International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 05 | May 2021 www.irjet.net p-ISSN: 2395-0072

Facial Emotion Detection Using Keras

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Abstract - *A Facial Emotion Detection is a very complex issue now a days. Real-time Facial Emotion Detection (FED) is very difficult work. This Paper is based on Deep Learning domain. In this proposed system we used Convolution Neural Network (CNN) to detect human facial emotion and for the better performance outcome. In this project we used Keras which is a deep learning API which helps to design deep learning model. Here we used TensorFlow as Back-End and Python Spyder (Anaconda) as Front-End. In this project I used Standard Data FER2013 it consists of 30,219 images which is further used for the purpose of training (24,282) and for validation (5937) images. This project helps to detect a face within a boundary of 48*48 pixel and detects the emotion for the inputted images. The basic five emotions of human beings are Happy, Sad, Angry, Neutral and Surprise.*

Key Words*: *Keras, NumPy , TensorFlow , FED , CNN

1.INTRODUCTION

We can find human emotions by various things like facial expression, body posters, gestures and through speech. Among them facial expressions is easy to obtain [2]. Facial expressions can be used to obtain 5 categories of expressions like neutral, happiness, surprise, anger and surprise. The baseline of the test will be around 14.7% [1]. Emotion is very much important, very complex and most researched topic in the fields of biomedical engineering, psychology, neuroscience and health. Studies in this area focus on detecting human facial 5 basic emotions. There are diverse methods in these works to detect emotional states such as electroencephalography (EEG), galvanic skin response (GSR), speech analysis, facial expression, multimodal, visual scanning behavior and so more [3]. It is very intricate to detect the emotions and separate among them. Early years emotion is starts to become an anxiety as a vital count towards the modern technology world. It rises the anticipation of new emergence for intelligence gear.

In the fresh ages, with the swift evolution of pattern recognition and artificial intelligence much more and more research has been directed in the field of human-computer interaction technology [7]. Feature detection procedures built on motionless images include Gabor wavelet transform [15], Haar wavelet transform [16], Local Binary Pattern (LBP), and Active Appearance Models (AAM) [7]. With the superior kind of scheming then that machine could detect the supplementary penalties and by which menfolk could sidestep serious environments and lot more [4]. FED systems can be separated into two main classes according to the feature depictions: static image FED and dynamic sequence FED [5]. Human emotion detection is implemented in numerous areas requiring extra safety or evidence about the person. It can be seen as a second step to face detection where we may be essential to build a second layer of safety, where along with the face, the emotion is also detected [6].

Commonly speaking, the measurement of feature is large before and after the achievement of feature, and thus the dimension reduction is sometimes disbursed. The facial expression classification refers to the utilization of specific algorithms to spot the categories of facial expressions in step with the extracted features. Unlike traditional CNN, the convolution core of CNN diverges thanks to the more discriminant differences between feature maps at the identical level, leading to fewer redundant features and a more compact image representation [7].

"The Facial expression was primarily introduced as a research field by Darwin in his book - The Expression of the Emotions in Man and Animals" [7], and then it was studied by many other researchers. Ekman introduced the six basic emotions which are; happiness, sadness, anger, surprise and the neutral emotion that is measured in most of the works, these emotions became worldwide among human beings [8]. The chief pro of such an approach is low computational necessities [9].

Occasionally the facial expression study has been confused with emotion study in the computer vision domain [10]. Recently, due to the swift progress in pattern recognition and artificial intelligence, lots of studies has been carried out in the field of human- computer interaction technology. The facial emotion detection is one of the most appreciated aspect of intelligent human-computer collaboration, and has a wide-ranging application background [11].

Numerous other chief tasks, computers can offer rewards over humans in analysis and tricky-solving. Computers that can detect facial emotions can find application where efficacy and automation can be beneficial, including in entertainment, public media, content analysis, unlawful justice, and healthcare [12]. Emotion can be detected through a variability of means such as voice inflection, body language, and more difficult methods such electroencephalography (EEG) [1]. Though, the relaxed, more hands-on method is to examine facial expressions.

There are five types of human emotions shown to be universally familiar across diverse principles [13]. "In 1978, Ekman et al. [2] presented the system for gaging facial expressions called FACS – Facial Action Coding System". FACS was industrialized by analysis of the relations between muscle(s) reduction and deviations in the face presence caused by them. Shrinkages of muscles accountable for the same act are noticeable as an Action Unit (AU) [14].

This effort explains a instantaneous automatic facial emotion detection system using open cv or webcam through static images or series of video as input. Our effort attentions on primarily detecting the human face within a boundary in the video form, on categorizing the human emotion from facial structures and on imagining the recognition outcomes [15]. Instinctive human emotion detection has established much courtesy recently with the starter of IOT and smart surroundings at hospitals, smart homes and smart cities. "Intelligent personal assistants (IPAs), such as Siri, Alexia, Cortana and others", practice natural language processing to connect with humans, but when augmented with emotions, it upsurges the neck and neck of effective message and human-level cleverness [16]. Multiplayer online games (MOGs) have turn out to be popular over the past few years. The interaction, communication, and collaboration capability of MOGs empower players to collaborate or contest with each other on a bulky gauge [17].

Here is a increasing essential and mandate towards automata distribution space with humans as cooperative robotics or assistive robotics. Robots are today, progressively being deployed in a diversity of provinces as receptionists, educational instructors, household helpers and caretakers . Therefore, there is a necessity for these social robots to effectually interact with humans, both vocally and non-verbally [18]. There are five basic emotions that are worldwide to human beings. Namely neutral, angry, happy, sad, and surprise, and these elementary emotions can be detects from human's facial appearance [19].

In deep learning, a convolutional neural network (CNN) is a type of feedstuff advancing artificial neural network in which the connectivity design between its nerve cell is enthused by the society of the animal pictorial pallium. Distinct cortical neurons respond to spurs in a limited region of space known as the interested field. The approachable fields of diverse neurons partially intersection such that they stone the pictorial field. The reply of an distinct neuron to stimuli within its friendly field can be approached precisely by a convolution operation. Convolutional systems were enthused by biological progressions [20].

2. LITERATURE SURVEY

The enthusiasm behind selecting this theme especially deceits in the giant investments bulky corporations do in responses and reviews but flop to get reasonable reply on their investments. Emotion Detection through facial motions is a technology that intentions to progress product and facilities presentation by nursing customer behavior to certain products or staff by their estimation. "Substantial discussion has mounted in prior concerning the emotions represented in the world famed work of genius of Mona Lisa". British Weekly "New Scientist" has detailed that she is in fact a blend of many distinct emotions, "83%happy, 9% disgusted, 6% fearful, 2% angry". We have likewise been inspired observing the benefits of physically handicapped people like deaf and dumb. But if any normal human being or an automatic system can appreciate their wants by perceiving their facial expression then it develops a lot informal for them to make the parallel human or automatic system appreciate their wishes [13].

Primarily, we would like to outline the elementary impression of the FED system and describe the most vital problems which should be taken under attention in the procedure of system strategy and progress. Then, each FED system phase will be defined in particulars, namely: main duty, emblematic difficulties and future approaches. Additionally, the fresh advances in the zone of facial emotion detection analysis will be itemized. To conclude, some model applications of FED systems will be revealed to show that they are extensively used in many arenas of science as well as in everyday natural life [14].

Subsequently the initial 1970s there have been widespread revisions of human facial expressions. Ekman et al initiate indication to provision universality in facial terminologies. These 'universal facial expressions' are those on behalf of happiness, sadness, anger, surprise and neutral [15].

Earlier works are focused on producing outcomes from unimodal systems. Machines used to forecast emotion by only facial emotions or only verbal noises. After a while, multimodal systems that use added than one features to predict emotion has more active and bounces more truthful outcomes. So that, the mixture of features such as audio-visual terminologies, EEG, body signs have been used meanwhile. More than one intellectual machine and neural networks are used to instrument the emotion detection system [4].

Table -1: List of Previous works

Year	Dataset	Accuracy	Architecture
2019	CK+ JAFFE	93.24% 95.24%	C layers combined with residual blocks

2019	Multiple Databases	96.24%	3 C layers, 4 FC layers, data augmentation
2018	CK+ MMI	98.95% 97.55%	3 C layers, geometric and appearance features, classification is done using self-organizing map(SOM)
2017	CK+, JAFFE, BV-3DFE	96.76%	3 C layers, 2 Sub-sampling layers, FC layers, pre-processing steps
2017	JAFFE CK+	76.7442% 80.303%	3 C layers, 2 Sub-sampling layers, Softmax classifier, Haar like features
2017	Kaggle Website	64%	CNN combined with HOG, Architecture 1 (2 C layers, 1 FC layer) Architecture 2 (4 C layers, 2 FC layers)
2017	FER2013	66%	Gender and emotion classification, Architecture 1 (eliminating FC layers), Architecture 2 (elimination combined with residual models)
2017	CFEE RaFD	95.71% 74.79%	CNN architecture based on AlexNet
2017	CK+, MMI, FERA, DISFA	93.21% 77.50% 77.42% 58.00%	CNN combined with facial landmarks
2016	CMU MultiPIE, MMI CK+, DISFA, FERA, SFEW,FER2013	94.7% 77.9% 93.2% 55.0% 76.7% 47.7% 66.4%	2 C layers, max pooling layer, Inception layer
2016	FER2013	-	3 C layers, 2 FC layers, rectifies linear unit (ReLU) activation function.

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3. PROPOSED MODEL

In harmony with the disadvantages of Present system, we are going to develop this project. The strategy starts with the preparing CNN model by pleasing an input image (static or dynamic) by accumulating a convolution layer, pooling layer, flatten layers, and dense layers. Convolution coats will be added for better accuracy for large datasets. The dataset is collected from CSV file (in pixels format) and it's converted into images and then classify emotions with respective expressions. Here emotions are classified as happy, sad, angry, surprise, neutral, disgust, and fear with lots of images for the training dataset and huge images for testing. Each emotion is expressed with different facial features like eyebrows, opening the mouth, Raised cheeks, wrinkles around the nose, wide-open eyelids and many others. Trained the large dataset for better accuracy and result that is the object class for an input image. Based on those features it performs convolution layers and max pooling.

In this proposed system, Deep learning is used with the help of Keras, contains several Models. Among those models, the facial emotion of the human is classified. Here emotions are classified as happy, sad, angry, surprise and neutral with lots of images for the training dataset and huge images for testing. Each emotion is expressed with different facial features like eyebrows, opening the mouth, Raised cheeks, wrinkles around the nose, wide-open eyelids and many others. Trained the large dataset for better accuracy and result that is the object class for an input image.

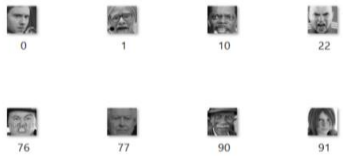
3.1 THE DATASET

The dataset used is FER2013 for training the model. The dataset is from a Kaggle Facial Expression Recognition Contest a few years ago. The data contains of 48x48 pixel grayscale pictures of faces. The faces have been robotically recorded so the face is comparatively positioned and dwell in about the equal amount of space in each image. The mission is to categorize each face based on the emotion display in the facial expression in to one of five categories (1-Angry, 2-Happy, 3-Sad, 4-Surprise, 5-Neutral).

The dataset used here is FER2013 that consists of 30,219 images which is further categorized into training (24,282) and validation (5937) images respectively.

Here we used these amount of data for the project.

ANGRY



For Training 3993

For Validation 960

HAPPY

For Training 7164

For Validation 1825

NEUTRAL

For Training 4982

For Validation 1216

SAD

For Training 4938

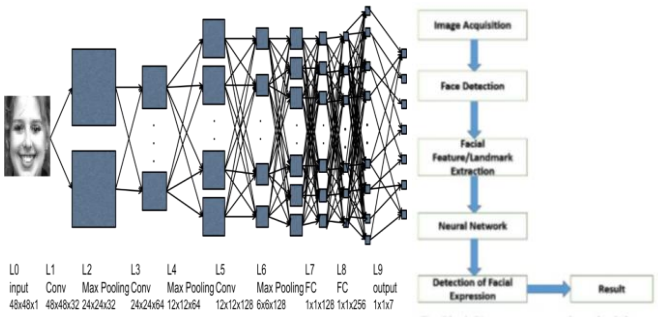
For Validation 1139

SURPRISE

For Training 3205

For Validation 797

3.2 PROPOSED DIAGRAM AND FLOW



3.3 TRAINING NEURAL NETWORK

- A good amount of images with different emotions will be collected.
- These datasets are used to tarin the Convolutional Neural Network(CNN) classifier.
- This would be done by feeding the coordinates of features extracted from the images.
- Each emotion would generate particular instances after training.
- These instances would be used to detect the emotions of facial expression.
- 90% of the images would be used as training dataset.

3.4 TESTING NEURAL NETWORK

- The trained classifiers are then tested with a dataset of images which were not used for training the classifiers.
- 10% of the images would be used as a testing dataset.
- Then used to find the accuracy of the System

3.5 DEPENDENCIES

- **OpenCV** :OpenCV (Open Source Computer Vision Library) is an open source computer vision also machine learning software library. It is the library we will be using for image conversion functions such as altering the image to grayscale.
- **Keras** : Keras is an API provisions to design deep learning model. It is a high-level neural link API, written in python. It is an API planned for human beings, not machines.
- **TensorFlow** :TensorFlow (TF) is an open source software library for machine learning written in Python and C++. Its released some months earlier (Nov 15) had a robust press exposure. These responsibilities include speech recognition in Google Now, search features in Google Photos, and the smart reply feature in Inbox by Gmail.
- **NumPy** : NumPy or Numerical Python is an open-source Python library this leads it easy to complex numerical operations.

4 EXPERIMENTAL RESULTS

CNN architecture for facial emotion detection as stated above was executed in Python. Along with Python programming language, NumPy, Keras, OpenCV and many libraries were used. Experiment was achieved with FER-2013 dataset which involves of 48x48 pixel grayscale pictures of faces based on 5 emotions. The dataset was trained using the CNN model. The system has two convolutional coats that uses a ELU activation function and tailed by a max pooling layer with 2x2 pooling pool size. Then, 2 fully-connected layers includes batch normalization used and attached. The network has an output of 5 classes. During training we set our batch-size to 32, epoch to 35.

This project detects a face within the boundary and for the inputted data i.e., either image or a series of video and it detects five different basic emotions of human beings outcome with accuracy of 72.14 % which was very great.

5 CONCLUSION

In this paper, we propose a facial expression recognition method using a CNN model which extracts facial features effectively. Compared to traditional methods, the proposed method can automatically learn pattern features and reduce the incompleteness caused by artificial design features. a research to classify facial emotions over static or a series of video input using deep learning techniques was developed. This is a complex problem that has already been approached several times with different techniques While good results have been achieved using this project focused on keras and CNN which is one of DL promises. This project achieves the desired output that is it detects face from the given input within a boundary and it detects the emotion of face and displayed the detected output as happy, sad, neutral, angry and surprise with good accuracy of 72.14%.

6 FUTURE ENHANCEMENT

For upcoming work, a more robust facial emotion detection algorithm attached with some respectable features can be explored to progress the outcomes. We focused on only some distances and zones, there can be many more such exciting features on the face which can be statistically planned and used for training the algorithm. Also, not all the features help to progress the exactness, some maybe not helpful with the other features. Feature choice and reduction method can be implemented on the created feature to progress the accurateness of the dataset. If we could focus on enlightening the detection rate of my system. One of the possible explanations could be adding the gesture info to the appearance illustration. The achievement could be described by geometric features as well as presence features. Finally, It would better to reduce the time efficiency of my system in order to make it suitable to use in diverse applications.

REFERENCES

[1] Chieh-En James Li, Lanqing Zhao "Emotion Recognition using Convolutional Neural Networks", Purdue University Purdue e-Pubs Purdue Undergraduate Research Conference 2019.

[2] Rachoori Keerthi, A. Obulesh, Pallam Ravi, Deepika.S.A. "A Literature Survey on Emotion Recognition System Using Facial Expressions", nternational Journal of Engineering Research in Computer Science and Engineering (IJERCSE) Vol 5, Issue 4, April 2018.

[3] Dipika Raval , Mukesh Sakle "A Literature review on Emotion Recognition System Using Various Facial Expression", Vol-1 Issue-2 2015 IJARIIE-ISSN(O)-2395-4396 1177 www.ijariie.com 326

[4] Reeshad Khan, Omar Sharif "A Literature Review on Emotion Recognition using Various Methods", Global Journal of Computer Science and Technology: F Graphics & vision Volume 17 Issue 1 Version 1.0 Year 2017 Publisher: Global Journals Inc. Reviewed International Research Journal By American International University.

[5] Shan Li, Weihong Deng "Deep Facial Expression Recognition: A Survey", arXiv:1804.08348v2 [cs.CV] 22 Oct 2018.

[6] Nitisha Raut "Facial Emotion Recognition Using Machine Learning" IEEE San Jose State University SJSU Scholar Graduate Research Spring 2018.

[7] Hongli Zhang , Alireza Jolfaei , and Mamoun Alazab "A Face Emotion Recognition Method Using Convolutional Neural Network and Image Edge Computing" Hongli Zhang: Preparation of Papers for IEEE Access (October 2019).

[8] Meriem Sari , Abdelouahab Moussaoui, and Abdenour Hadid "Automated Facial Expression Recognition Using Deep Learning Techniques: An Overview" International Journal of Informatics and Applied Mathematics e-ISSN:2667-6990 Vol. 3, No. 1, 39-53.

[9] Neeta Sarode, Prof. Shalini Bhatia "Facial Expression Recognition" Neeta Sarode et. al. / (IJCSE) International Journal on Computer Science and Engineering Vol. 02, No. 05, 2010, 1552-1557.

[10] Yingli Tian, Takeo Kanade, and Jeffrey F. Cohn "Facial Expression Recognition".

[11] Enkhzul Enkhtaivan, Tosin A. Adesuyi, Sunmyeng Kim, "Facial Emotion Recognition using Convolutional Neural Network Based on Repetitive Learning Blocks Approach" Department of Software Engineering, Kumoh National Institute of Technology, Gumi, South Korea.

[12] James Pao "Emotion Detection Through Facial Feature Recognition".

[13] Dan Duncan, Gautam Shine, Chris English "Facial Emotion Recognition in Real Time".

[14] Ewa Piątkowska, Prof. Dr. Jacob Furst "Facial Expression Recognition System", DePaul University College of Computing and Digital Media.

[15] Aitor Azcarate, Felix Hageloh, Koen van de Sande, Roberto Valenti "Automatic facial emotion recognition" Universiteit van Amsterdam June 2005.

[16] Aya Hassouneh a, A.M. Mutawa a , M. Murugappan, "Development of a Real-Time Emotion Recognition System Using Facial Expressions and EEG based on machine learning and deep neural network methods" Informatics in Medicine Unlocked 20 (2020) 100372.

[17] Ce Zhan, Wanqing Li, Philip Ogunbona, and Farzad Safaei, "A Real-Time Facial Expression Recognition System for Online Games" International Journal of Computer Games Technology, Received 31 July 2007; Accepted 31 January 2008.

[18] Niyati Rawal· Ruth Maria Stock-Homburg "Facial emotion expressions in human-robot interaction: A survey", arXiv:2103.07169v1 [cs.RO] 12 Mar 2021.

[19] Sakib Hussain, Abu Mohammad Hammad Ali "Thesis Report Emotion Detection from Frontal Facial Image".

[20] Deepesh Lekhak, "A Facial Expression Recognition System using Convolutional Neural Network", Department of Electronics and Computer Engineering (072/MSCS/654) May 2017.