iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** VII **Month of publication:** July 2019

DOI: http://doi.org/10.22214/ijraset.2019.7006

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue VI, June 2019- Available at www.ijraset.com

Expression Recognition using Neural Network

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Abstract: ***A facial expression is a gesture created by the facial muscles that can convey human emotions. Facial expression recognition system is used to recognize different emotions of a face. A facial expression is exhibited by the movement of muscles underneath the face skin. Facial expression Recognition comprises of three main phases viz. face detection using Haar classifier, feature Selection using Local Binary Pattern algorithm and Expression Classification using Support Vector Machines. The image files for training are stored in the form of pixels in CSV file and are then converted by the algorithm to form images which subsequently decreases the size of the training data set. The proposed system predicts various emotions from a single image rather than predicting only one kind of emotion as done by the existing systems. Training of the system is done using the neural network.***

Keywords: Include at least 5 keywords or phrases

I. INTRODUCTION

A facial expression is the visible manifestation of the affective state, cognitive activity, intention, personality and psychopathology of a person and plays a communicative role in interpersonal relations. Though so much work has been carried out in this area from a long period of time, but it's obtaining progress in the recent decades. The process of recognizing facial expression with a high accuracy remains to be difficult due to the complexity and varieties of facial expressions. Generally human beings can convey intentions and emotions through nonverbal ways such as gestures, facial expressions and involuntary languages. This system can be significantly useful, nonverbal way for people to communicate with each other. The important thing is how fluently the system detects or extracts the facial expression from image. The system is growing attention because this could be widely used in many fields like lie detection, medical assessment and human computer interface.

II. RELATED WORK

Research in the fields of face detection and tracking has been very active and there is exhaustive literature available on the same. The major challenge that the researchers face is the non-availability of spontaneous expression data [1]. Capturing spontaneous expressions on images and video is one of the biggest challenges ahead[2]. Many attempts have been made to recognize facial expressions. Zhang et al investigated two types of features, the geometry-based features and Gabor wavelets based features, for facial expression recognition.

Appearance based methods, feature invariant methods, knowledge based methods, Template based methods are the face detection strategies whereas Local Binary Pattern phase correlation, Haar classifier, AdaBoost, Gabor Wavelet are the expression detection strategies in related field [3]. Face reader is the premier for automatic analysis of facial expression recognition and Emotient, Affectiva, Karios etc are some of the API's for expression recognition. Automatic facial expression recognition includes two vital aspects: facial feature representation and classifier problem [2]. Facial feature representation is to extract a set of appropriate features from original face images for describing faces. Histogram of Oriented Gradient (HOG), SIFT, Gabbor Fitters and Local Binary Pattern (LBP) are the algorithms used for facial feature representation [3,4]. LBP is a simple yet very efficient texture operator which labels the pixels of an image by thresholding the neighborhood of each pixel and considers the result as a binary number. The operator labels the pixels of an image by thresholding the 3X3 neighborhood of each pixel with the center value and considering the result as a binary number [3]. HOG was first proposed by Dalal and Triggs in 2005. HOG numerates the appearance of gradient orientation in a local path of an image. For classifier problem we use algorithms like Machine learning, Neural Network, Support Vector Machine, Deep learning, Naive Bayes. The formation of histogram by using any of facial feature representation will use NN for expression recognition. NN builds a hyperplane to separate the high dimensional space. An ideal separation is achieved when the distance between the hyper plane and the training data of any class is the largest [4].

The size of the block for the LBP feature extraction is chosen for higher recognition accuracy. The testing results indicate that by using LBP features facial expressions recognition accuracy is more than 97%. The block LBP histogram features extract local as well as global features of face image resulting higher accuracy. LBP is compatible with various classifiers, filters etc. [3].

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Volume 7 Issue VI, June 2019- Available at www.ijraset.com

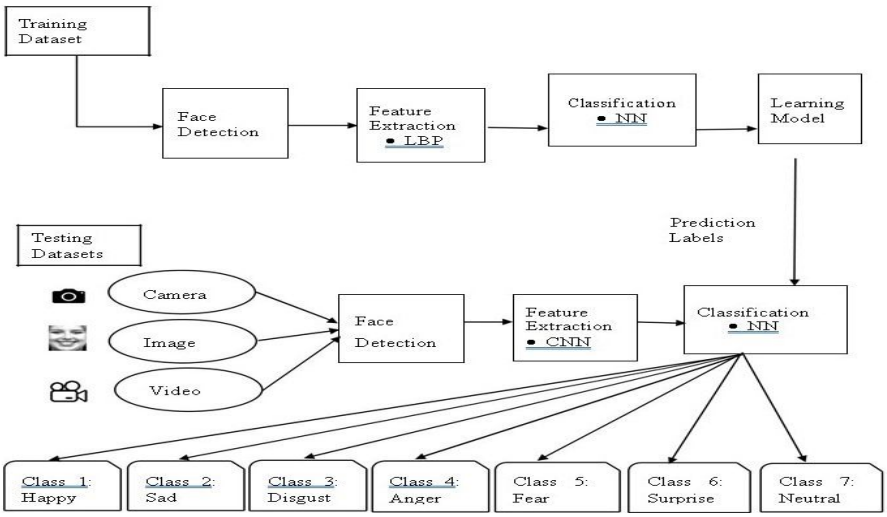


Fig. 1 System Diagram

III.PROPOSED SYSTEM

The proposed system is used to recognize different emotions of a face. Facial Expression Recognition comprises of three main phases as shown in Fig 1. They are face detection using Haar classifier, feature Selection using Local Binary Pattern algorithm and Expression Classification using Support Vector Machines. In the proposed system image files are given for training the system. The image files are stored in the form of pixels in CSV file and are then converted by the algorithm to form images which subsequently decreases the size of the training data set. The proposed system predicts various emotions from an image rather than predicting only one kind of emotion as done by the existing systems. Training of the system is done using the neural network. Support vector machine approach is used to classify various emotions from an image.

The both training and evaluation operations would be handled with FER 2013 dataset. Compressed version of the dataset takes 92 MB space whereas uncompressed version takes 295 MB space. There are 70K training and 30K testing images in the dataset. Each image was stored as 48×48 pixel. The pure dataset consists of image pixels (48×48=2304 values), emotion of each image and usage type (as train or test instance).The eight expressions are angry, surprise, contempt, fear, happy, sad, disgust and neutral.

A. Face Detection

Face Detection is useful in detection of facial image. Face Detection is carried out in training dataset using Haar classifier called Voila-Jones face detector and implemented through OpenCV. Haar like features encodes the difference in average intensity in different parts of the image and consists of black and white connected rectangles in which the value of the feature is the difference of sum of pixel values in black and white regions.

B. Feature Extraction

Selection of the feature vector is the most important part in a pattern classification problem. The image of face after pre-processing is then used for extracting the important features. The inherent problems related to image classification include the scale, pose, translation and variations in illumination level . The important features are extracted using LBP algorithm.

LBP is the feature extraction technique. The original LBP operator points the pixels of an image with decimal numbers, which are called LBPs or LBP codes that encode the local structure around each pixel. Each pixel is compared with its eight neighbours in a 3 X 3 neighbourhood by subtracting the center pixel value. In the result, negative values are encoded with 0 and the others with 1. For each given pixel, a binary number is obtained by merging all these binary values in a clockwise direction, which starts from the one of its top-left neighbour. The corresponding decimal value of the generated binary number is then used for labelling the given pixel. The derived binary numbers are referred to be the LBPs or LBP codes.

C. Classification

The dimensionality of data obtained from the feature extraction method is very high so it is reduced using classification. Features should take different values for objects belonging to different class so classification will be done using Support Vector Machine algorithm.

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IV. RESULTS

The proposed system predicts eight different facial expressions as shown in fig 2.



Fig. 2 Representation of various emotions predicted by the proposed system

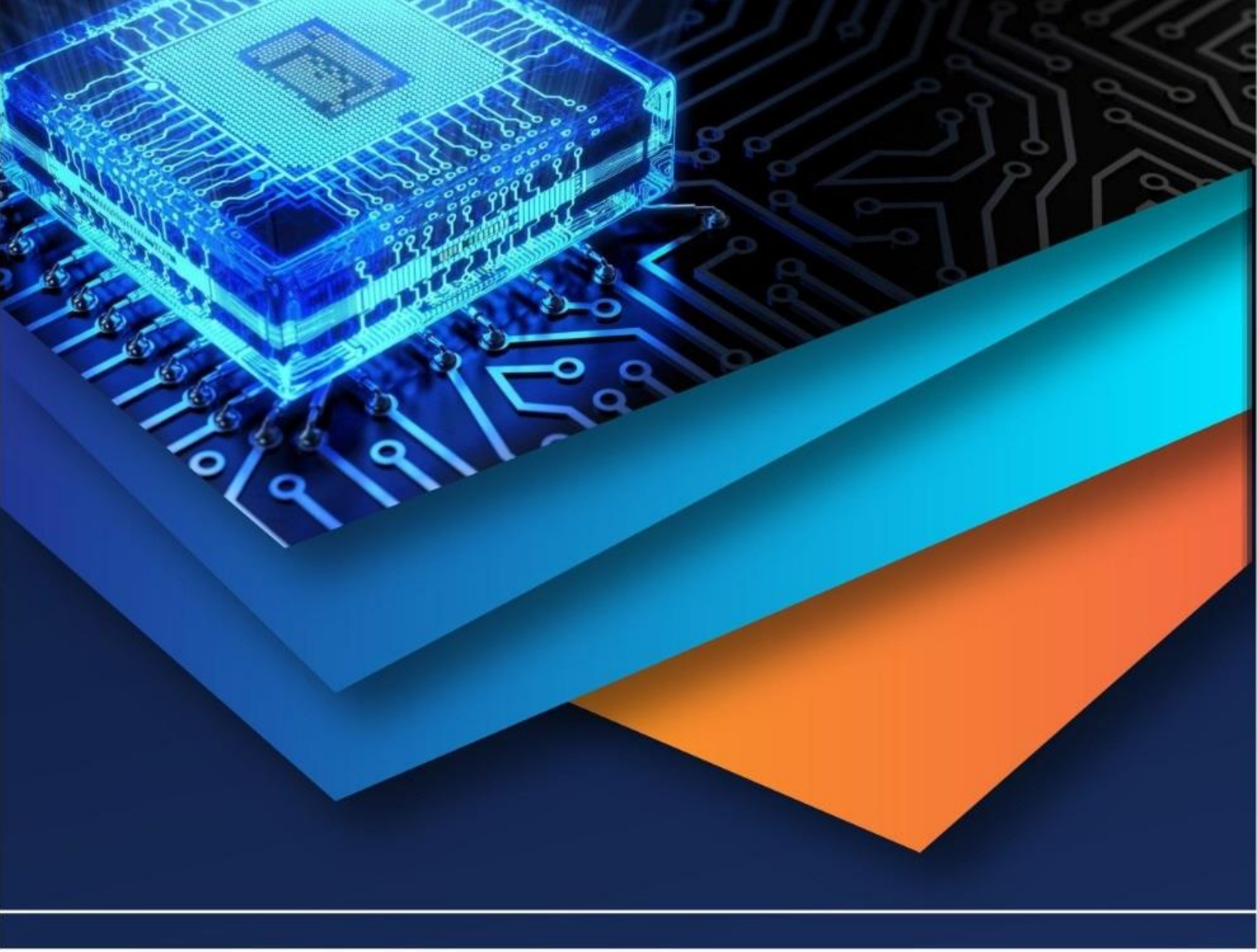
V. CONCLUSION AND FUTURE WORK

This work proposes an approach for recognizing the category of facial expressions. Face Detection and Extraction of expressions from facial images is useful in many applications, such as robotics vision, video surveillance, digital cameras, security and human-computer interaction. The objective of the work was to develop a facial expression recognition system implementing the computer vision and enhancing the advanced feature extraction and classification in facial expression recognition. In future, more work need to be carried out in the area of spontaneous expression recognition to develop more accurate systems.

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