A Method for the Analysis of Facial Expressions using Machine Learning Algorithms

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Abstract— The interaction between human and machine systems have thrived a great importance in understanding the emotions and extracting them. Emotional analysis statement has a complication with large number of input features and varying human expressions, which needs classification of compact number of similar features using classification algorithm. Automatic facial recognition.may sometimes act as an element for natural human interface machines. Various techniques have been proposed to perform emotional analysis which shown a great progress in success in adopting the algorithms and methods. This paper provides a survey on the different algorithms and techniques emphasized for emotional analysis.

I. INTRODUCTION

Facial expressions are the natural methods to deliver social information without the use of words among humans. There has been a constant research on Facial Expression Recognition to enable the systems to utilize the emotive details for human-machine interaction. The visible proof of intent, psychology of a person is the facial expression which plays a huge consideration in communication of human to human, human to machine. Smart machines like robots or computers could concede these expressions, hence analyse a person. Human beings instinctively use facial expressions as a significant method to deliver message and interchange emotions. In the educational process of higher vocational college of higher vocations, information technology helps to extracting data of emotional intelligence, and analysing it, this will play a crucial part in improving education process.

II. BACKGROUND ANALYSIS

Recognition of facial expression and analysing the emotions by machines has been a great challenge for days and years. Whereas, humans can recognize emotions with no effort and significant delay. Different techniques used for recognition of expressive faces are:

i)Method based on Zernike movements[1]:

Zernike movements have been proposed by this paper which is invariant facial expression recognition with noise and rotation . To the Naive Bayesian classifier features extracted from Zernike movements are given as input for facial expression recognition. Moments of Zernike are used to achieve and retrieve the invariance in rotation..

Recognition time is found to be less than 2 seconds for frontal face image. Rotation official images has lead to the damage emotion recognition system.

ii)Method based on correction that includes illumination automatically[2]:

Facial expressions of face are identified by localizing points known as Action Unit (AU's) were used to determine the facial expressions. The skin & chrominance of the extracted image are used to recognize face. Mapping of extracted eyes and mouth are done by using mapping technique. Pixels of both skin and non-skin types of face are segregated face from the background by using Haar-Cascaded method.It is based on multiplied recognition of face image. The benefits are: Single ,multiplied detection system of face.Disadvantage that includes illumination is removed and corrected by consistency algorithm of color.. The drawbacks are found to be :60% rate of recognition is found in face images that includes multiple samples. It requires higher accuracy as it suffers from lighting system which is not efficient.

iii) Social Robot emotional recognition[3]:

Identification is done prior to emotion classification to identify the personalized facial emotions. This paper has made an approach to find hybrid facial configuration. It involves Active Space and Appearance models. Face detection of face is done by face tracker.. Texture data includes vectors to elaborate 3D model of face.

The advantges include : Identification and earlier knowledge of subject enhances quality, speed of classification thus increases performance. And 82% rate of recognition is achieved with social robot that consists of different lighting conditions, positions, orientations of face. Training is required prior to application of emotion recognition in social robot..

iv)Emotion analysis system using E-learning[4]:

Adoost algorithm based on Support Vector Machine classifier is determined for locating human face. This extracts features as strong and weak classifier.

This is an iterative weight updating process which can be used in network teaching system. The measured distance between camera and face shows impact on face recognition. Effects of performance in emotion recognition include regional impacts such as like- Hear, Sitting postures, Light strength.

v) Interactive System used for cognitive analysis of TV viewers[5]:

Emotions of members watching TV Program are recognized by method proposed by this paper. Emotion of particular TV viewer and internal state are identified using face expression. In Ada-LDA technique for recognition, 15 frames per second are operated. This paper proposed novel architecture for future interactive TV. Real time emotion recognition system is emphasized in proposed work.

vi) Optical flow Technique for detecting motion[6]:

Localizing facial features in approximate manner is found to be hard. To do this, active Infra-Red illumination can be used. Vector collection is done by source vector that depicts motion, deformation caused by emotional representation. Source vector, execution motion vector is taken to classify emotions. High degree similarity could be estimated as the required emotion. Three to four f image frames are enough for detecting facial expression. Exact facial feature locations are not necessarily to be identified. The approximate locations are foun to be sufficient. "Fear" emotion rate is less than other emotions.

III. RESEARCH METHODOLOGY

DATA MINING FOR EMOTIONAL ANALYSIS

The emotional intelligence combined with data mining provides the basis for novel methods in advance. The most efficient methods among data mining techniques is the K-means clustering algorithm. When larger samples are involved in clustering and categorizing the emotions, K-means clustering has greater importance since it consumes less memory and it's simple and has extended flexibility. The parameters of K-means clustering has efficient role. Those parameters are error criterion function, clusters, cluster seeds and samples. When clustering was experimented with students of a university, five various capacities of students such as regulation, expressiveness, resilience, evaluation were indentified. Based on these the students were categorized under different types. The types were balanced types students, adaptive types of students, students with weak mind but strong adaptive, strong assessment type, weak awareness type. Data mining technology to has shown an emphasized importance in finding required information in large quantities of data. People have drawn number of achievements in multiple fields. But with data mining techniques and emotional intelligence theory of emotional analysis which helps in analysing the situation of vocational students is still an attempt to break the theoretical records so far.

EMOTIONAL ANALYSIS USING BEIZER CURVE FITTING

Various ways have been proposed to display the human emotions. But facial expressions have been found to be the most natural way to display or depict the emotional analysis. This implementation is done as automatic segmentation of still image input, facial expression recognition using colour-based feature and classification with simple curve. It involves two major steps: one is a analysis and detection of original facial area input image, and the other one is a characteristic verification of the facial emotion. After acquiring the region of interest, we extract the feature map points to apply Bezier curve on mouth as well as eyes. Then, by training the difference of Hausdorff distance is done next to recognition of facial emotion performance. Bezier curve is deduced among images of faces in the database. Normalization of face images is done with some parameters. The Bezier points are depicted over the principal lines of characteristic features of faces. The adjacent curve segments are formed by these Beizer points. The curve segments help in calculating Hausdroff. Then the decision of facial emotion with clear understanding is chosen by measuring similarity in faces. The success ratio was 60%, which has proved as good performance and extendible to mobile devices.

FEATURE ANALYSIS IN EMOTIONAL SPEECH

Emotions and feelings are also a part of human language. An impression taken from a sentence may differ according to the different emotions. Thus efficient processing of emotion signals is done using Artificial Intelligence, Signal Processing. Joy, worry, shock and anguish are four signals.Constructing these features along with amplitude, frequency, time, and formant are determined. Further performances were compared with the emotionless speech signals. A regular pattern was obtained in respect to distribution of signals. Emotion features are determined and represented using changing speech melody. Each main element concur to each value of character. These values are arranged from high to low. The main element is named the first, so on respectively. The vectors are said to be base vector in correspondence to main element. Base vectors are obtained by training of main elements. This tends choose the main elements, used for recognition.. The average values and standard values of main elements provide types of emotions. Two factors are taken into consideration while choosing sentence: First, sentence with emotional preferences; second, sentence with increased emotional freedom degree. The results found all kinds of emotions comparing and analyzing.

COMPREHENSIVE EMOTIONAL THEORY FOR EMOTION RECOGNITION

Recent researches of science and neuro-biology have proved the inter-dependability of emotion and science. They affect each other with many complications of internal links. Researchers have come to conclusion to be known it is to propose an important idea to relate the relationship between cognition and emotion. This work defines a set of the priori, posterior, obtained emotion, expected, exported, human emotion interaction.

Comprehensive emotional theory is emphasized to be the base of a affective interaction mechanism. Cognitive construction has been the reference of the existing information.. And when compared with experience,judgement of object's property is in the existing cognitive storage. "New knowledge experience" are also added cognitive storage. This work has lead to the absorption such as emotional motivation information. They defined the main parts of the priori, posterior, expected, interactive, information, emotion, and, deduced the interaction mechanism. It still needs improvements and feedbacks to get improved performance.

IV. PROPOSED WORK

Ekman,Friesen developed Facial Action Coding System. It is the most optimized method for describing facial behavior.The basic six emotions such as happiness, sadness, disgusting,fear, shock, and anguish have been analyzed by their method. It is a system developed that has found to enabling standardized coding of changing emotional faces. This proposed system consists of 46 units of action of which 41 are directly associated with movement of eyes, eyebrows and mouth. They depict basic facial movements. The muscle activity corresponds in detail to each face features., To extract the most important 30 FCP"s template matching mechanism that matches the eyes is applied. It also matches eyebrows and mouth template. The 30 FCPs are taken into consideration for computing the position and shape of the different components of the face, such as, eyes, eyebrows and mouth. These FCPs compute the different parameters and are inputted in the decision tree algorithm, used for recognizing different facial expressions.

V. EXPERIMENTAL METHODOLOGY

(i)Feature Extraction Using Template Matching

Feature extraction is the process of extracting important attribute which are used to classify the images into different classes. Template matching is being carried out by making use of convolution and correlation coefficients for the highest and perfect matching.

(ii)Extracting The Facial Characteristic Points

The rectangles around the matched template deduces the value of top-left corner pixel from the rectangles.Width and height of the template size specified in computation of all the 30 FCPs. These pixel values is used to evaluate the facial animation parameters.

(iii)Computation Of Facial Animation Parameter

The facial animation parameters are evaluated as
(i)Openness of eyes:
$((fc7\_y - fc5\_y) + (fc8\_y - fc6\_y))/2$
(ii)Width of eyes:
$((fc1\_x - fc3\_x) + (fc4\_x - fc2\_x))/2$
(iii)Height of eyebrows:
$((fc19\_y - fc1\_y) + (fc20\_y - fc2\_y))/2$
(iv)Opening of mouth: $(fc26\_y - fc25\_y)$
(v)Width of mouth: $(fc24\_y - fc23\_y)$
where, fc1_x, fc2_x, fc3_x, fc4_x, fc7_y, fc5_y, fc8_y, fc6_y are the x, y coordinate position of the FCP. Deriving

these facial parameters from FCP's, labelling is done in an efficient manner.

(iv) Classification using Gini Index

It is a classification techniquethat works as the decision tree. The tree is formed ,best attributes are opted for efficient split. The formed tree is further converted in IF- Then rule to predict the dataset and text the data.
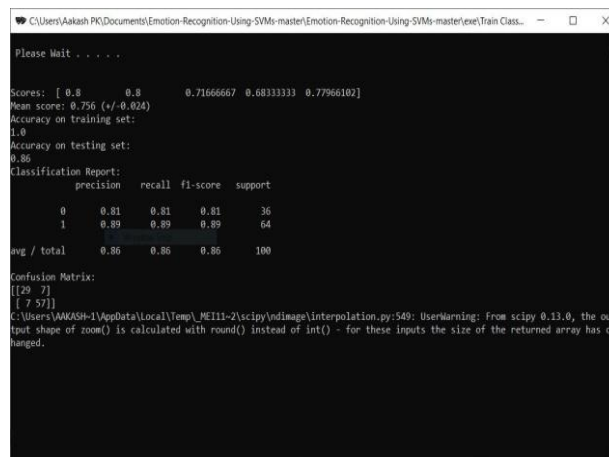
VI. EXPERIMENTAL RESULTS

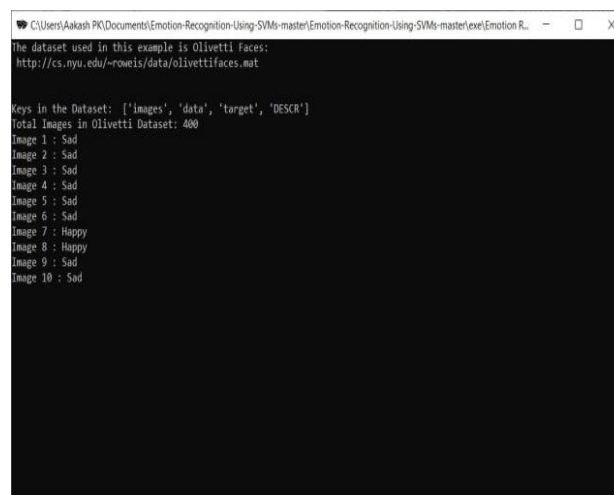**Figure (1) The training report which classifies the action units- facial animation parameter.**

Figure (2) Emotional analytic output of different images in the database.

Emotional detection is done by recognizing face and producing the split of face indexes. Analytic emotion is detected by classifying action points using Gini Index. And using IF-Then rule the particular split is matched with the dataset which gives the required output.

VII. CONCLUSION

Various technologies with different methods and algorithms have been proposed and implemented to perform emotional analysis.

Emotional analysis from facial expression recognition plays an effective and important role in information technology to develop the intelligence theory to improve educational discipline among students. Extracting information from the emotional data and analysing it for various purposes has always been a great challenge. But scientists and technologists have paved way for it by performing research and helped in finding various method to perform this analysis and has lead to another success in the field of technology. In this paper, data mining is used with Gini index to recognize the perfect emotion.80.9% of accuracy is shown in the experiment. Which recognizes the correct image. In future the accuracy of algorithm can be improved by performing more training experiments.

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