

## Chapter 9

# Real-Time Recording and Analysis of Facial Expressions of Video Viewers

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### **ABSTRACT**

*Automated facial emotion recognition (AFER) is a technique with rising usage across a range of practical real-world applications ranging from security to advertising. AFER can be used to assess the emotional state of patients with mental health conditions, such as depression or anxiety to guide treatment decisions. Companies can use facial emotion recognition to gauge consumer reactions to different products or advertisements, providing valuable insights for product development and marketing strategies. The following paper examines the concept of facial emotion recognition using AI-based models and compares the results of two different techniques. The first technique uses face emotion detection using haar cascade classifier along with convolutional neural networks (CNN), and the second technique uses face emotion detection using facial landmarks along with CNN.*

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## **1. INTRODUCTION**

In contrast to conventional surveys, facial expression analysis is a practical method of learning more. Using it, one may learn about the user's experiences and receive feedback. The feedback is also not disruptive to the user experience, which is the best part. Facial recognition techniques are not currently in common use. This paper's objective is to implement and analyze different techniques of facial emotion recognition (Chakravarthi & Venkatesan, 2015).

Emotion detection is convenient for quantifying an individual's natural reaction to any situation. This "reaction" can come in handy in many applications - one being sentiment analysis, which has a wide scope. It is helpful in understanding and determining what is going on inside any person's mind. This proves to be one of the most efficient ways of identifying and extracting facial features (Shriram et al., 2022). The data acquired can be used for applications that rely on emotional feedback, such as digital advertisements, interactive multimedia, helping psychiatrists identify the patient's emotional state, sentiment analysis to decide wait time, and more (Chakravarthi et al., 2015).

Digital media leverages deliver promotional content to consumers through innumerable channels. Any digital media can help tell the story of a brand. Digital advertising being universal and flexible enables you to tell the brand story on channels visited by your consumers (Ogunmola et al., 2021). Advertisers believe that with such steps (digitisation), they can promote their products or businesses more efficiently and reach their target users (Sharma, et al., 2021). But more importantly, getting feedback from their users in some form will help them improve the quality of content. One of the best ways they can receive feedback is through a "reaction", in this case, a facial reaction or an 'emotion' (Lohit Ujjainiya et al., 2014). This form of data can predict the interest of the viewer for the advertisement as well as be used for identifying a person with suspicious behaviour at common places such as airports and stations and prevent any mishap from happening (Doss, et al., 2022).

It is observed that such facial recognition systems are not commonly placed everywhere. We have discussed two techniques for emotion recognition, and they are as follows:

The first emotion recognition technique using CNN consists of four phases: preprocessing, face detection, model training, and classification. In the pre-processing phase, OpenCV changed the image from RGB to Grayscale. Haar cascade classifier was utilised in the face identification phase to identify faces quickly. Following face detection, the model is created using the Keras framework and Convolutional Neural Network (CNN) architecture. The second technique is emotion recognition using facial landmarks, and it consists of five phases: pre-processing, face detection, landmark detection, model training, and classification. Face detection was carried out using a Python facial recognition tool like Dlib. The previously trained model is combined with the "shape predictor." After detecting landmarks, the Convolutional Neural Network architecture is used for model development, and the Keras library is imported.

This paper's organisation is as follows – we first discuss the literature survey, then we discuss emotion recognition techniques using CNN, followed by a discussion on emotion recognition techniques using Facial Landmarks, and lastly, we compare both techniques.

## **2. LITERATURE REVIEW**

Various people have researched detecting and recognising facial emotion using facial features in this field. In one of the research projects by Silva & Hui (2003), to determine the local motion vectors of

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