Journal Homepage: - www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/18230
DOI URL: http://dx.doi.org/10.21474/IJAR01/18230

RESEARCH ARTICLE

FACIAL EXPRESSION RECOGNITION

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Manuscript Info

Manuscript History
Received: 20 November 2023
Final Accepted: 31 December 2023
Published: January 2024

Key words:-
Facial Expression Recognizer and the CNN Algorithm

Abstract

Facial Expression Recognition is a system which provides an interface for computer and human interaction. With the advancement of technology and need of the hour such systems have earned the interest of researchers in psychology, medicine, computer science and similar other fields as its applications are identified in such fields. Facial expression recognizer is an application which uses live data coming from the camera or even the existing videos to capture the expressions of the person in the video and is represented on the screen in the form of attractive emojis. Expressions form the basis of human communication and interaction. Expressions are used as a crucial tool to study the behaviour in the medicine and psychological fields to understand the state of mind of the people. The main objective to develop such a system was to be able to classify facial expressions using CNN algorithm which is responsible for the expression detection and then providing a corresponding emoticon relevant to detected facial expression as the output.

Introduction:-

Facial expression recognition and analysis has gained widespread attention with the advancement of technology as a natural and effective mean to communicate among humans. The applications of the systems have a wide range and include person identification and access control, video call and teleconferencing, forensic applications, human-computer interaction, automated surveillance, cosmetology and so on. Facial expression is an import aspect in all of these and thus the performance of facial expression detection affects the performance of all the above-mentioned applications.

There are several different ways through which human face can be detected in videos and pictures and can be divided into four types: feature-based methods, knowledge-based methods, template-based methods and appearance-based methods. Individually these methods are unable to solve the problems faced in face detection like pose, expression, orientation. Hence several methods are used in parallel to overcome the difficulties. We will implement CNN algorithm to build our complete system.

Facial expressions are used as a crucial tool in medical rehabilitation, monitoring of individuals and in psychological studies as well.

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The objective is to develop a system which can efficiently detect facial expression from real time data as well as video fed as input and recognize it into different expressions.

Literature Review:-

Facial expression recognition will serve as a product which can be integrated in the devices generating a video output which will be fed as input to this device. The system will then perform its function of classifying the expressions of the person in the video.

The development of such systems is hindered by various challenges which can be countered by following a generalized computational flow. The flow can be understood in the following ways:

Pre-processing-

This step is crucial but can be ignored in some cases based on the quality of the dataset that whether the preparation was done or not.

Preprocessing becomes essential for dataset containing raw images as it becomes the deciding factor in success or failure of a recognition system.

Preprocessing aims to reduce or suppress imperfections such as noise, reduce distortions and highlight the most important features only.

Feature Extraction-

Feature extraction is a crucial important stage in recognition methods, being mainly applied when each volume of data is extremely large. It has main objective to extract only the most important and descriptive piece of information from the samples, getting rid of what is not relevant for the given problem. This is usually necessary because of the high computational complexity of training in classification models and due to the fact that the more data there is in each sample, the more computing will be required to extract the features.

Dataset for training-

It is essential to source the data for training and testing purpose. The data source should be reliable and must be free from noisy data as much as possible. We will be using a data set from Kaggle as our source which is further divided into training and testing data. Our dataset will contain a thousand black and white images featuring people expressing different emotions and facial expressions.

Data Augmentation-

It is a process which deals with changing the parameters of an image to generate several images from it with slight variation such that the size of dataset can be increased as to train better**.** It is obvious that a large original dataset can provide abundant image features for the human face recognition problem. Unfortunately, however, such an ideal database is difficult to obtain in practical applications. By using the transformation of the face images, the small image dataset can be tremendously augmented to be a large one. As such, more image features can be extracted to train the classifier so as to achieve better face recognition result. the dataset can be augmented tremendously by tuning the parameters of the augmentation methods. Then, the images are scaled, normalized and labelled before they are put into the face recognition system. It can be predictable that the augmented dataset can not only reduce the probability of over-fitting but also improve the robustness of the system.

Purpose

1. Emotion recognition in for online admissions and interviews: -Emotion recognition can be used to understand how candidates feel during interviews and to measure how they react to certain questions.
2. Emotion recognition in health care: -An industry that's taking advantage of this technology is health care, with AI-powered recognition software helping to decide when patients need medicine, assess their emotional response in clinical trials or to help physicians in deciding how to best triage their patients.
3. Automotive industry and emotion analysis: -In their pursuit to build smart car features, it makes sense that car manufacturers use AI to help them understand human emotions. Using facial emotion detection smart cars can alert the driver when he is feeling drowsy and in turn help to decrease road casualties..

4. Public Safety: - lie detectors and smart border control ,predictive screening of public spaces to identify emotions triggering potential terrorism threat, analysing footage from crime scenes to indicate potential motives in a crime

Implementation

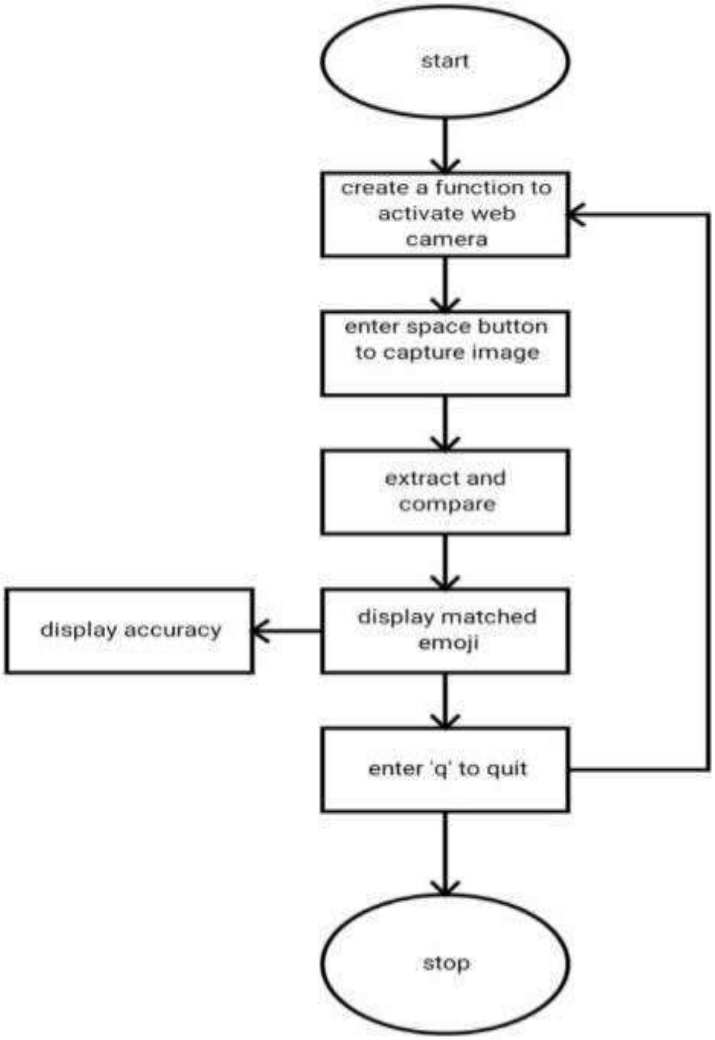

Fig:- Flow diagram of facial express recognition.

The implementation of facial expression recognitionare as follows:

1. Facial expressions can be described as the arrangement offacial muscles to convey a certain emotional state to theobserverinsimplewords.Emotionscanbedividedintosixbroad categories—Anger, Disgust, Fear, Happiness, Sadness,Surprise, and Neutral.
2. We are basically using Convolution Neuro Network algorithm for this purpose.

CNN Algorithm

1. A **Convolutional Neural Network (ConvNet/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.
2. The pre-processing required in a ConvNet is much lower as compared to other classification algorithms.
3. While in primitive methods filters are hand-engineered, with enough training, ConvNets have the ability to learn these filters/characteristics.

Different Layers used in CNN Algorithm

a) **Convolution Layer:-**This layer is the first layer that is used to extract the various features from the input images. In this layer, the mathematical operation of convolution is performed between the input image and a filter of a particular size.
b) **PoolingLayer: -**In most cases, a Convolutional Layer is followed by a Pooling Layer. The primary aim of this layer is to decrease the size of the convolved feature map to reduce the computational costs. This is performed by decreasing the connections between layers and independently operates on each feature map.
c) **Fully Connected Layers: -** 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.
d) **Dropout Layer:** - Randomly turns off few neurons in the network to prevent over fitting.
e) **Activation Functions:** -They are used to learn and approximate any kind of continuous and complex relationship between variables of the network. In simple words, it decides which information of the model should fire in the forward direction and which ones should not at the end of the network.

Steps for emotion detection

Decomposinganimage.

Imagesarecomposedofpixelsandthesepixelsarenothingmore than numbers. Often it is considered that the coloredimagescanbedividedintothreecolorchannels,whichare

red, green, and blue and each channel is represented by agrid (2-dimensional array). Each cell in the grid stores anumber between 0 and 255 which denotes the intensity ofthatcell.

1. **Data :-** We will use Keras to create a Sequential Convolutional Network. Which means that our neural network will be a linear stack of layers. This network will use CNN algorithm.
2. **Training of Data: -** Training of data is done with the help of TensorFlow which is an end to end open source platform for ML. It builds and train ML models easily using high level APIs.
3. **Testthemodel: -** The project is started off by defining a loading mechanismand loading the images. Then a training set and a testing setarecreated. Afterthisa finemodelandafewcallbackfunctionsaredefined.Thebasiccomponentsofaconvolutional neural network are considered and then wetrainingis doneto the network.
4. **Output:-**

Conclusion:-

Proposed is a human emotion detector using emoticon using machine learning, python to predict emotions of the people and represent them using emotion whether the person is happy, sad, neutral or surprised. These include image acquisition, preprocessing of an image , face detection, feature extraction, classification and then when the emotions are classified the system assigns the user particular music according to his emotion. Our system focuses on live videos taken from the webcam. This project is up to industry standard and designed to mainly focus of real world problem like stress , anger issues of the people. With this project implementation we'll know in advance what the person is feeling from his/her emotions and can react and provide solutions to their problems. This will help in increase the output of employees for their employers.

Future Scope

In our project we are detecting emotions from frontal face recognition which is using less facial landmarks. The future scope of our project will be to detect the emotion through sideway face also. In order to detect the complete face we need to detect 468 facial landmarks . For sideways face detection research is under process.

References:-

[1] Dataset is taken fromhttps://www.kaggle.com/c/emotion-detection-from-facial- expressions/data
[2] AboutTensorFlowfromhttps://www.tensorflow.org/
[3] https://www.kaggle.com/dansbecker/rectified -linear-units-relu-in-deep-learning
[4] Facial Emoji RecognitionN. Swapna Goud1, K. Revanth Reddy2, G. Alekhya2, G. S. Sucheta21Assistant Professor, 2UG Student1,2CSE Department, Anurag Group of Institutions, Telangana, India
[5] Andalibi, Nazanin and Justin Buss (2020). The Hu-man in Emotion Recognition on Social Media: At-titudes, Outcomes, Risks. In: Proceedings of the 2020 CHI Conference on Human Factors in Comput- ing Systems. CHI '20. Honolulu, HI, USA: Associ- ation for Computing Machinery, pp. 1–16. isbn: 9781450367080. doi: 10.1145/3313831.3376680(2002) The IEEE website. [Online]. Available: http://www.ieee.org/
[6] Du, Shichuan et al. (2014). Compound facial expres- sions of emotion. In: Proceedings of the National Academy of Sciences 111.15, E1454–E1462. Issn: 0027-8424. doI: 10.1073/pnas.1322355111. eprint: https://www.pnas.org/content/111/15/E1454.full. pdf.
[7] https://www.sciencedirect.com/science/article/abs/pii/S0020025521010136.