Chapter 9
Emotion-Based Human-Computer Interaction

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ABSTRACT

One of the important aspects of human-computer interaction is the detection of emotions using facial expressions. Emotion recognition has problems such as facial expressions, variations of posture, non-uniform illuminations, and so on. Deep learning techniques becomes important to solve these classification problems. In this chapter, VGG19, Inception V3, and Resnet50 pre-trained networks are used for the transfer learning approach to predict human emotions. Finally, the study achieved 98.32% of accuracy for emotion recognition and classification using the CK+ dataset.

INTRODUCTION

Today's most challenging question about human-computer interaction is how to make computers more user-friendly using intelligent user interfaces. The design of recent human-machine interfaces should take this to promote more natural and human-like interaction (Acharjya & Chowdhary, 2018). Emotions are the user effects and have been recognized as the most essential methods by which people can

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communicate with one another. The significance and potential of emotions and sentimental interfaces given using human emotions are becoming increasingly desirable in intelligent user interfaces, such as human-robot interactions. To provide an effective user interface and take advantage of the user's emotions, the user's emotional state must be identified or observed in various ways considering a variety of methods such as facial emotions, speech or words, and facial gestures. Facial emotions are the major mode of human communication and hence it is the consequence of the messages being communicated. Facial attachments, nonuniform illuminations, position variations, and other such factors all pose obstacles in the field of emotion recognition. The conventional method for facial emotion detection has the drawback of extracting features and classification analysis. To this issue, research people are more interested in deep learning techniques.

Deep learning has proven to be an extremely useful technique over the last few decades due to its ability to manage a large number of data. (LeCun et al., 2015) Hidden layers are gaining popularity over standard methods in pattern recognition from small input images, such as handwritten numeral identification. In a Deep neural learning network, a convolutional neural network (CNN) is widely used. CNN is the most popular model for the image domain because of its intrinsic structure. According to the researcher (Ravi, 2018), pre-trained CNN components of facial expression recognition have been presented. The parameters are taken using a VGG19 network. The research was carried out on CK+ and JAFFE databases, with 91.15%, and 91.75% of accuracy, correspondingly. The author (Shaha et al., 2018) uses transfer learning techniques of a VGG19 pre-trained network for image classification. This chapter trains the CNN model with the CK+ Dataset and classifies emotions based on extracted features. Resnet50, VGG19 and Inception V3 networks have been trained on ImageNet in this chapter. The pre-trained network model is used in an initial point of the model, using Transfer Learning if the domain was the same. This chapter describes the objective, results, comparisons, and conclusion.

RELATED WORK

The authors (Ozdemir et al., 2019) suggested a LeNet architecture-based facial detection system. This study makes use of a combined KDEF and JAFFE dataset The Haar cascade package is being used to filter the emotion recognition. This task was accomplished with an accuracy of 95.40%.

The authors (Jyostna & Veeranjaneyulu, 2019) demonstrated how to deal with different situations using a CNN. VGG16 and SVM classifier is deployed for extracting features. The algorithm had an 82.27% of accuracy without face detection and 87.16% of accuracy with face detection on the CK+ database. The author (Fan et al., 2018) presented recognising emotional expressions for the multi-region CNN method, as indicated in this paper. The sub-networks provided the attributes derived from the eyes, mouth and nose. To estimate emotions, the ratings over the sub-networks are integrated.

In this article (Wang et al., 2019) collect the most number of data. Here they used FER2013, CK +, JAFFE and SFEW datasets to test the model. The databases RAF- DB and AFEW 7.0 have been used in this study. The authors (Sreelakshmi & Sumithra, 2019) created an emotion identification system based on the MobileNet V2 architecture. The model is evaluated on real-time images and obtains an accuracy of 90.15%. Resnet50 and VGG16 facial expression recognition were exhibited as the state of the science.

To achieve the highest accuracy they used the CNN model and the SVM classifier. As stated the author (Roopa, 2019) suggests using the Inception V3 model to detect facial expressions. This model used the KDEF database, to achieve an accuracy of 35%.