



Emotion Analysis using Deep Learning Techniques

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Abstract :

Image sharing has become one of the primary means to communicate with people as the world is being influenced by social media. People show their emotions or feelings to others by sharing their images in the social media where a large amount of unstructured data is generated. These images will help the people around him to analyze his behaviour at that particular moment. A model is proposed to detect the emotion of the person in the image that would evaluate his feelings at that moment and the emotion detection algorithm performs facial recognition and detects the facial expression and conveys the appropriate captions.

Keyword - Image processing, Emotion detection, CNN.

I. INTRODUCTION

The enhanced usage of social media in today's world made social media platforms to attain with innovative ideas enabling the people to communicate. Generally human beings express their emotions through non-verbal ways such as gestures and facial expressions which can be treated as a major limitation of texting. The analysis of emotions would help us to study the behavior of a person and measures the well being of a person. The process of texting can be enhanced with filtered images that brings life to communicate online while these filtered images would prove to be even more useful if the system can detect the emotion of the person in the image. Many social media platforms ask us to select the status or the emotion to be displayed when the image is shared and this emotion detection algorithm would automatically detect the person's emotion and update accordingly. The system classifies the facial expression of the same person into basic emotions namely happiness, anger, fear, disgust, surprise and sadness. The emotion detection can be used to update the status automatically instead of choosing it manually every time. It can be used in social media platforms to share our emotions with people across the world as this makes reaching out to the world easier, better and faster.

II. LITERATURE SURVEY

Emotions play an important role in improving social life and also communicating among people. In recent days, facial emotion recognition is extremely adopted to develop human-computer interfaces (HCI) and humanoid robots. A method of triangulation to extract a set of geometric features is proposed to classify six facial emotional expressions (sadness, anger, fear, surprise, disgust, and happiness). In this paper [1], the authors defined a mathematical model which places eight virtual markers in a specified location on the person's face in an automated way where five triangles are designed using eight markers' positions as an edge of each triangle. The features are extracted to classify the facial emotions and distinguish them using various types of machine learning algorithms. The feature gives a maximum mean classification rate of 98.17% using a Random Forest (RF) classifier compared to other features and classifiers in distinguishing emotional expressions. But since this algorithm deals with more of the geometry of the facial features when compared to their positioning, this seems to be ineffective for a certain class a people.

In the paper [2], the authors investigated on negative emotions states recognition where they employed Fuzzy Adaptive Resonance Theory (Fuzzy-ART) which considered the various changes involved in the activities of autonomic nervous system (ANS). Some experiments were done to encourage suitable physiological responses on individuals to obtain an appropriate database for training, validating and testing the proposed procedure. The physiological responses were analysed by Fuzzy-ART [2] to recognize which question excites the negative emotions. An accuracy of 94% is obtained from this model which delivers a great accuracy but doesn't continue the approach of taking into account the positioning and the movement of facial attributes, which becomes a major criterion to consider the facial expression. Hence, the deduction can't be trusted as a whole.

Emotion identification has become more precise and accessible due to the advancement in computer vision and machine learning [3]. Recognition of facial expression is growing very quickly as a sub-field of image processing.

The most common way for the humans to convey their mood or emotions or feelings is through their facial expression. There are many attempts to make an automatic facial expression analysis tools [4] since it can be used as an application in many fields.

III. PROPOSED SYSTEM

The data is obtained by converting the images into 2-dimensional pixelated arrays, which depict the position of the attributes of a human face. These position vectors can be used to depict the underlying emotion of the person involved. The captions can be determined

through the facial emotions of the people involved and also the other interesting captions also can be added to the picture as per the emotion.

PREPROCESSING

The first step in preprocessing includes importing the libraries and reading the CSV file. After reading the file, the data is divided into X and Y labels to create a dependency variable. Then the features are extracted using `expand_dims()` function and the image is converted into a pixel array of size $n*n$ that represents the positioning of facial attributes and the colour combinations of the image. Once the data is preprocessed, we get,

- Number of Features: 2304(48x48)
- Number of Labels: 7
- Number of images in the dataset: 35887

Initially, the model is being trained with the dataset `fer2013.csv` and as the image is given as an input, the model detects the emotion through prediction from the trained CNN model. The images are stored in the form of an array which depicts the pixel location of $n*n$ size and using this array, the position of different facial attributes can be identified which classifies the images broadly under the categories of happy, sad, surprise, angry, neutral and disgust. The data is processed initially to bring uniformity while training the model. Accuracy of the CNN model can be determined by testing the model against similar kind of data. At UI level, as the image is being inserted, it is subsequently being converted into an $n*n$ pixel array, which when subjected with the ML model, can detect the emotion and printing the corresponding statement.

DEVELOPMENT

It is necessary to import the required libraries and initialize the variables needed for training our CNN model and since the pixel resolution is 48x48 the width and height is taken as 48. As we considered 7 emotions for prediction namely (0=Angry, 1=Disgust, 2=Fear, 3=Happy, 4=Sad, 5=Surprise, 6=Neutral) there are 7 labels. The inputs are being processed with a batch size of 64 and the dataset `fer2013.csv` has been downloaded from Kaggle. Here data is represented in a favorable format that do not require to use `train_test_split()` function to divide the data into train and test data. Along with X and Y labels, a new label is also used in this dataset only to distinguish the entry as training data or testing data. This validation is used to determine the accuracy of the model and to derive the efficiency and consistency with which the model can be used. The output generated would be

- Images number in Training Data set: 32298
- Images number in Test Data set: 3589

DESIGNING THE CNN

This step is the most important part of the entire process as the CNN is designed through which all the features are passed to train the model and eventually test it using the test features. The CNN model developed is provided with ample features which determine the prediction of the dependent variable based upon the parameters that are provided to the model. Variations observed among different CNN models can be observed below:

1. `Sequential()`: A sequential model is just a linear stack of layers which is putting layers on top of each other as we progress from the input layer to the output layer.
2. `model.add(Conv2D())`: This is a 2D Convolutional layer which performs the convolution operation on the input layers.
3. `model.add(BatchNormalization())`: It performs the batch normalization operation on inputs to the next layer so that we have our inputs in a specified scale say 0 to 1 instead of being scattered all over the place.
4. `model.add(MaxPooling2D())`: The pooling operation is performed on the data by making use of a pooling window of 2x2 with 2x2 strides in this model.
5. `model.add(Dropout())`: In this technique randomly selected neurons are disregarded during training the model that reduces overfitting on given input layers.
6. `model.add(Flatten())`-This just flattens the input from ND to 1D and does not affect the batch size.
7. `model.add(Dense())`-According to Keras Documentation, Dense implements the operation: $output = activation(dot(input, kernel))$ where activation is the element-wise activation function passed as the activation argument, kernel is a weights matrix created by the layer. During testing, this layer is responsible for creating the final label for the image being processed from the input layers. After the `model.summary()` function is executed, the summary representation of the model is printed.

IV. RESULTS AND DISCUSSION



Fig 1: Image with happy emotion and grey-scale filter

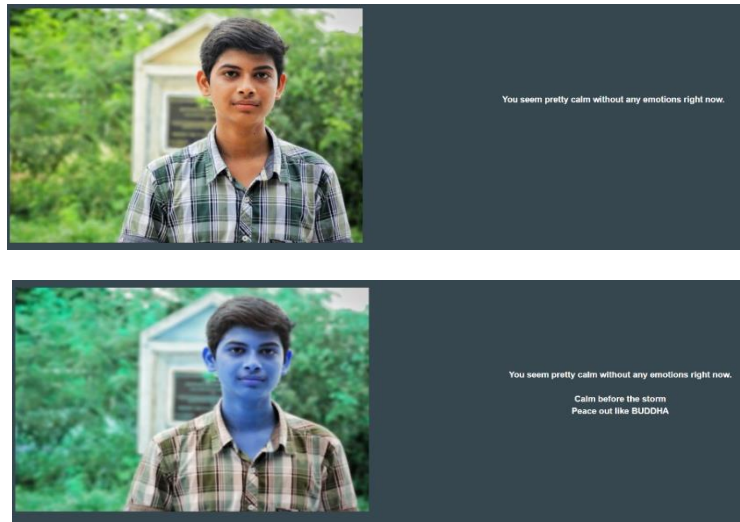


Fig 2: Image without any emotion and UV filter

V. CONCLUSION

The application gives accurate results and proves to be helpful among various domains, i.e., to post the images on social media, expression detection among the individuals. The main objective was to develop a facial expression recognition system implementing the computer vision and enhancing the advanced feature extraction and classification in face expression recognition. Experiment results on the FER dataset show that the proposed method gives 71% accuracy. Certain models that include image libraries in python can bring up the accuracy of the models as high as 86.43%. Our model has been trained with the existing data set. Our future work will focus on improving the performance of the system through providing multiple filters and achieving a greater classification among the emotions.

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