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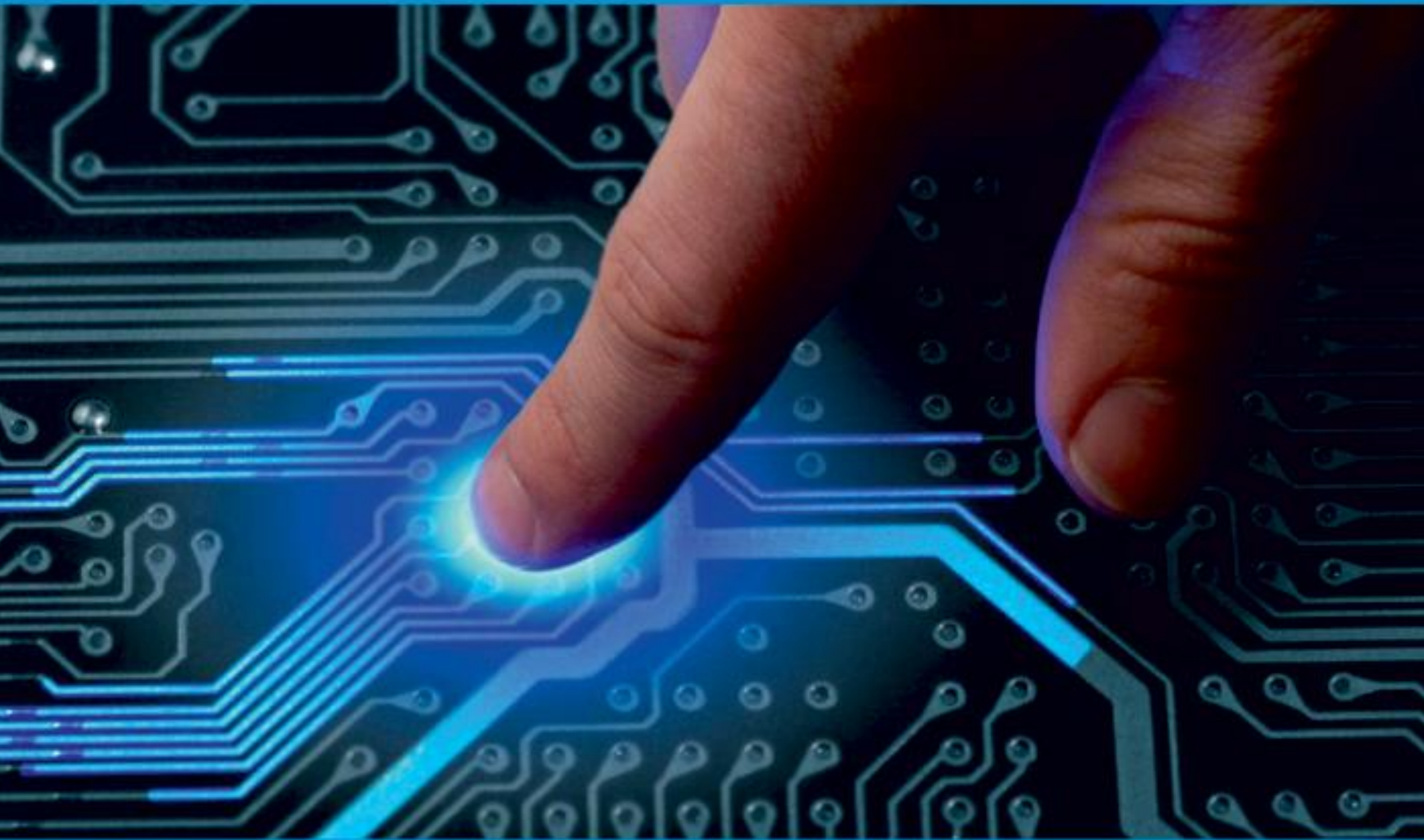

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Facial Expression Based Smart Music Player Using Machine Learning

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ABSTRACT: Music has always had a profound impact on our lives, evoking powerful emotions and enriching our experiences. With the advent of machine learning technology, a monumental shift has occurred, completely transforming how we interact with music. This research provides a comprehensive comparison of two machine learning algorithms that is Convolutional Neural Networks (CNN) and the Visual Geometry Group 16(VGG16) model to enhance the user's music-listening experience and determines the most suitable one for specific use cases. The field of application development continues to progress rapidly, with new and innovative ideas emerging constantly. These ideas may not always be revolutionary, but they are constructive and contribute to a brighter future by making people's work easier. The captivating realms of sound and graphics continue to captivate music enthusiasts, enticing them to delve deeper into their intricacies. As technology advances, so does the sophistication of software, opening up new possibilities for exploration and creativity. Facial expressions are incredibly revealing when it comes to deciphering someone's mood. From sadness and anger to happiness and every other emotion in between, each individual possesses a unique way of expressing themselves through their facial features. This application offers a unique approach that sets it apart from traditional applications. With its innovative features and functionalities to user experience. With this innovative application, there's no need for users to spend time searching for songs. It intelligently detects their mood and plays music that matches their emotions perfectly.

KEYWORDS: Convolutional Neural Networks, VGG16, Machine Learning.

I. INTRODUCTION

The Intelligent systems that attempt to improve our daily lives by seamlessly fusing technology and interpersonal connection have seen a considerable uptick in development in recent years. Affective computing, which focuses on understanding and deciphering human emotions, is one such subject that has attracted a lot of attention. Our choice of music is only one example of how emotions may dramatically affect our preferences and general well-being.

The human face is not only a vital part of our physical being, but it also serves as a powerful tool for understanding and deciphering emotions. We can now effectively capture and analyze facial expressions directly through the use of cameras. This breakthrough offers a convenient and accurate method for extracting valuable insights from individuals' moods based on their facial cues. Then, there are several uses for this input this input may be used, among other things, to extract data that can be used to infer the state of a person. This information can then be used to create a set of music that correspond to the mood using the input from earlier. This helps to create a playlist that is appropriate for a specific person based on their emotional features and avoids the difficult as well as tedious effort of manually categorizing songs into various categories. For automating the playlist generating process, many algorithms have been created. The mood sound system, which is based on the theory of human-based emotion, uses the integrated local camera to process images, examine pictures that have been used, and evaluate emotions to improve emotional state. Emotions of any human can easily capture thorough facial expression and detect moods like happy, sad, anger etc. Emotions are detected by the help of image processing and machine learning techniques.

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II. RELATED WORK

Following a thorough review of the literature, we have chosen a few notable works and have listed them as follows:

Dr. M. Srinivas et al [1] developed a machine learning algorithm music player system that uses facial expressions to control music playback. They also suggested a user-friendly interface that analyzes facial expressions and converts them into music commands. In this case, they used the Fisher Face Algorithm. In order to improve the user experience, it integrates facial expression recognition technology with music player technology. Music player featuring three modes—emotion mode, random mode, and queue mode—and an interactive user interface. But they did not have a lot of moods in it.

Perera R.M et al [2] aims to recommend musical tunes by taking into account the user's emotional condition. To provide personalized and relevant music suggestions, MusicMate analyzes user preferences and emotional aspects using machine learning algorithms like Russel 2D valence Arousal model. The research explores the use of machine learning algorithms for effective music recommendation and also highlights the significance of emotion in musical perception. Overall, MusicMate provides an effective method for enhancing the user's musical experience by offering music selections that are dependent on their emotional state.

Maruthi Raja S K et al [3] the goal of this article is to develop a music player that can choose and play songs automatically based on the user's emotional condition. The technology uses machine learning to assess the user's emotional cues and map them in real-time to the right musical tracks. This use a Bezier Curve algorithm and YCBCR method this will classify face detection, emotion recognition, skin color classification but anger is misclassified so it not suitable.

Jayshree Jha et al [4] introduced Viola and Jons face detection algorithm. Based on this algorithm, human facial expression is recognized. This will scan audio recordings, extract features using a support vector machine classifier, and then do facial recognition. However, this procedure takes a long time and only produces results for the audio recordings that we already have.

M.Srinayani et al [5] have used fisher face algorithm harcascade machine learning algorithm used to extract and identify the features of captured images. Selection of three different modes and playing of songs according to their moods and they have used less amount of data and more accuracy in that.

Dipika D Kalsait et al [6] paper consist of comparisons different algorithm review they suggest to add other factors like age weather. Experiment performed on minute dataset and circumscribed number of features. It provides good experience to user in playing good music.

Zhengaa et al [7] divided facial features into two major categories, namely appearance-based data and geometric features, for the objective of feature recognition. The mouth and eyes are two significant facial features that were used to determine the shape or significant points of the geometric features.

K. McKaay et al [8] A music player with motion and emotion recognition was created. The framework uses sensors to collect information about a user's actions and emotions in order to make music recommendations. The system was built on a client/server design.

Renuka R et al [9] suggested an accurate and effective statistical-based approach for examining the features that were extracted of facial expression. The focus of the paper was on changes in the levels of the associated pixels in images and the curvatures of faces.

III. PROBLEM STATEMENT

Traditional music players use manual controls to control playback, which can be annoying and distracting, especially when performing physical tasks or when the user's hands are occupied. A hands-free music player that is user-friendly, adaptable, and can offer seamless control is required. It is possible to create a smart music player using facial recognition technology that can recognize and interpret facial expressions and gestures to control music playback, resulting in a more engaging and user-friendly experience.

The difficulty is in creating a facial recognition system that can reliably and accurately interpret user cues and translate them into the proper music playback actions while maintaining user privacy and consent. Users should be able to

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control playback, skip tracks, adjust volume, and browse music libraries using only their facial expressions and gestures as part of the solution's seamless and simple method of music interaction.

IV. DESIGN AND IMPLEMENTATION

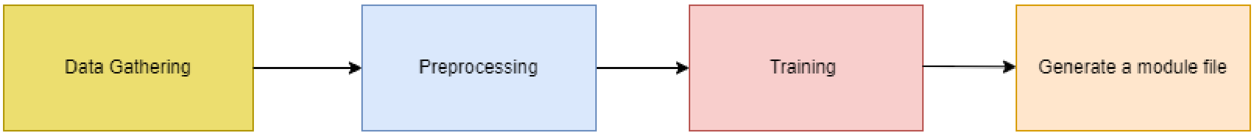

Figure 1: Block Diagram

The above Figure 1 depicts the generating of a module file.

Data Gathering: Identify pertinent data sources, such as emotional datasets and music libraries, for music playback and emotion recognition. Use existing emotion detection systems or manual labeling to gather emotional datasets that contain labeled emotional data. Obtain a varied selection of music that reflects a range of emotions, either from selected or public music libraries.

Preprocessing: Create labels for the emotions in the emotional dataset to make sure the information is correctly annotated with the appropriate labels. Extract pertinent features from the emotional data using techniques like sentiment analysis for text or acoustic features for audio.

Training: Create training and testing sets from the labeled emotional dataset to ensure an even distribution of the emotions. Utilize the retrieved features and emotion labels from the training set to train the emotion detection model. Utilizing the proper measures, assess the model's performance and make any necessary adjustments. Here we have used CNN and VGG16 machine learning algorithms.

- **CNN:** CNNs are frequently used for image analysis, but they may also be utilized for audio or text analysis. CNNs can be trained on audio or textual input to classify emotions for emotion detection. Convolutional layers for feature extraction and pooling layers for dimensionality reduction make up the CNN architecture.
- **VGG-16:** The VGG-16 CNN architecture is distinguished by its many deep layers and superior performance in image classification applications. VGG-16 is primarily intended for picture analysis, but it may be modified to detect emotions in audio by transforming audio inputs into spectra or other appropriate representations. The learnt features can be input into a classifier for emotion prediction using the VGG-16 architecture as a feature extractor.

Generate a Module File: You can save your model as a module file for usage at a later time once it has been trained and optimized.

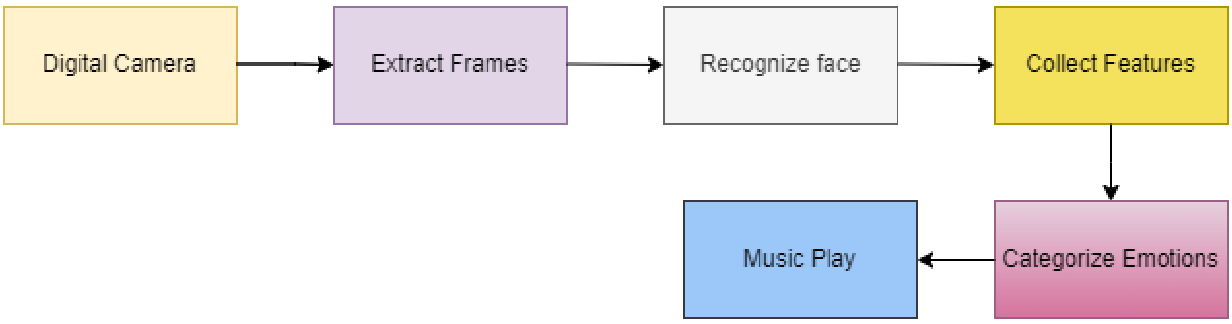

Figure 2: Block diagram of emotions based music player

The above Figure 2 depicts the flow of emotions based music player.

1. Digital Camera: The digital camera records still photos or video frames.
2. Extract Frames: the frames are extracted from the images.

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3. Recognize Face: Facial recognition methods are applied to the collected frames in order to locate and identify faces within them.
4. Collect Features: Features of all the photos are collected in order to categorize the emotions
5. Categorize Emotions: Machine learning algorithms examine the data to classify the emotions shown by the faces based on the obtained facial features. This classification can encompass feelings like joy, sorrow, rage, surprise, etc.
6. Music Play: After completing the classification of emotions, music will begin to play.

V. RESULT AND DISCUSSION

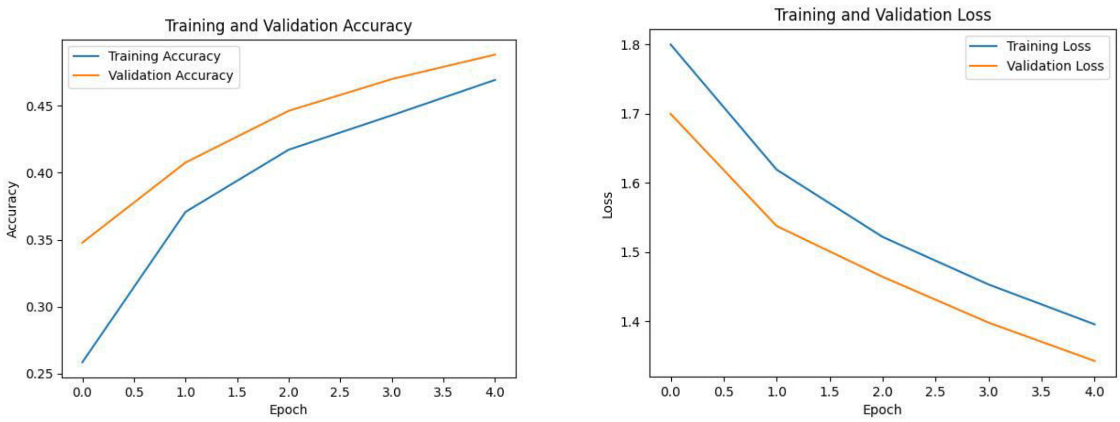

Figure 1: Training and Validation Accuracy and Training and Validation Accuracy Loss of CNN algorithm

The above Figure 1 graph depicts the training and validation accuracy and training and validation accuracy Loss.

- Training accuracy: The model's training accuracy is a metric for how well it performs on training data. It is determined by comparing the model's total number of training examples to the number of right predictions it made.
- Validation Accuracy: It is a measurement of how well the model generalizes to fresh, untested data. Although it employs a different validation dataset, it is calculated in a manner similar to training accuracy. The validation dataset is separate from the training data and is not utilized to train the model.
- Training Loss: This term refers to the error or difference between the target output and the projected output of the model during the training phase. Typically, a loss function like mean squared error (MSE) or categorical is used to calculate it.
- Validation Loss: This term refers to the inaccuracy or difference between the target output on the validation dataset and the predicted output. It acts as a gauge of the model's generalization abilities. Its calculation makes use of a loss function, just like training loss does.

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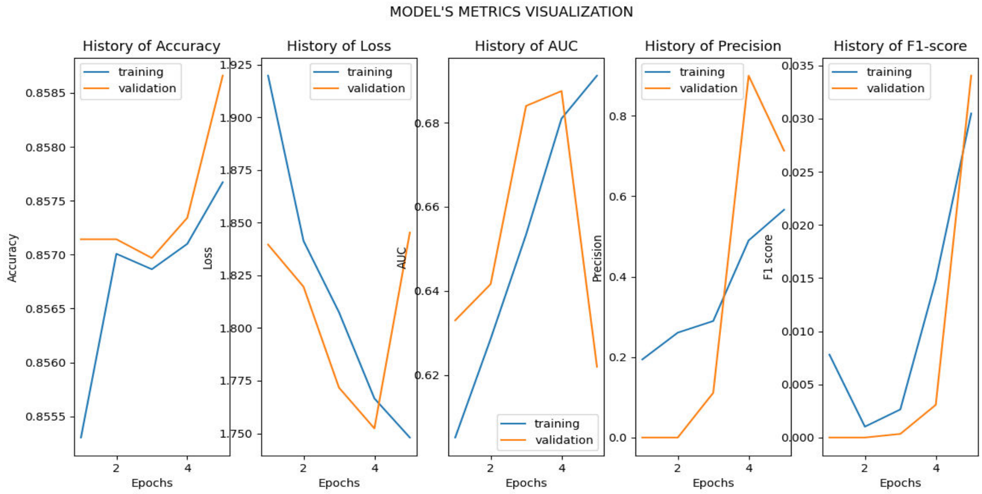

Figure 2: Models Metric Visualization of VGG-16

The above Figure 2 depicts the models metrics visualization of vgg16 algorithm.

Results:

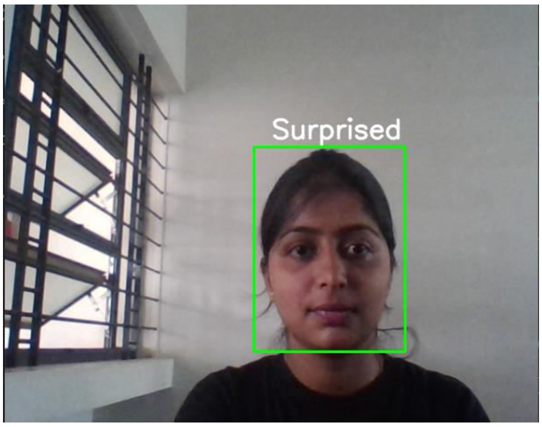

Figure 1: Surprised emotion

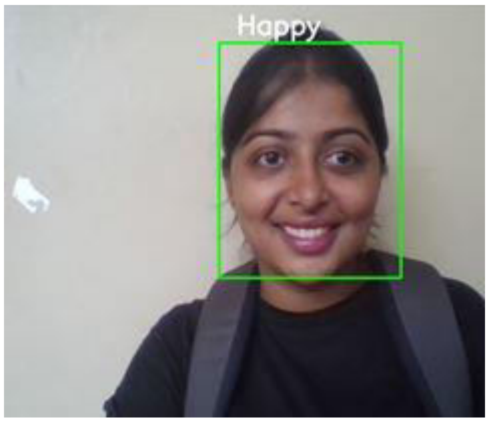

Figure 2: Happy emotion

The experience will be smoothly accompanied by a carefully chosen playlist of music once the emotion detecting technology is active. Users can fully immerse themselves in an engaging and customized experience by matching the emotional response with a pleasing music.

VI. CONCLUSION AND FUTURE WORK

A key development in the fields of music personalization and emotional wellbeing is the emotions-based music player. This player has the ability to transform how we interact with music and improve our emotional experiences by utilizing the strength of artificial intelligence and emotional analysis tools. The emotional music player has a bright future thanks to continued technological improvements. The player can continue to provide users increasingly accurate and personalized musical recommendations that connect with them on a profound emotional level through additional advancements in emotional analysis, personalization, and connectivity with wearable devices. Additionally, the potential for mood control and therapeutic uses creates new opportunities for utilizing music's emotional power to advance mental health and wellbeing. The emotion-based music player can be enhanced even further by using more advanced emotional analysis algorithms. In order to do this, machine learning algorithms that can detect minute emotional cues in physiological signals, facial expressions, and voice patterns would be used. Based on age, weather and some other factors these algorithms may determine if music should be played, which is beneficial in many ways.

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