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AI Therapist – Emotion Detection using Facial Detection and Recognition & Showing Content According to Emotions

Sanket Godbole[1], Jaivardhan Shelke[2]

[1]Student, [2]Software Engineer,
[1]Departmet Information Technology, Government College of Engineering, Aurangabad, Maharashtra, India
[2]Kanthaka Consultancy Services Pvt Ltd, Pune, Maharashtra, India

ABSTRACT

This paper presents an integrated system for emotion detection using facial detection and recognition. we have taken into account the fact that emotions are most widely represented with eyes and mouth expressions. In this research effort, we implement a general convolutional neural network (CNN) building framework for designing real-time CNNs. We validate our models by creating a real-time vision system that accomplishes the tasks of face detection, emotion classification, and generating the content according to the emotion or mood of the person simultaneously in one blended step using our proposed CNN architecture.

Our proposed model consisted of modules such as image processing, Feature extraction, feature classification, and recommendation process. The images used in the experiment are pre-processed with various image processing methods like canny edge detection, histogram equalization, fit ellipse, and FER dataset is mediated for conducting the experiments. With a trained profile that can be updated flexibly, a user can detect his/her behavior on a real-time basis. It utilizes the state of the art of face detection and recognition algorithms.

KEYWORDS: *classification and recognition, Convolutional Neural Networks, Feature Extraction*

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I. INTRODUCTION

Human emotions and its detection and recognition play a very vital role in applications intended for handicapped persons or robotic intelligence or persons with difficulty in recognizing emotions or for developing intelligent Graphical Application. To detect the facial expressions on the human face his face must be detected and the face location and position must be known. Hence in most cases, emotion detection algorithms start with face detection, taking into account the fact that face emotions are mostly depicted in eyes and mouth.

There are two mutually benefited subtasks in any facial detection and recognition task that include Detection and Extraction of the image features. facial expression recognition system detects a face within the captured image and then it extracts features from the potential face for the recognition task. There are many different types of emotions that influence how we live and interact with others. At times, it may seem like we are ruled by these emotions. we intend to find this type of emotion like sadness, anger, happiness, disguise, etc.

Furthermore, CNNs are used as black-boxes and often their learned features remain hidden, making it complicated to establish a balance between their classification accuracy and unnecessary parameters Therefore, we implemented a real-time visualization.

II. Literature Review

IliasMaglogiannis, Demosthenes Vouyioukas, and Chris Aggelopoulospresented [1] presented an emotion detection and recognition system for color images. The proposed system detects the skin color using MRFs estimation in YCbCr space, overcoming the difficulty ofvarious skin regions detection under different lighting conditions, emotion recognition then follows, based on the construction of face, eye, and mouth maps.

Octavio Arriaga and Matias Valdenegro [2] have proposed and tested general building designs for creating real-time CNNs. Their architecture has been systematically built to reduce the number of parameters. by eliminating the fully connected layers and by reducing the number of parameters in the remaining convolutional layers via depth-wise separable convolutions.

Bee Theng Lau [3] developed to help to detect the emotions of the disabled who could not make a speech and also physical movements easily. These people tend to be seated at one fixed location or wheelchair and require assistance in most of the physical movements. the detection and

recognition rate is up to 89%, this is sufficient for assisting the disabled and their family members or caretakers to use in their daily life.

Wenlu Yang, Christophe Marsala [4] Investigates the psychophysiological response to events on an affective database in a game context. We address some common challenges for a physiological-based affective model such as segmentation, normalization, or relevant signals. For emotion detection task, we show that high arousal emotions are more detectable than the low arousal ones.

Fig1. Samples of FER 2013 Dataset

III. Emotion Recognition

The process of emotion detection system is to develop a system that can recognize the faces under different viewing angles in real time using video in an uncontrolled environment. The only problem persists while doing this is, we need to update the output in real time.

Facial detection is important step in emotion detection. The first thing to do in any machine learning task is to collect the data. What we need are thousands of images with labelled facial expressions. The public FER dataset is a great starting point for that. We imported the FER 2013 dataset for the emotion detection step.

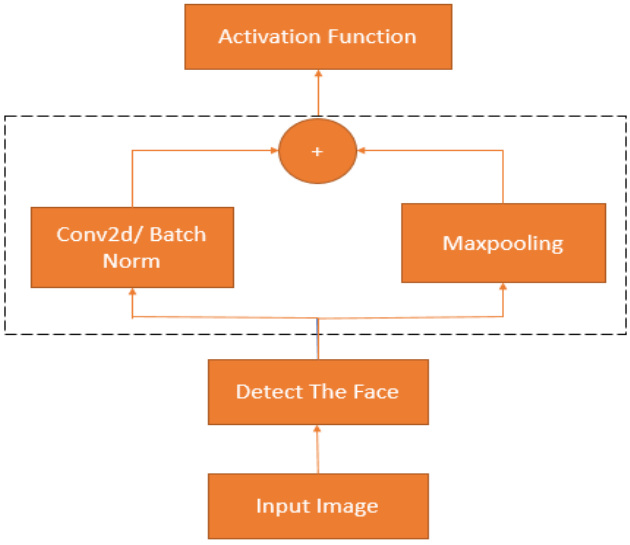

Fig2. Our Proposed System Architecture

Before we train an emotion detector, we first must be able to locate the faces within each image. Since the goal is to classify emotions from facial expressions, it makes sense to only keep the faces we find and ignore all the irrelevant things.

A. Converting Images into Grayscale Format

Grayscale is a range of monochromatic shades from black to white. Therefore, a grayscale image contains only shades of gray color and no color. While digital images can be saved as grayscale images, even color images contain some grayscale information. This is because each pixel has a certain brightness or intensity value despite its color. intensity values which can be measured on a scale from black to white. Black means zero intensity and White means high intensity. grayscale images are less complex and having an only single layer for processing and thus making it efficient for processing.

B. Histogram equalization

Histogram Equalization is a technique in image processing for adjusting image intensities to enhance contrast. Some of our images are blurry, dark and fragile we need to enhance those images by using Open CV function. For equalizing the histogram, we need to compute the histogram of the image and then normalize it into a probability distribution. For normalization, we just need to divide the frequency of each pixel intensity value by the total number of pixels present in the image. This is equal to the resolution of the image. The equalization process makes sure that the resulting histogram should be flat.

C. Neural Network

Implementation database is categorized as the Preprocessing phase, Learning phase, validation and testing phase. This has been carried outusing Keras and its functions which significantly reduces the time for neural network training, validation and testing. Keras is a high-level neural networks API, written in Python and capable of running on top of Tensor Flow, CNTK, or Theano.

Our Convolutional neural network model consisted of layers of Conv2d and Maxpooling parameters. **Keras Conv2D**is a 2D Convolution Layer, this layer creates a convolution kernel that is a wind with layers input which helps produce a tensor of outputs. Max-pooling reduces the dimensionality of images by reducing the number of pixels in the output from the previous convolutional layer and it also reduces the problem of over fitting.

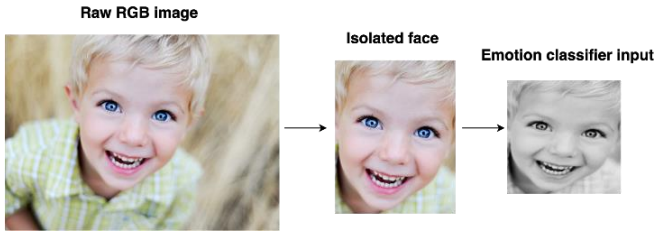

Fig3. Greyscale Conversion

D. Recommendation System

Recommender systems are algorithms that support human decision making by reducing the amount of available options to choose from. Understanding the factors that influence decision making is important for designing better recommender systems. Emotions and personality traits are psychological constructs that are linked to decision making and are used to improve recommendations.

The input is acquired in real-time. The hidden markov model classification are used for processing the acquired images. The frames that are obtained are considered in all frames

and all pixel formats for the purpose of emotion classification. The value of each landmark in the face is calculated and is stored for future use. The efficiency of classifier is about 90-95%.

The emotions are assigned for every content shown. When the emotion is transferred the respective content will displays. There are four emotions that can be used and the emotions are happy, anger, sad, surprise. When the happy emotion is recognized the content that are assigned for that particular emotion are played and the same happens with the other emotions as well that is it the content is displayed for the emotions detected respectively.

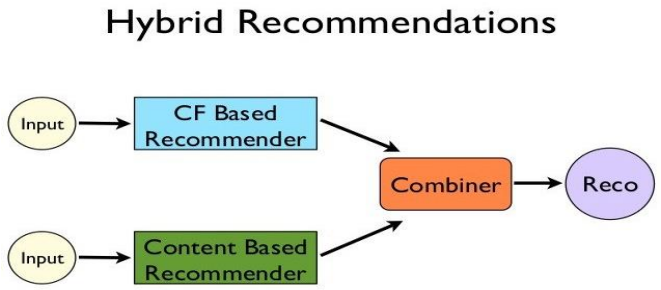

Fig 4 Recommendation Module

IV. Result

We validated this model in the FER-2013 dataset. This dataset contains 35,887 grayscale images where each image belongs to one of the following classes ["angry", "disgust", "fear", "happy", "sad", "surprise", "neutral"].

Table No.2 Sequential Model Performance

Epochs	Loss	Accuracy
1	1.4103	0.4147
2	1.1550	0.5257
3	1.0292	0.5817
4	0.9121	0.6352
5	0.8040	0.6867
6	0.6949	0.7329
7	0.5645	0.7840
8	0.4347	0.8373
9	0.3135	0.8875
10	0.2440	0.9150

The system was trained with training data set, and validated with validating data set to find the best network architecture and find the optimal solution. Our initial model achieved an accuracy of 65% in this dataset.

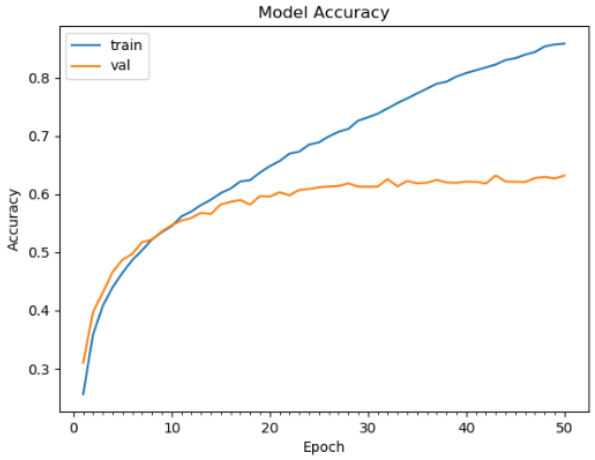

Chart1. Epoch vs Accuracy

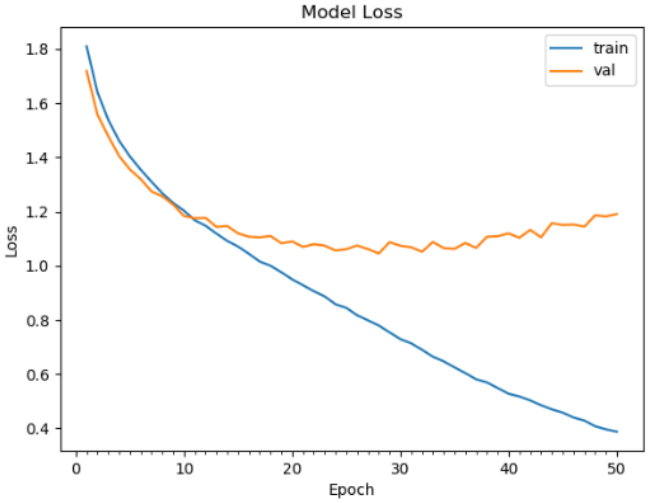

Chart2. Epoch vs Loss

V. Conclusion

This paper has described an approach to detect and recognize face with the CNN and show contents like music, blog, news according to the emotion of the person and it describes its overall performance. The algorithm proposed has three main stages Preprocessing, neural network classification and testing. Our analysis shows that the performance of Neural network data with a precise accuracy rate of 65%. This could significantly use to identify people suffering from depression, anxiety etc. and at the same time help them too. If user is often angry, program will suggest him tips for anger management. Future work also would investigate the use of a better complementing feature for real-time classification and recognition and showing the results live.

VI. References

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