

A Review on Facial Expression Recognition using Raspberry Pi

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Abstract: Facial Detection and recognition research has been widely studied in recent years. The facial recognition applications plays an important role in many areas such as security, camera surveillance, identity verification in modern electronic devices, criminal investigations, database management systems and smart card applications etc. User's emotion using its facial expressions will be detected. These expressions can be derived from the live feed via system's camera or any pre-existing image available in the memory. Emotions possessed by humans can be recognized and has a vast scope of study in the computer vision industry upon which several researches have already been done. The work has been implemented using raspberry pi. The scanned image (testing dataset) is being compared to training dataset and thus emotion is predicted. This paper presents various studies conducted for facial expression recognition using various techniques.

Keywords: Face, Expression, Raspberry Pi, Recognition

I. Literature Survey:

Shervin Emami (2012) et al. proposed the growing interest in computer vision of the past decade. Fueled by the steady doubling rate of computing power every 13 months, face detection and recognition has transcended from an esoteric to a popular area of research in computer vision and one of the better and successful applications of image analysis and algorithm based understanding. Because of the intrinsic nature of the problem, computer vision is not only a computer science area of research, but also the object of neuro-scientific and psychological studies, mainly because of the general opinion that advances in computer image processing and understanding research will provide insights into how our brain work and vice versa. Because of general curiosity and interest in the matter, the author has proposed to create an application that would allow user access to a particular machine based on an in-depth analysis of a person's facial features. This application will be developed using Intel's open source computer vision project, OpenCV and Microsoft's .NET framework.

Daniel Llatas Spiers (2016) proposed a pure convolutional neural network approach outperformed other statistical methods' results achieved by other authors that include feature engineering. Utilizing convolutional networks involves feature learning; which sounds very promising for this task where defining features is not trivial. Moreover, the network was evaluated using two different corpora: one was employed during network's training and it was also helpful for parameter tuning and for network's architecture definition. This corpus consisted of facial acted emotions. The network providing best classification accuracy results was tested against the second dataset. Even though the network was trained using only one corpus; the network reported auspicious results when tested on a different dataset, which displayed facial non-acted emotions. While the results achieved were not state-of-the-art; the evidence gathered points out deep learning might be suitable to classify facial emotion expressions. Thus, deep learning has the potential to improve human-machine interaction because its ability to learn features

will allow machines to develop perception. And by having perception, machines will potentially provide smoother responses, drastically improving the user experience.

Luis Antonio Beltrán Prieto (2017) et al. presented emotions represent feelings about people in several situations. Various machine learning algorithms have been developed for emotion detection in a multimedia element, such as an image or a video. These techniques can be measured by comparing their accuracy with a given dataset in order to determine which algorithm can be selected among others. This paper deals with the comparison of two implementations of emotion recognition in faces, each implemented with specific technology. OpenCV is an open-source library of functions and packages mostly used for computer-vision analysis and applications. Cognitive services is a set of APIs containing artificial intelligence algorithms for computer-vision, speech, knowledge, and language processing. Two Android mobile applications were developed in order to test the performance between an OpenCV algorithm for emotion recognition and an implementation of Emotion cognitive service. For this research, one thousand tests were carried out per experiment. Our findings show that the OpenCV implementation got a better performance than the Cognitive services application. In both cases, performance can be improved by increasing the sample size per emotion during the training step.

Mrs. Madhura.M (2018) et al. presented face detection and recognition from an image or a video is a popular topic in biometrics research. Face recognition technology has widely attracted attention due to its enormous application value and market potential, such as real-time video surveillance system. It is widely acknowledged that the face recognition has played an important role in surveillance system as it doesn't need the object's co-operation. We design a real-time face recognition system based on IP camera and image set algorithm by way of OpenCV and Python programming development. The system includes three parts: Detection module, training module and recognition module.

Nitisha Raut (2018) proposed face detection has been around for ages. Taking a step forward, human emotion displayed by face and felt by brain, captured in either video, electric signal (EEG) or image form can be approximated. Human emotion detection is the need of the hour so that modern artificial intelligent systems can emulate and gauge reactions from face. This can be helpful to make informed decisions be it regarding identification of intent, promotion of offers or security related threats. Recognizing emotions from images or video is a trivial task for human eye, but proves to be very challenging for machines and requires many image processing techniques for feature extraction. Several machine learning algorithms are suitable for this job. Any detection or recognition by machine learning requires training algorithm and then testing them on a suitable dataset. This paper explores a couple of machine learning algorithms as well as feature extraction techniques which would help us in accurate identification of the human emotion.

Raghav Puri (2019) et al. proposed a face detection and recognition system using python along with OpenCV package. This system contains three modules which are detection, training and recognition. Basically, the detection module detects the face which gets into the field of vision of the camera and saves the face in the form of an image in JPG format. LDA is a method to find a linear combination of features which characterize or separate two or more classes of objects or events. Linear classifier can be obtained from the resultant. Large number of pixels are used to represent face in computerized face recognition. Before classification Linear discriminant analysis is used to reduce features and makes it more manageable. New dimensions are a linear combination of pixel values which forms a template.

Dr. Shaik Asif Hussain (2019) et al. presented deep learning algorithms used in facial recognition for accurate identification and detection. The main objective of facial recognition is to authenticate and identify the facial features. However, the facial features are captured in real time and processed using haar cascade detection. The sequential process of the work is defined in three different phases where in the first phase human face is detected from the camera and in the second phase, the captured input is analyzed based on the features and database used with support of keras convolutional neural network model. In the last phase human face is authenticated to classify the emotions of human as happy, neutral, angry, sad, disgust and surprise. The proposed work presented is simplified in three objectives as face detection, recognition and emotion classification. In support of this work Open CV library, dataset and python programming is used for computer vision techniques involved. In order to prove real time efficacy, an experiment was conducted for multiple students to identify their inner emotions and find physiological changes for each face. The results of the experiments demonstrates the perfections in face analysis system. Finally, the performance of automatic face detection and recognition is measured with Accuracy.

Malyala Divya (2019) et al. presented the idea related to automated live facial emotion recognition through image processing and artificial intelligence (AI) techniques. It is a challenging task for a computer vision to recognize as same as humans through AI. Face detection plays a vital role in emotion recognition. Emotions are classified as happy, sad, disgust, angry, neutral, fear, and surprise. Other aspects such as speech, eye contact, frequency of the voice, and heartbeat are considered. Nowadays face recognition is more efficient and used for many real-time applications due to security purposes. We detect emotion by scanning (static) images or with the (dynamic) recording. Features extracting can be done like eyes, nose, and mouth for face detection. The convolutional neural network (CNN) algorithm follows steps as max-pooling (maximum feature extraction) and flattening.

Nithya Roopa. S (2019) proposed facial expression recognition is the part of Facial recognition which is gaining more importance and need for it increases tremendously. Though there are methods to identify expressions using machine learning and Artificial Intelligence techniques, this work attempts to use deep learning and image classification method to recognize expressions and classify the expressions according to the images. Various datasets are investigated and explored for training expression recognition model are explained in this paper. Inception Net is used for expression recognition with Kaggle (Facial Expression Recognition Challenge) and Karolinska Directed Emotional Faces datasets. Final accuracy of this expression recognition model using Inception Net v3 Model is 35%(~).

Ninad Mehendale (2020) presented facial expression for emotion detection has always been an easy task for humans, but achieving the same task with a computer algorithm is quite challenging. With the recent advancement in computer vision and machine learning, it is possible to detect emotions from images. In this paper, we propose a novel technique called facial emotion recognition using convolutional neural networks (FERC). The FERC is based on two-part convolutional neural network (CNN): The first part removes the background from the picture, and the second part concentrates on the facial feature vector extraction. In FERC model, expressional vector (EV) is used to find the five different types of regular facial expression. Supervisory data were obtained from the stored database of 10,000 images (154 persons). It was possible to correctly highlight the emotion with 96% accuracy, using a EV of length 24 values. The two-level CNN works in series, and the last layer of perceptron adjusts the weights and exponent values with each iteration. FERC differs from generally followed strategies with single-level CNN, hence improving the accuracy. Furthermore, a novel background removal procedure applied, before the generation of EV, avoids dealing with multiple problems that may occur (for example distance from the camera). FERC was extensively tested with more than 750K images using extended Cohn-Kanade expression, Caltech faces, CMU and NIST datasets. We expect the FERC emotion detection to be useful in many

applications such as predictive learning of students, lie detectors, etc.

II. Conclusion:

Numerous researches and studies about Emotion Recognition, Deep learning techniques used for recognizing the emotions are conducted. Face recognition applications are used improve access to identify and verify the people by their face features. Hence interpreting the facial features and their actions is much required. As these features and expressions helps in classify the emotions of human face. Recent advances in technology has resulted in the use of Artificial intelligence system as these systems are capable to understand and realize the emotion recognition through facial features. Hence this is an attempt to prove the existence of latest technological developments for human-computer interaction. Artificial Intelligence can be used to solve intriguing tasks such as emotion detection, although this task was quite convolute even more when using a great number of images.

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