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Music Recommendation System Based on Facial Emotions

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A B S T R A C T

Through the use of a cutting-edge music recommendation system based on facial expression recognition, this research promises to revolutionize personalized music suggestions. The focus is on emotions, which can be expressed through a variety of signs like verbalization, body language, and facial expressions. The suggested method makes use of facial recognition software to monitor a user's emotional state when they interact with distant learning. The three phases of the emotion recognition model are feature extraction, subset feature selection, and emotion categorization. It starts with Haar-cascade-based face detection to separate the user's face, then extracts pertinent facial features, paying special attention to the areas around the eyes and mouth. To derive characteristic values, additional fine-tuning using Sobel edge detection is used. The classification of emotions into six different groups is completed by training a Convolution neural network (CNN) classifier. By matching users' musical preferences to their emotional states, this ground-breaking method has the potential to improve personalized music suggestions and make listening more interesting and personalized.

Keywords: Cutting edge, Music, emotions, Haar-cascade, Sobel edge, Convolution neural network

1. Introduction

Recent studies have shown that listening to music can alter how people feel, act, and think. In a study on the motivations behind music consumption, researchers found that connecting emotions and moods is one of music's important functions. The positive effects of music on mood and self-awareness are significant. According to research, there is a significant correlation between a person's emotional state and musical tastes [1]. Additionally, musical characteristics like rhythm, tone, timbre, and meter interact with the brain areas in charge of controlling emotions and mood [2]. Personal interaction is an essential part of our daily lives. It enables us to closely examine human behavior, which includes important elements like body language, voice, facial expressions, and emotions [3]. Emotion detection is incorporated into many applications in today's technologically advanced society, including security systems and smart cards. This useful application not only recognizes user moods but also creates playlists that are suited to those feelings. For instance, the system will play cheerful, mood-lifting music when someone is feeling down, while it will provide a mix of various musical genres to reinforce positive sensations when someone is feeling upbeat [4]. This system's soundtrack is composed of Hindi songs. It uses Hear-cascade technique, which has an accuracy rate of about 92.10% and is a key technology in this context, for face expression identification. Thanks to advancements in digital signal processing and feature extraction techniques, the field of automated emotion identification in multimedia, which includes music and movies, is developing quickly. This system has the potential to be very important in many applications, such as music entertainment and human-computer interaction systems. We suggest creating a face expression-based recommendation system that would provide better user experiences and tailored recommendations.

2. Literature survey

All Facial expressions can describe a person's current mood. Most of the time, when we communicate with others, we express our emotions mostly through non-verbal cues such as gestures, facial expressions, and tone of voice. Preema et al. claim that creating and maintaining a sizable playlist requires a lot of time and work [5]. Utilizing energy levels in audio files, the Viola-Jones method for face detection, and emotion categorization into five themes (anger, happiness, surprise, sorrow, and disgust) with SVM, the music player creates playlists that are tailored to the user's mood. To improve emotional awareness, Yusuf Yaslan et al. offer an emotion-based music recognition system using skin GSR and PPG data. The ability to read a person's mood and feelings from facial expressions, taking into account numerous emotions, is highlighted by Ayush Goodale et al. [6]. In this study, face recognition was performed using neural networks. The "language of emotion" is often used to describe music around the world. A study by Ramya Ramanathan et al using cognitive tools. Describes smart music. An important aspect of human nature is emotion. They play the most important role in life. Human emotions are designed to be shared and understood by others. The first group of users of the local music collection evokes the needs of the album. This is usually determined by considering the lyrics of the song. It also provides playlist creation, distribution thinking, and a quick summary of work Radhika et al., introduced manual grading and adding song descriptions, which is time-consuming and labor-intensive, according to the current mood of the user [7]. For automating this operation, a variety of methods have been proposed. However, current algorithms are slow, require extra hardware (such EEG models and sensors), increase system expenses, and make only marginal advancements. This article provides an automated way for creating music playlists based on facial expressions to improve and streamline the process. This technique aims to lower overall system costs, speed up processing, and improve

accuracy. These advancements are verified by comparing the facial recognition module's performance with user-dependent and user-independent datasets. Vincent Tabora [8] investigated the Haar-Cascade classifiers for face detection using OpenCV. According to Zhuwei Qin et al. give an overview of visualization methods for comprehending convolutional neural networks [9]. With applications in real-time object recognition, Paul Viola et al. paper introduces a quick machine learning approach for object detection that makes use of the "Integral Image," AdaBoost, and a cascade structure for effective background rejection [10]. T-H. Wang et al. paper explores how motion separation and 3D position estimate can improve face emotion recognition [11]. Hemanth P et.al. Demonstrate a music recommendation system based on emotional analysis [12]. Ankita Mahadik et al. describes a system that recognizes users' moods based on their facial expressions and suggests music in line with those moods. By highlighting the value of emotion in music listening, this creative method improves on conventional music player apps [13]. Gokul Krishnan K et al. describes a project that improves the music-listening experience using automation and machine learning. In order to improve user experiences and provide individualized music suggestions, resource optimization is the essential innovation [14]. C. Shan et al. paper analyses facial emotion recognition utilizing local binary patterns in great detail [15].

3. Proposed Methodology

The system under consideration allows for user-music player interaction. In order to adequately capture the face with the mobile camera, the system is designed to do so. The Hear cascade algorithm predicts the emotion using the captured photos as input. The block design of the suggested system is shown in Figure 1 and Haar cascade architecture is shown in Figure 2. A playlist of songs is generated using the emotion extracted from the input image. Our system's primary goal is to automatically provide a music playlist to modify the mood when the proposed system is used. User’s emotions, which may be joyful, depressing, normal, or startled. The proposed system analyzes the emotions, and if the topic involves a negative emotion, a chosen playlist will be played that includes the best types of music to lift the listener's spirits. Four modules make up the face emotion-based music recommendation system.

1. Real-Time Capture: The system must accurately capture the user's face in this module.
2. Face Recognition: In this case, the user's face will be used as the input. The Haar-cascade algorithm is set up to analyze the user image's features.
3. Emotion Detection: In this step, elements from the user's image are extracted to determine their emotions, which are then used as the foundation for creating captions.
4. Music Suggestion: The recommendation module makes song suggestions to the user by correlating their emotions with the song's mood.

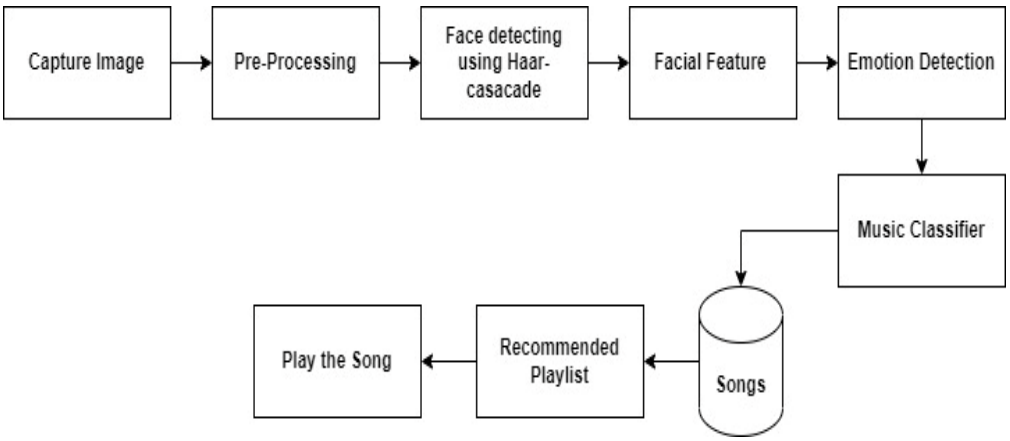


Figure 1. Block Diagram of the Proposed System.

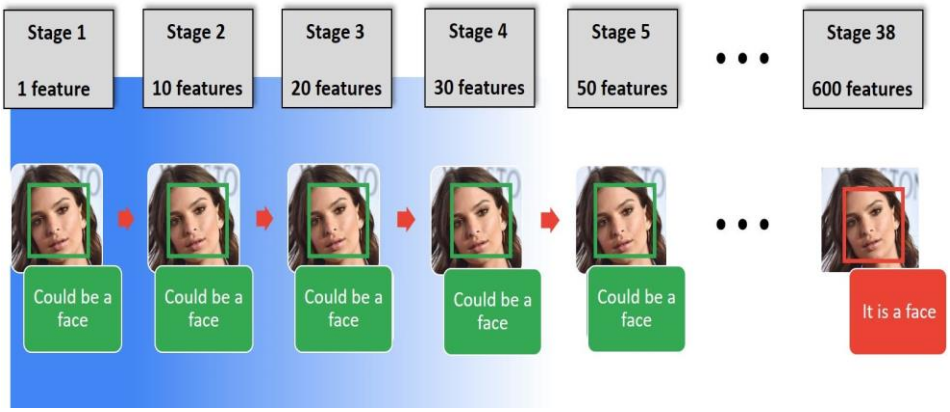


Figure 2. Haar cascade Architecture.

3.1 Dataset description

- Our convolutional neural network model was created using the Kaggle dataset FER2013. Images in this dataset are categorized according to emotions including surprise, happiness, sadness, and rage. The photos have automatically aligned and centered faces that take up a consistent amount of space in each picture to preserve uniformity. Both posed and unposted headshots are present in the dataset.
- The Emotion Detection Module is a face detection-focused component of computer vision technology. In order to effectively recognize faces or objects within photos, which is essential for many applications like object detection and related systems in photographs, this includes designing and training algorithms.
- We believe that the pre-trained network, which was created as a sequential model, can function as a flexible feature extractor. Let the image enter the next layer, stop it, and use the output of the process according to our specifications. Use only a few filters because the initial convolutional network layers retrieve the highest-level characteristics from the captured image. As we add deeper levels, we multiply the number of filters by two or three, depending on how big the filter was in the preceding layer. The deeper layer filters are computationally demanding yet gains more characteristics.
- In Emotion Detection, a convolutional neural network architecture uses the Relu activation function to apply filters or feature detectors to input images, producing feature maps or activation maps. Edges, curves, vertical and horizontal lines, among other aspects in an image are some of the several elements that these feature detectors help identify. The feature maps' translation invariance is subsequently evaluated using pooling. The primary concept of pooling is that even when the input marginally varies, the pooled outputs stay largely constant. There are several pooling techniques you can utilize, including minimum, average, and maximum pooling, however max-pooling often provides the best performance. Each input is then flattened before being fed into a deep neural network, which creates outputs for each item class.
- Bollywood Hindi music database: We built this database.
- Songs for each emotion. As is common knowledge, music may undoubtedly improve our mood. As a result, if a user is depressed, the Haar cascade algorithm will suggest a music playlist that will uplift him or her. As a result, the user's mood will automatically improve.
- The emotion module uses real-time user emotion detection for music playlist recommendation, classifying emotions into categories including happy, sad, angry, surprised, and neutral.

4. Experimental results and discussions

Users first register with the system during the execution process by entering their username and password, as shown in Figure 3. After successfully registering, users are taken to the main page, which acts as the focal point for all available features. Users use the "Capture Image" option to continue, as seen in Figure 4. They can take a clear image of themselves thanks to this action, which they must verify by pressing the "Confirm" button. An emotion detection module uses machine learning and Haar cascade techniques to analyze the collected image and determine the user's emotions, such as happiness, sadness, anger, or neutrality. The technology suggests a song that fits the user's emotional state based on the emotion that was detected; When "happy" is detected, for example, the system advises playing a cheerful song, and when "neutral" emotions are detected, it offers a song appropriate for that mood, as seen in Figures 5 and 6. The ability to interact with the application, manage music playback, discover more features, or go back to the home page is still available to users. Throughout this procedure, strict controls are enforced to guarantee user data and image privacy, giving careful data handling and security first priority.

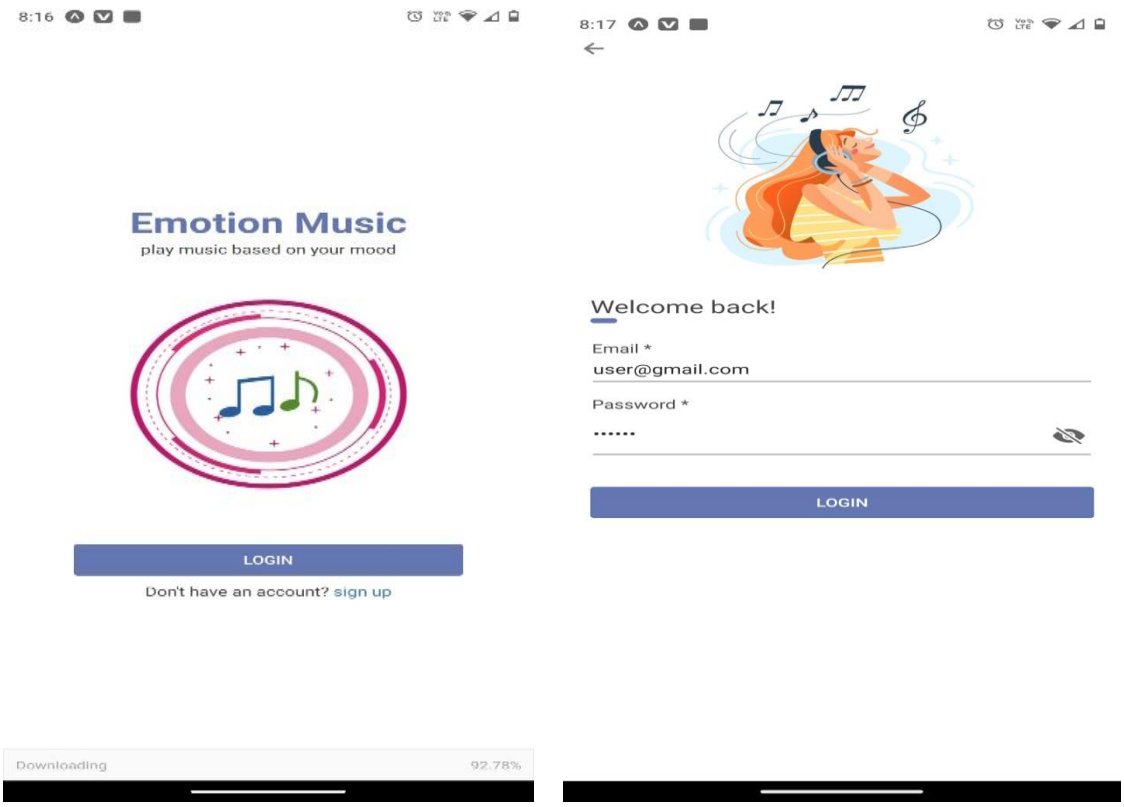


Figure 3. Login page

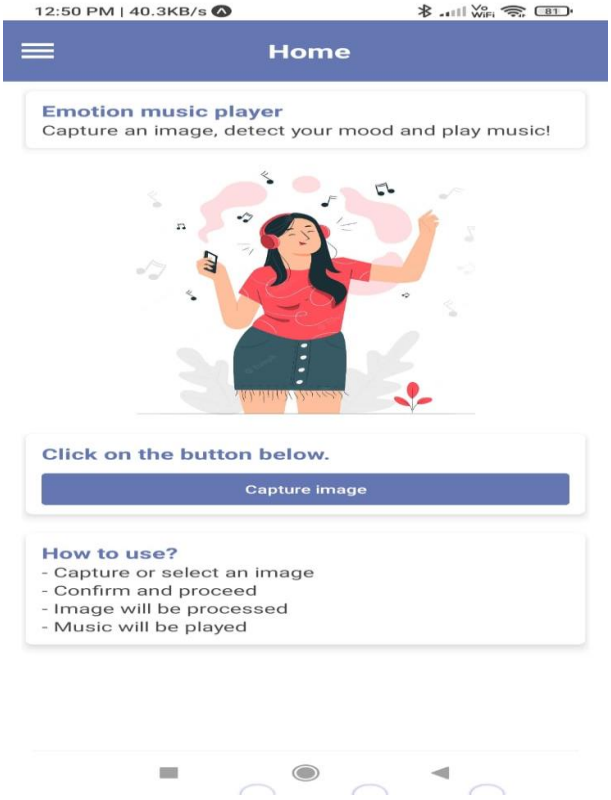


Figure 4. Home page

Figure 5. Output

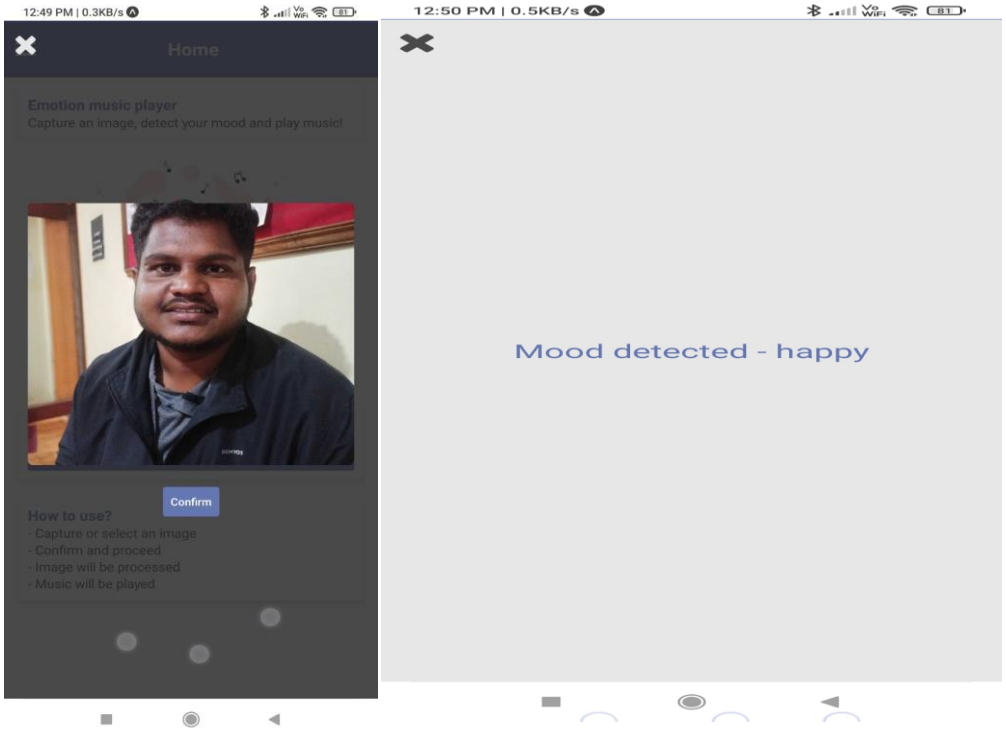
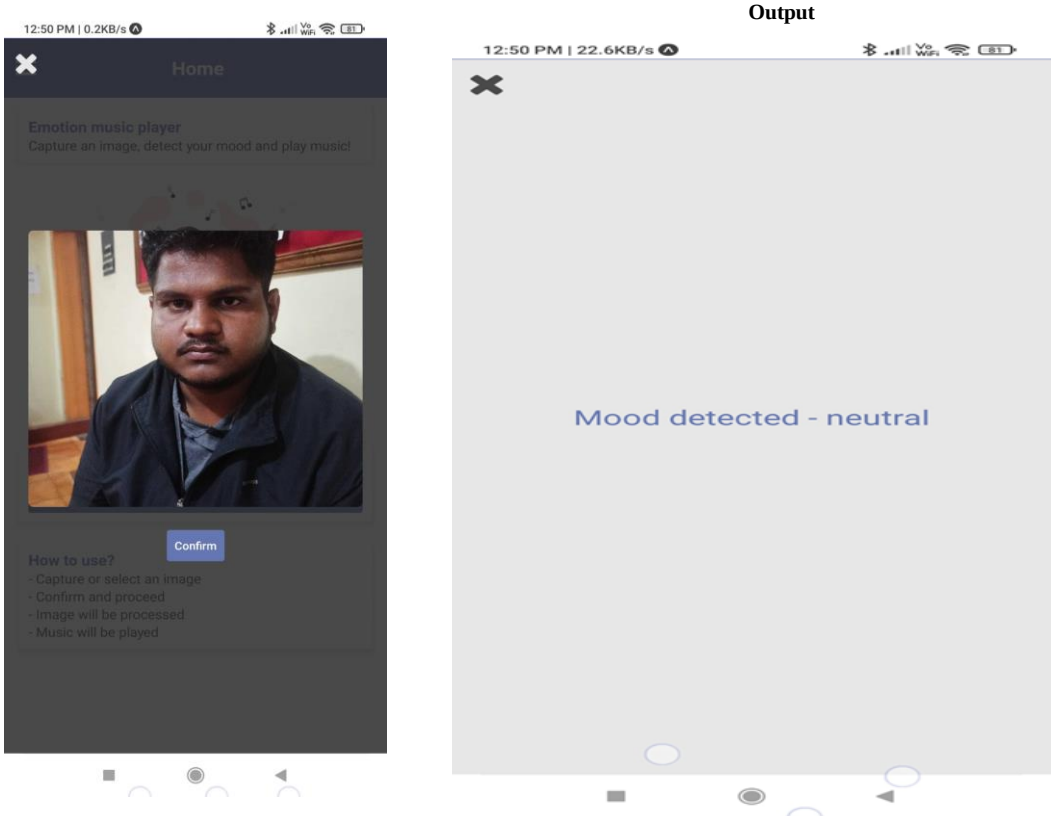


Figure 6 **Output**



5.Conclusion

The suggested approach to overcoming difficulties with emotion recognition in virtual learning environments details automating a number of processes, ensuring efficiency and accuracy. This is accomplished using neural network techniques to recognize a variety of emotions along with HAAR Cascades for the detection of the lips and eyes. It has been extensively studied how to include emotion recognition into virtual learning environments. React Native, a platform that can be used on both IOS and Android, is another area of my research.

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