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Survey on Emotion-Based Song Recommendation System

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ABSTRACT -The Emotion-Based Music Player is a technology that uses artificial intelligence and machine learning to play music according to a user's mood and emotional state. It captures an image of the user, detects their expression, maps their mood, and then plays music from a playlist designed to boost the user's mood. The system uses machine learning algorithms to detect and predict emotions. The software analyses the user's image to classify it into different emotions such as happy, unhappy, neutral, or angry. The music player also recommends related songs that resonate with the user's state of mind. The goal of this technology is to make it easier for users to select music based on their current mood without having to manually search through a large playlist. The emotion-based music recommendation system aims to provide personalized music suggestions to users based on their current emotional state. The system uses facial expression analysis to determine the user's mood, and then recommends songs from the user's playlist that match their mood. This system solves the problem of having too many options in a large music library. This allows users to quickly and easily find music that suits their mood or emotional state. The webcam captures an image of the user, which is then analyzed to determine their mood. The system then shows the user songs from their playlist that match their mood. This reduces the stress and confusion associated with searching for music from a large collection of options. This system provides a simple and convenient way for users to find music that matches their moods, helping them improve their listening experience. The proposed system is a mood-based music player that integrates computer vision and machine learning techniques to detect the user's mood through facial expressions. The system then suggests songs suitable for the detected mood to improve the user's mental health and overall experience. The system is an additional feature to traditional music player apps and aims to analyze the user's image and predict their expression for personalized song suggestions. The use of mobile networks and digital multimedia technologies has increased the demand for digital music, making mood-based music players a useful tool for young people to regulate their moods through music.

KEYWORDS: mood detection, image processing, machine learning, pattern recognition

I. INTRODUCTION

The classification of human emotions is as follows: fear, disgust, anger, surprise, sadness, happiness, and neutral, which can include variations such as cheerfulness and contempt. Detecting subtle emotions through facial expressions is challenging due to minimal muscle contortions and context dependence. Machine learning algorithms, particularly neural networks, and deep learning, have been useful in mood detection through pattern recognition and classification. With the growth of digital music technology, the development of a personalized music recommendation system is crucial. Personalized music recommendations can be made through two major approaches: content-based filtering, which analyses past music preferences, and collaborative filtering, which recommends music based on peer group preferences. Both approaches have their drawbacks, and a hybrid approach combining both content and collaborative technique is often implemented to achieve maximum accuracy and overcome the drawbacks. Companies such as Amazon, eBay, Spotify, and Pandora use machine learning and deep learning techniques for personalized music recommendations based on the user's preferences. They are expressed through facial expressions. The project combines this aspect of human behavior with technology to provide a personalized music recommendation system that caters to a user's mood. The software captures the user's facial expressions through a webcam and uses image processing and segmentation techniques to extract features and detect the emotions being expressed. The music player then selects songs that match the user's mood, providing a calming and pleasing effect. The aim is to enhance the mood of the user through the use of appropriate music. This is done with a focus on facial expression recognition as the primary mode of mood detection.

II. LITERATURE SURVEY

An emotion-based song recommendation system is a system that uses algorithms to recommend songs to users based on their emotional state. The system typically works by using machine learning techniques to analyze the emotions expressed in a song, such as happiness, sadness, anger, fear, and others.

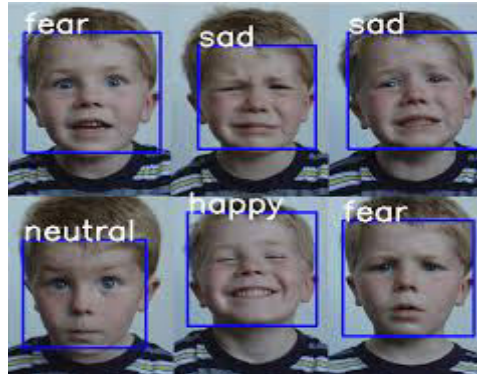
- Numerous research studies have been conducted on emotion-based music recommendation systems. Some of the key studies include: Emotion Recognition in Music Using Deep Learning by Fu, X. et al. (2018) This study uses deep learning algorithms to analyze music features such as rhythm, melody, harmony, and timbre to classify emotions in music.
- Emotion-Aware Music Recommendation Using Deep Neural Networks by Kim, H. et al. (2017) This study used deep neural networks to analyze the emotions expressed in music and analyzed the results to recommend songs to users.
- A Music Recommendation System Based on Emotion Analysis and the User's Profile by Xu, Y. et al. (2015): This study used a combination of emotion analysis and user profile information to recommend songs to users. The system used natural language processing techniques to analyze the lyrics of songs and classify their emotion
- Emotion-Based Music Recommendation Using Fuzzy Logic by Veena, B. et al. (2013) This study applied fuzzy logic to analyze the emotions expressed in music and used the results to recommend songs to users.
- Music Recommendation System Based on Emotional and Social Contexts by Kim, Y. et al. (2012) This study used both emotional and social contexts to recommend songs to users. The system analyzed the emotions expressed in music and the social context in which the music was played (such as a party or a romantic dinner).
- These studies demonstrate the feasibility of using emotion-based techniques to recommend songs to users and highlight the importance of considering both emotional and contextual factors in music recommendation systems.

III. PROPOSED SYSTEM

One can tell exactly how someone is feeling by looking at their face. The human face is photographed by a camera and utilised as input. With the use of specific algorithms, we extract the elements from the captured image and use them to determine the emotion or mood of the subject. The user can then be given a playlist that has been prepared in advance for each feeling based on the predicted emotion. The emotion-based music recommender takes a picture of the face, extracts the features, and then trains itself to learn the pattern so that it can accurately recognise the emotions for various faces. It is crucial for the system to identify the emotion as precisely as possible because music is utilised to align the emotion or mood.

Project is implemented in two phases:

1. Emotion detection software detects the emotion using facial expression with the help of python
2. Integrating the code with web service in order to play the recommend music based on facial expression.



ADVANCED SYSTEM ARCHITECTURE

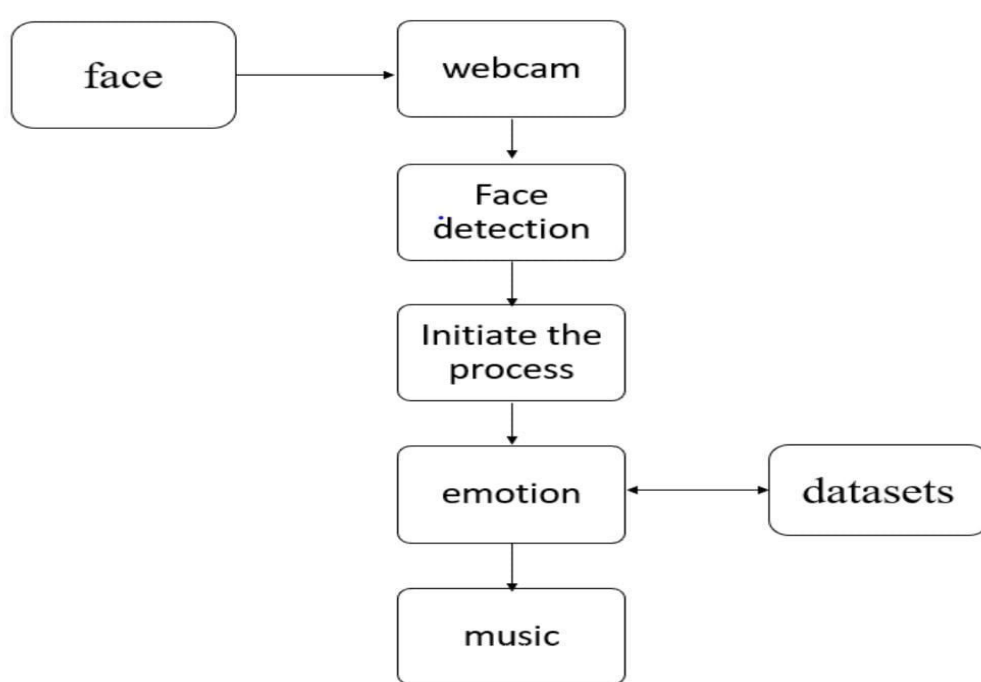


Fig. Advanced System Architecture

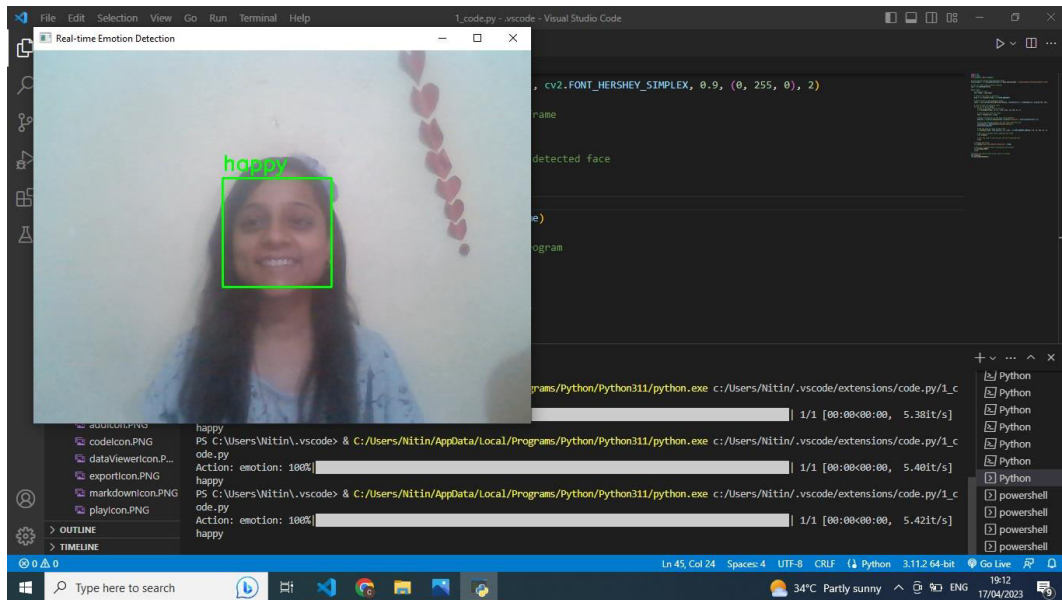
IV. RESULTS

1 Face Detection:-

Face detection is one of the applications which is considered under computer vision technology. 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. OpenCV uses two sorts of classifiers, LBP (Local Binary Pattern) and Haar Cas-cades. A Haar classifier is used for face detection where the classifier is trained with pre-defined varying face data which enables it to detect different faces accurately. The main aim of face detection is to spot the face within the frame by re-ducing external noises and other factors. It is a machine learning-based approach where the cascade function is trained with a group of input files. It is supported the Haar Wavelet technique to research pixels



inside the image into squares by function [9]. This uses machine learning techniques to urge a high degree of accuracy from what's called "training data."



V. EMOTION DETECTION

Convolution neural network architecture applies filters or feature detectors to the input image to get the feature maps or activation maps using the Relu activation function [11]. Feature detectors or filters help in identifying various features pre-sent in the image such as edges, vertical lines, horizontal lines, bends, etc. After that pooling is applied over the feature maps for invariance to translation. Pooling is predicted on the concept that once we change the input by a touch amount, the pooled outputs don't change. We can use any of the pooling from min, average, or max. But max-pooling provides better performance than min or average pooling. Flatten all the input and giving these flattened inputs to a deep neural network which are outputs to the class of the object

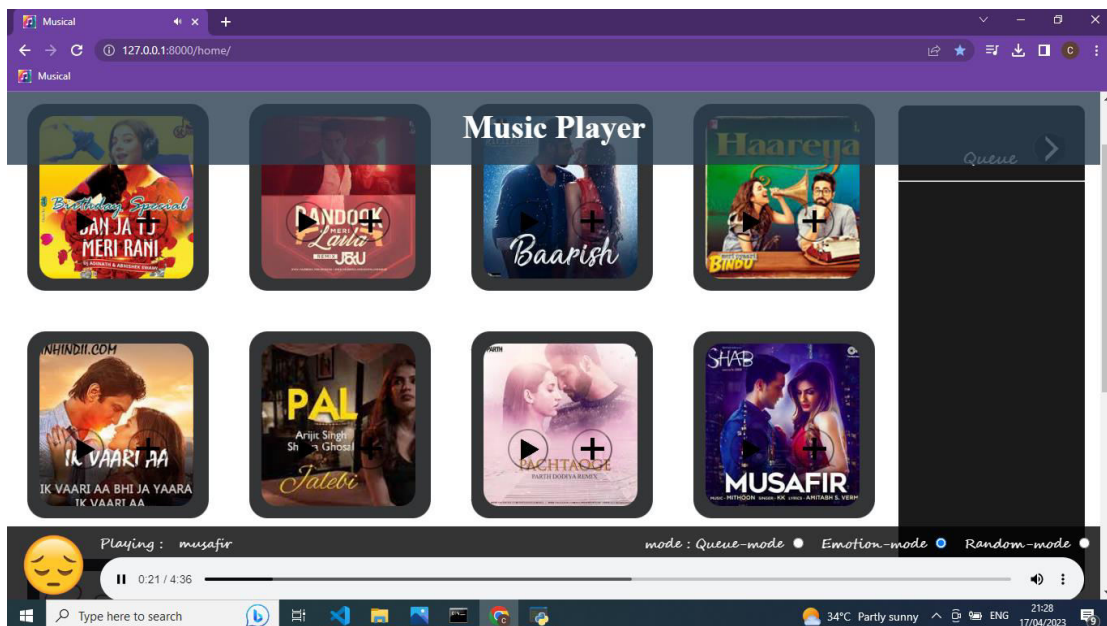
The class of the image will be binary, or it will be a multi-class classification for identifying digits or separating various ap-parel items. Neural networks are as a black box, and learned features in a Neural Network are not interpretable. So basically, we give an input image then the CNN model returns the results [10]. 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.

```

1_code.py x
extensions > code.py > 1_code.py > ...
24 cv2.rectangle(frames, (x, y), (x+w, y+h), (0, 255, 0), 2)
25
26 # Crop the face from the frame
27 face = frame[y:y+h, x:x+w]
28
29 # Detect the emotion in the face using DeepFace
30 emotions = DeepFace.analyze(face, actions=['emotion'], enforce_detection=False)
31
32 # Print the dominant emotion for the first detected face
33 face_emotion = emotions[0]['dominant_emotion']
34 print(face_emotion)
35
36 # Add the emotion label to the frame
37 cv2.putText(frame, face_emotion, (x, y-10), cv2.FONT_HERSHEY_SIMPLEX, 0.9, (0, 255, 0), 2)
38
39 # Wait for 3 seconds before updating the frame
40 time.sleep(3)
41
42 # Exit the loop to only process the first detected face
43 break
44
45 # Display the frame
46 cv2.imshow('Real-time Emotion Detection', frame)
47
48 # Wait for 10 seconds before terminating the program
49 cv2.waitKey(10000)
50 break
51
52 # Release the capture device and close all windows
53 cap.release()
54 cv2.destroyAllWindows()
55
    
```

VI. MUSIC RECOMMENDATION

We have manually parted the music using JavaScript as arrays and assigned them to each of the 4 emotions which is why whenever an emotion is detected the playlist automatically suggests a particular song.



APPLICATIONS

1. Personal entertainment: A user can simply open the application, let it capture their facial expression, and receive personalized music recommendations based on their mood.
2. Therapy: The application can be used by therapists to create a calming and relaxing environment for their patients. By capturing the patient's mood, therapists can provide them with music that will help them feel better.
3. Mood improvement: People who are feeling sad, angry, or frustrated can use the application to receive recommendations for music that will help improve their mood.
4. Events and parties: The application can be used to set the mood for events and parties by playing music that matches the overall emotion of the attendees.

5. Education: The application can be used in education to help students identify and understand their emotions and provide them with music that can improve their mood and concentration.

ADVANTAGE:

There are several advantages to an emotion-based song recommendation system:

- Personalization: An emotion-based song recommendation system can provide personalized recommendations to users based on their current emotional state, helping them find songs that match their mood.
- Improved User Experience: By recommending songs that match a user's emotional state, the overall music listening experience can be enhanced, leading to increased engagement and satisfaction.
- New Music Discovery: Users are more likely to discover new music that they enjoy when recommendations are based on their emotional state rather than on their listening history.
- Increased Engagement: An emotion-based recommendation system can help keep users engaged with the music streaming service, encouraging them to spend more time listening to music and exploring various artists and songs.
- Better Understanding of User Preferences: By analyzing a user's emotional state in conjunction with their listening history, the recommendation system can better understand their musical preferences and provide even more accurate recommendations over time.

Overall, an emotion-based song recommendation system can provide a more personalized and enjoyable music listening experience, leading to increased engagement and user satisfaction. Advantages of using an emotion-based song recommendation system for real-world use.

- Improved Mental Health: By recommending songs that match a user's emotional state, the recommendation system can help improve their mental health by providing a source of comfort and support during times of stress, anxiety, or sadness.
- Enhanced Mood: An emotion-based recommendation system can help users enhance their mood by recommending songs that match their current emotional state and help lift their spirits.
- Better Marketing Opportunities: Music streaming services and other companies can use emotion-based recommendation systems to better target their marketing efforts at users, improving their chances of success.

Disadvantages:

- Human have a wide range of emotions, which the proposed system does not consider

VII. CONCLUSION

The emotion-based song recommendation system is a novel application of technology that leverages computer vision, image processing, and machine learning algorithms to capture and analyze human emotions. This system is designed to enhance the overall musical experience of a user by recommending songs that match the emotions expressed through their facial expressions. The system captures an image of the user through a webcam and uses image processing techniques to extract features from the face of the target individual. These features are then fed into a machine-learning model to detect the emotion being expressed. The recommendation engine then suggests songs that match the mood of the user, providing a more personalized and enjoyable musical experience. This technology has the potential to revolutionize the way people listen to music, making it more intuitive and responsive to their emotional state.

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