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Music Recommendation System Using Facial Expression

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Abstract:
The human face is an important instrument for determining someone's emotional state. The required input is instantly obtained from the subject's face using a camera. One way to use this input would be to extract the data and use it to infer someone's mood. The list of songs that fit the "mood" that was established from the previously supplied input may then be obtained using this data. This information can then be used to acquire the list of songs that match the "mood" and removes the laborious and time-consuming chore of manually sorting music into distinct lists. To detect emotions, we have employed a convolutional neural network. We use an integrated camera to record facial expressions. Using input facial photos, feature extraction is used to identify emotions including surprise, happy, angry, sad, and neutral. By figuring out the user's current emotional state, a playlist of music is automatically constructed. Compared to the approach in the current literature, it produces better results in terms of computational time. By using facial expression analysis, the Music Recommendation System seeks to provide a more personalized and engaging music discovery experience by gaining a deeper knowledge of the user's emotions. This novel combination of computer vision and music recommendation algorithms has the potential to completely change how people engage with and find music by dynamically and responsively responding to their emotional states.

1. Introduction:

Emotions are typically expressed by people through their facial expressions. People's moods have traditionally been recognised to be altered by music. The ability to record and identify the feelings someone exhibits, then play music that fits the mood, can gradually calm the user's thoughts and have a pleasant effect. The project's goal is to use a person's facial expressions to convey their feelings. a music player that uses the computer system's web camera interface to record human emotions. The software captures a picture of the user, extracts the target's facial features using image segmentation and processing algorithms, and then tries to figure out what emotion the user is attempting to convey.

The rapid development of digital signal processing technology and other effective feature extraction techniques has led to the quick development of automatic emotion identification in multimedia properties, such as music or movies. Numerous other applications, including music entertainment and systems for human-computer interaction, could benefit greatly from this technology. We offer an emotion detection recommendation system that recognises users' feelings from their facial expressions and suggests songs to them. The suggested system can identify an individual's feelings; if the individual is experiencing negative feelings, a specific playlist with the best appropriate music to lift their spirits will be shown. Additionally, if the feelings are positive, a particular playlist with different genres of music that uplift the mood will be shown.

2. Literature review

In a research paper, by Miss Harsha Varyani and Prof R. B. Late investigate the use of face recognition technology to create an emotion-based music player. In order to categorize human emotions and associate them with appropriate audio data, the article develops a facial emotion framework. Using signature points like the tongue, mouth, and eyebrows, facial recognition, attribute extraction techniques, and emotion identification are all part of the procedure. The algorithm identifies specific emotions to play an emotional audio recording if the input face exactly fits the emotion dataset. The suggested method highlights its significance in the domains of face detection, feature extraction, and face emotion identification by emphasizing its simplicity, efficacy, and dependability. This paper's research and findings point to a workable and exciting solution for an emotion-based music player. [1] In this article, the author describes Blue Eyes Technology's Automatic Music Player, which is based on Human Emotions. With the use of mouse movements and facial expressions, computers can detect people' moods because to such technology, which gives computers perceptual and sensory abilities. The study presents a "emotion sensory technique" that uses speech recognition, facial recognition, age tracking, and picture processing to identify moods. The suggested method seeks to improve efficient and user-friendly computer-human communication by utilizing cloud storage and authentication. The methodology defines the phrase "digital world" and highlights the evolution and survival of the digital world.[2] The authors examine facial expression recognition (FER) technology in this study as a means of improving mental health. Inspired by the idea that emotions can be expressed through human expressions, the study investigates the many uses and ongoing development of FER. Using a large dataset, the research gathers and examines human expressions and suggests ways to improve them. Based on people's facial expressions, the research aims to create a calming environment considering the widespread mental health difficulties, especially among young people.[3] The study presents a face expression-based music recommender system that is emotion-based. It uses a multi-step procedure that includes acquiring images, pre-processing, splitting them, extracting features, and using SVM to classify emotions. Mood-based playlist selection is triggered by realtime facial expressions. The accuracy of the Bezier curve approach is improved. Findings show consistency, pointing to potential uses in psychology and medicine. Although there is room for development, the system demonstrates how computer vision and machine learning may be applied to provide individualized music recommendations based on facial expressions, which may boost user wellbeing.[4] The research presents a Facial Expression Based Music Player that creates playlists according to users' moods by recognizing facial emotions using the Fisherface algorithm and the HAAR classifier. It recognizes emotions with an accuracy of up to 88.82%. A web application featuring queue-based, emotion-based, and random-based modes is part of the suggested system. The output of the command prompt shows that emotion recognition was effective. Future uses, including mental health therapies and smartphone applications, are suggested. [5] The study presents a web application that uses facial recognition to provide individualized music recommendations and real-time emotion detection. With the FER-2013 dataset as its training set, the system attains 81% accuracy. By making song recommendations based on identified emotions, it seeks to improve listening experiences. Through user experiments, the effectiveness of the system is validated by the study. Future research might expand on emotion detecting skills and integrate with wearables.[6] The study suggests an innovative approach for making individualized music recommendations based on facial expression analysis. It blends a collaborative filtering method for music suggestions with a deep learning model for facial expression interpretation. The algorithm predicts emotional states accurately and generates wellreceived personalized recommendations when assessed using ratings of music preferences and photos of facial

expressions. The goal of this innovative approach is to raise user engagement and satisfaction levels using music recommendation systems.[7] The study presents a Face Emotionbased Music Player System that automatically recognizes facial expressions using a convolutional neural network (CNN). By applying face mood and emotion recognition algorithms, it aims to increase the accuracy of music recommendations. The suggested method uses a webcam to detect live facial emotions instead of physiological sensors. Fast extraction and effective feature selection are among the benefits. Future uses could involve mental health and physiotherapy.[8] In order to improve mood, the "Facial Emotion Detector and Music Player System" described in this work uses facial expressions to predict the feelings of the user and plays music accordingly. It facilitates the selection of songs for improved mood or based on the user's current mood using Haar featurebased cascade classifiers. YouTube-based music playback, facial identification, and emotion recognition are all part of the system design. The system, which is written in Python and makes use of OpenCV, TensorFlow, Keras, and Web Browser, is designed to make users' life easier by providing them with a pleasant, emotionally driven music experience. [9] This study presents an Emotion-Based Music Player that makes song recommendations based on users' facial expressions by using a convolutional neural network. With 28,000 emotion-labelled images used for training, the system achieves an 85% training and an 83% testing accuracy. The easy-to-use app provides a reliable and automatic music recommendation experience by skilfully suggesting songs that correspond with the identified emotions.[10] A smart music player called "Moodify" uses the Fisherface Algorithm to identify the emotions on a person's face. It has queue, emotion, and random modes and plays music according to the user's mood. The system uses a dataset for training, extracts face features using the Haarcascade classifier, and combines JavaScript and Python to provide an intuitive user interface. The project's automated emotion-based music selection seeks to improve user experience. Subsequent research endeavours may encompass augmenting mood analysis via video-based emotion identification.[11] Using emotion recognition, the author has created a music recommendation system. The technology uses the user's facial expressions captured by a webcam to interpret their mood and recommend either a default or personalized playlist. With the use of the Spotify API integration and a VGG16 CNN model, it can make playlist suggestions with a high accuracy of about 98% in the training set. Authentication, integration with Smart Homes, and mood assessment for various user groups are examples of future applications. The solution improves user involvement and overall efficiency by reducing the music choosing process.[11] The research suggests combining CNN and fuzzy categorization to use facial expressions to suggest songs based on mood. Related works include apps that link menu choices to lighting changes in restaurants, mood tracking systems, and physiological parameterbased mood detection. The conclusion highlights how crucial machine learning is to their methodology, and further research attempts to develop CNN, fuzzy categorization, and skin detection.[12] Using facial emotion recognition and a CNN that achieves 95.14% accuracy, the article provides a music recommendation system. It uses Pygame for audio playback and Tkinter for the GUI to collect and recognize emotions in real-time facial expressions and recommend music playlists. Future upgrades will fix issues with changing lighting situations and provide other emotions.[13] This study presents a facial emotion detection-based music recommendation system. In order to identify emotions from facial expressions, the system makes use of a seven-layer convolutional neural network (CNN). The objective is to suggest music playlists that correspond with the identified emotions. With an accuracy rate of 74.8%, the model is intended to enhance user experience by eliminating the need for manual music selection. Using Dlib and OpenCV for face detection, a CNN for emotion detection, and song playback based on the identified emotion comprise the methodology. Future research is suggested in the report, including developing features for identifying suspicious human behaviour and improving the system's functionality.[14] In order to detect emotions, the article suggests a facial expression-based music recommendation system. It references similar work in face detection, emotion recognition, and music recommendation as it addresses content-based and collaborative filtering. With modules for face detection, emotion categorization, and music selection, the system makes use of MobileNet and Firebase. Different algorithms are taken into consideration. The final section highlights the enhanced user experience with emotion-aligned music recommendations while displaying the system architecture. [15]

3.System Architecture:

Facial expressions are used by the suggested music recommendation algorithm to provide individualized user experiences. The system includes modules for music suggestion, emotion classification, and facial identification.

1. Face Detection Module:

- Uses a camera to capture facial expressions to initiate the process.

2. Emotion Classification Module:

- Effectively classifies detected emotions using advanced algorithms (e.g., gradient boosting, decision trees, etc.).
- Uses MobileNet to effectively classify emotions.

3. Music Recommendation Module:

- Makes musical recommendations according to the categories of emotions.
- Uses Realtime to store and retrieve song data.

By integrating music recommendations with identified facial emotions, the technology guarantees a smooth and emotionally impactful user experience. Through customized and emotionally aware music recommendations, this integration of computer vision and machine learning technology seeks to improve customer satisfaction.

Emotions Used

- Happy
- Sad
- Angry
- Surprised
- Neutral
- disgust
- fear

4.Methodology

The use of facial expressions in a music recommendation system requires combining computer vision techniques, machine learning models, and traditional recommendation algorithms. The process of developing a user-facial expression-responsive music recommendation system is outlined in the following steps:

4.1) Face detection: One of the uses of computer vision technology that is being considered is face recognition. It's the process by which algorithms are created and honed to recognise faces or other objects in photos with object detection or related systems. Real-time detection from the image is possible. Reducing outside noise and other

distractions is the primary objective of face detection techniques, which also aim to identify faces within the frame. The matching procedure will become invalid if any facial feature in the database is altered. dependable face recognition method based on eigenface technique and genetic algorithm: First, all valley regions in grayscale images are examined to identify potential regions visible to the human eye.
A genetic algorithm is then used to generate all possible regions of the face, including the eyebrows, iris, nostrils, and corners of the mouth. Each candidate face can be normalized to also reduce lighting effects caused by uneven lighting; and the aggregation effect, due to head movement.

4.2) Emotion classification: The camera or webcam records the user's image. To enhance the performance of the classifier—which is used to identify faces in the image—the picture frames taken from the webcam feed are converted to grayscale images after they are taken. After conversion, the picture is fed to a classification algorithm that can identify faces in the webcam feed by employing feature extraction techniques. A network trained to identify the user's expressed emotions receives individual features from the extracted face. The classifier will be trained using these images so that when it receives a brand-new, unidentified set of images, from these pictures, it will be able to identify the locations of facial landmarks. Its perception is predicated on the information it has learned. returns the coordinates of recently found facial landmarks from the training set. An extensive set of CK datasets is used to train the net. This is used to ascertain the user's expressed emotions.

4.3) Music recommendation: Input images are obtained from a web camera and used for realtime photography. It is difficult to identify all the emotions and with limited options it can reduce compilation time and the result will be more complex. Emotions are assigned to each song. It compares the current values as thresholds in the code. To run the web service, the values will be passed. Depending on the identified emotion, the song will be played. Songs are numbered and assigned to corresponding emotions as they are expressed. The following seven emotions can be used: neutral, fear, disgust, surprised, angry, sad, and happy. Song selections corresponding to the detected emotions are played when a happy emotion is identified. This also applies to other emotions.

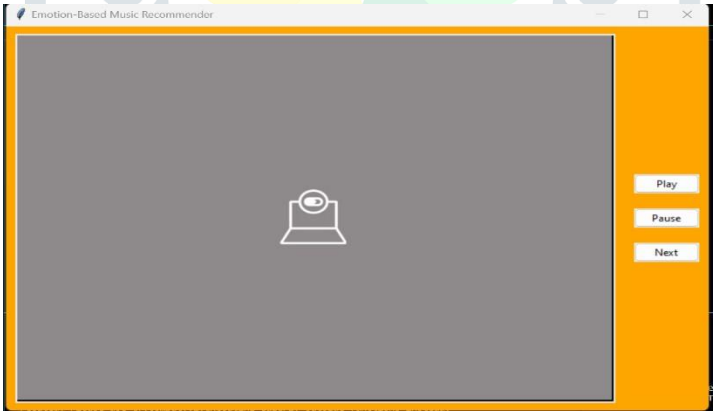


Fig.: Main Window

5.Results and Discussions

Experiment Results: - Instructions Explained to the User. In this scenario the users were given instructions as to what is to be done to perform the prediction of the emotion expressed which provided the following results.

Table: Instruction explained to user

Users	Emotions	Facial Expression	Accuracy
1	Happy	Happy	100
2	Sad	Sad	100
3	Sad	Happy	0
4	Happy	Happy	100

This proposed research describes human facial emotions, and the song is played based on the current mood or to improve or soothe the user's mood. Images of human faces are recorded by cameras. After the photo is captured, the captured frame will be converted to a grey scale image to improve the performance of the classifier, which will then send the converted image to the classification algorithm where the Image features Individually extracted from faces. Some implementations of this functionality would help train the classifier even better. Corresponding emotions are detected and recognized using patterns, then making informed decisions will help the user get his music.

Fig.: happy face detected.

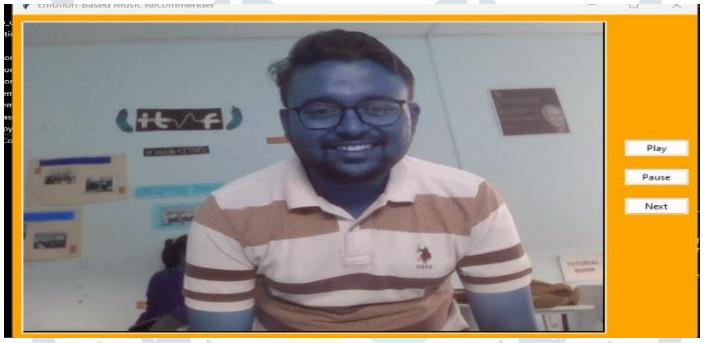


Fig.: sad face detected.

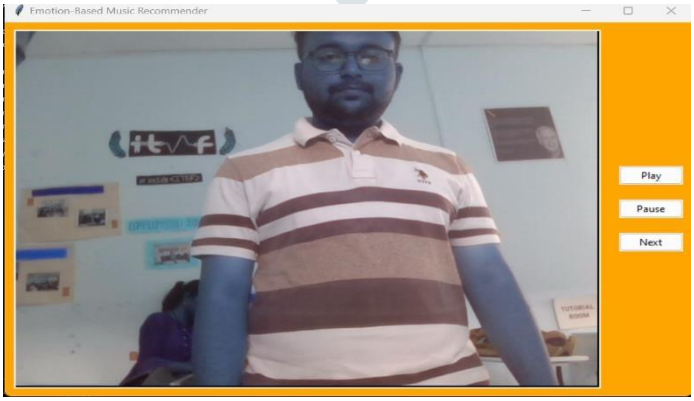
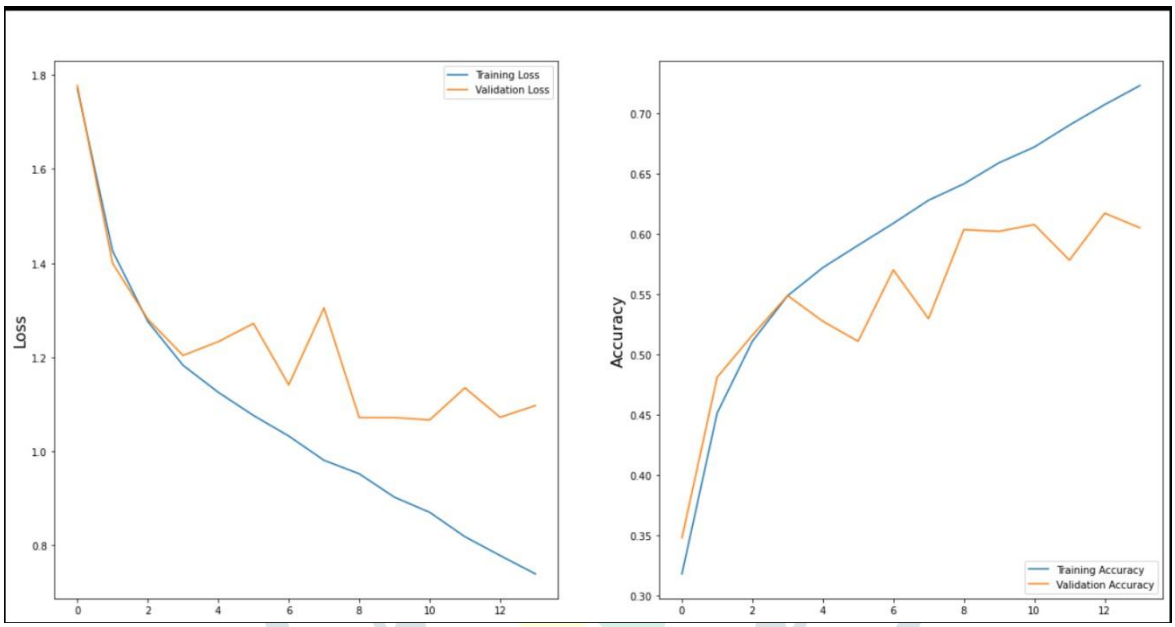


Fig.: happy face detected.

- **Plotting Accuracy and loss**



6. Conclusion

The proposed music recommendation system for emotion detection uses computer vision and machine learning techniques to understand human emotions from facial expressions captured by webcams. Its architecture provides a flexible user experience with emotion classification, facial recognition, and music recommendation modules. Research on various emotion classification algorithms, including K-Nearest Neighbours and decision tree classifiers, highlights the importance of matching music to the user's emotional state. The system contributes to the conversation about the connection between humans and machines in addition to providing specific music recommendations. In short, this solution represents a comprehensive approach by integrating modern technologies such as MobileNet and Firebase.

An understanding of its possible implementation can be obtained from visual representations of the Android application and system architecture. Music recommendation systems for detecting emotions are an example of how technology is evolving, combining human emotions with artificial intelligence to deliver unique and meaningful music experiences.

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