Face Expression Detection using CNN

Rohini Godbole[1], Saloni Burad[2]
[1,2] *Dept of Electronics Engineering, Vishwakarma Institue of Technology, Pune*

***Abstract*- Face expression detection is one of the most commonly used application of computer vision. It is rigorously used in medical applications like old age health monitoring, counseling and determining client's medical state, determining patient's mental preparedness for treatment. In case of e-learning, it is used to study the emotions of the students and accordingly the methods of teaching and learning process are modified. But, to detect any face and its components, a proper and straight orientation of face is demanded. The algorithms for detection won't work if the face is titled or rotated. This paper introduces an algorithm to detect faces in any orientation, limited to some angles. This algorithm is further followed by face expression detection algorithm. Firstly, face straightening algorithm is used to convert the oriented image in straight image. And then the face expressions are detected.**

Index Terms- Face expression detection, Computer Vision, Orientation, Image Straightening, Face Components

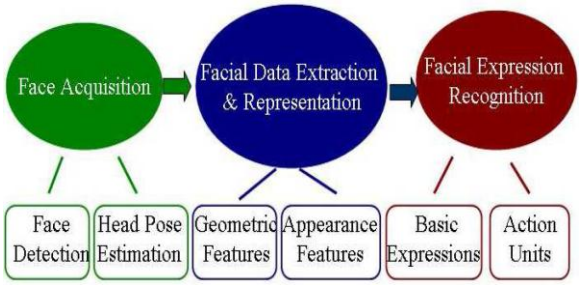
I. INTRODUCTION

Facial expression analysis includes both measurement of facial motion and recognition of expression. The general approach to Automatic Facial Expression Analysis (AFEA) systems consists of 3 steps: face acquisition, facial feature extraction and representation, and facial expression recognition.

Face acquisition is a processing stage to automatically find the face region for the input images or sequences. It can be a face detector to detect a face in each frame or just detect face in the first frame and then track the face in the remainder of the video sequence. In order to handle large head motion, head finding, head tracking and pose estimation can be applied to a facial expression analysis system.

After the face is located, the next step is to extract and represent the facial changes caused by facial expressions. In facial feature extraction for expression analysis, there are mainly two types of approaches: geometric feature based methods and appearance-based methods. The geometric facial features present the shape and locations of facial components (including mouth, eyes, brows, nose etc.). The facial components or facial feature points are extracted to form a feature vector that represents the face geometry. In appearance-based methods, image filters, such as Gabor wavelets, are applied to either the whole face or specific regions in a face image to extract a feature vector. Depending on the different facial feature extraction methods, the effects of in-plane head rotation and different scales of the faces can be eliminated, either by face normalization before the feature extraction or by feature representation before the step of expression recognition.

Facial expression recognition is the last stage of AFEA systems to identify facial changes as facial action coding system (FACS) action units (AUs) or prototypic emotional expressions.



Along with face expression analysis, the paper also describes face alignment algorithm. First step is of identifying the geometric structure of faces in digital images. Second step is of attempting to obtain a canonical alignment of the face based on translation, scale, and rotation. There are many forms of face alignment.

Some methods try to impose a (pre-defined) 3D model and then apply a transform to the input image such that the landmarks on the input face match the landmarks on the 3D model. Other, more simplistic methods rely only on the facial landmarks themselves (in particular, the eye regions) to obtain a normalized rotation, translation, and scale representation of the

face. The reason we perform this normalization is due to the fact that many facial recognition algorithms, including Eigen faces, LBPs for face recognition, Fisher faces, and deep learning or metric methods can all benefit from applying facial alignment before trying to identify the face. Thus, face alignment can be seen as a form of "data normalization". Just as you may normalize a set of feature vectors via zero centering or scaling to unit norm prior to training a machine learning model, it's very common to align the faces in your dataset before training a face recognizer. By performing this process, we get higher accuracy from your face recognition models [6, 7, 10, 12, 14, and 15].

II.LITERATURE SURVEY

Human facial expression is one of the most important aspect in social communication. It is nonverbal type of communication. Other nonverbal communication includes eye contact, hand gestures, body language and paralanguage.

Face expression include smile, sad, anger, disgust, fear, happiness and surprise[1].Facial Expression recognition has important stages which are preprocessing on images and extracting faces, then feature extraction and classification The geometrically based feature extraction comprises eye, mouth, nose, eyebrow, other facial components and the appearance based feature extraction comprises the exact section of the face.

Recognizing an emotion in computer vision is one of the classic problems and can be classified into 2 types: image sequence based and still image based approach.

Image sequence based approach is used to increase the performance by extracting useful temporal features from the image sequences. It is better than still image based approach.

Well known algorithms used for face detection are Deep Neural Networks (DNNs) and Convolutional Neural Network (CNNs)[2].

Expression of a person can vary when lightning conditions, background, pose of the person varies in the photo.

III. EXPERIMENTATION AND PROCEDURE

A face recognition system comprises of two process i.e face detection (boundary detection) followed by emotion detection.

1.HAAR Based Cascade Classifier-It detects normal frontal face in an image as well as real time in video processing. It is a classifier which is used to detect the object for which it has been trained for, from the source. It is trained by superimposing positive image over negative image.[3]

2.Convolutional Neural Network (CNN)-

For training the CNN algorithm we can download the dataset from Kaggle challenge. The data consists of 48X48 pixel gray scale images of faces more or less concentrated in the centre. The training set consists of nearly 35,000 samples comprising of all the expression like neutral, sad and happy.[4, 8, 11, 13]

IV. OBSERVATIONS AND RESULTS

It can be observed that using HAAR based cascade algorithm we can detect the faces which are facing forward. After the preprocessing of image is conducted the detected faces are cropped and stored into a new folder. After training the CNN algorithm on the cropped faces we can see that emotion of each individual is seen in the image

V. CONCLUSION

Face Recognition has applications in many fields such as business, security in the form of facial

biometrics, payments, criminal identification, advertising, and health care. HARR Based Cascade Classifier can be effectively used for face recognition [5]. CNN based emotion recognition algorithm detects the emotions of the detected faces.

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