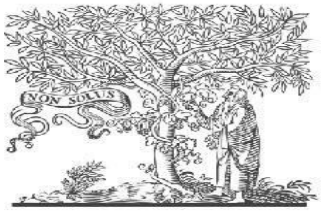
International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

COPY RIGHT



ELSEVIER SSRN

IJIEMR Transactions, online available on 10th Apr 2023. Link :http://www.ijiemr.org/downloads.php?vol=Volume-12&issue=Issue 04

10.48047/IJIEMR/V12/ISSUE 04/104

Title **FACIAL EXPRESSION RECOGNITION**

Volume 12, ISSUE 04, Pages: 829-835

Paper Authors

N. Ashok, Gollapudi Sravani, Ala Devi Nandini, Avula Venkata Sireesha, Inakollu Sravani

USE THIS BARCODE TO ACCESS YOUR ONLINE PAPER

To Secure Your Paper As Per UGC Guidelines We Are Providing A Electronic Bar Code

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

Facial Expression Recognition

N. Ashok[1], Assistant Professor, Department of IT,
Vasireddy Venkatadri Institute of Technology, Nambur, Guntur Dt., Andhra Pradesh.

Gollapudi Sravani[2], **Ala Devi Nandini**[3], **Avula Venkata Sireesha**[4], **Inakollu Sravani**[5]
[2,3,4,5] UG Students, Department of IT,
Vasireddy Venkatadri Institute of Technology, Nambur, Guntur Dt., Andhra Pradesh.
[1]sravanigollapudi978@gmail.com, [2]devinandiniala2002@gmail.com ,
[3]sirishaavula27@gmail.com , [4]inakollusravani@gmail.com

Abstract

In numerous application domains, including speech recognition, image interpretation, and other fields, deep learning has produced ground-breaking breakthroughs. To identify human emotions based on facial expressions, we are employing deep learning techniques and a camera. This system can recognize people and recognize faces from up to three meters away. It can also determine a person's mood, including neutral, furious, shocked, disgusted, happy, sad, happy-sad, and any combination of those emotions. It is applicable to a wide range of services, including market research, psychology, usability studies, and consumer behavior research.

Keywords: Haar Cascade Classifier, CNN, Deep Learning, Machine Learning.

1.Introduction

Emotions often operate as mediators and facilitators in interpersonal interactions. Social communication often requires an understanding of emotion to put unusual and/or complex social communication into context. A variety of methods, including more complex ones like electroencephalography, can be used to detect emotion, such as voice intonation and body language (EEG). Studying only facial expressions, however, is the more straightforward approach.

One study found that seven human emotions are universally recognized across cultural boundaries: anger, disgust, fear, happiness, sorrow, surprise, and contempt. The fact that cross-cultural understanding is still present in society is noteworthy. when making complex statements that could be accompanied by a variety of feelings. Hence, a device that can deduce emotion from a person's expressions would be immensely beneficial. Such a breakthrough could be advantageous to marketing, healthcare, and entertainment. Due to two factors, it is extremely challenging to recognize emotions. The difficulty of classifying emotion

depends on whether the input image is static or a frame that transitions into a facial expression, and there is a severe lack of a substantial library of training images. Real-time recognition of the latter problem is quite challenging because of how dynamic facial emotions are.

2.Literature Survey

There is a vast amount of literature on the subject and there has been a lot of research in the areas of face tracking and detection. A lot of work has gone into creating face expression analysis techniques during the last ten years. The generalizability of these different strategies is yet uncertain since the majority of researchers have only used small amounts of data. Some of the studies on Facial expression Recognition are Strong evidence for universals in facial expressions: is a reply to Russell's mistaken critique, J. A. Russell (1994) misrepresents what universality entails, interprets the data from prior studies incorrectly, and neglects to take into account or mention findings that contradict his claims. The primary query Russell asks regarding the use of a forced-choice format in many previous studies receives a conclusive response from new data. This essay also demonstrates the lack of substance in his several more concerns regarding other facets of the methodology used in studies of literate civilizations. Russell's criticism of the preliterate cultures is untrue; he omits key information about the methods used to study preliterate persons and the conclusions that were reached. Despite all of Russell's concerns, analysis shows that that there is overwhelming evidence from both literate and preliterate civilizations in favor of universals in facial expressions.

A module was created in 2019 by Palanivel N. et al. that recognizes facial features and generates attendance data to verify people's presence. The dependability rating for face identification is bestrewed with the factors such as changing the glowing, changing position, changing expression, and occlusion. They used the algorithmic K-means clustering rule to evaluate the facial traits. No longer regarded as biometric, face characteristics. Using the K-mean clustering method, the facial features are gathered. Then, the attributes of the pictures are identified using the SVM method. It may nevertheless satisfy strict identification displaying criteria with fewer characteristics.

Facial Expression (FE) is a term that describes details about a person's emotional and physical states. FE Recognition (FER) has become a successful research field in recent years. The main technique for deciphering nonverbal intents is called FER, and it is also a significant and productive area of computer vision and artificial intelligence. In addition to emphasizing the depth of the learning model, Deep Learning (DL), a novel machine learning theory, also highlights the significance of Feature Learning (FL) for the network model and

has led to numerous breakthroughs in FER research. Here, the latest FE extraction method and the FER with a DL focus are frequently used to analyze the current research states.

Automated Facial Expression Recognition has remained a challenging and interesting problem in computer vision. The recognition of facial expressions is difficult problem for machine learning techniques, since people can vary significantly in the way they show their expressions. Deep learning is a new area of research within machine learning method which can classify images of human faces into emotion categories using Deep Neural Networks (DNN).

Convolutional neural networks (CNN) have been widely used to overcome the difficulties in facial expression classification. we present a architecture network based on CNN for facial expressions recognition. To evaluate our architecture we test edit with many largely public databases (CK+, MUG, and RAFD).Obtained results show that the CNN approach is very effective in image expression recognition on many public databases which achieve an improvements in facial expression analysis.

3. Problem Identification

1. variations in lighting.
2. individual variations in emotional displays.
3. categorization of face expressions.

The primary element of the facial expression system is the derivation of an effective and efficient characteristic i.e., how human emotions and intentions are represented through facial expressions. For applications like intelligent visual surveillance, teleconferencing, real-time animation from live motion images, and intelligent man-machine interaction and communication, face recognition is crucial for the interpretation of facial expressions. Using facial expressions effectively helps communication.

Six fundamental expressions are typically exclusively recognized by facial expression recognition algorithms and study (joy, sad, anger, disgust, fear, surprise). As there isn't enough room to describe every facial emotion, these emotions are divided into categories based on facial movements.

4. Methodology:

The supervised learning approach is used to train the facial recognition system on images of people with varied facial expressions. In face-recognition software application prior to acquiring images, identifying faces in those photographs, analyzing those photographs, and categorizing them in accordance with their features, the system goes through a training and testing process.

Following face identification and feature extraction from face images, the faces are divided into six classes that match the six main expressions listed below:

4.1 Image Acquisition

Face expressions are detected using static images or image sequences. Faces can be captured by Webcam.

4.2 Face detection

Face detection is useful in recognizing facial images. In the training dataset, faces are detected using the Haar classifier, which is implemented using OpenCV. The difference in average intensity in various areas of the image is encoded by Haar-like features, which are made up of connected rectangles of black and white and whose value is the difference in the sum of the pixel values in the black and white regions.

4.3 Image Pre-processing

During image pre-processing, noise is removed, and variances in brightness or pixel position are normalised.

1) Colour Normalization
2) Histogram Normalization

4.4 Feature Extraction and Classification

Typically, the following processes are involved in facial expression recognition: facial expression data pre-processing, feature extraction, and classification are the three steps involved.

Facial features and face model features are two types of features that are frequently taken into account. The features of the face model are used to model the facial features, which are particular features of the face such as eyes, lips, and eyebrows. The features that are used to model the face are known as the face model features. As a result, there are several techniques for representing faces, including using the entire face to generate a holistic representation, concentrating on a particular area to create a local representation, and combining different points to create a hybrid technique. The last step is to specify a group of categories to which the expression belongs. Traditional techniques frequently make use of manually constructed features like Local Binary Patterns (LBP) and conventional machine learning algorithms like Support Vector Machine to categorise expression recognition as a classification problem (SVM). These techniques might work well with datasets collected under controlled circumstances, but they fall short when used to more difficult expression datasets (like FER2013), which are collected under uncontrolled circumstances. Fortunately, since deep learning was applied to solve the image categorization problem, it has become more user-friendly and efficient. There are two sorts of images and they are positive and negative images. images having faces in them are regarded as positive, whilst those without faces are regarded as negative. The classification of a image as positive or negative is done by a device known as classifier. Before it can correctly determine whether a new image is one with or without a face, it must be trained on tens of thousands of face and non-facial images.

4.4.1 Haar Cascade Classifier

The machine learning technique known as Haar Cascading is used to train a classifier utilising a large number of both positive and negative images. Using cascade classifiers based on Haar characteristics, objects are detected. This classifier uses a machine learning method that includes a cascade operation from

the original images in order to recognise objects in further images for successful face and facial expression recognition in images. To complete the task, both positive and negative images are shown to the classifier. Then the characteristics are removed out of the image.

The Haar-like feature is depicted in Fig.1. It consists of line and edge features. The grayscale image's white bar indicates the Pixels closest to the Light source.

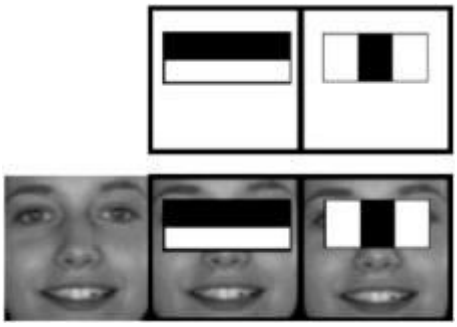


Fig.1. Haar like feature.

Haar Value Calculation:

Pixel value = SumoftheDarkpixels/NumberofDarkpixels)−(SumoftheLightpixels/NumberofLightpixels)(1)

The features of the object will be gathered from the image in order to detect it and determine what it is.

It is possible to calculate the haar pixel value using equation (1).

4.4.2 Building the Model: Convolutional Neural Network

Convolutional Neural Network: The convolution operation allows us to process images more efficiently while maintaining the system's accuracy. Similar to MLP, it develops a facial expression recognition system utilizing pixel values.

Generally, a CNN architecture consists of three different kinds of layers:

1.Convolutional Layer:

Convolution is a mathematical operation that requires two inputs. Assuming that the two inputs are x and f. Convolution converts a specified section of the input into Y by using the values of the filter input, f.

Y = x f

2.Pooling Layer:

The model's parameters won't be changed by this layer. In other words, it will scale down the prior image by the specified amount. For our deep learning project, we'll utilize the most popular "max-pooling method," which only keeps the most data and discards the rest. There are several ways to pool data. The overall training parameters might be decreased with the help of this layer. It is also possible to investigate this approach for reducing input variance.

3.Fully connected layer:

This neural network is similar to others. There is a layer of neurons there, and they are all trained throughout the training process. The top layer of the model will be a completely linked layer whose dimensions match the categories in the classification issue. The final layer of our model will be the top layer, which corresponds to seven categories (sad, surprise, happy, fear, anger, disgust, neutral).

5.Implementation

Facial expression recognition is accomplished using deep learning

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

methods. The deep network concept was created for Windows-based real-time applications. Because it is CUDA-based, it is faster than a CPU. We also utilized a webcam to recognize faces and facial expressions from a distance. The FER 2013 database was reviewed in order to train the proposed deep networks. In total, the FER 2013 database consists of 35887 photos. These photos were also used to train our deep network models. The training set was horizontally flipped throughout. We used 71774 training photos as a result. The complete retraining set was horizontally flipped after each individual face expression photos was captured 200 times for each emotion. Therefor, there are 2400 more pictures in total for one person.

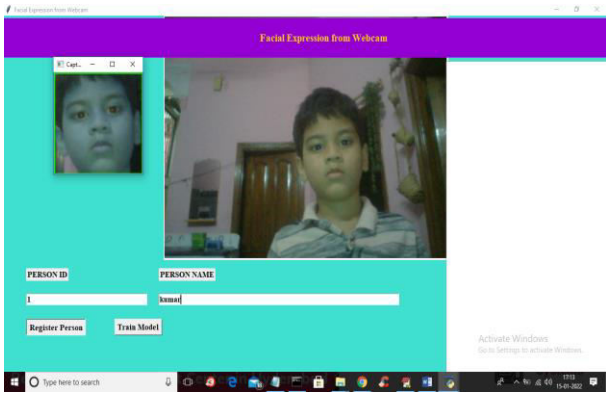


Fig.2 Face Capturing for training the model

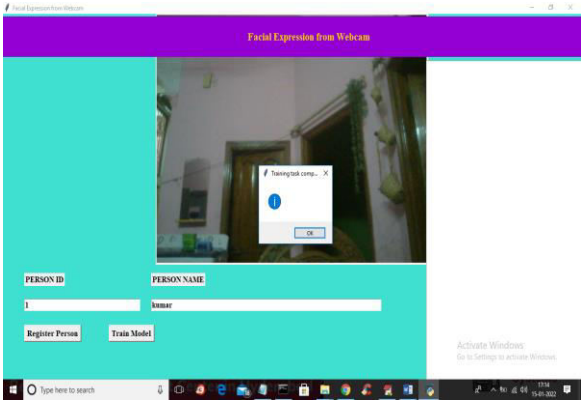


Fig.3 Training task completed

6.Results

In Fig. 4, the qualitative outcomes are displayed. The expected emotion type and likelihood are shown by the text in Green, Where the face detected in the image is represented by a square which is in Red color.

Results of the recognition:

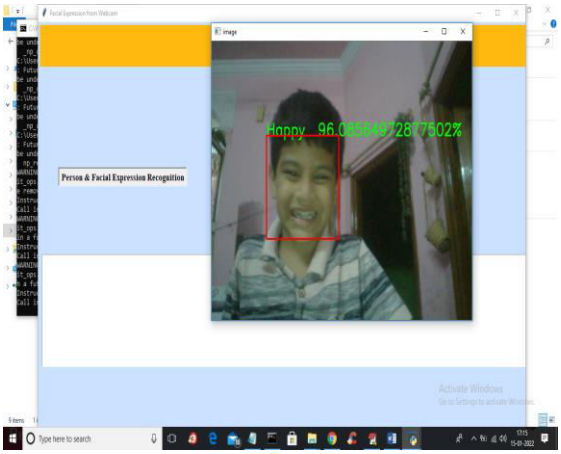


Fig.4 Real time facial expression recognition result

7. Conclusion

Face expression recognition uses deep learning techniques. For this stud, a system for categorizing facial expressions is suggested. Many applications, including robotic vision, video surveillance, digital

cameras, security, and human-computer interaction, can benefit from face detection and the extraction of facial expressions.

The purpose of this project was to develop a sophisticated feature extraction and classification system for face expression recognition that makes use of computer visions.

8.Limitations and Future Scope

In this study, a technique for classifying face expressions is proposed. A number of applications, including robotic vision, video surveillance, digital cameras, security, and human-computer interaction, benefit from face detection and emotion extraction from facial images.

The purpose of this research was to develop an advanced feature extraction and classification system for facial emotion recognition using computer vision.

Our approach might be included into security systems that can identify a person no matter how they present themselves. A person can adjust the lighting and television in a room when they enter there to suit their tastes. With this method, doctors can comprehend the condition or amount of agony of a deaf patient.

9. References

1. Ekman, P. (1994). Strong evidence for universals in facial expressions: a reply to Russell's mistaken critique.

2. F. Kong, "Facial expression recognition method based on deep convolutional neural network combined with improved LBP features," Personal and Ubiquitous Computing, vol. 23, no. 3-4, pp. 531–539, 2019.

3. Viola, Paul, and Michael J. Jones. "Robust real-time face detection." International journal of computer vision 57.2 (2004)J.

4.Shao *et al.* Three convolutional neural network models for facial expression recognition in the wild.
Neuro computing(2019)

5. X. Pan, "Fusing HOG and convolutional neural network spatial–temporal features for video-based facial expression recognition," IET Image Processing, vol. 14, no. 1, pp. 176–182, 2020.

6. Z. Zhang *et al.* From facial expression recognition to interpersonal relation prediction Int. J. Comput. Vis.(2018)