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Facial Expression Recognition using DL

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Abstract: *In In this project, we develop a system to predict emotions from facial expressions images. Human emotion detection is implemented in many areas requiring additional security or information about the person. It can be seen as a second step to face detection where we may be required to set up a second layer of security, where along with the face, the emotion is also detected. This can be useful to verify that the person standing in front of the camera. Human emotions can be classified as: anger, fear, disgust, happy, sad and surprise. We use convolution neural network for classification of emotions.*

Keywords: Machine Learning algorithms, Libraries, User Interface, Jupyter Notebook

I. INTRODUCTION

Facial expressions play an important role in understanding and recognition of emotions. For facial emotion recognition, the traditional approaches usually consider a face image that is distinguished from an information picture, and facial segments or milestones are recognized from the face districts. After that, different spatial and worldly highlights are separated from these facial segments. At last dependent on the separated highlights a classifier, for example, Keras library, random forest, is trained to produce recognitions results. This work is an applied, deep learning model. Deep learning is a well-set model in the pattern recognition domain. It uses a Convolutional Neural Network (CNN) algorithm using Keras library. CNN is a specific sort of artificial neural network that uses a machine-learning unit. CNN applies to objects detections, face recognition, image processing, etc. Deep convolutional neural network (DCNN) composition of many neural network layers. Which is also can be able to extract significant features from the data.

II. PROPOSED SYSTEM

Deep learning techniques, specifically to predict the facial expressions of humans. Recurrent Neural Network is a very powerful classification algorithm that makes use of Deep Learning approach in Artificial Neural Network. Therefore we used CNN and Keras library in order to recognize the emotion.

III. TECHNOLOGIES USED

3.1 Jupyter Notebook

It uses to compile all aspects of a project in one place. Instead of Google colab we used this because it helps to create a user interface, which is required to predict the output in this project. Users can create data visualizations through jupyter notebook. Data visualization is easy in jupyter notebook.

3.2 Python Libraries

[1]NumPy are used for data analysis. [2] Pickling is the process of converting a Python object into a byte stream to store it in a file/database, maintain program state across sessions, or transport data over the network.[3] Scikit provides a selection of efficient tools for machine learning and statistical modeling including classification, regression, clustering and dimensionality reduction via a consistence interface in Python. [4] Logistic Regression is used for predicting the categorical dependent variable using a given set of independent variables. [5] OpenCV is a Python library that allows you to perform image processing and computer vision tasks. [6] Keras is written in Python and is used to make the implementation of neural networks easy. [7] Matplotlib is a comprehensive library for creating static, animated, and interactive visualizations in Python. [8]TensorFlow is a Python-friendly open source library for numerical computation that makes machine learning and developing neural networks faster and easier. [9] The OS module in Python provides functions for creating and removing a directory (folder), fetching its contents, changing and identifying the current

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directory, etc. [10] Adam optimization is a stochastic gradient descent method that is based on adaptive estimation of first-order and second-order moments.

3.3 Dataset

Dataset is downloaded from Kaggle as test and train data.

3.4 Modules

- **Data Collection:** Data is divided in two categories-Test and Train. These further are divided into seven different emotions Angry, Fear, Disgust, Sad, Happy, Neutral, Surprise.
- **Training Module:** In this module we have trained our model in order to recognise the facial expression when the input is given by the user.
- **Testing Module:** In this module we have tested our model in order to predict the facial expression as an output for the input is given by the user.
- **Accuracy:** In order to get the accuracy, we run a couple of epochs through which we can gain better accuracy. We can calculate the accuracy by the formula.
- **Test Accuracy:** {scores [1] *100}
- **Prediction:** We find the prediction for each emotion individually and prediction which has the highest value will be considered as the output.

IV. RESULTS

4.1 Model Summary

```
In [15]:
model.summary()
Model: "sequential_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_1 (Conv2D)            (None, 48, 48, 32)        896
_________________________________________________________________
activation_1 (Activation)    (None, 48, 48, 32)        0
_________________________________________________________________
batch_normalization_1 (Batch (None, 48, 48, 32)        128
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 16, 16, 32)        0
_________________________________________________________________
dropout_1 (Dropout)          (None, 16, 16, 32)        0
_________________________________________________________________
conv2d_2 (Conv2D)            (None, 16, 16, 64)        18496
_________________________________________________________________
activation_2 (Activation)    (None, 16, 16, 64)        0
_________________________________________________________________
batch_normalization_2 (Batch (None, 16, 16, 64)        256
_________________________________________________________________
conv2d_3 (Conv2D)            (None, 16, 16, 64)        36928
_________________________________________________________________
activation_3 (Activation)    (None, 16, 16, 64)        0
_________________________________________________________________
batch_normalization_3 (Batch (None, 16, 16, 64)        256
_________________________________________________________________
max_pooling2d_2 (MaxPooling2 (None, 8, 8, 64)          0
_________________________________________________________________
dropout_2 (Dropout)          (None, 8, 8, 64)          0
_________________________________________________________________
conv2d_4 (Conv2D)            (None, 8, 8, 128)         73856
_________________________________________________________________
activation_4 (Activation)    (None, 8, 8, 128)         0
_________________________________________________________________
batch_normalization_4 (Batch (None, 8, 8, 128)         512
```

Figure 1.1: Models Taken

The above figure 1.1 shows the models which are loaded, taken and then used for the facial emotion recognition. These are some of the main models for the process of recognition.

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4.2 Accuracy Graph

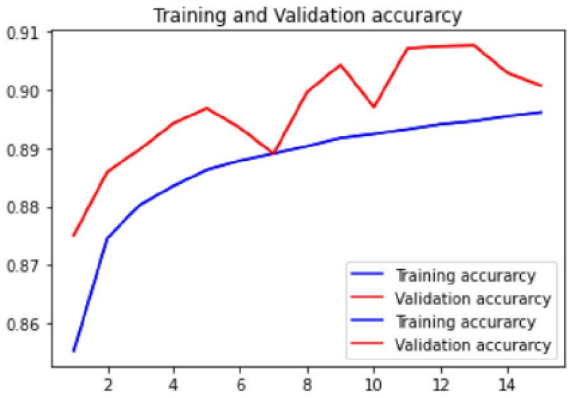

Figure 1.2: Training and Validation Accuracy

The above figure 1.2 shows how accurately the results are shown. The models which are taken for training are also tested for getting the best accuracy. The figure describes the both accuracies.

4.3 Loss Graph

Figure 1.3: Training and Validation Loss

The above figure 1.3 shows the graphical relation of the training loss and validation loss. With the graph of the loss of both methods together, we can get the loss in an easier way.

4.4 Accuracy of the Model

```
[INFO] Calculating model accuracy
60289/60289 [==============================] - 187s 3ms/step
Test Accuracy: 90.07328748703003
```

Figure 1.4: Calculation of Accuracy

The above fig 1.4 shows the calculation of model's accuracy. Based on this accuracy, we can make an estimation of the working of facial emotion recognition.

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4.5 Input Given

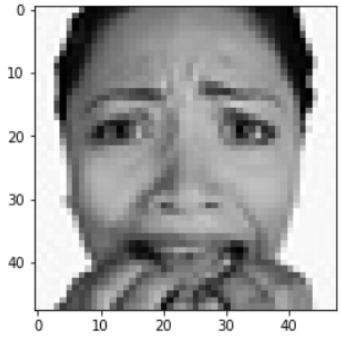

Figure 1.5: Image used as the input

The above fig: 1.5 is currently used as an input factor. As the algorithm goes on, we'll get the emotion of the taken picture in the output we get.

4.6 Output Obtained

```
Predictions & Output:

[3.6401331e-04 7.5761392e-08 9.8414779e-01 7.9269063e-05 3.0935422e-04
 1.3762464e-02 1.3370444e-03]
Fear
```

Figure 1.6: Result obtained from the input

The above fig: 1.6 shows predictions from the taken values for recognizing the emotion. In the next line, the model we've prepared will process the image and gives the output of emotion.

V. SCOPE OF FUTURE USE

We have predicted the facial emotion of the given picture with our method. This facial emotion recognition can be mainly used in various fields to identify different things from a person's face. Mainly for future, it'll be easy and a quick way to recognize the emotions with images. The main scope is, it can be used in lot of real-life events like a doctor identifying the patient's suffering through the image, any company recognizing the emotions of its employees to know how they feel, for parents who wants to know the emotions of their children by seeing pictures etc. Without this model, one of the main ideas of Machine Learning of knowing facial emotions cannot be done. This makes a good advantage for the present and future technologies to know the emotions of a person. This research also helps others to work on image preprocessing and the techniques used for it.

VI. CONCLUSION

Therefore, by this prediction of facial emotion recognition, we've come to know how the facial emotions can be recognized with almost full accuracy that we've seen in the above model. At last, we've found the facial emotion.

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