Facial Emotion Recognition System Using Deep Learning

S PRASANNA
Dept. of Information Technology
Meenakshi Sundararajan Engineering College
(Affiliated to Anna University)
Chennai, India
prasanna9713@gmail.com

M HANISHKAR
Dept. of Information Technology
Meenakshi Sundararajan Engineering College
(Affiliated to Anna University)
Chennai, India
Hanishharish46@gmail.com

M SUGANTHAPRIYAN
Dept. of Information Technology
Meenakshi Sundararajan Engineering College
(Affiliated to Anna University)
Chennai, India
msugan99@gmail.com

Mrs. M.R.NITHYA
Dept. of Information Technology
Meenakshi Sundararajan Engineering College
(Affiliated to Anna University)
Chennai, India
nithyamr06@gmail
.com

***Abstract*—In our day to day life emotions or facial expression are the prime factor which are required for communication purpose. For humans it is quite easy to detect an emotion but difficult for a computer or a machine to do so. This project deals with 3 emotions they are Neutral, Happy and Sad. As we are developing the need and importance of automatic emotion recognition has increased which supports Human Computer Interaction applications. Facial expression defines the emotions of an individual which is required for Human Computer Interaction (HCI) in this project.In this work, user's emotion using its facial expressions will be detected. These expressions can be derived from the live feed via system's camera or any pre-existing image available in the memory. Emotions possessed by humans can be recognized and has a vast scope of study in the computer vision industry upon which several researches have already been done. The scanned image (testing dataset) is being compared to training dataset and thus emotion is predicted. The objective of this paper is to develop a system which can analyze the image and predict the expression of the person. The study proves that this procedure is workable and produces valid results.**

Keywords-dataset,opencv,deep learning

I. INTRODUCTION

The project aims to integrate the concepts of convolutional neural networks(CNN), tensorflow, keras to recognize the facial emotions in humans. In this work, user's emotion using its facial expressions will be detected. These expressions can be derived from the live feed via system's camera or any pre-existing image available in the memory. Emotions possessed by humans can be recognized and has a vast scope of study in the computer vision industry upon which several researches have already been done. The work has been implemented using Python (2.7), Open Source Computer Vision Library (OpenCV) and NumPy. The scanned image (testing dataset) is being compared to training dataset and thus emotion is predicted. The objective of this paper is to develop a system which can analyze the image and predict the expression of the person. The study proves that this procedure is workable and produces valid results.

II. RELATEDWORKS

A.*DEEP LEARNING:*

Deep learning is a machine learning technique that teaches computers to do what comes naturally to humans: learn by example. Deep learning is a key technology behind driverless cars, enabling them to recognize a stop sign, or to distinguish a pedestrian from a lamppost. It is the key to voice control in consumer devices like phones, tablets, TVs, and hands-free speakers. Deep learning is getting lots of attention lately and for good reason. It's achieving results that were not possible before. In deep learning, a computer model learns to perform classification tasks directly from images, text, or sound. Deep learning models can achieve state-of-the-art accuracy, sometimes exceeding human-level performance. Models are trained by using a large set of labeled data and neural network architectures that contain many layers.

B.*CONVOLUTIONAL NEURAL NETWORKS :*

A **Convolutional Neural Network (CNN)** is a Deep

Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other. The pre-processing required in a CNN is much lower as compared to other classification algorithms. While in primitive methods filters are hand-engineered, with enough training, CNN have the ability to learn these filters/characteristics.

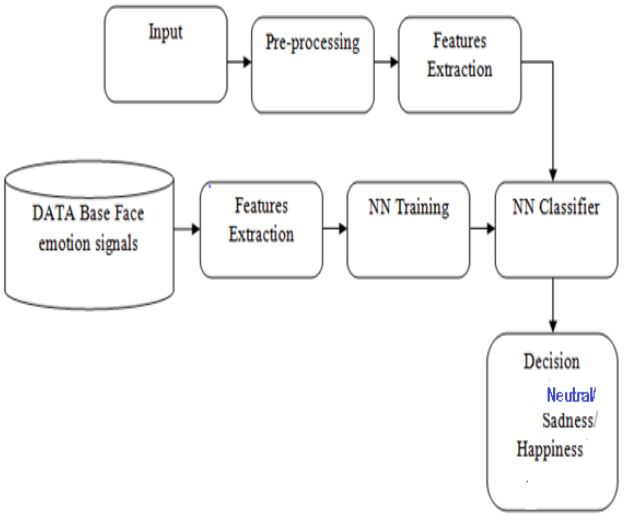
C. EXISTING SYSTEM:

The system detects and recognizes the human using image processing techniques. But the face recognitions provide only the user's name and details. But it fails to provide the actions performed by the user. Pose variation, illumination conditions, bad lighting etc., are still challenging factors faced by all algorithms. The existing system does not recognize the real time facial emotions which can be used in various fields for feedback purposes.

D. PROBLEM STATEMENT:

In present day technology human-machine interaction is growing in demand and machine needs to understand human gestures and emotions. Emotions and expressions are the natural physiological response of the human body which can be recognized by the facial expression. In our day to day life emotions or facial expression are the prime factors which are required for communication purpose. For humans it is quite easy to detect an emotion but difficult for a computer or a machine to do so. This can be done using the proposed system.

III. SYSTEM ARCHITECTURE



The human faces are collected as a dataset through camera and converted to grayscale images ,which is further used for feature extraction and stored. After which with the help of datasets, each emotions are trained .Then using camera the human images are fed as input to Pycharm and the emotion is recognized and displayed in the window.

IV .PROPOSED SYSTEM

The proposed system comprises of a high tech camera as input to detect various face expressions. The output of camera is fed into OpenCV processor for further dataset creation and processing. Based on a person's different face expressions, his/her emotions can be diagnosed or evaluated. The camera used here is of high quality, because every human emotion are reflected with minute changes in facial like changes in eyebrow shape, eyeball rotation, movement in cheek and chin. Then the dataset is trained using Convolutional Neural Network. In this system, both emotion analysis detection are done by using tensor flow algorithm which is more suited for face detection and recognition. After training the dataset the system prompts for camera access to get real-time facial expression and outputs the corresponding emotion and emoji in the window.

V. SYSTEM IMPLEMENTATION

The system here is divided into three modules as listed below:

i. Creating dataset

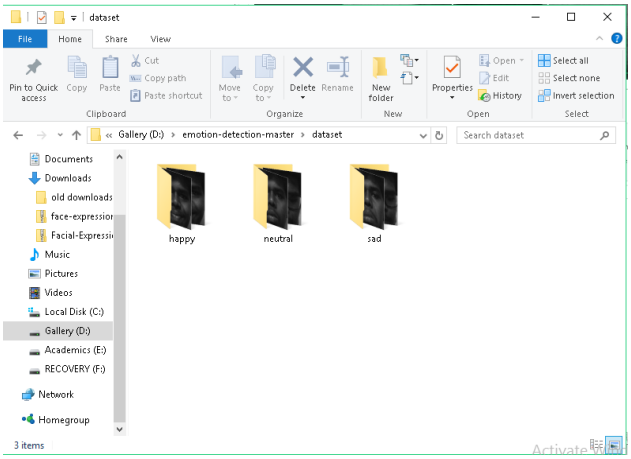
ii. Learning using datasets

iii .Detection of emotion

The system provides assistance to the admin by using the learning dataset. The dataset which contains the images of labelled emotions is fed and training using datasets is done. The accuracy is calculated based on the dataset provided. The system gets the web camera input and displays the predicted emotion on the output window spontaneously.

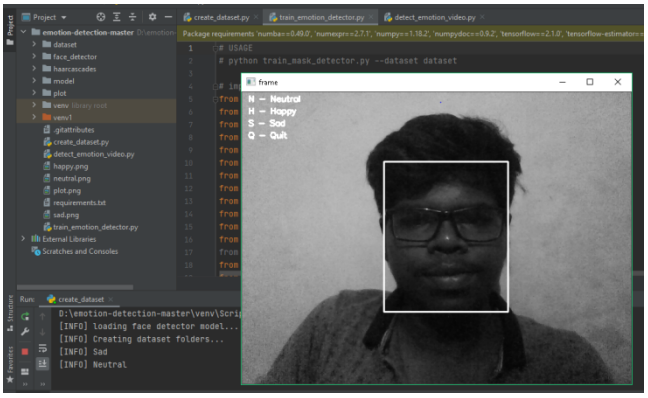
i.CREATING DATASET:

The admin creates a directory named 'dataset' to store the images of labelled emotions. Inside a unique folder is created for each emotion like Sad, Happy and Neutral. With the help of web camera the user adds the specific images in the corresponding folder based on the user inputs.For accessing the camera and performing functions like converting it into Grayscale image, cropping, displaying the cv2 python package is used. Thus the dataset is created. The user should provide ample amount of images labelled to get trained with accuracy.



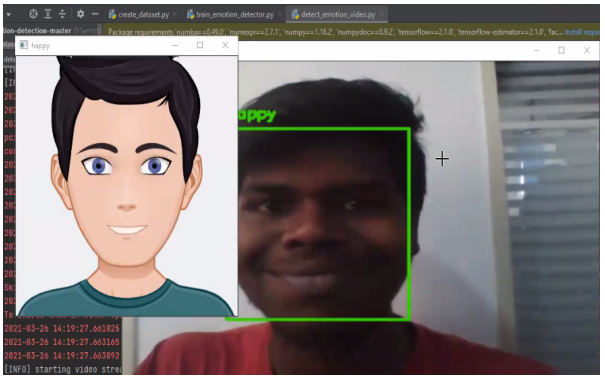
ii. LEARNING USING DATASET:

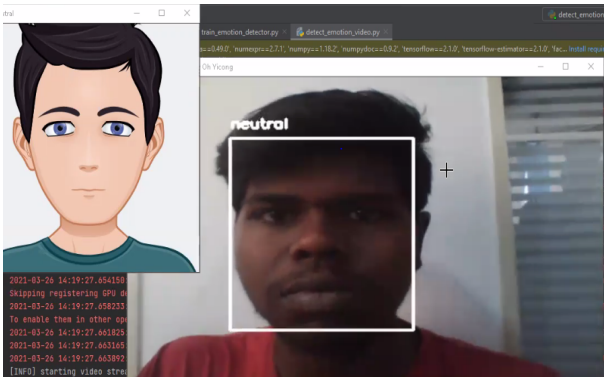
The dataset is collected that consists of various significant parameters like eyebrow shape, eyeball rotation, movement in cheek and chin which are required for the decision and uses various techniques to quantize them. The learning of dataset is done using CNN with the help of libraries like tensorflow, keras, sckitlearn, scipy, numpy ,matlab. A **Convolutional Neural Network (CNN)** is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other. The pre-processing required in a CNN is much lower as compared to other classification algorithms. While in primitive methods filters are hand-engineered, with enough training, CNN have the ability to learn these filters/characteristics.The based on the training from the dataset, the details are stored in a file.

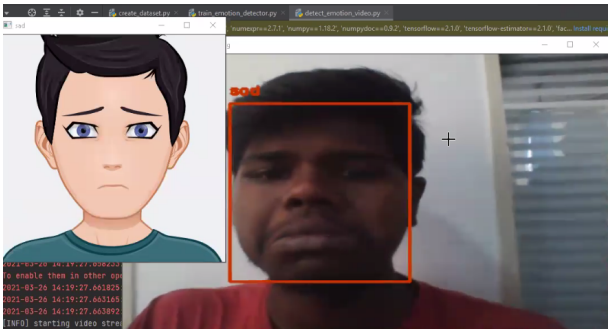


iii. DETECTION OF EMOTIONS:

The system prompts the user for web camera access and once the user allows it, the system capture the input of realtime and shows in the output window along with the correct predicted emotion. Based on the dataset learned, the system shows the detected emotion along with a emoji for every instance of the video's input. The accuracy depends on the distinction of each dataset and only the high accuracy obtained during the training is taken into account. The system detects and displays the predicted emotion in accordance with the input from the web camera.







VI . CONCLUSION AND FUTUREWORK

CONCLUSION:

It can be concluded that a reliable, secure, fast and an efficient Face Emotion detection system has been developed replacing a manual and unreliable system. This face detection and recognition system will save , reduce the amount of work done by the administration. There is no need for specialized hardware for installing the system as it only uses a computer and a camera. The camera plays a crucial role in the working of the system hence the image quality and performance of the camera in real time scenario must be tested especially if the system is operated from a live camera feed. The system can also be used in permission based systems and secure access authentication (restricted facilities) for access management, home video surveillance systems for personal security or law enforcement. The major threat to the system is Spoofing. For

future enhancements, anti- spoofing techniques like eye blink detection could be utilized to differentiate live from static images in the case where face detection is made from captured images from the classroom. From the overall efficiency of the system i.e. 83.1% human intervention could be called upon to make the system foolproof.

FUTURE ENHANCEMENT:

In the future, the next step would ideally be to make a complete and universal model that the organizations can use to help them reduce their human resource costs. Furthermore, can also be combined with other machine learning algorithms to create a highly robust and powerful system. Various other concepts of machine learning can be implemented to improve the efficiency of the system as a whole. The more the training data the more the accuracy. So, the importance should be given to select quality dataset and make the right partition to achieve more efficient system. Anti- spoofing techniques like eye blink detection could be utilized to differentiate live from static images in the case where face detection is made from captured images from the classroom. To improve any business, feedback is very important .Example : hotels need feedback about their services and foods. But many customers or humans can't express their view(either written feedback or a word of mouth) exactly all the time because words either written or spoken are not that powerful as human expressions .Thus implementing suitable strategic ideas for different fields to make use of the detected emotions a very efficient manner.

VII. REFERENCES

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