Facial Expression Recognition Using KERAS

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Abstract. Recognition of Facial expression in technology plays a major role in many sectors. It has many advantages because of which it is very important. It is mainly used in market research and testing. Many companies require a good and accurate testing method which contributes to their development by providing the necessary insights and drawing the accurate conclusions. Facial expression recognition technology can be developed through various methods. This technology can be developed by using the deep learning with the convolutional neural networks (CNN). The main objective here is to classify each face based on the emotions shown into seven categories which include Anger, Disgust, Fear, Happiness, Sadness, Surprise and Neutrality. The main objective here in this project is, to read the facial expressions of the people and displaying them. OpenCV is used for automatic detection of faces and drawing bounding boxes around them. Face detection using the Haar cascades is a machine learning based algorithm where a cascade function will be trained with a set of input data. OpenCV contains many pre-trained classifiers for face, eyes, smile etc. The deep learning is a subset of machine learning. Deep learning is used by Google to translate the information form one language to another using deep learning approach. The network should be trained with relatively more data in deep learning.

1. Introduction

The facial recognition technology has many uses like providing security whereas the facial expression recognition technology will be useful for detection of truthfulness or potential deception. This is of great use for the police department for solving a crime. The police can analyze if the eyewitness or the suspect is lying which is very useful in analyzing the crime scene [1-3]. By using this technology, it gets easy to know persons way of thinking and his interest in various aspects which will be very advantageous for various companies for improving their sales. Facial expressions and other gestures are very important in the nonverbal communication which plays a major role in interpersonal relations. So, facial expression recognition, as it extracts and analyzes the information taken from the images or videos, it will be able to deliver the exact or the unbiased emotional responses as data. We achieve the facial recognition by detecting the faces and by analyzing the movement of our eyes, nose, lips etc. and analyzing changes in the appearance of the facial features and classifying various expressions. Analyzing the facial expressions helps the companies in market research. Market research is very important for the companies to have a clear picture on what the people have their interest in. If a company launches a product without any market research, there will be very high chances of failure [4-7]. So, the companies perform some market research prior to launching the product. The market research is done in many ways, one of which is analyzing the facial expressions of people when they are viewing
the product which helps in determining their interest in it. Facial expression recognition technology can also be used in video game testing. During the video game testing, certain users are asked to play the game for a specified period and their expressions, and their behavior are monitored and analyzed. The game developers usually use the facial expression recognition and get the required insights and draw the conclusions and provide their feedback in the making of the final product. In this project, deep learning with the convolutional neural networks (CNN) approach is used. Neural networks need to be trained with large amounts of data and have a higher computational power [8-11]. It takes more time to train the model.

2. Methodology

In this paper, deep learning with the convolutional neural network approach is used. The Keras Application Programming Interface and OpenCV framework were used [12]. OpenCV is used for the automatic detection of faces and drawing bounding boxes around them. OpenCV consists of many pre-trained classifiers for face, eyes, smile etc [13-16]. The model here is trained with the dataset used in the ICMR (International Conference on Machine Learning). This dataset can be taken from the Kaggle website.

All the images of the dataset are of size 48*48. To select some images from every category, utility function can be used [17-20].

![Fig.1. Training Dataset](image)
Fig 1 shows the facial expressions datasets of different people. We need to check the class imbalance problem before modeling and perform the data augmentation and check which class has lesser data and provide more of the data of the minority class. So, the number of images contained in each section should be checked [21-23]. These command lines can be used for this purpose, for expression in os.listdir("train/"):print(str(len(os.listdir("train/" + expression))) + " " + expression + " images")The training data should be set based on expressions. Dataset is split into 80% training and 20% test. During training, the loss of the neural network is minimized using the mini batch gradient descent[24-25]. In the paper, two data generators are used. One is for the training and the other is for testing.

![Convolutional Neural Network (CNN) Diagram](image)

**Fig.2.** Creating the Convolutional Neural Network (CNN)

Fig 2 shows the creation of CNN Network In the convolution block1, the data will be convoluted, and batch normalization is performed, and activation is done using the RELU activation function. Then, the Max pooling is performed, and dropout is done. The same process is done in the block2 and block3. In block4, the same process takes place, but at the end flattening is done. In the FC1 (fully connected layer), the data will be passed to a dense function and batch normalization is performed and activation is done using the RELU activation function. Then, the Max pooling is performed, and dropout is done. This repeats even for FC2. At the output, dense function is performed and SoftMax is applied. By this process, size decreases from layer to layer and it finally chooses one out of the seven classes. Flask web application is used to view the output. Flask is a web framework, which provides us with tools, libraries and technologies that allow us to build a web application. This web application can be some web pages, a blog, a wiki or go as big as a web-based calendar application or a commercial website. In this project flask web framework is used to create a web page where our output will be detected.

### 3. Results and Discussion

Validation of the designed network is done using different real facial expressions in which the faces are detected and bounded by a box and the facial expressions are named accordingly which are shown below.
From the above figures it is clear that the designed CNN Predicts facial expression clearly.

4. Conclusion:
Facial expression recognition is done using deep learning with the convolutional neural network approach CNN and automatic detection of faces and drawing bounding boxes around them are done using different data set’s. The activation is done using the RELU activation function in the work. The validation is done with the real time images with different expression. The proposed model gives the correct expression name using the trained CNN network.

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