disgust, fear, surprise, neutral, sad, happy and angry. Recently many researchers focus their research work in emotion recognition field, because if computer are able to interact with human being in proper way it is very valuable in different field. Human communication has two main aspects; verbal and non-verbal. Facial expression, body motion and physiological reaction are the unit of non-verbal communication [3].

Happy Angry Normal Sad Surprise

Figure 1: Facial Expression

1.1 Types of Facial Expression

1.1.1 Anger: Anger is an expression related to one's psychological interpretation of having been offended, wronged or denied and a tendency to undo that by retaliation. Ekman and Friesen claimed that anger is very likely the most dangerous emotion. When people are angry, they hurt others purposefully. However, according to Lazarus, although anger is commonly classified as negative expression, people often report reaction good about their anger. On the other hand, he added that when anger is acted out, it can have dangerous public or physiological consequences, mainly when it is not managed [2].

1.1.2 Disgust: Disgust is a feeling of dislike and is the expression of dislike and prevention of anything that makes one sick. People can feel disgust from any taste, a smell, a sight, a touch or a sound or even a plan. Disgust usually involves getting-rid-off and getting-away from responses [2].

1.1.3 Fear: Fear is the expression of anticipated danger, psychological or physical spoil. Fear renders a mode of readiness to survive with danger. Thus, it promotes awareness for the feared occasion that can be a fantastic or genuine [2].

1.1.4. Happy: Happy is the expression that most people want to experience. Defined happiness as the emotion or mood of achieving sub goals and of being engaged in that one is doing. It is used mostly synonymous with the excitement and pleasure. However, Excitement is defined as the reverse of tediousness. Excitement and pleasure are different experiences, which often involve happiness. Pleasure is defined as a product of positive physical sensations that is reverse of the physical sensation of pain [2].

1.1.5 Sad: There are many words to explain sad feelings: despairing, distraught, disappointed, dejected, blue, depressed, grieved, helpless, miserable, and sorrowful. According to Oatley and Jenkins, sadness can be explained simply as the expression of losing a goal or social role. As compared with fear that looks toward future, sadness seems to look toward the past. Sadness is rarely a brief and passive reaction that includes mostly disappointment and hopefulness. It is one of the long-lasting expressions [2].

1.1.6 Surprise: Surprise is a brief expression state experienced as the outcome of a suddenly event. Surprise can have any valence; that is, it can be neutral or reasonable, satisfying, or unlikeable. If a person experiences a most powerful or long lasting surprise, it may be considered shock [2].

Existing System: Many methods have been used in the past to classify emotional facial expressions, such as Artificial Neural Networks, Bayesian Networks, Support Vector machines, Optical Flow etc. In 2015, Murari Mandal et al. proposed a method to classify facial expression in two classes using the Zernike moments. The proposed system consists of two parts: facial feature extraction and facial expression classification. The facial features were extracted using higher order Zernike moments and the features were classified by an ANN based classifier. The facial expressions were classified into groups that represented either positive or non-positive emotion. The system was tested on Cohn-Kanade (CK) dataset and 69% accuracy was achieved. The image in training section were not repeated in the testing section. It is not so much required to know the exact emotion of a person but a general explanation of the state of mind of the person is sufficient [1].

3. SYSTEM INFRASTRUCTURE

In Our proposed system, the first module, the image of the face will be taken as input. Then the pre-processing step is performed to make the image data more usable for the methodology. The image pre-processing steps in our study includes, frame based images, face detection, intensity normalization of the image and making all the images uniform in size and shape. The images with maximum arousal of emotion intensity were selected by manual inspection. After the pre-processing of the image, the facial features were extracted from the image using the Hybrid Feature. In Hybrid Feature, extract eye, nose and mouth. Which has highest efficiency in facial expression classification. The Hybrid Feature have been calculated and facial expression recognition systems where the expressions are classified to represent emotions, here we are classifying the facial expression dataset to represent two broad categories of positive emotion and non-positive emotion. After extracting the Hybrid Feature, the classification was performed by using ANN. The features are fed into the neural network to train and then identify the positive and non-positive expressions for non-labeled data.

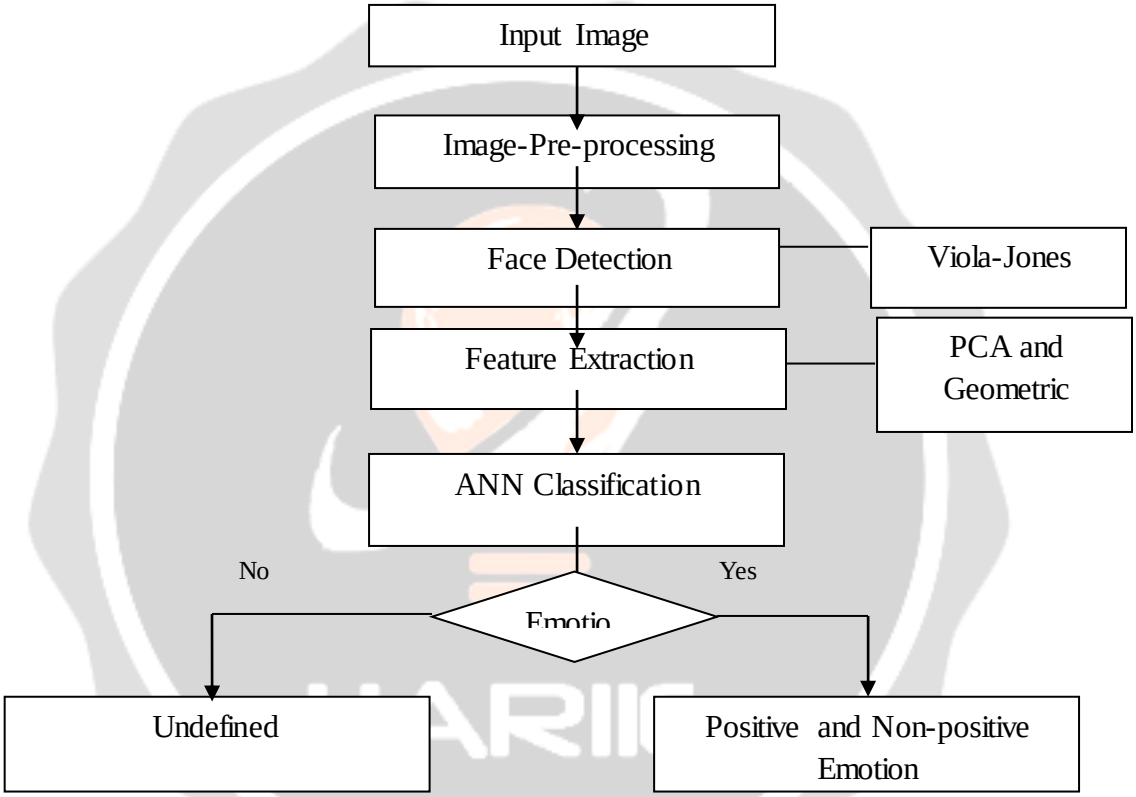


Figure 2 : Proposed System

3.1 Face Detection

The Viola-Jones detector is famous face detector that has found its use in many applications that involve face detection. It performs much good considering both accuracy and speed needed for real-time processing. The facial feature extractor described which implements several features of Viola-Jones detector, also performs the work of face detection much better [4]. The Viola–Jones object detection structure is the first object detection structure to provide competitive object detection rates in real-time Paul Viola and Michael Jones. Even though it can be trained to detect a mixture of object classes, it was encouraged mostly by the problem of face detection. This face detection framework is capable of processing images extremely rapidly while achieving higher detection rates. There are three key assistance [5]: The first is the introduction of a new image illustration called the ―Integral Image which allows the features used by our detector to be computed very quickly. The second is an easy and efficient classifier which is built using the Adaboost learning algorithm to select a small number of critical visual features from a very large set of potential features. The third contribution is a process for combining classifiers in a ―cascade which allows background regions of the image to be quickly discarded while spending more computation on promising face-like regions.

3.2 Principle Component Analysis

Principle component analysis is a standard statistical method used for facial expression recognition and mostly used for facial feature extraction. Principle component analysis is dimensionality reduction techniques which are used for compression and face recognition problem. PCA calculates the eigen vectors of the covariance matrix, and projects the original data onto a lower dimensional feature gap, which is defined by eigen vectors with largest eigen values. PCA has been used in face presentation and identification where the eigen vectors calculated are referred to as eigen faces.PCA is a valuable statistical technique that has found application in fields such as face recognition and image compression, and is a general technique for finding patterns in data of higher dimension. It is one of the most powerful techniques of face recognition. The goal of PCA is to decrease the dimensionality of the data while retaining as more information (but no redundancy) as possible in the original dataset. By using PCA Reduced the difficulty in face image [7].Noise reduction since maximum difference basis is chosen and so the small difference in the back-ground are ignored automatically [7].2D PCA is that the feature vector is now two-dimensional so the problem of dimensionality is very much reduced.

3.3 Geometric Feature based Method

Geometrical feature matching methods are based on the calculation of a set of geometrical features from the picture of a face. The whole configuration can be described by a vector which presenting the position and size of the main facial features like eyes and eyebrows, nose, mouth, and an outline of face [6].

Bounding box locations of feature segments obtained using steps in are used to compute the height and width of left eyebrow, height and width of left eye, height and width of right eyebrow, height and width of right eye, height and width of nose and height and width of mouth. Distance between centre of left eye and eyebrow, right eye and eyebrow and mouth and nose is also calculated [8].

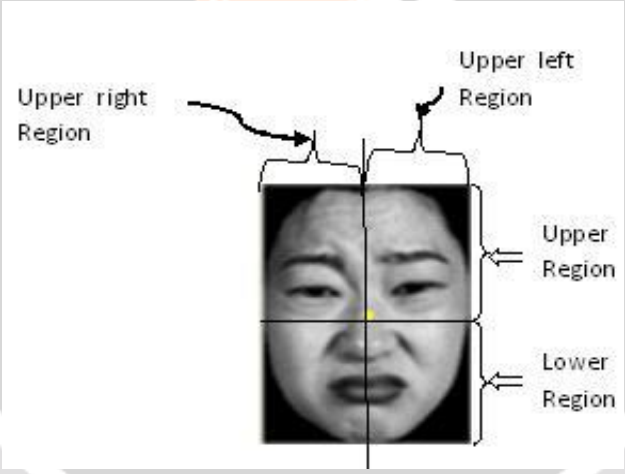


Figure 3 : Geometry for extracting facial feature segments[8]

3.4 Artificial Neural Network

Artificial Neural Networks (ANN) are statistical learning algorithms which is one of the most effective ways for performing pattern recognition and data classification. They consist of interconnected neurons where each unit takes an input, applies a function (often non-linear) to it and then passes the output [1].

An Artificial Neural Network (ANN) is a mathematical model that tries to simulate the structure and functionalities of biological neural networks. Basic building block of every artificial neural network is artificial neuron, that is, a simple mathematical model (function). Such a model has three simple sets of rules: multiplication, summation and activation. At the entrance of artificial neuron the inputs are weighted what means that every input value is multiplied with individual weight. In the middle section of artificial neuron is sum function that sums all weighted inputs and bias. At the exit of artificial neuron the sum of previously weighted inputs and bias is passing trough activation function that is also called transfer function[9].

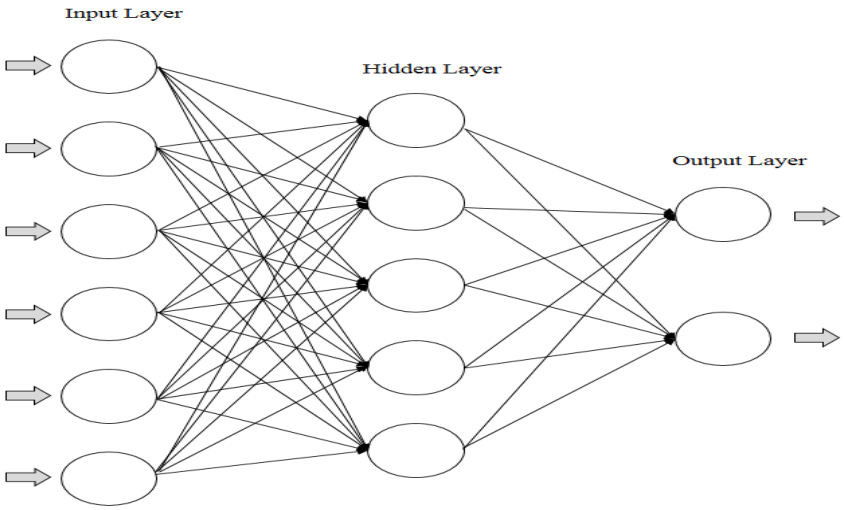


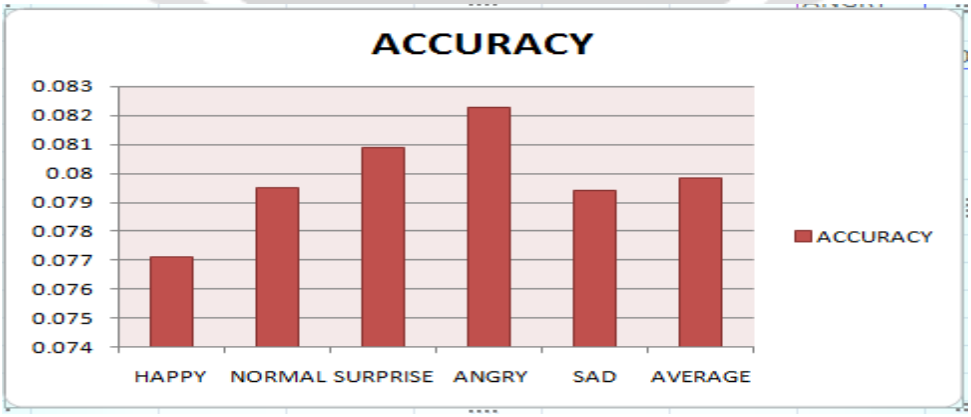
Figure 4 : Artificial Neural Network [1]

3.5 Dataset

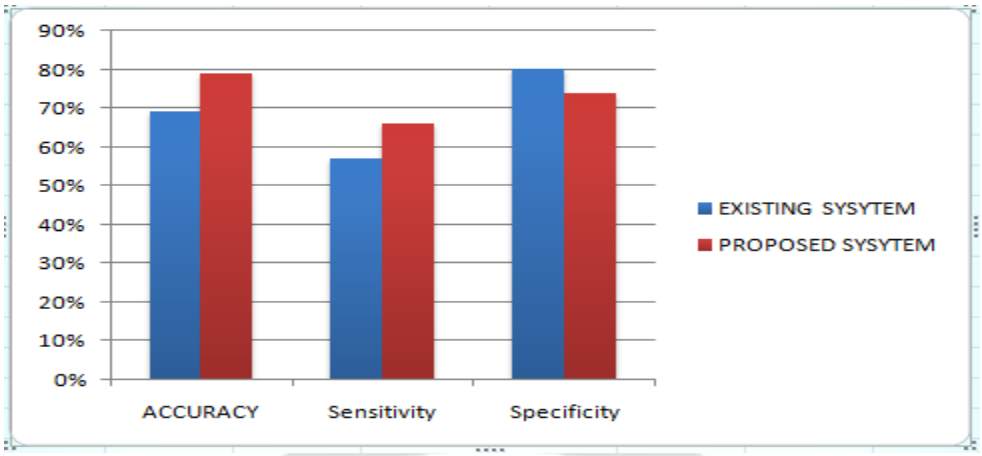
A database of facial expression images was collected. Six expressions posed 3 or 4 examples of each of the six basic facial expressions happiness, sadness, surprise, anger and a normal face for a several images of facial expressions. For simplicity of experimental design only Japanese female expressions . Fig. 1 shows the apparatus used to photograph the expressions. Each expression took pictures of her self while looking through a semi-reflective plastic sheet towards the camera. Hair was tied away from the face to expose all expressive zones of the face. Tungsten lights were positioned to create even illumination on the face. A box enclosed the region between camera and plastic sheet to reduce back-reflection. The images were printed in monochrome and digitized using a flatbed scanner. Sample images are shown in Fig. 1.

4. EXPERIMENTAL RESULTS AND DISCUSSION

The facial expression classification system was trained and tested with the JAFFE dataset .image pre-processing techniques was applied on the dataset images and the final output of this phase is used to compute the pca and geometric feature based method. After computing the pca and geometric feature of an image, these moments were used as a feature vector for the ANN based classification system.



Comparison between Existing system and Proposed system



4. CONCLUSIONS

This paper deals with using PCA and geometric feature based method in face expression recognition and gives the detailed comparisons with Zernike moment features .Experimental results show that the PCA ad geometric features perform better in recognition rate than Zernike moment.

5. ACKNOWLEDGEMENT

I wish to warmly thank my guide, Assist Prof. Mr. Dipak L. Agrawal for all his diligence, guidance, encouragement and help throughout the period of research, which have enabled me to complete the research work. His constant inspiration and encouragement along with his valuable guidance has been instrumental in the successful completion of this research. He has always been willingly present whenever I needed the slightest support from him. I also thank his for the time that he spared for me, from his extreme busy schedule.

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