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Real time Emotion Based Automatic Music Recommendation System

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***Abstract*— It is often confusing for a person to decide which music he/she has to listen from a massive collection of existing options. There have been several suggestion frameworks available for issues like music, dining, and shopping depending upon the mood of the user. The main objective of our music recommendation system is to provide suggestions to the users that fit the user's preferences. The analysis of the facial expression/user emotion may lead to understanding the current emotional or mental state of the user. Music and videos are one region where there is a significant chance to prescribe abundant choices to clients in light of their inclinations and also recorded information. It is well known that humans make use of facial expressions to express more clearly what they want to say and the context in which they meant their words. Human expression is one of the ways of communication. The human mood can be recognized by facial expression. In this system, facial expression-based music recommendation has been presented. The system consists of two modules, first is facial expression recognition and second is music recommendation system. There are some basic moods, neutral, anger, surprise, disgust, sadness, and happiness. The CNN based approach is used to classify the human expression from facial image. The music is then recommended based on the recognized facial expression. This system would help the user to make a music playlist without wasting time.**

***Keywords*—** facial expression recognition, convolution neural network (CNN), average weighting method, Deep Learning, Image Recognition.

I. Introduction

Humans have the innate capacity to read someone's emotions by looking at their face. This ability, if learned through an electronic device, has real-world applications. Music is significantly more powerful than language in terms of evoking emotions and sentiments. Music has the ability to get deep into our emotional core as humans. As a result, listening to wonderful music might make us feel better. To make this challenge easier to solve, we propose developing an application that uses facial expression recognition algorithms to record the user's feelings. After capturing the feeling, a selection of music based on the sentiment is provided. Many developments are taking place in the music industry to attract more customers and raise revenue by running adverts. Because music is linked to the emotions of the listener, some studies believe that music is the greatest treatment for mental diseases, sleeping issues, and depression. As a result, many academics are contributing new ideas in the field of music content, such as the use of software technologies, mobile apps, signal processing, and analytics, among other things

II. Literature Survey

K. Chankuptarat, R. Sriwatanaworachai and S. Chotipant, "Emotion Based Music Player," 2019, in this paper proposes an emotion-based music player, which is able to suggest songs based on the user's emotions; sad, happy, neutral and angry. The application receives either the user's heart rate or facial image from a smart band or mobile camera. It then uses the classification method to identify the user's emotion. This paper presents 2 kinds of the classification method; the heart rate-based and the facial image-based methods. Then, the application returns songs which have the same mood as the user's emotion**.** R. Ramanathan, R. Kumaran, R. Ram Rohan, R. Gupta and V. Prabhu, "An Intelligent Music Player Based on Emotion Recognition," 2017 paper proposes an intelligent agent that sorts a music collection based on the emotions conveyed by each song, and then suggests an appropriate playlist to the user based on his/her current mood. The user's local music collection is initially clustered based on the emotion the song conveys. This is calculated taking into consideration the lyrics of the song, as well as the melody. Every time the user wishes to generate a mood-based playlist, the user takes a picture of themselves at that instant. This image is subjected to facial detection and emotion recognition techniques, recognizing the emotion of the user. The music that best matches this emotion is then recommended to the user as a

playlist. Henal Shah, Tejas Magar, Purav Shah and Kailas Devadkar "An Intelligent Music Player Using Sentimental Analysis" 2015 in this the images are taken using the camera and they are stored by using OpenCV. The Harr Cascade training is a tool used to accurately detect and recognize the hand gestures. In the Harr Cascade algorithm, the data are stored in Xml format. The motion of the hand gestures is stored in the OpenCV database. The arm controller recognizes the hand gestures and sends to RS232. The RS232 acts as a interface between arm controller and the PC. The songs are sorted in playlist and played automatically according to the hand gesture. Author proposed intelligent music player according to the user's mood by using sentimental or emotion analysis

III. Proposed Design

The block diagram fig (1) will show the implementation of Facial Expression Recognition

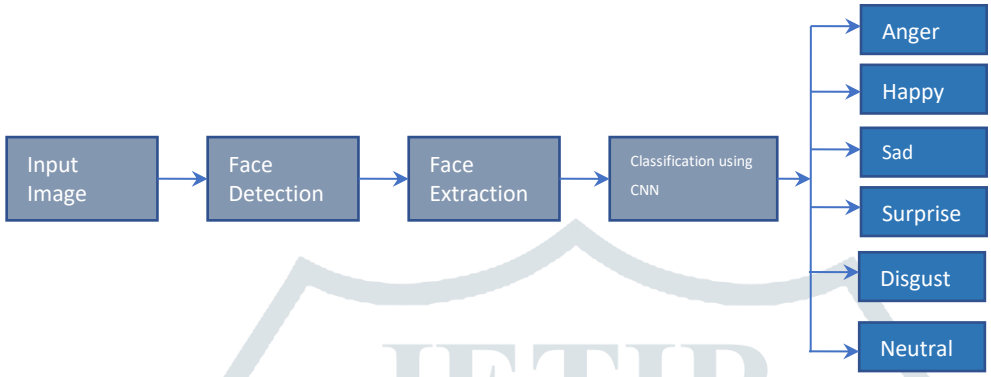


Fig 1. Block Diagram of Facial Expression Recognition

BLOCK DIAGRAM DESCRIPTION

- User take an input from the camera
- The face is detected by the viola-Jones algorithm
- The facial expression will be classify using CNN algorithm
- The music would be recommended by the output facial expression

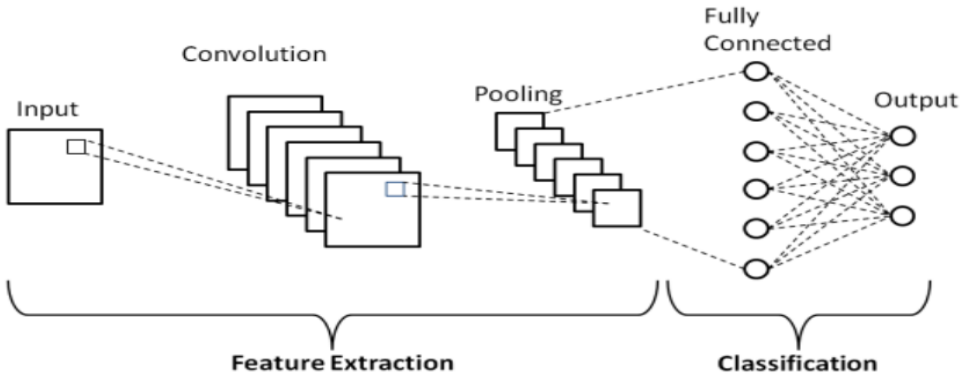


Fig 2. Block Diagram of CNN

Layer Information

Convolutional Layer: The primary purpose of the Convolution layer is to extract features from the input data which is an image.
Pooling Layer: The pooling layer reduces the dimensionality of each activation map but continues to have the most important information

IV. Implementation

Software Specifications

Image processing library: OpenCV 4.1.1: Open source Computer Vision (OpenCV) is an image processing and computer vision library mainly developed for artificial vision. It has a BSD license (free for commercial or research use). OpenCV was originally written in C, but currently, it's a whole C++ interface, and there's additionally an entire Python interface to the library. Open-source computer Vision Library, also called OpenCV, is associated with a freeware software package aimed toward computer vision. It is used in this project because of its versatility and the fact that it has a C++ interface. OpenCV runs on most major Operating Systems (OS), making it worthwhile to use another computer to program or test.

Keras : Keras is an open-source NN library written in Python. It can be executed on top of Tensorflow Microsoft Cognitive Toolkit, R-language, Theano, or PlaidML. It is developed to enable superior experimentation with DNN. It focuses on being user-

friendly, modular, and extensible. It was developed as part of the study effort of project ONEIROS, and its primary author and maintainer are Francois Chollet, a Google engineer. In 2017, Google's TensorFlow group decided to support Keras in TensorFlow's core library. Chollet explained that Keras was conceived to be an interface somewhat a standalone ML framework. It offers a higher-level, more spontaneous set of abstractions that make it simple to develop DL models regardless of the computational backend used. Keras was created to be user-friendly, modular, simple to enlarge and to work with Python. The API was "designed for human beings, not machines", and "follows best practices for reducing cognitive load".

Language: Python 3.7: Python is a high-level programming language extensively used for programming. Python, an interpreted language, supports several programming scripts and a syntax that allows you to use programs in most languages such as C ++ or Java. The language provides constructions designed to permit clear programs at each scale. Python is easy and simple to know, the python code is way easier than alternative languages.

Spyder: Spyder is an Integrated Development Environment (IDE) used in computer programming, especially for Python language. For the programming part, we need to install an extra three important libraries i.e. OpenCV, Scikit-learn and Keras

Anaconda: Anaconda is an open-source distribution of the python libraries. It includes data processing and predictive analysis. This distribution provides the number of libraries within the single package called conda.

Hardware Specification

Hard Disk: 200 GB

RAM: 8 GB, Processor: Intel Pentium i5 and above

V. Results

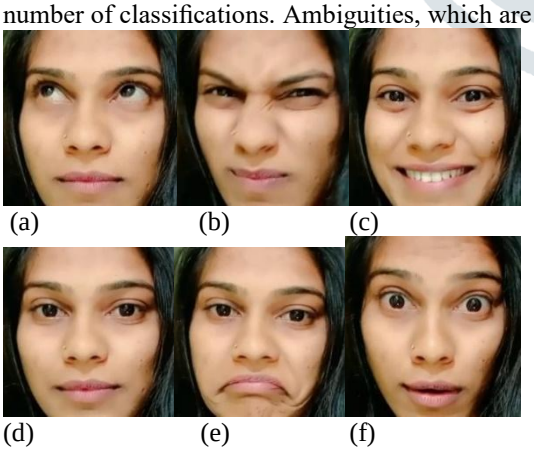
The facial emotion requires an image database. In this approach the database is collected from the USB camera. The face is detected, cropped and stored in the respective folders. The database distribution of the emotions is as shown in Table 1.

Emotions	Total image	Training data	Testing Data
Anger	437	316	121
Disgust	549	402	147
Happy	801	584	217
Neutral	750	541	209
Sad	615	447	168
Surprise	398	294	104

Table 1.Database distribution

Qualitative Analysis

The aim of qualitative analysis is a complete, detailed description. No attempt is made to assign frequencies to the linguistic features which are identified in the data, and rare phenomena receive (or should receive) the same amount of attention as more frequent phenomena. Qualitative analysis allows for fine distinctions to be drawn because it is not necessary to shoehorn the data into a finite number of classifications. Ambiguities, which are inherent in human language, can be recognized in the analysis.



(a) (b) (c)

(d) (e) (f)

Fig 1. Input Facial Expression Dataset (a) anger (b) Disgust (c) Happy (d) Neutral (e) Sad (f) Surprise

Quantitative Analysis

In quantitative research, the approach is to classify features, count them, and even construct more complex statistical models in an attempt to explain what is observed. Findings can be generalized to a larger population, and direct comparisons can be made between two corpora, so long as valid sampling and significance techniques have been used. Thus, quantitative analysis allows us to discover which phenomena are likely to be genuine reflections of the behavior of a language or variety, and which are merely chance occurrences. The more basic task of just looking at a single language variety allows one to get a precise picture of the frequency and rarity of particular phenomena, and thus their relative normality or abnormality. The quantitative analysis of the proposed

system is calculated using an accuracy parameter. The accuracy of the facial emotion-based music recommendation system is given as (Eq.1.1.)

$$Accuracy = \frac{No\ of\ sample\ correctly\ detected}{Total\ no\ of\ samples} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad \text{Eq (1.1)}$$

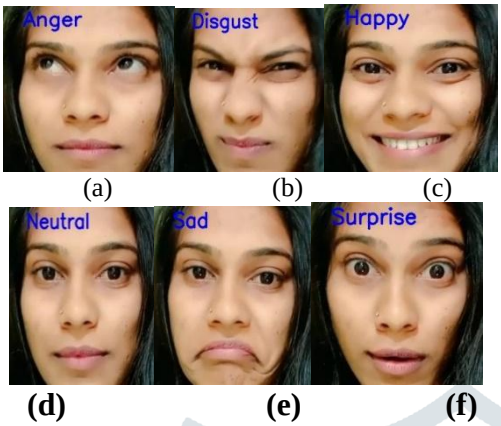


Fig 2. Output Facial Expression Dataset (a) anger (b) Disgust (c) Happy (d) Neutral (e) Sad (f) Surprise

Conclusion In this phase, the face detection algorithm is implemented to collect the database of different emotions. The database is created of three users of different emotion in different angle and light conditions.In the next phase, the convolutional neural network is applied over the database images and train a model for facial expression recognition A music recommendation system can incorporate a user's emotions into the user's profile to provide users with well-recommended music based on their emotional state. User's feedback about how a recommended music meets their preferences improves the quality over time of the system. Based on the recognized emotion list of music are recommended. Music Recommendation is based on content-based filtering. Different movie genres are associated with recognized emotion. and recommendation of the music based on the recognized emotion.

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