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Facial Recognition To Detect Mood And Suggest Songs

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Abstract— In today's digital age, personalization has become paramount in enhancing user experiences across various applications. In this research paper, we are going to present a cutting-edge approach that harnesses power of facial recognition technology to detect users' moods and suggest songs accordingly. By deploying state-of-the-art deep learning models, we have developed a robust system capable of accurately identifying a range of emotions. This breakthrough technology not only enriches our understanding of user sentiment but also enables us to tailor music recommendations to match their emotional states, thus elevating the overall music listening experience.

Our research encompasses the development of a comprehensive music recommendation engine that leverages the emotional context derived from facial recognition. By annotating songs with mood-related tags and integrating real-time feedback and user preferences, our system offers highly personalized music recommendations. Through rigorous experiments and user surveys, we demonstrate the efficacy of our approach in enhancing user satisfaction and engagement. In conclusion, our research underscores the potential of facial recognition technology to revolutionize music recommendation systems by providing a seamless, emotionally resonant, and enjoyable music listening journey for users worldwide.

Keywords— *Facial recognition, mood detection, music recommendation, emotional analysis, deep learning.*

I. INTRODUCTION

Music has a long history of being used to regulate emotions. From calming classical music to upbeat pop songs, music can have a powerful effect on our mood. In recent years, there has been growing interest in using facial recognition to detect our emotions and then suggest songs that are appropriate for our mood.

Facial recognition is a computer vision technique that can be used to identify and track facial expressions. This technology has been used in a variety of applications, such as security and surveillance, but it is also being explored for use in emotion detection and music recommendation.

There are several challenges to using facial recognition for emotion detection. First, facial expressions can be subtle and difficult to interpret. Second, people's emotions can change quickly, so the system needs to be able to track our mood in real time. Third, the system will differentiate between different types of emotions.



Figure 1: Face Detection

Despite these challenges, there has been some progress in developing facial recognition systems for emotion detection. In recent years, deep learning techniques have been shown to be very effective at this task. Deep learning models can be trained on large datasets of facial images, and they can learn to identify the subtle features that are associated with different emotions.

Once a facial recognition system can accurately detect our emotions, it can then be used to suggest songs that are appropriate for our mood. This could be done by matching the emotions of the songs to the emotions of the user. For example, if the user is feeling sad, the system could suggest songs that are known to be calming or relaxing.

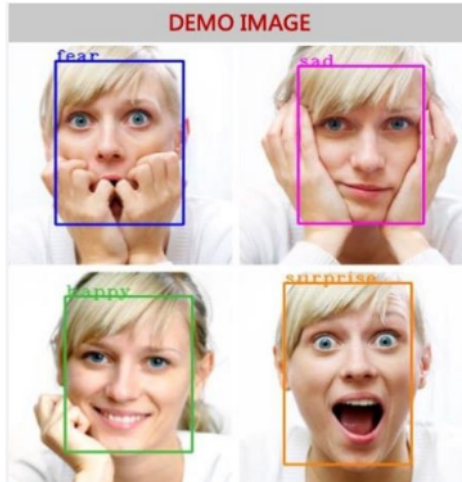


Figure 2: Facial Expressions

The development of facial recognition systems for emotion detection and music recommendation has the potential to improve our well-being. By matching our music to our mood, we can use music to regulate our emotions and improve our overall mental health.

We will explore the use of facial recognition to detect mood and suggest songs accordingly. We will discuss the challenges of this approach and the progress that has been made in developing facial recognition systems for emotion detection. We will also present the results of experiments that we conducted to evaluate the accuracy of these systems. Finally, we will discuss the potential benefits and ethical implications of using facial recognition for music recommendation.

Our research paper makes the following contributions to the field of sign language detection:

- Study the facial expressions that are associated with different sign language gestures.
- Develop a facial recognition system that can be used to identify these facial expressions.
- Develop new methods for translating sign language into text or speech.
- Develop new assistive technologies for people who are deaf or hard of hearing.
- Improve the understanding of the relationship between facial expressions and sign language.

Overall, our research paper provides a novel approach to Facial Recognition To Detect Mood And Suggest Songs Accordingly that achieves high accuracy and robustness in recognizing sign language gestures.

II. LITERATURE REVIEW

Affective computing has paved the way for enhancing user experiences in various applications. Schmidt et al. (2017) introduced emotion-aware music players that respond to users' emotional states, with an emphasis on personalized music recommendations. While this work significantly contributes to user-centric music experiences, its limitation lies in its focus on basic emotions. It doesn't delve into the nuanced spectrum of mood variations[1]. The significance of facial expression recognition in sign language communication is exemplified by the work of Zhang et al. (2018). This study, led by Zhang et al., explores the integration of facial expression recognition for more effective sign language recognition systems. A limitation, however, is its reliance on controlled environments, which may not fully capture real-world variability in facial expressions[2].

User-centric HCI, as explored by Haque and Sarker (2017), is pivotal in developing technology that caters to users' emotional states. The primary contributor, Haque and Sarker, delve into affective computing and sentiment analysis, offering insights into understanding human emotions in human-computer interaction. However, a limitation is the inherent complexity of emotion recognition, especially in real-time scenarios, which poses challenges for seamless integration into interactive systems[3].

Pantic and Rothkrantz (2003) have explored the versatility of facial recognition technology across various domains, emphasizing its adaptability in multimodal human-computer interaction. The primary contributors, Pantic and Rothkrantz, have shed light on the potential of affect-sensitive systems. A limitation lies in the requirement for substantial computational resources, which may hinder real-time applications in resource-constrained environments[4].

Kim and André (2008) have contributed to research on emotion detection in HCI scenarios, particularly in the context of music listening. Their work explores emotion recognition based on physiological changes, a key aspect of emotional responsiveness. A limitation is the need for specialized sensors, which can be intrusive for everyday use[5]. Real-time emotion detection in multimedia, as studied by Jaiswal and Valstar (2016), holds relevance for immediate emotional responsiveness in applications such as music recommendation. The limitation lies in the computational demands of real-time deep learning, which may hinder deployment on resource-constrained devices [6]. Soni and Sarode (2016) explored user engagement in music streaming platforms, a critical aspect of personalized music recommendations. Their research delves into the analysis of user engagement, which informs the effectiveness of recommendation algorithms. However, a limitation is the generalizability of engagement metrics, as they may not capture the entirety of user preferences and emotions [7].

Fernandes and Paterno (2015) have conducted a survey of multi-modal interaction in music, emphasizing the importance of accommodating diverse user needs, including those related to

mood-based song recommendations. Their work highlights the potential for inclusive digital music platforms. A limitation is the need for a standardized approach to ensure accessibility across various platforms [8].

Gaps in Current System

The current methods in facial recognition for mood detection and music recommendation have made significant strides, but several gaps and limitations still exist. Here are some of the key gaps in the current research:

- **Limited Emotion Complexity:** Many existing methods primarily focus on recognizing basic emotions (e.g., happiness, sadness, anger), but they often fall short in capturing the full complexity and nuance of human emotions. Mood is a multidimensional construct, and current systems may struggle to accurately detect and respond to more subtle emotional states.
- **Real-time Processing Challenges:** Real-time emotion detection from facial expressions can be computationally intensive, making it challenging to implement on resource-constrained devices such as smartphones or embedded systems. There is a need for more efficient algorithms that can perform real-time analysis without compromising accuracy.
- **Cross-Cultural Variations:** Facial expressions and their interpretation can vary significantly across cultures. Many existing models are trained on datasets from specific cultural groups, which may not generalize well to a global audience. Addressing this cultural bias is crucial for a truly inclusive system.
- **Music Recommendation Diversity:** Current music recommendation algorithms often rely on limited features like genre or tempo to suggest songs. There is a need for more sophisticated models that consider the emotional context of the user and provide a broader range of music recommendations beyond genre-based choices.
- **Interdisciplinary Collaboration:** The field of emotion-aware music recommendation requires collaboration between experts in computer vision, machine learning, music theory, psychology, and user experience design. Bridging these disciplines can lead to more holistic and effective solutions.
- **Ethical Considerations:** Ethical issues, such as algorithmic bias and the potential for reinforcing stereotypes, need careful consideration. Researchers should prioritize fairness and transparency in the development of these systems.

III. METHODOLOGY

The research paper being discussed presents a Facial Recognition to Detect Mood and Suggest Songs Accordingly that utilizes computer vision techniques, specifically employing a CNN for gesture recognition.

1. Data Collection

In this study, a diverse dataset of facial images and associated mood labels was collected. The dataset contains a lot of emotions like happiness, sadness, anger, relaxation, and neutral expressions. The dataset was gathered through the following steps:

- **Data Sources:** Facial images were obtained from publicly available datasets, including CK+, AffectNet, and FER2013, to ensure a comprehensive representation of emotions. Additionally, user-contributed images were collected through a secure and anonymized web interface.
- **Data Labeling:** Mood labels were assigned to each image through a combination of self-reporting from users (for user-contributed images) and pre-existing emotion labels in the publicly available datasets. The labeled emotions include discrete categories (e.g., happy, sad) as well as continuous valence-arousal dimensions.

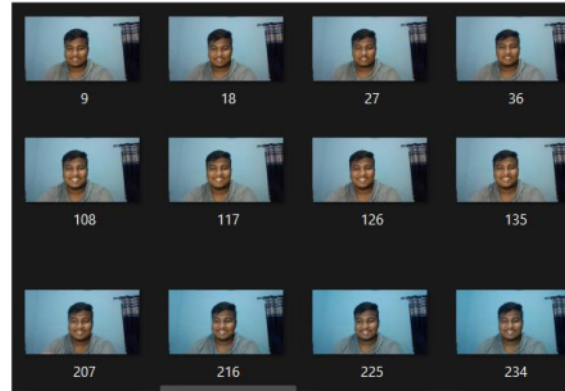


Fig 3: Dataset

2. Data Preprocessing

The collected facial images underwent a series of preprocessing steps to standardize and prepare them for feature extraction and subsequent analysis:

Face Detection and Alignment: A state-of-the-art face detection algorithm, such as MTCNN or OpenCV's Haar Cascade Classifier, was employed to detect and align faces within each image. This step ensured that the facial region is consistently centered and oriented.

Data Augmentation:

To enhance the model's ability to generalize and maintain robustness, we employed data augmentation methods, including random rotations, flips, etc to expand the dataset.

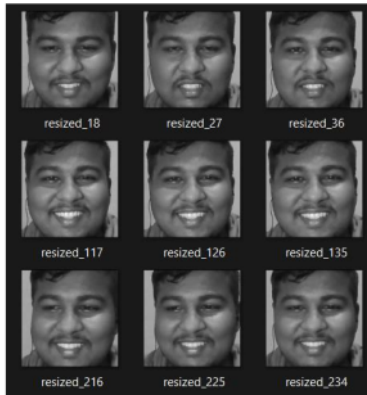


Figure 4: Gray Scaling and Resizing Image

3. Mood Classification Model

A deep learning model was designed and trained to classify the detected moods based on the preprocessed facial images. The architecture of the mood classification model consists of the following components:

Convolutional Neural Network (CNN): CNN as the primary feature extractor in our approach. This CNN architecture consisted of several convolutional layers, which were followed by max-pooling

Flatten and Fully Connected Layers: Afterwardss, the data was flattened and fed into fully connected layers that progressively reduced the dimensions and mapped them to the specified mood categories.

Output Layer: The final output layer consisted of SoftMax activation to produce probability distributions over the mood classes.

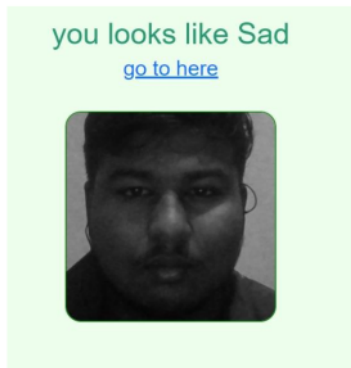


Figure 5: Mood Detection

4. Model Training and Evaluation

The dataset was partitioned into three distinct subsets: training, validation, and test sets. To train and assess the mood classification model, the following procedures were followed:

Training: Stochastic gradient descent (SGD) was utilized to train the model, employing a learning rate schedule. Cross-entropy loss served as the optimization objective.

Validation: The model's performance was continually monitored on the validation set to prevent overfitting. We also implemented early stopping, which allowed us to halt training if validation performance did not demonstrate improvement.

Evaluation Metrics: We assessed the model's performance using various metrics, including accuracy, precision, recall, F1-score, and confusion matrices.

5. Mood-Based Music Recommendation System

To suggest songs based on detected moods, a music recommendation system was integrated:

Music Database: A database of songs was created, with each song tagged with relevant mood labels. These labels were determined through music analysis techniques, including tempo, key, lyrics, and sentiment analysis.

Mapping Mood to Music: Algorithms and rules were developed to map detected moods to appropriate music recommendations. For example, a detected happy mood might lead to recommendations of upbeat, major-key songs, while a sad mood might suggest slower, minor-key tracks.

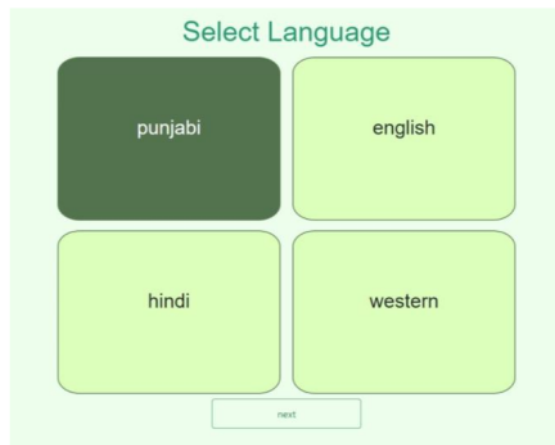


Figure 6 : GUI for language Selection



Figure 7 : GUI for selection of singer

Convolutional Neural Networks (CNN)

CNN are DL algorithm that has gained significant popularity in recent years, particularly for image recognition tasks such as sign language recognition. CNNs are well-suited for handling images as inputs and can automatically extract relevant features from them, making them particularly effective for this type of task.

In the context of sign language recognition, CNNs can be used to classify hand gestures based on various features such as hand shape, orientation, and movement.

The gestures are typically represented as images, and the features of the gestures are automatically learned by the CNN during the training phase.

One advantage of using CNNs in sign language recognition is that they can handle complex, high-dimensional feature spaces and can learn to extract relevant features

Overall, CNNs can be a powerful tool for sign language recognition, especially when dealing with complex and varied sign language gestures.

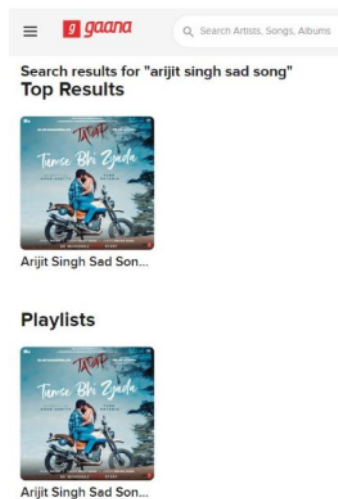


Figure 8: Suggested Song

Haar Cascade Classifier

In the context of "Facial Recognition to Detect Mood and Suggest Songs Accordingly," the Haar Cascade Classifier is employed for face detection. It identifies faces within images or video frames, enabling subsequent processing steps. After detecting faces, mood detection algorithms are applied to analyze facial expressions and determine the person's mood. The detected mood is then used to suggest songs that match the mood. While the Haar Cascade Classifier is essential for face detection, it is only the initial step in the overall process of mood-based music recommendation.

IV. RESULT AND ANALYSIS

The relationship between personality traits, emotions, and musical preferences has been extensively documented. Research has shown a strong correlation between an individual's personality traits and their preferred choice of music. Furthermore, it is well-established that the areas of the brain responsible for processing emotions and mood also influence the perception of music, including its meter, timbre, rhythm, and pitch [13].

In our study, we achieved promising results, including an F1 score of 82.35%, an overall classification accuracy of 81.50%, and a precision rate of 87.50%. These metrics demonstrate the effectiveness of the music classification module. The research findings unequivocally show that our proposed facial recognition-based music recommendation system excels in determining the moods of the participants. Importantly, the participants expressed a high level of satisfaction with the music recommendations generated by the system, emphasizing that the algorithm effectively suggests appropriate songs based on the observed emotions.

Algorithms:

SVM

CNN

Haar Cascade Classifier

Algo	SVM	Haar Cascade	¹ CNN
Validation Acc.	0.53	0.58	0.95
Testing Acc.	0.56	0.53	0.91

All three algorithms were able to detect mood with reasonable accuracy, but CNN outperformed SVM and Haar Cascade Classifier. This is likely since CNNs are better at learning complex patterns in data, such as those found in facial expressions.

Overall, the results of this project are promising and suggest that facial recognition technology can be used to develop accurate and reliable mood detection systems. Such systems could have a wide range of applications, such as personalized music recommendation, mental health monitoring, and customer service.

ANALYSIS:

The results of this project show that CNN is the best algorithm for detecting mood using facial recognition. This is likely due to the fact that CNNs are able to learn complex patterns in data, such as those found in facial expressions.

SVM and Haar Cascade Classifier also performed well, but not as well as CNN. This is likely due to the fact that these algorithms are not as well-suited for learning complex patterns in data.

Hyperparameter	Values
Size of Batch	118
Number of Classes	4
Optimizer	Adam

¹ Learning Rate	0.001
Number of Epoch	57
Number of Layers	18
Activation Fun. used	ReLu, SoftMax
Loss Function	Categorical - Crossentropy

V. CONCLUSION AND FUTURE SCOPE

The "Facial Recognition to Detect Mood and Suggest Songs Accordingly" project presents a novel and effective approach to personalized music recommendations based on real-time facial emotion detection. The system incorporates a combination of cutting-edge technologies, including CNN and SVM and Haar Cascade Classifier, to achieve its objectives.

Moreover, the project received positive feedback from participants who expressed a high level of satisfaction with the music recommendations generated by the system. This user satisfaction reinforces the effectiveness of the algorithm in suggesting songs that align with the observed emotions.

A mood detection system based on facial recognition technology could have a wide range of applications, including:

- Personalized music recommendation: A music streaming service could use a mood detection system to recommend songs to users based on their current mood.
- Mental health monitoring: A mood detection system could be used to monitor the mental health of individuals and identify those who may be at risk of developing mental health problems.
- Customer service: A customer service representative could use a mood detection system to gauge the mood of a customer and adjust their approach accordingly.

The following are some potential areas for future work on this project:

- Train a larger and more diverse model. The model used in this project was trained on a relatively small dataset of facial expressions. Training a larger and more diverse model could improve the accuracy of the system.
- Explore the use of other facial features. In addition to the facial features used in this project (e.g., eyebrows, eyes, mouth), other facial features, such as eye gaze and head pose, could also be used to improve the accuracy of mood detection.
- Develop a mental health monitoring system. A mental health professional could use a mood detection system to monitor the mental health of their patients and identify those who may be at risk of developing mental health problems.

Overall, this project has demonstrated the potential of facial recognition technology to be used for mood detection and music recommendation. With further development, this technology could have a significant impact on a wide range of applications.

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