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REVIEW ON LITERATURE SURVEY ON FACE DETECTION AND EMOTION RECOGNITION

[1]Dr. Vandana S Bhat, [2]Dhanya M, [3]Shrinidhi Joshi, [4]Kavya M Hiregoudar [5]Nandita V Hiremath

[1]Assistant Professor, [2]Student, [3]Student,[4]Student[5]Student

[1]Information Science and Engineering,

[1]SDM College of Engineering and Technology, Dharwad, India

Abstract: Facial expression recognition or computer-based facial expression recognition system is important because of its ability to mimic human coding skills. Facial expressions and other gestures convey nonverbal communication cues that play an important role in interpersonal relations. These cues complement speech by helping the listener to interpret the intended meaning of spoken words. Therefore, facial expression recognition, because it extracts and analyses information from an image or video feed, it is able to deliver unfiltered, unbiased emotional responses as data. Different approaches i.e., Haar cascade, VGG-16 CNN Model, OpenCV, *Viola Jones* etc. are studied in this paper to conclude which paper is feasible. Face Detection is the first and essential step for face recognition, and it is used to detect faces in the images. It is a part of object detection and can use in many areas such as security, bio-metrics, law enforcement, entertainment, personal safety, etc.

IndexTerms **- Viola Jones, OpenCV, Haar cascade Convolutional Neural Network, VGG – 16 Model.**

I. INTRODUCTION

Emotions are expressed when interacting and socializing with other people. Studying how to read them can be a tough task, so technology is used to do that job. Emotion recognition is one of the many facial recognition technologies that have developed and grown through the years. Currently, facial emotion recognition software is used to allow a certain program to examine and process the expressions on a human's face. Using advanced image dispensation, this software functions like a human brain that makes it capable of recognizing emotions too.

It is AI or "Artificial Intelligence" that detects and studies different facial expressions to use them with additional information presented to them. This is useful for a variety of purposes, including investigations and interviews, and allows authorities to detect the emotions of a person with just the use of technology. Many face detection methods are very similar to face recognition algorithms. An algorithm could belong to two or more categories. This classification can be as follows:

Appearance-Based Methods: - The appearance-based method depends on a set of delegate training face images to find out face models. The appearance-based approach is better than other ways of performance. In general appearance-based method rely on techniques from statistical analysis and machine learning to find the relevant characteristics of face images. This method also used in feature extraction for face recognition.

Feature-Based: -The feature-based method is to locate faces by extracting structural features of the face. It is first trained as a classifier and then used to differentiate between facial and non-facial regions. The idea is to overcome the limits of our instinctive knowledge of faces. This approach divided into several steps and even photos with many faces they report a success rate of 94%.

II. LITERATURE SURVEY

1.A. Jaiswal, A. Krishnama Raju and S. Deb, "Facial Emotion Detection Using Deep Learning," 2020 International Conference for Emerging Technology (INCET), 2020.

In emotion detection we are using three steps, i.e., face detection, features extraction and emotion classification using deep learning with our proposed model which gives better result than previous model. In the proposed method, computation time reduces, validation accuracy increases and loss accuracy decreases, and further performance evaluation achieved which compares our model with previous existing model. We tested our neural network architectures on FERC-2013 and JAFFE database which contains seven primary emotions like sad, fear, happiness, angry, neutral, surprised, disgust. It is clearly

observable that neutral has higher proportion than other emotions and easy way to comply with the conference paper formatting requirements is to use this document as a template and simply type your text into it. That means, the emotion detected for this image is neutral. Similarly, show another image and corresponding emotion proportions. From it is observable that happy emotion has higher proportion than others. That suggests that image of detects happy emotions.

ALGORITHMS

In this paper we use the deep learning (DL) open library "Keras" provided by Google for facial emotion detection, by applying robust CNN to image recognition [12]. We used two different datasets and trained with our proposed network and evaluate its validation accuracy and loss accuracy. Images extracted from given dataset which have facial expressions for seven emotions, and we detected expressions by means of an emotion model created by a CNN using deep learning. We have changed a few steps in CNN as compared to previous method using a keras library given by Google and also modified CNN architecture which give better accuracy. We implemented emotion detection using keras with the proposed network. In emotion detection we are using three steps, i.e., face detection, features extraction and emotion classification using deep learning with our proposed model which gives better result than previous model. In the proposed method, computation time reduces, validation accuracy increases and loss also decreases, and further performance evaluation achieved which compares our model with previous existing model. We tested our neural network architectures on FERC-2013 and JAFFE database which contains seven primary emotions like sad, fear, happiness, angry, neutral, surprised, disgust. It is clearly observable that neutral has higher proportion than other emotions.

2.C. Jain, K. Sawant, M. Rehman and R. Kumar, "Emotion Detection and Characterization using Facial Features," 2018 3rd International Conference and Workshops on Recent Advances and Innovations in Engineering (ICRAIE), 2018.

Face detection is regarded as one of the most complex problems in computer vision, due to the large variations caused due to changes in lighting, facial appearance and expressions. Let's solve all the stages step by step. For face detection Viola Jones Algorithm is used. Though it was proposed in 2001 it is one of the simple and easiest method for face detection giving high accuracy.

ALGORITHAMS

Once faces have been detected and the required features have been extracted, it is now time to put them through various methods designed to simplify and classify them into 6 emotions (happy, sadness, fear, neutral, anger, disgust). It is important to note that each and every method described below is independent of each other in terms of application. The section heading defines the combination of filter(s)/transform(s)/classifier(s) used in the respective method. This section gives a brief account of all the methods used, along with description and methodology. Methodology highlights the application of that method in the dataset being used in this work. • Fisher face Classifier Linear Discriminant Analysis is a supervised algorithm that aims for classification of the input dataset. They analyse the sub space that matches the given vectors of the same class in a single blot of the feature presentation and the different classes. Thus, it improves the ratio between the class scatter to the within class scatter. The sub space presentation of a group of face images, the outcome of the basis vector resulting those spaces are defined as Fisher faces. They are helpful when facial images have wide differences in facial expressions and illumination. Principal component Analysis is predominantly used for dimensionality reduction in facial classification, image compression, etc. Initially, the training data is to be reduced to at least N-c dimension using Principal Component Analysis where N represents the number of images in the images in the training set and c represent the number of classes. Thereafter Linear Discriminant Analysis is applied to further reduce the projected data. The equation for finding optimum weight is as follows: Where Projection representing the reduction in PCA space (Further Projection representing further reduced in LDA-space. Both of the given projection, has combination of PCA and LDA. The precision of classification for Fisher face classifier turns out to be 0.74.

3. R. S. Deshmukh, V. Jagtap and S. Paygude, "Facial emotion recognition system through machine learning approach," 2017 International Conference on Intelligent Computing and Control Systems (ICICCS), 2017.

SYSTEM ARCHITECTURE

Facial expression presents key mechanism to describe human emotion. From starting to end of the day human changes plenty of emotions, it may be because of their mental or physical circumstances. This is both something that humans do automatically but computational methodologies have also been developed. The general approach that is proposed to automatic facial emotion recognition consists: input (image), pre-processing, face detection and tracking, feature extraction and expression classification / recognition.

Face detection stage processes stimuli to automatically find the face region from the input images or sequences. After face is located, the next step is to extract meaningful or discriminative information caused by facial expressions. Facial emotion recognition is the last stage of the systems. The system architecture describes the various phases that is included in an emotion recognition system. The emotion detection block includes normalization where the pre-processing on takes place on the image, the capturing and feature selection module are further developed followed by the training. The dataset will be further used for the purpose of training and testing of the system. The emotions considered for the experiments include happiness, Sadness, Surprise, Fear, Disgust, and Anger that are universally described.

Conveying emotions of an individual. Pose, speech, facial expressions, behaviour and actions are some of them. From these above-mentioned factors, facial expressions have a higher importance since they are easily perceptible.

The table depicts the emotions and their impact on facial feature that can be considered for classification of emotions. In this research, the system will recognize the six universal emotions from face images. The system can be broadly categorized in to three stages: Pre-processing stage, face detection stage, feature extraction stage and emotion classification stage. The input to the system is live image taken from the webcam. The pre-processing stage include conversion of the facial image to binary image. The Viola Jones algorithm is implemented for the face feature detection as it does not consume much time, thus giving

greater accuracy. The further steps are of feature extraction, will consider basic facial features eyes (left eye and right eye), nose, mouth for further classification of emotions. The system will further classify the emotion of an individual.

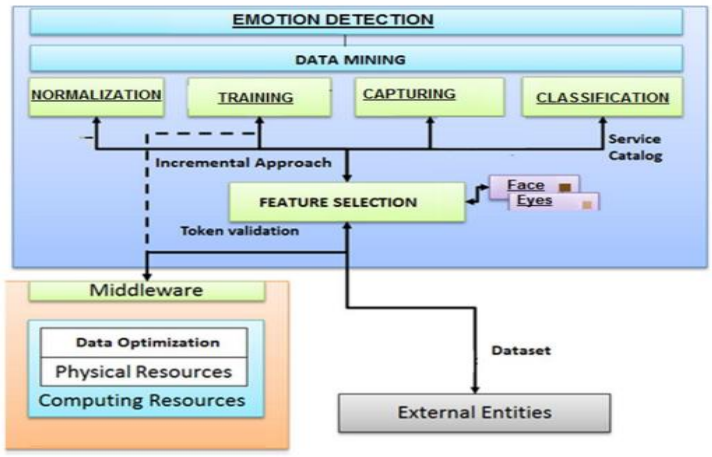

Fig 1. System Architecture

SYSTEM ANALYSIS

Emotion	Motion of Facial parts
Happy	open eyes, open mouth,lip corner pulled, cheeks raised
Sad	Outer eyebrow down,inner eyebrows raised, eyes closed, lip corner down
Suprise	Eyebrow up, open eyes, jaw dropped
Anger	Eyebrow pulled down, open eyes, lip tightened
Fear	Outer eyebrow down, inner eyebrow up, mouth open

Fig 2. Expression Analysis

4.A. S. Dhavalikar and R. K. Kulkarni, "Face detection and facial expression recognition system," 2014 International Conference on Electronics and Communication Systems (ICECS), 2014.

Image-based methods have been applied in many areas of facial computing. One of the most successful recent techniques, which, incorporates both shape and texture information from facial neutral image in the database. It automatically creates a Data File which gives the information about model points located on the detected face. Then the sequence of different expressions like Happy, Sad, Anger, Fear, Disgust, and Surprise is given as a video input starting with the neutral expression. The change in the AAM shape model according to the change in facial expressions measures the distance or the difference between Neutral and other facial expressions.

ALGORITHMS OF FACE DETECTION

In this method, the database consists of training data sets and testing data sets of images. For one particular subject, the training and testing data sets consist of images of different expressions like Neutral, Happy, Sad, Anger, Fear, Disgust, and Surprise. Using AAM method, the points on facial features are located for all these images and stored in the form of data file, to improve the recognition rate of the system, further modification in the third phase is done using Artificial Neuro-Fuzzy Inference System (ANFIS).

III. COMPARISION OF VARIOUS APPROACHES

Methodology	Computer Vision	Convolution Neural Network
Approach	Computer Vision is an interdisciplinary field of science that aims to make computers process, analyses images and videos and extract details in the same way a human mind does.	A convolutional neural network (CNN) is a type of artificial neural network used in image recognition and processing that is specifically designed to process pixel data.
	Computer vision enables computers to see, identify and process images in the same way that human vision does, and then provide appropriate output. It is like imparting human intelligence and instincts to a computer.	CNNs are powerful image processing, artificial intelligence (AI) that use deep learning to perform both generative and descriptive tasks, often using machine vison that includes image and video recognition, along with recommender systems and natural language processing (NLP)/
	Time and error rate are reduced in the process of Computer Imagining. It reduces the cost of hire and train special staff (human force) to do the activities that computers do.	It is computationally very expensive and time consuming to train with traditional CPUs.
		Once we train the system, the predictions are pretty fast.

Table 1: Computer Vision and Convolutional Neural Network

Methodology	Haar like features and Adaboost	VGG- 16 CNN Model
Approach	The wavelet template has ability to capture high-level knowledge about the object class (structural information expressed as a set of constraints on the wavelet coefficients) and incorporate it into the low-level process of interpreting image intensities.	In order to avoid a bad reconstruction process, these approaches aim to detect regions found to be occluded in the face image and discard them completely from the feature extraction and classification process.
	Due to the non-invariant nature of the normal Haar-like features, classifiers trained with this method are often incapable of finding rotated objects.	VGG16 significantly outperforms the previous generation of models in the ILSVRC-2012 and ILSVRC-2013 competitions.
	Calculates the coefficients of wavelets by the average intensities of the pixels of a region may increase learning time.	The size of VGG-16 trained ImageNet weights is *528* MB. So, it takes quite a lot of disk space and bandwidth that makes it inefficient.
	Haar-like features are more robust to illumination changes than colour histogram. The Integral Image allows the sum of pixel responses within a given sub-rectangle of an image to be computed quickly.	In VGG16 instead of having a large number of hyper-parameters they focused on having convolution layers of 3x3 filter with a stride 1 and always used same padding and maxpool layer of 2x2 filter of stride 2.

Table 2: Haar and Adaboost and VGG-16 Model

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