ABSTRACT

Facial expression recognition (FER) is a signiﬁcant task for the machines to understand the emotional changes in human beings. However, accurate hand-crafted features that are highly related to changes in expression are difﬁcult to extract because of the inﬂuences of individual difference and variations in emotional intensity. Therefore, features that can accurately describe the changes in facial expressions are urgently required.

Method: A weighted mixture deep neural network (WMDNN) is proposed to automatically extract the features that are effective for FER tasks. Several pre-processing approaches, such as face detection, rotation rectiﬁcation, and data augmentation, are implemented to restrict the regions for FER. Two channels of facial images, including facial grayscale images and their corresponding local binary pattern (LBP) facial images, are processed by WMDNN. Expression-related features of facial grayscale images are extracted by ﬁne-tuning a partial VGG16 network, the parameters of which are initialized using VGG16 model trained on Image Netdatabase. Features of LBP facial images are extracted by a shallow convolutional neural network (CNN) built based on Deep ID. The outputs of both channels are fused in a weighted manner. The result of ﬁnal recognition is calculated using softmax classiﬁcation. Results: Experimental results indicate that the proposed algorithm can recognize six basic facial expressions (happiness, sadness, anger, disgust, fear, and surprise) with high accuracy. The average recognition accuracies for benchmarking data sets ‘‘CK+,’’ ‘‘JAFFE,’’ and ‘‘Oulu-CASIA’’ are 0.970, 0.922, and 0.923, respectively. Conclusions: TheproposedFERmethodoutperformsthestate-of-the-artFERmethodsbasedonthehand-craftedfeatures or deep networks using one channel. Compared with the deep networks that use multiple channels, our proposed network can achieve comparable performance with easier procedures. Fine-tuning is effective to FER tasks with a well pre-trained model if sufﬁcient samples cannot be collected.

The use of machines to perform different tasks is constantly increasing in society. Providing machines with perception can lead them to perform a great variety of tasks. Machine perception requires that machines understand about their environment. Recognizing facial emotions will thus help in this regard. We use the TensorFlow library and the Inception model and apply transfer-learning for our dataset to retrain the model. We then identify the facial emotions: happiness, sadness, anger and surprise.

Interest is growing in improving all aspect of the interaction between human and computer including human emotions. It is a crucial task for a computer to understand human emotions. A very meaningful way of expressing human emotions is facial expression. In this paper, a model facial expression recognition based on Extreme Learning Machine is proposed. Salient facial feature segments like eyebrows, eyes, mouth, and nose are detected from a face image and then these feature segments are extracted by using morphological image processing operation and edge detection technique to form feature vectors.

Extreme Learning Machine, a feed-forward neural network classifier with a single layer of hidden nodes is used for recognizing expressions of the input faces into six basic categories like happy, sad, surprise, angry, disgust, and fear. The experiments of facial expression recognition system are carried out on JAFFE facial expression database and performances of experimental results are analysed.