FACIAL EXPRESSION BASED SMART MUSIC PLAYER

A PROJECT REPORT

(Project Report Phase – I)

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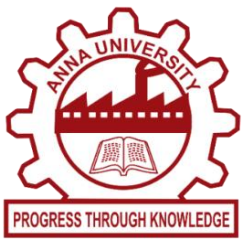

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ABSTRACT

Human expressions may be recognized through their facial expression, according to studies. Human Sentiments may be recognized through their facial expression, according to studies. As a result, this project captures human expression and selects songs based on the emotions observed. Using one's system web camera, this can be done in real time. The sentiment is discovered using Machine Learning and distinguishing traits associated with the face. Facial expression provides current mind state of person. Listening to music affects the human brain activities. Emotion based music player with automated playlist can help users to maintain a particular emotional state. Image recognition is used to find people in images and analyze their emotions. The study then displays a personalized playlist depending on the inferred sentiment. The CNN algorithm is used in this project to accomplish this task. Given an image, it will search for faces, identify them, place a rectangle in their positions, and describe the emotion found and present a playlist of songs based on the user's facial expression. The research project's main goal is to make the tedious and time-consuming operation of manually classifying music into separate lists easier by assisting in the creation of a relevant playlist based on an individual's emotional characteristics. The research Project's main goal is to make the tedious and time-consuming operation of manually classifying music into separate lists easier by assisting in the creation of a relevant playlist based on an individual's emotional characteristics.

KEYWORDS:

Machine learning, Facial expression, Image recognition, Playlist, Emotional characteristics, Inferred sentiment;

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CHAPTER - 1
INTRODUCTION

Music is noted for its adaptability. It brings people of diverse ages, ethnicities, languages, tastes, political affiliations, and income levels together. Music is thought to be the universe's rhythm, capable of transporting one on any kind of long journey. Listening to the proper music can even help you feel better. Human often use nonverbal cues such as hand gestures, facial expressions, and tone of the voice to express feelings in interpersonal communications. The face of the human is an important organ of an individual’s body and it plays an important role in extraction of an individual’s behavior and emotional state.

Melophiles frequently have a difficult time manually creating and organizing playlists, especially if they have a long list of favorites. It also gets tough for them to choose the appropriate music at the appropriate time to match their present mood. They now see the need for a mood detector as well as a recommender system to recommend tracks based on the mood. This reduces the amount of time and effort required to browse playlists.

This research proposes an emotion based music player that creates a playlists based on captured photos of the user. Manual sorting of a playlist and annotation of songs, in accordance with the current emotion, is more time consuming and quite tedious. This paper presents an algorithm that not only automates the process of generating an audio playlist, but also to classify those songs which are newly added and the main task is to capture current mood of person and to play song accordingly.

1.1 OBJECTIVE

The most important goal is to make change the mood of person if it is a negative one such as sad, depressed. This model is validated by testing the system against user dependent and user independent datasets. It aims at increasing the accuracy of the system by providing a feedback.

1.2 SCOPE OF THE PROJECT

Nowadays, almost everyone is in Depression or in Anxiety around the globe and Teenage people are mostly found in this category. This Project acts as a Personal Therapist provides the relaxation and Mental peace to the user in terms of music. The experiment was performed on a small datasets and limited number of features, in future it can be improved by adding more features like age, weather etc. More number of attributes will improvise decision making and prediction of song.

Each user has it’s own preferences about what kind of song is to be played for corresponding mood. for e.g., some users listen sad songs when they are sad while some may prefer happy songs to change their mood. Collecting this data from every user can help us build better user specific radio application. Implementing this prototype in current music applications can provide better music experince to user.

CHAPTER – 2
LITERATURE SURVEY

2.1 INTRODUCTION

The most crucial phase in the software development process is conducting a literature review. It is vital to establish the time factor, the economics, and the company's strength before building the tool. After these requirements have been met, the next stage is to choose which operating system and programming language will be utilized to construct the tool.

Once the programmers start building the tool the programmers need a lot of external support. This support can be obtained from senior programmers, from books or from websites. Before building the system, the above considerations are taken into account for developing the proposed system. A major part of the project development sector considers and fully surveys all the required needs for developing the project. For every project, the Literature survey is the most important sector in the software development process. Before developing the tools and the associated designing it is necessary to determine and survey the time factor, resource requirement, manpower, economy, and company strength.

Once these things are satisfied and fully surveyed, then the next step is to determine the software specifications in the respective system such as what type of operating system the project would require, and what all the necessary software is needed to proceed with the next step such as developing the tools, and the associated operations. In various fields, there is a necessity to detect the target object and also track them effectively while handling occlusions and other included complexities.

2.2 LITERATURE SURVEY

Mood based Music Recommendation System[1]

Author - Mahadik, A., Milgir, S., Jagan, V., Kavathekar, V., & Patel, J.

Year - 2022

Content -

In their work, they targeted to improve the emotional state of the person and make him happy, by recognizing the persons emotion and plays corresponding music which helps user in changing their mood. Music's magical power has been scientifically established and people enjoy listening to music that reflects their emotional feelings, it is a stress-relieving tool and has the ability to control a wide range of psychological states. They used Viola Jones algorithm, Data augmentation and CoAtNet algorithm to detect the emotion of a person.

Moodify: Smart Music Player based on Facial Emotions[2]

Author - Srinayani, M., Jahnavi, P. N., & Kavishree, S.

Year - 2021

Content -

In their paper, they presented an affective cross-platform music player, which recommends music based on the real-time mood of the user. This music player contains three modules: Emotion Module, Music Classification Module and Recommendation Module. The Emotion Module takes an image of the user's face as an input and makes use of deep learning algorithms to identify their mood. The Music Classification Module makes use of audio features to achieve a remarkable result of 97.69% while classifying songs into 4 different

mood classes. The Recommendation Module suggests songs to the user by mapping their emotions to the mood type of the song, taking into consideration the preferences of the user.

Mehfil : Song Recommendation System Using Sentiment Detected [3]

Author - Sangita S. Keluskar, Vaishnavi L. Dhuri, Shreya S. Gonjari, Nidhi Sanghavi

Year - 2022

Content -

In their work, they detected sentiment using Machine Learning and distinguishing traits associated with the face. They used Haar Cascade technique to recognise faces, which was then they processed by a pre trained lightweight model MobileNet V2. Their study then displays a personalized playlist depending on the inferred sentiment. Furthermore, for the construction of the dataset and suggestion, they used the Spotify platform and API. They classified music into separate lists easier by assisting in the creation of a relevant playlist based on an individual's emotional characteristics.

A real time face emotion classification and recognition using deep learning model[4]

Author - Dr. Shaik Asif Hussain and Ahlam Salim Abdallah Al Balushi

Year - 2020

Content -

In their work,they presents deep learning algorithms used in facial recognition for accurate identification and detection. The main objective of facial recognition is to authenticate and identify the facial features. However, the facial features are captured in real time and processed using haar cascade

detection. The sequential process of the work is defined in three different phases where in the first phase human face is detected from the camera and in the second phase, the captured input is analyzed based on the features and database used with support of keras convolutional neural network model.

Their proposed work is simplified in three objectives as face detection, recognition and emotion classification. In support of their work Open CV library, dataset and python programming is used for computer vision techniques involved. Their results of the experiments demonstrates the perfections in face analysis system.

An Emotion-Aware Personalized Music Recommendation System Using a Convolutional Neural Networks Approach[5]

Author - Ashu Abdul, Jenhui Chen, Hua-Yuan Liao, Shun-Hao Chang

Year - 2018

Content -

In this paper, they propose an emotion-aware personalized music recommendation system (EPMRS) to extract the correlation between the user data and the music. To achieve this correlation, we combine the outputs of two approaches: the deep convolutional neural networks (DCNN) approach and the weighted feature extraction (WFE) approach. The DCNN approach is used to extract the latent features from music data (e.g., audio signals and corresponding metadata) for classifification. In the WFE approach, they generate the implicit user rating for music to extract the correlation between the user data and the music data. In the WFE approach, they use the term-frequency and inverse document frequency (TF-IDF) approach to generate the implicit user ratings for the music. Later, the EPMRS recommends songs to the user based on calculated implicit user rating for the music.

CHAPTER - 3
SYSTEM ANALYSIS

3.1 EXISTING SYSTEM

EMO Player:

Emo player (an emotion-based music player) is an approach that helps the user to automatically play songs based on the emotions of the user.

SoundTree:

Sound Tree is a music recommendation system which can be integrated to an external web application and deployed as a web service. It uses people-to-people correlation based on the user's past behaviour such as previously listened, downloaded songs

Music.AI:

It uses the list of moods as input for mood of the user and suggests songs based on the selected mood. It is a combination of Collaborative filtering based and Content based filtering models. Emotion, time, ambience and learning history are the features taken into account for music recommendation.

Reel Time.AI:

This system works by having the user subscribe to them. The user can then upload images of large gatherings such as shopping malls, movie theatres and restaurants. The system then identifies the moods happy and sad. It recognizes which faces portray happy emotion and which faces portray sad emotion, and gives the verdict

Lucyd:

Lucyd is a music recommendation tool developed by four graduate students in UC Berkeley's Master of Information and Data Science (MIDS) program. Lucyd lets the user ask for music recommendations using whichever terms they want.

3.2 DRAWBACKS

- Chances of obtaining incorrect playlist due to poor recognition of user input (image).
- Does not provide much accuracy.
- Existing systems are very complex in terms of memory requirements.

3.3 PROPOSED SYSTEM

The proposed system benefits us to present interaction between the user and the music player. The purpose of the system is to capture the face properly with the camera. Captured images are fed into the Convolutional Neural Network which predicts the emotion. Then emotion derived from the captured image is used to get a playlist of songs.

The main aim of our proposed system is to provide a music playlist automatically to change the user's moods, which can be happy, sad, natural, or surprised. The proposed system detects the emotions, then a selected playlist is going to be presented that contains the foremost suitable sorts of music that will enhance the mood of the person positively.

3.4 METHOD USED

3.4.1 CNNs DETECTION SYSTEM

A Convolutional Neural Network(ConvNet/CNN) is a Deep Learning algorithm that 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 ConvNet is much lower as compared to other classification algorithms. While in primitive methods filters are hand-engineered, with enough training, ConvNets have the ability to learn these filters/characteristics.

The architecture of a ConvNet is analogous to that of the connectivity pattern of Neurons in the Human Brain and was inspired by the organization of the Visual Cortex. Individual neurons respond to stimuli only in a restricted region of the visual field known as the Receptive Field. A collection of such fields overlap to cover the entire visual area.

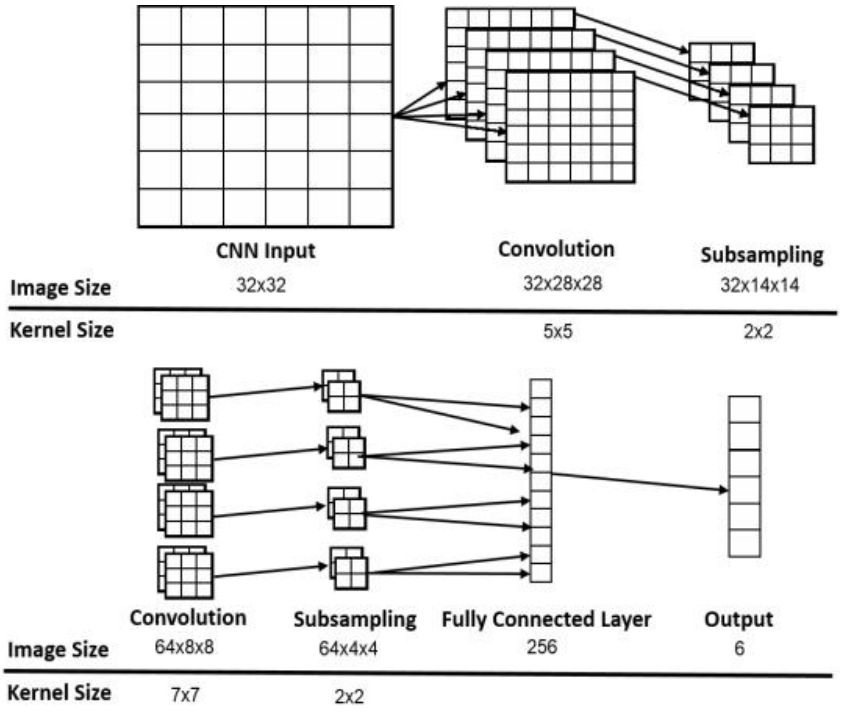

Figure 1: CNN Detection System

CHAPTER - 4

SYSTEM DESIGN

4.1 SYSTEM ARCHITECTURE

The architecture behind the approach is depicted in Figure 2. It is configured into various modular tasks. A webcam captures the image of the user or the user can also select the emoji for expressions. If face in the image is not clear, error message will be displayed and returns to main screen. It then extracts the facial features of the user from the captured image. It then uses the classification method (CNN) to identify the user's emotion. Then, the application fetch the songs that have an equivalent mood based on the user's emotion from the cloud storage and displays the playlist as output.

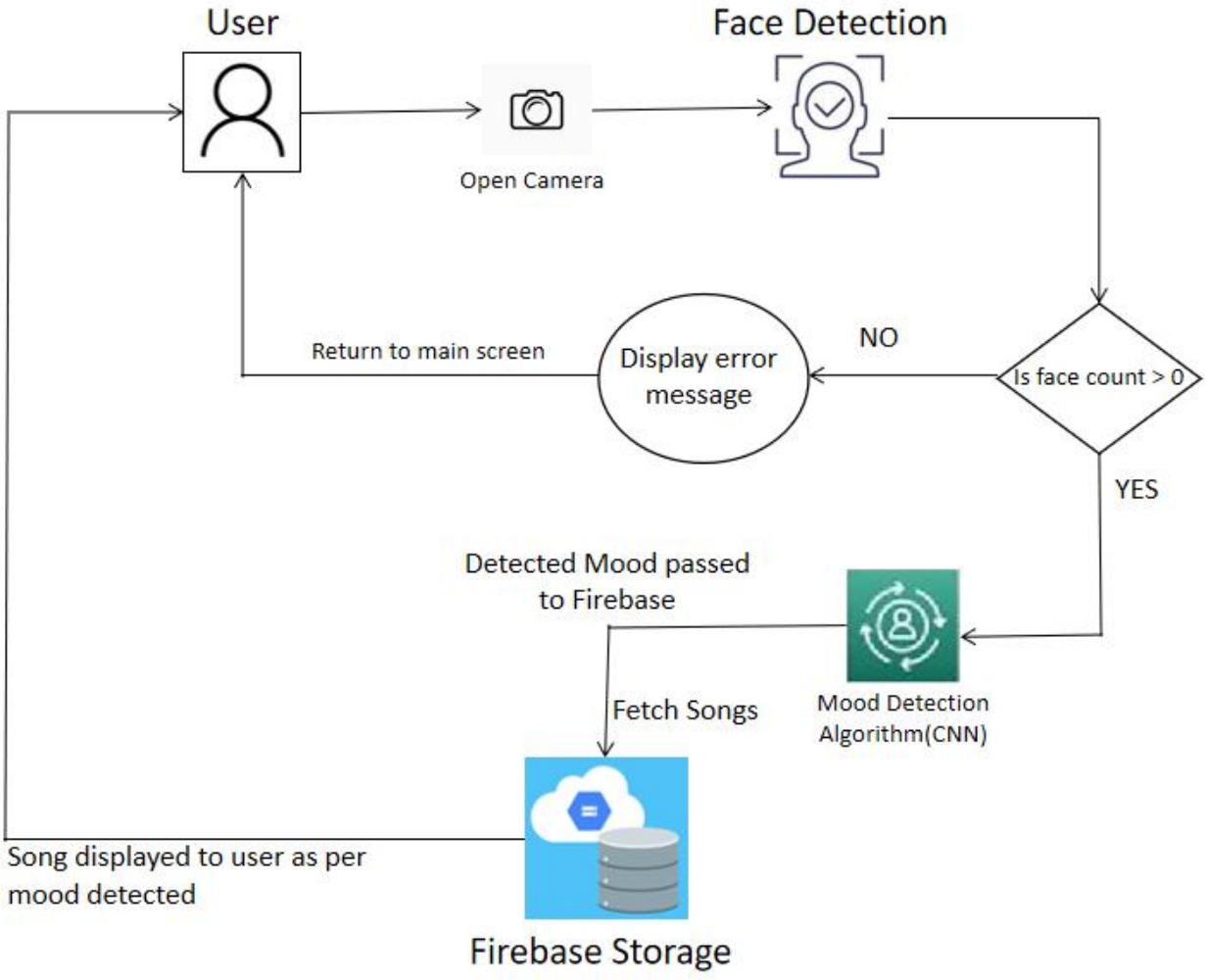

Figure 2: System Architecture

4.2 FLOWCHART

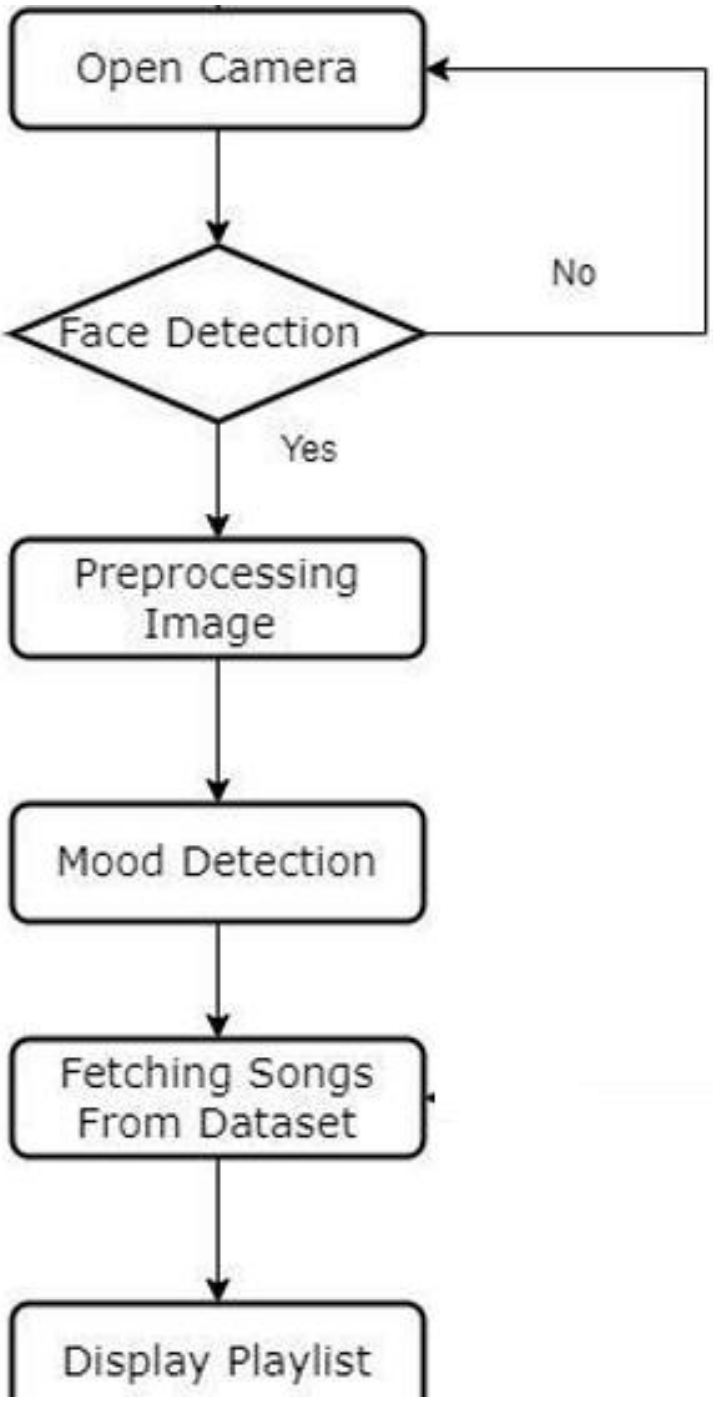

Figure 3: Flowchart

4.3 MODULE MAPPING

The classification method Convolutional Neural Network (CNN) is used to detect the user's facial expression.The detected emotion of the user is mapped with the created playlist. Then, the application fetch the songs from the mapped playlist that have an equivalent mood based on the user's emotion from the cloud storage and displays the playlist as output.

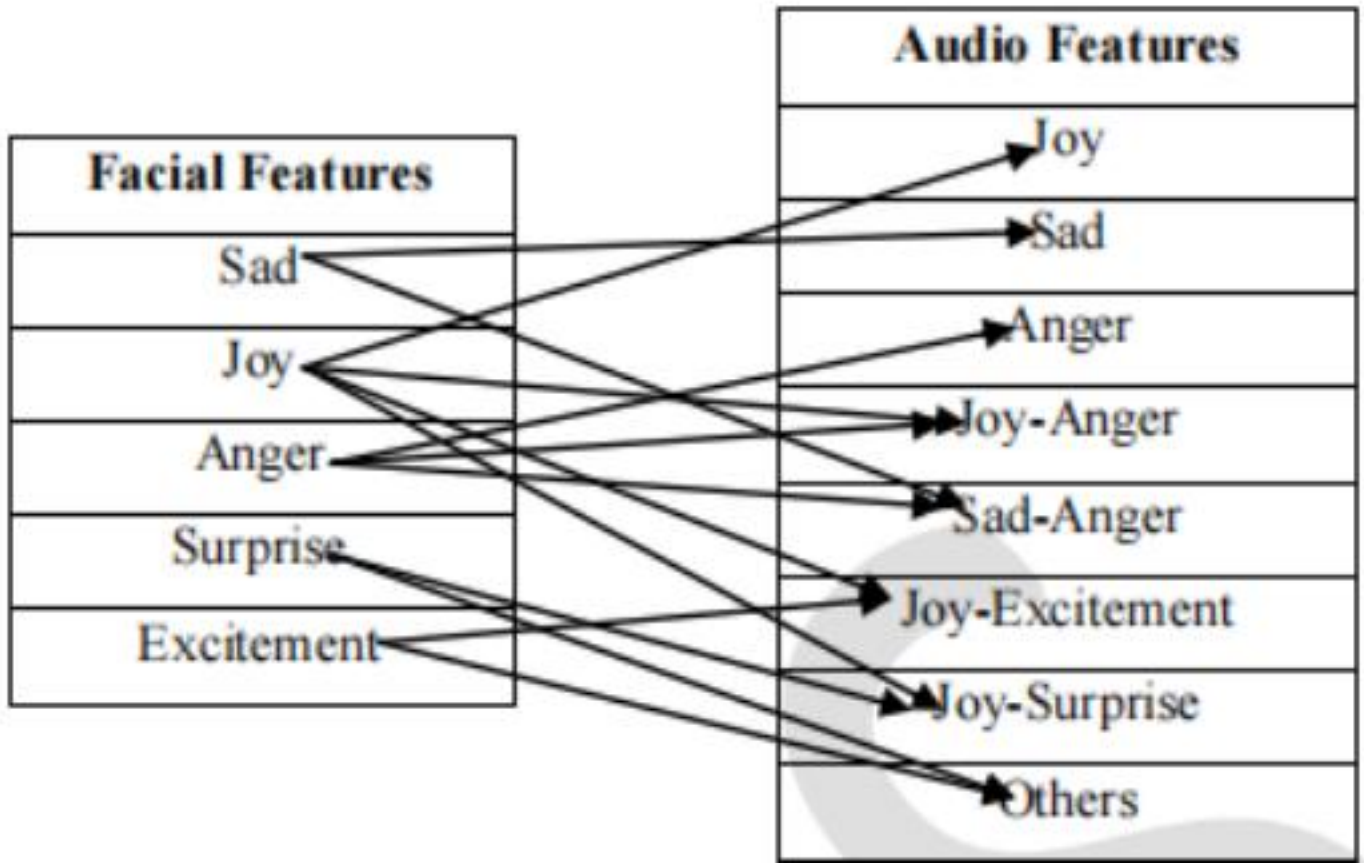

Figure 4: Module Mapping

4.4 SOFTWARE REQUIREMENTS

The functional requirements or the overall description documents include the product perspective and features, operating system and operating environment, graphics requirements, design constraints and user documentation.

- Anaconda, Python 3.8
- Python libraries
    - ➢ Open CV 4.0.1
    - ➢ Flask
    - ➢ Tensorflow 2.0
    - ➢ Keras
    - ➢ Scikit Learn Package
- Operating System: Windows (Vista/7 or above)
- Jupyter Notebook / Google Colab
- IDE (e.g. Visual Studio)

4.5 HARDWARE REQUIREMENTS

Minimum hardware requirements are very dependent on the particular software being developed by a given Enthought Python / Canopy / VS Code user. Applications that need to store large arrays/objects in memory will require more RAM, whereas applications that need to perform numerous calculations or tasks more quickly will require a faster processor.

- User System RAM: 2 GB and above
- Development RAM: 8 GB and above
- ROM: 10 GB HDD
- Device Processor: Intel i5 and above
- Webcam (for testing on laptop/desktop)

CHAPTER 5

METHODOLOGY

5.1 DATABASE DESCRIPTION

5.1.1 IMAGE DATASET

We built the Convolutional Neural Network model using the Kaggle dataset. The database is FER2013 which is split into two parts training and testing dataset. The training dataset consists of 24176 and the testing dataset contains 6043 images. There are 48x48 pixel grayscale images of faces in the dataset. Each image in FER-2013 is labeled as one of five emotions: happy, sad, angry, surprise, and neutral. The faces are automatically registered so that they are more or less centered in each image and take up about the same amount of space. The FER-2013 dataset was created by gathering the results of a Google image search of every emotion and synonyms of the emotions. FER systems being trained on an imbalanced dataset may perform well on dominant emotions such as happy, sad, angry, neutral, and surprised but they perform poorly on the under -represented ones like disgust and fear.

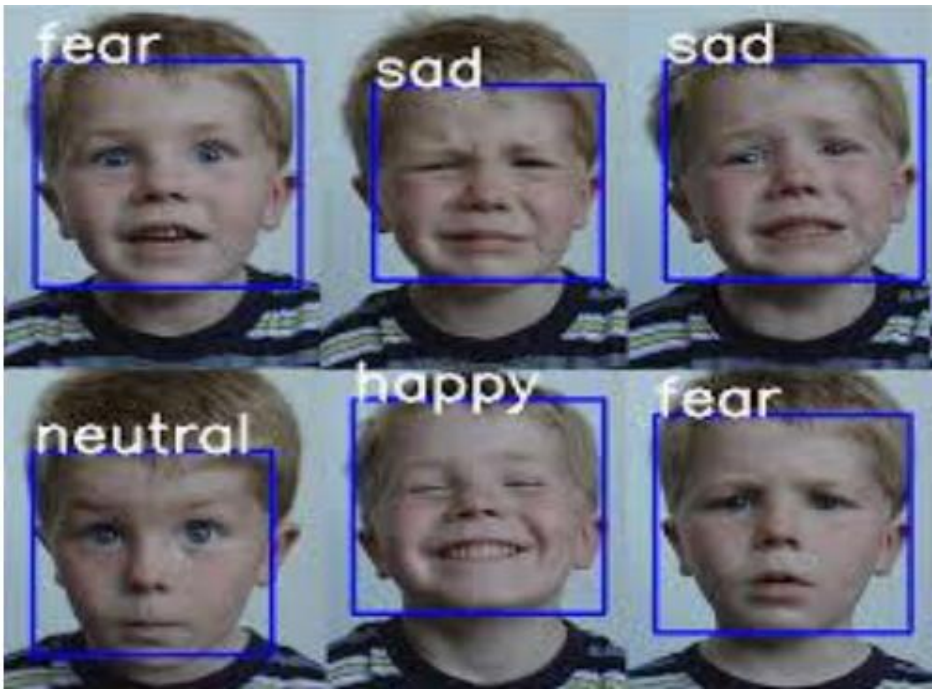

Figure 5: Image Dataset(Facial Expressions)

5.1.2 SONG DATASET

We created a database for songs. It consists of 10 to 15 songs per emotion. As we all know music is undoubtedly involved in enhancing our mood. So, suppose a user is sad then the system will recommend such a music playlist which motivates him or her and by this automatic mood will be delighted.

5.2 MODULES

Music recommendation based on facial emotion recognition contains three modules.

• Face Recognition: Here it will take the user's face as input. The convolutional neural network is programmed to evaluate the features of the user image.

• Emotion Detection: In this section extraction of the features of the user image is done to detect the emotion and depending on the user's emotions, the system will generate captions.

• Music Recommendation: Song is suggested by the recommendation module to the user by mapping their emotions to the mood type of the song.

5.2.1 FACE RECOGNITION MODULE

This is the process in which algorithms are developed and trained to properly locate faces or objects in object detection or related system in images. This detection can be real-time from a video frame or images. Face detection uses such classifiers, which are algorithms that detect what's either a face (1) or not a face (0) in an image. Classifiers are trained to detect faces using numbers of images to get more accuracy. The main aim of face detection is to spot the face within the frame by reducing external noises and other factors.

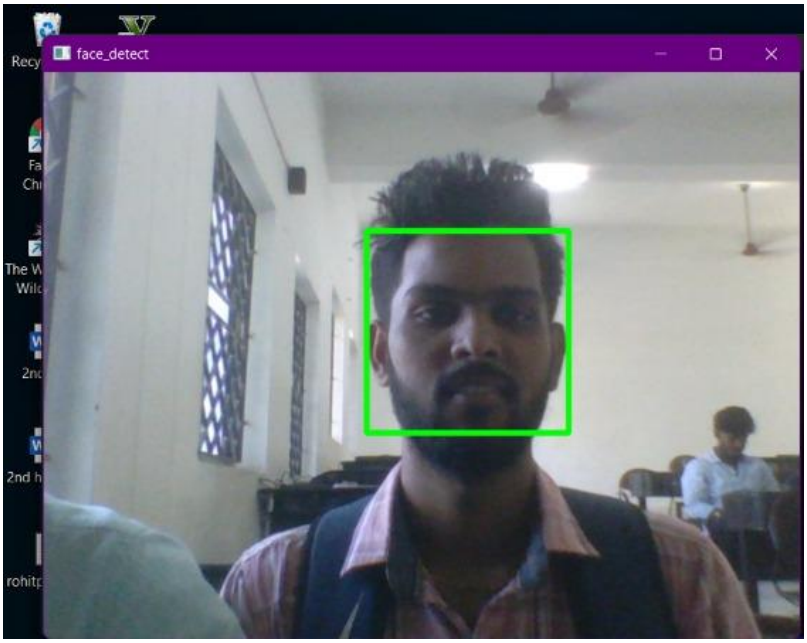

Figure 6: Face Recognition Module

5.2.2 EMOTION DETECTION MODULE

Convolution neural network architecture applies filters or feature detectors to the input image to get the feature maps or activation maps. Feature detectors or filters help in identifying various features pre-sent in the image such as edges, vertical lines, horizontal lines, bends, etc. We give an input image then the CNN model returns the results. Emotion detection is performed by loading the model which is trained by weights using CNN. When we take the real-time image by a user then that image was sent to the pre-trained CNN model, then predict the emotion and adds the label to the image.

5.2.3 MUSIC RECOMMENDATION MODULE

By using the emotion module real-time emotion of the user is detected. This will give the labels like Happy, Sad, Angry, Sur-prise, and Neutral. Using the os.listdir() method in python we connected these labels with the folders of the songs database which we have created. This method of os.listdir() is used to get the list of any file in the specified directories.

CHAPTER 6

IMPLEMENTATION

6.1 PRELIMINARY CODE

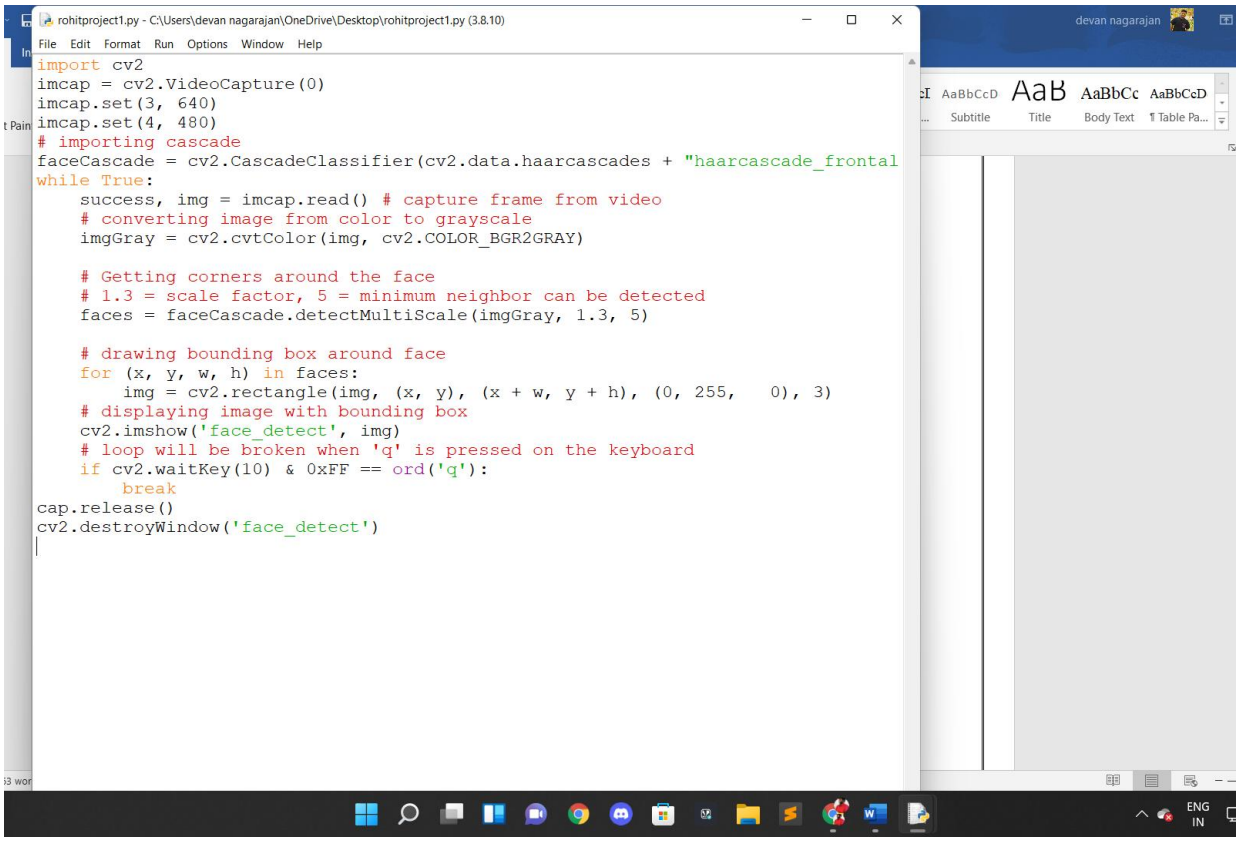

Figure 7: Preliminary Code

6.2 CODING

```
import cv2
imcap = cv2.VideoCapture(0)
imcap.set(3, 640)
imcap.set(4, 480)
# importing cascade
faceCascade = cv2.CascadeClassifier(cv2.data.haarcascades +
"haarcascade_frontalface_default.xml")
while True:
```

```
    success, img = imcap.read() # capture frame from video
    # converting image from color to grayscale
    imgGray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
    # Getting corners around the face
    # 1.3 = scale factor, 5 = minimum neighbor can be detected
    faces = faceCascade.detectMultiScale(imgGray, 1.3, 5)
    # drawing bounding box around face
    for (x, y, w, h) in faces:
        img = cv2.rectangle(img, (x, y), (x + w, y + h), (0, 255,   0), 3)
    # displaying image with bounding box
    cv2.imshow('face_detect', img)
    # loop will be broken when 'q' is pressed on the keyboard
    if cv2.waitKey(10) & 0xFF == ord('q'):
        break
cap.release()
cv2.destroyWindow('face_detect')
```

6.3. PRELIMINARY OUTPUT

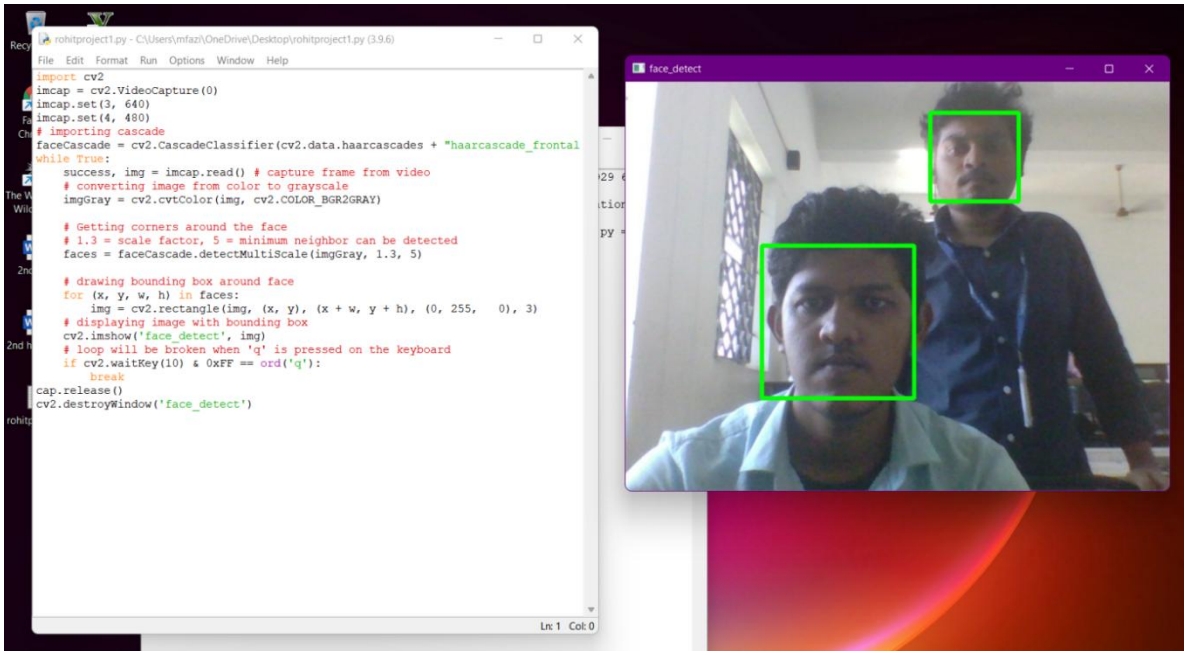

Figure 8: Output - Face Detection

CHAPTER 7
CONCLUSION

This research has been developed with an aim to contribute greatly in the field of machine learning and deep learning technology. It performs sorting out of the music based on one's emotions, such as whether they are happy or sad. Therefore, the main purpose of this research is to develop a web application in which a real time image of the user can be captured and further based on the mood detected, a list of songs could be recommended. It is especially useful for reviving the user when he or she has free time and wants to listen to music that is appropriate for the scenario. The mood detection model, is capable of detecting five moods accurately, viz. happy, sad, neutral, fear, and anger. In addition to that, it will have the ability to suggest a list of songs that would be suitable for the detected mood.

CHAPTER 8
FUTURE ENHANCEMENT

As of now we are taking the music from the database available online. But in future we can even take directly take songs from online where different kind of options will come like languages, newest released song, old songs from 80’s and 90’s etc. The future scope of this proposed method is that it can be used for music therapy session which will help music therapists to help patients suffering from depression, mental illness etc. It can also be implemented as a mobile app in future which will be convenient for the user. The current system does not perform well in extremely bad light conditions and poor camera resolution thereby provides an opportunity to add some functionality as a solution in the future.

The application asks for feedback from the user whether it has predicted correct or not, based on feedback it will learn. The above process increases model accuracy and results in improved quality. We can also add new features such as heart rate which is somewhat connected to human emotions to increase the correctness of the model. We can also consider background while predicting the emotion, this way we can get better results than the previous method. For example, if we are in the gym the application must detect objects in a gym and play motivational songs that are suited for the gym.

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