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Implementing ML for emotion detection Based on facial expression

Adithya S[1], Sujith S[2], Vidyarani H J[3],

[12]BE Information Science Student, Dr. Ambedkar Institute of Technology
[3]Asst.Professor, Dept. Of ISE, Dr. Ambedkar Institute of Technology

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Abstract – Automatic emotion recognition is a challenging task that has gained significant scientific interest in recent years due to its applications in crowd analytics, social media, marketing, event detection and summarization, public safety, human computer interaction, digital security surveillance, street analytics, and image retrieval.

Face detection has been around for many decades. Human emotion detection is very important at this point of time so that modern artificial intelligent systems can detect and capture emotion from human facial expression. This work could be used to make informed decisions regarding identification of people's intent, promotion offers to the employees or security related threats.

Recognition of human emotion from images or video is a trifling task for human eyes, but it has been proved to be very challenging task for machines and this process requires many image processing techniques for extracting the images. Different types of machine learning algorithms are appropriate for this job. For a machine to detect or recognize human requires various training algorithms and then testing them on a variety of fit dataset. This paper features emotion extraction techniques and machine learning algorithms which help us in faster and more accurate detection of the human emotion.

Key Words: Emotion detection,kaggle dataset, keras, opencv, Python.

1. INTRODUCTION

Facial emotion detection system is used in majority of areas where additional security or information about the person is required. It is like a next step to face detection where there is a need for second layer of security, where both face and emotion are detected. This is very useful to find whether the person in front of camera is 2D image or not.

Another significant field where we see the importance of emotion detection is for promotion of businesses. Most of the businesses struggle on the responses of customers to the products and offers offered by them. If an AI system can figure out the emotions based on user image or video, they can come to a conclusion on whether the customer liked or disliked the products and offers offered by them.

We know that security is the major reason for finding out a person. It can also be based on biometrics matching, speech recognition, passwords, retinal scanning and many more. Finding out the intention of the person is also a major aspect to avoid problems. This might be very helpful in delicate areas like airports, bus stations, railway stations, concerts and public gatherings where many attacks have took place in the recent years. Human emotions can be of many types, namely: Happy, contempt, disgust, anger, surprise, sad, fear, and neutral. Facial muscle contractions are very minute and finding out these changes is very difficult as even small changes result in diff emotions. Also, emotions of even the same people sometimes vary for the same emotion, While focusing on only the areas of the face where the display of a emotions is maximum like around the mouth and eyes is a problem, how we extract these changes and categorize them is another problem. Neural networks and machine learning have areas of the face which display a maximum of emotions like around the mouth and eyes, how we 2 extract these gestures and categorize them is still an important question. Machine learning algorithm is proven to be a very good tool in pattern recognition and classification as its faster and easier. The main reason for using machine learning is because of its features. Class probability and offset values for the bounding box. The human emotion dataset can be a very good example to study nature of classification algorithms and their strengths and how well they perform with respect to different types of dataset. For most of the cases before extracting the features for emotion detection, face detection algorithms are applied on the image. We could generalize the emotion detection process as follows:

1) Dataset preprocessing
2) Face detection
3) Feature extraction
4) Classification based on the features

2. LITERATURE SURVEY

2.1 Facial Emotion Analysis using Deep Convolution Neural Network

The emotion displayed by human are mental states of moods that arise instinctively rather than through mindful efforts by the brain and these emotions are accompanied by physiological variations in facial muscles which indicates expression displayed by the face. The common emotion displayed is happy, sad, anger, disgust, fear, surprise etc. Facial expressions have an important role in nonverbal communication which appears due to internal feelings of a person which inurn reflects on the faces. In order to computer modeling of human's emotion, a plenty of research has been accomplished. But still it is far behind 13 from human vision system. In this system, they are providing better approach to predict human emotions using deep Convolution Neural Network (CNN) and how emotion intensity changes on a face from low level to high level of emotion.

2.2 Automatic facial expression recognition based on Local Binary Patterns of Local areas

Automatic facial expression recognition is one of the great challenges in facial expression recognition field. An algorithm of automatic facial expression recognition is proposed based on Local Binary Patterns of local areas (LLBP) in this work. First, the position of eye balls is fixed by paperion method. Then the local areas of the eyes and mouth's neighborhood could be determined through the prior knowledge of face

structure. The LBP feature on the local areas is then computed as the facial feature for facial expression recognition.

2.3 Understanding of a Convolutional Neural Network

the term Deep Learning or Deep Neural Network refers to Artificial Neural Networks (ANN) with multi layers The interest in having deeper hidden layers has recently begun to surpass classical methods performance in different fields; Convolutional Neural Network (CNN) is very popular especially in pattern recognition it is based on deep neural network.

3. PROPOSED SYSTEM

Convolutional Neural Network as the name suggests is a type of neural network model which allows the user to get higher depictions for the image content. Whereas in the classical image recognition the user has to define the image features themselves, the neural network takes the raw image pixel data and using the data the model is trained, then the features are automatically extracted for better classification.

It has proven been that the CNN performs accurately and faster than the other algorithms. We used following methodology, design, tools to build the object detection system.

3.1 Methodology

Step 1: Image Acquisition: Getting input i.e., image from kaggle dataset. It contains 48 X 48 size grayscale images of the human face. Which provide a large dataset divided into seven directories which contain the image of happy, sad, disgust, angry, neutral, fear, surprise.

Step 2: Importing libraries and categorize the datasets: Python libraries are imported. We then check if the image belongs to which set training or test set. If the image belongs to either of them then they get appended to their respective sets.

Step 3: CNN model: Then we design the CNN model for emotion recognition having four layers. Initialize the model followed by batch normalization layer and then different convents layers with ReLu as an activation function, max pool layers, and dropouts to do learning efficiently.

Step 4: Compiling the model: The model is then compiled using Adam as an optimizer. Then loss and matrix are defined as loss as categorical cross-entropy, and metrics as accuracy.

Step 5: Saving the model weights: By saving the model weights in an h5 file. Now we can make use of this file to make predictions rather than training the network again.

Step 6: Testing the model in Real-time using OpenCV and WebCam:

Required libraries and Model weights that were saved during training are imported. Import the haar cascade file and write a code to detect faces and classify the emotions. Assign the labels that will be differentiate the emotions

Like happy, sad ,angry ,surprise ,neutral .

3.2 System Architecture

The architecture of a convolutional neural network

Or CNN contains many layers mainly input layer, some convolutional layers, some fully-connected layers, and an output layer.

• Input Layer**:**

The input layer in CNN has pre-determined, fixed dimensions, so the image is pre-processed before being fed into the layer. Normalized gray scale images of size 48 X 48 pixels from Kaggle dataset are used in this training, validation and testing. For testing propose webcam images are also used, in which face is detected and cropped using OpenCV Haar Cascade Classifier and normalized.

• Convolution and Pooling (ConvPool) Layers:

Convolution and pooling is done based on batch processing. Each batch has N images and CNN filter weights are updated on those batches. Each convolution layer takes image batch input of four dimension N x Color-Channel x width x height.

The architecture of the Convolution Neural Network used in the paper is shown in the figure:

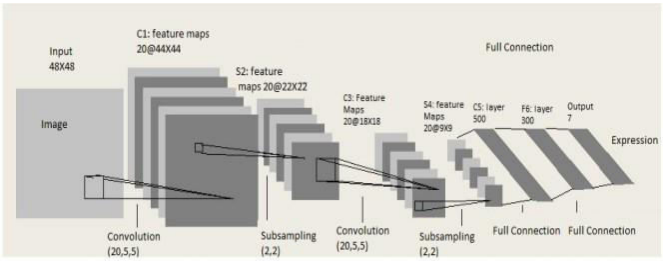

Fig 3.1: System architecture

• The Fully Connected (FC): layer consists of the weights and biases along with the neurons and is used to connect the neurons between two different layers. These layers are usually placed before the output layer and form the last few layers of a CNN Architecture.

In this, the input image from the previous layers are flattened and fed to the FC layer. The flattened vector then undergoes few more FC layers where the mathematical functions operations usually take place. In this stage, the classification process begins to take place.

• The Dropout layer: Dropout is actually used in regularization. which aims to help prevent overfitting by increasing testing accuracy, perhaps at the expense of training accuracy. For each mini-batch in our training set, dropout layers, with probability p, randomly disconnect inputs from the preceding layer to the next layer in the network architecture.

3.3 Tools Used

To develop this emotion detection paper, we used Python language in anaconda platform. We made use of many python libraries like keras , OpenCV, NumPy, OS and Flask.

Flask is used to integrate the python code with Html for building an efficient GUI.

4. RESULTS AND DISCUSSION

The results show that the system has performed well with the given input. Considering the elements which are present in

datasets we get 80% accuracy in recognizing the human emotion. This paper works for images with .jpeg .png .jpg formats. Fig-1 shows the output image of the recognized image with bounding box and the detected image with emotion classification above the box.

4.1 Output Image and Detected emotion:

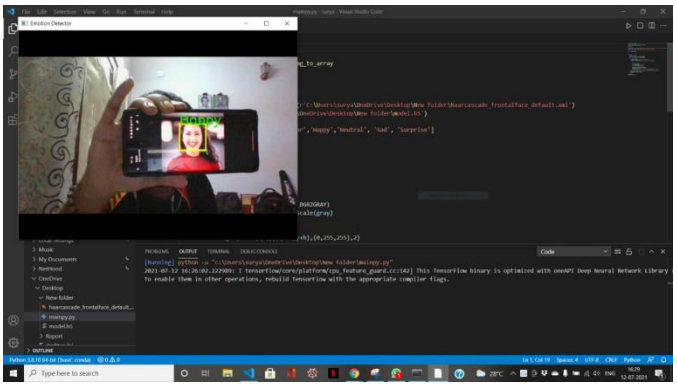

Fig: 4.1 Output Image

4.2 Discussion

The Fig-4.2 shows the accuracy and loss of the system. The image shows the graph plotted for showing the accuracy of the ml based emotion detection model, Adam optimizer is used to compile this. On the right is a graph of loss of the system. The graph contains two lines, the yellow and the blue colored line. The yellow line indicates the validation accuracy and the blue line indicates the training accuracy.by looking at the training and validation lines we can say the accuracy of the model. By looking at all the data present and analysis practically with n number of input and output images we can say that the proposed system is highly efficient, accurate and faster in emotion detection.

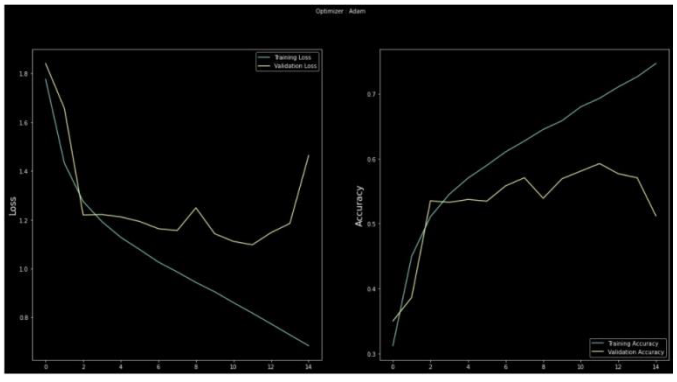

Fig: 4.1 graph of accuracy and loss

5. COCLUSION

We introduced machine learning based emotion detection, a unified model for emotion detection. Our emotion detection model is easy to develop and implement. It can be trained directly with custom datasets there are many ready datasets available on the internet. This model uses kaggle dataset for training the model. In this paper, seven different facial expressions of different persons' images from different datasets have been analyzed. This paper involves facial expression pre-processing of captured facial images followed by feature extraction using feature extraction using Local Binary Patterns and classification of facial expressions based on training of datasets of facial images based on CNN. This paper recognizes more facial expressions based on Haarcascade and Kaggle dataset.

In this paper, a CNN architecture based four layer convolution neural network is implemented to classify human facial expressions i.e. happy, sad, surprise, fear, anger, disgust, and neutral. The system has been evaluated using Accuracy, Precision, Recall and F1-score. The classifier achieved accuracy of 80%.

The emotion detection model is trained on a loss function that directly corresponds to performance of the emotion detection model and the whole model is trained jointly.

With the obtained tests and results of the model we can conclude that proposed model is one of the most powerful, accurate and the fastest object detection model that is present today. The Machine learning based emotion detection is always the first choice for every real-time identification of human emotion. Since its faster and accurate.

REFERENCES

[1] Shan, C., Gong, S., & McOwan, P. W. (2005, September). Robust facial expression recognition using local binary patterns. In Image Processing, 2005. ICIP 2005. IEEE International Conference on (Vol. 2, pp. II-370). IEEE.

[2] Chibelushi, C. C., & Bourel, F. (2003). Facial expression recognition: A brief tutorial overview. CVonline: On-Line Compendium of Computer Vision, 9.

[3] "Convolutional Neural Networks (LeNet) – DeepLearning 0.1 documentation". DeepLearning 0.1. LISA Lab. Retrieved 31 August 2013.

[4] Matusugu, Masakazu; Katsuhiko Mori; Yusuke Mitari; Yuji Kaneda (2003). "Subject independent facial expression recognition with robust face detection using a convolutional neural network" (PDF). Neural Networks. 16 (5): 555–559. doi:10.1016/S0893-6080(03)00115-1. Retrieved 17 November 2013.

[5] LeCun, Yann. "LeNet-5, convolutional neural networks". Retrieved 16 November 2013 [6] C. Zor, "Facial expression recognition," Master's thesis, University of Surrey, Guildford, 2008.

[7] Suwa, M.; Sugie N. and Fujimora K. A Preliminary Note on Pattern Recognition of Human Emotional Expression, Proc. International Joint Conf, Pattern Recognition, pages 408-410, 1978

[8] Vidyarani H J, Srishail math , Robust and Efficient Person Re-Identification Model using K-Nearest Neighbor Graph International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-9 Issue-2, December 2019