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HUMAN FACIAL EMOTION RECOGNITION USING CNN

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***Abstract*— Human beings express emotions in everyday interactions. Understanding their emotions and knowing how to react to these expressions greatly enhances the interaction. An automatic Facial Expression Recognition system must try to solve the following problems: detection and location of faces ina cluttered scene, facial feature extraction, and facial expression classification. Knowing the user emotion, the system can adapt to the user. Facial expressions play an important role in recognition of emotions and are used in the process of non-verbal communication. They are very important in daily emotional communication, just next to the tone of voice. They are also an indicator of feelings, allowing a man to express an emotional state. The main motivation behind this project is to detect mental health of an individual**.

I. INTRODUCTION

FER is been increasing recently with the rapid development of artificial intelligent techniques, including in human-computer interaction (HCI) , virtual reality (VR) , augment reality (AR) , advanced driver assistant systems (ADASs) , and entertainment . Although various sensors such as an electro myo graph (EMG), electrocardiogram (ECG), electroencephalograph (EEG), and camera can be used for FER inputs, a camera is the most promising type of sensor because it provides the most informative clues for FER and does not need to be worn.

In conventional FER approaches, the FER is composed of three major steps-

- Face and facial component detection
- Feature extraction
- Expression classification

First, a face image is detected from an input image, and facial components (e.g., eyes and nose) or landmarks are detected from the face region. Second, various spatial and temporal features are extracted from the facial components. Third, the pre-trained FE classifiers, such as a Support Vector Machine (SVM), AdaBoost, and random forest, produce the recognition results using the extracted features. Deep-learning-based FER approaches reduce the pre-processing techniques by enabling "end- to-end" learning to occur in the pipeline directly from theinput images . Among the several deep-learning models available, the convolutional neural network (CNN), a particular type of deep learning, is the most popular network model. In CNN-based approaches, the input image is convolved through a filter collection in the convolution layers to produce a feature map. Each feature map is then combined to fully connected networks, and the face expression is recognized as belonging to a particular class-based the output of the softmax algorithm shows the procedure used by CNN-based FER approaches. FER can also be divided into two groups according to whether it uses frame or video. First, static (frame-based) FER relies solely on static facial features obtained by extracting handcrafted features from selected peak expression frames of image sequences. Second, dynamic (video-based) FER utilizes spatio-temporal features to capture the expression dynamics in facial expression sequences. It provides higher recognition rate than static FER because it provides additional temporal information.

II. DATASET

Fer2013 is a open-source data set that is available in Kaggle. It contains 35587 48X48- pixel grayscale images of the face. There are seven categories (0=Angry, 1=Disgust, 2=Fear, 3=Happy, 4=Sad, 5=Surprise, 6=Neutral) present in the data. The CSV file contains two columns that are emotion that contains numeric code from 0-6 and a pixel column that includes a string surrounded in quotes for each image. The data set collected is in the .csv format. The dataset consists of emotion, pixels and usage as records. Emotion have the values from 0-6. Pixels have the values from 0-255. 35587 data consists of 28710 training data ,3589 public test, 3589 private test data.

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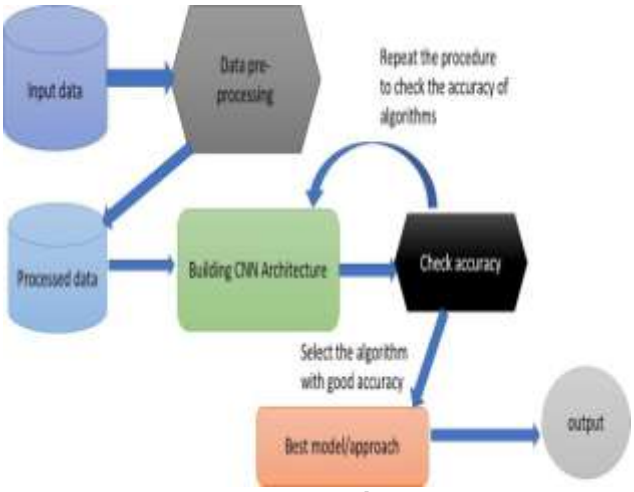

Fig. 1.Design Architecture

III. PROPOSED METHODOLOGY

To employee various libraries in python to get help in data pre-processing which is one of the major task in extracting the features that help in gaining good accuracy. Usage of machine learning libraries namely sklearn, openCV for the implementation.(Deep learning framework like keras).

Going to Building CNN Architecture algorithms and choosing best accuracy architecture. Perform different data cleaning and data pre-processing techniques to remove the stop words , spaces , punctuation and extract the required feature word. Libraries used for data visualization are matplotlib and seaborn. X_train and Y_train lists contains the training data of Pixels and emotion respectively. X_test and Y_test lists contains the test data of pixels and emotion respectively. Normalized the data into [0,1] by dividing the data by 255.

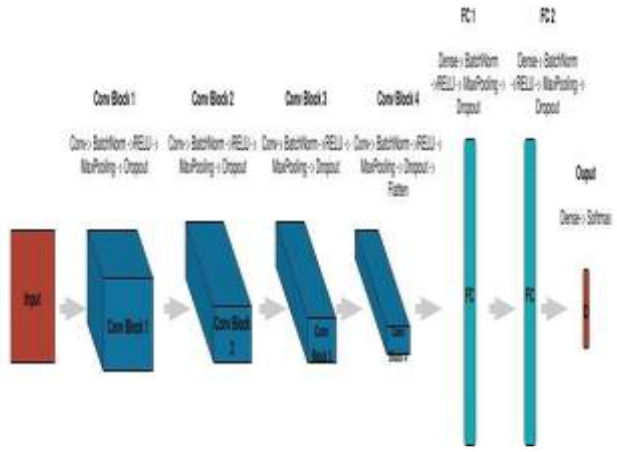

Fig. 2.CNN Model

Table- 1 Summary of some FER databases

MultiPie	More than 750,000 images captured by15 view and 19 illumination conditions	Anger, Disgust, Neutral, Happy, Squint, Scream, Surprise
MMI	2900 videos, indicate the neutral, onset, apex and offset	Six basic emotions and neutral
GEMEP FERA	289 images sequences	Anger, Fear, Sadness, Relief, Happy
SFEW	700 images with differentages, occlusion, illumination and head pose.	Six basic emotions and neutral
CK+	593 videos for posed andnon-posed expressions	Six basic emotions, contempt and neutral
FER2013	35,887 grayscale images collect from google imagesearch	Six basic emotions and n

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JAFFE	213 grayscale images posed by 10 Japanese females	Six basic emotions and neural
CASME II	247 micro-expressions sequences	Happy, Disgust, Surprise, Regression and others
RAFD-DB	30000 images from real world	Six basic emotions and neutral

Table-2 Experiment Result

EMOTION	NUMBER OF IMAGES	ACCURACY
Surprise	3171	75
Happy	7214	84
Neutral	4965	73
Angry	3995	70
Sad	4830	71
Disgust	436	59
Fear	4097	69

IV. CONCLUSION

Conventional FER approaches consisting of three steps, namely, face and facial component detection, feature extraction, and expression classification. The classification algorithms used in conventional FER include SVM, Adaboost, and random forest. deep-learning-based FER approaches highly reduce the dependence on face-physics-based models and other pre-processing techniques by enabling "end-to-end" learning in the pipeline directly from the input images Furthermore, evaluation metrics of FER-based approaches were introduced to provide standard metrics for comparison. Evaluation metrics have been widely evaluated in the field of recognition, and precision and recall are mainly used. However, a new evaluation method for recognizing consecutive facial expressions, or applying micro-expression recognition for moving images, should be proposed. Although studies on FER have been conducted over the past decade, in recent years the performance of FER has been significantly improved through a combination of deep-learning algorithms. Through the above stated approach with the current CNN model the least accurate emotion is disgust and the highest and most accurate emotion is happy and the model accuracy is found to be 67%. Because FER is an important way to infuse emotion into machines, it is advantageous that various studies on its future application are being conducted.

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