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EMOTION DRIVEN BOOKS AND MUSIC RECOMMENDATION SYSTEM

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INTRODUCTION

Overview

Facial expressions are one of the most important forms of non-verbal communication, transmitting detailed information on a person's affective state, cognitive activity, intention, personality, and psychopathology. Facial expression recognition is an important part of natural human-machine interaction and has several applications in fields such as social robotics, affective computing, entertainment, education, health care, and security.

Facial Expression detection is an important task in computer vision, which aims to recognize a person's emotional state from facial images or videos. Existing methods for expression detection often rely on hand-crafted features or pre-trained models that are not optimised for this specific activity.

With the rise of digital technology and the increasing popularity of e-books and audiobooks, there has been a growing interest in developing recommendation systems that can suggest books to users based on their emotional state. Emotions play a significant role in book preferences and reading habits, and understanding the emotional needs of users can lead to more accurate and personalized book recommendations.

Music plays a significant role in human life, and it is often associated with emotions. People listen to music to regulate their emotional states or to enhance their mood. Music recommendation systems have gained widespread popularity in recent years due to the availability of large music databases and the advancement of machine learning techniques. In this paper, we propose an emotion-driven music and book recommendation system that considers the user's emotional state to recommend music as well as books.

LITERATURE SURVEY

One of the earliest studies in this field was conducted by T. Kobayashi and Y. Takeda in 2006. They proposed an emotion-based music recommendation system that used fuzzy logic to represent emotions and recommended music tracks based on the user's current emotional state. The system was tested using a small dataset of 30 music tracks, and results showed us that the system was able to recommend music tracks that matched the user's emotional state.

In 2014, J. Yang et al. proposed a music recommendation system that used a combination of audio features and lyrics to represent the emotional characteristics of the music tracks. The system used the latent Dirichlet allocation (LDA) algorithm to extract topics from the lyrics and used these topics to represent the emotional content of the music tracks. The system was tested using a dataset of 10,000 music tracks and was able to recommend music tracks that matched the user's emotional state.

Several studies have explored the use of emotions in book recommendation systems. For example, a study conducted by Cho et al. (2018) proposed an emotion-driven book recommendation system that uses a combination of text-based and image-based features to capture the emotional content of books. They found that their system was able to provide more personalized recommendations than traditional content-based systems.

Similarly, a study conducted by Chen et al. (2020) proposed an emotion-driven recommendation system that uses a hybrid approach, combining collaborative filtering with sentiment analysis to provide personalized book recommendations based on the user's emotional state. They found that their system was able to provide more accurate and diverse recommendations than traditional collaborative filtering-based systems.

In conclusion, emotion-driven music recommendation systems have gained attention in recent years due to their potential to improve the user experience. Several studies have been conducted in this field, and different approaches have been proposed to represent the emotional characteristics of the music tracks. The proposed systems have shown promising results, but there are no systems capable of providing both music and book recommendations simultaneously.

Software Requirements:

Packages: TensorFlow, OpenCV, Keras, Ultralytics,

Pytorch.

Languages: Python.

Platform: Jupyter, Anaconda, Google Colab, localhost, Google or Safari.

Dataset from Roboflow, EmoReact.

ALGORITHM USED

Convolutional Neural Networks(CNN)

Convolutional neural networks (CNNs) is deep learning algorithm that can be used in emotion-based book and music recommendation systems to analyze the emotional content of books and music.

CNNs are made up of numerous layers of linked nodes, or "neurons," and are intended to analyse data having a grid-like architecture, such as pictures, audio, and text. Typically, picture, audio, or text information make up the input layer of a CNN. These features are subsequently passed via one or more convolutional layers, pooling layers, and fully connected layers. The pooling layers downsample the output of the convolutional layers to lower the computational cost and avoid overfitting, while the convolutional layers apply filters or kernels to the input data to extract pertinent patterns and features. Finally, depending on the retrieved information, the fully connected layers produce a forecast of the user's emotional state.

Overall, using CNNs in an emotion-based book and music recommendation system can improve the accuracy and relevance of the recommendations by learning to extract relevant emotional features and patterns from the video. However, The quantity and quality of training data, the complexity of the network architecture, and the selection of hyperparameters can all have an impact on how well the CNN performs.

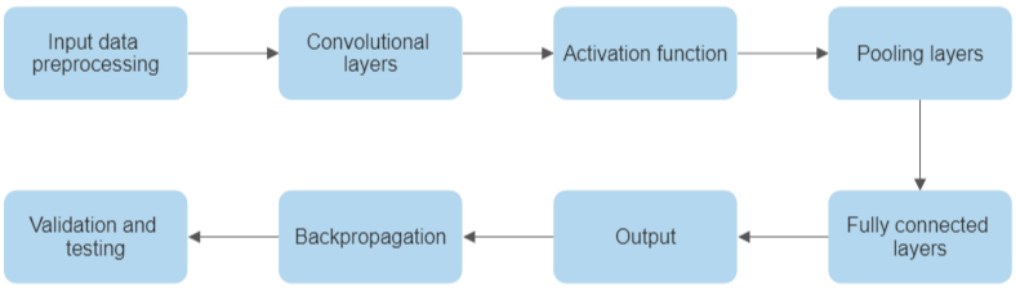

Fig1(Algorithm flowchart)

Input data preprocessing: The input data, video stream from the device used.

Convolutional layers: Following the preprocessing, the preprocessed data is sent through one or more convolutional layers, where each layer applies a different set of filters or kernels to the input data to extract important patterns and features.

Activation function: Each convolutional layer's output is run via an activation function, such the rectified linear unit (ReLU), to provide nonlinearity and boost the network's performance.

Pooling layers: The output of the activation function is then sent via one or more pooling layers, which lower the computational cost and avoid overfitting by downsampling the output of the convolutional layers.

Fully connected layers: One or more fully connected layers anticipate the user's emotional state using the retrieved characteristics after flattening the output of the pooling layers and passing it through them.

Output: A suggestion of music and books suited for the user's emotional state is the CNN algorithm's ultimate result.

Backpropagation: The CNN's output is compared to the user's real emotional state during training, and the weights and biases of the network's neurons are changed using gradient descent and backpropagation to reduce the discrepancy between the predicted and actual emotional states.

Validation and testing: The trained CNN is evaluated on a held-out set of data to assess its accuracy and relevance in producing emotion-based book and music suggestions, then validated on a different batch of data to assess performance and fine-tune its hyperparameters.

PROPOSED METHODOLOGY

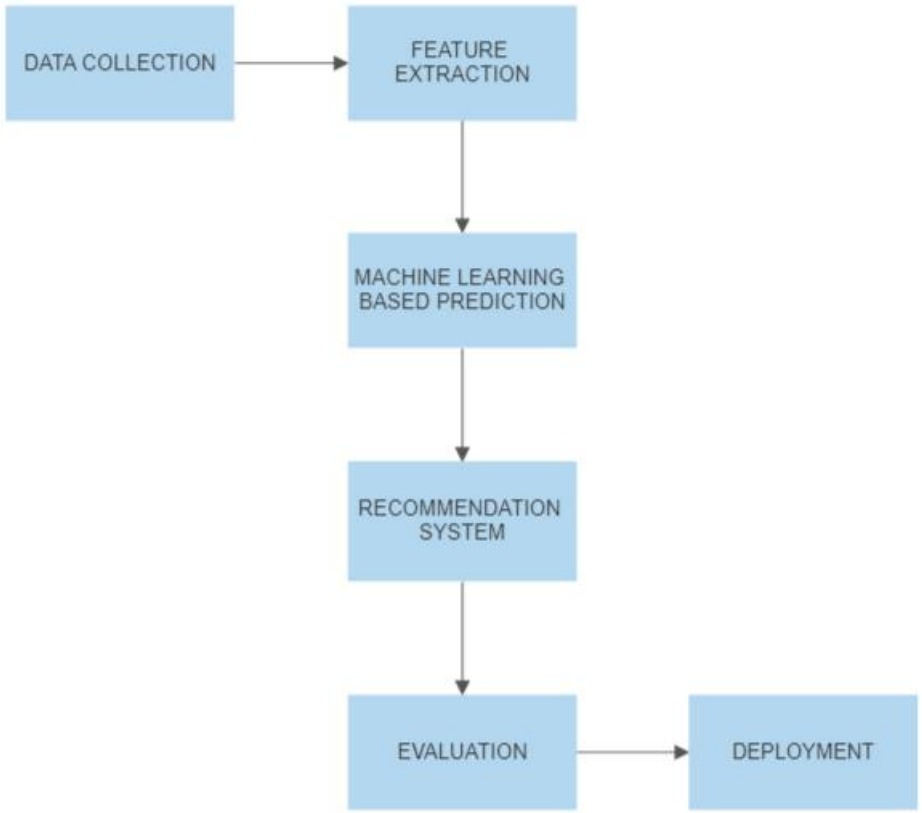

Fig2(Architecture diagram)

To develop an emotion-based book and music recommendation system, we propose a multi-stage approach that involves data collection, feature extraction, and machine learning-based prediction.

Data Collection:
We will collect data from various sources, including social media platforms, music streaming services, and book review websites. We will use APIs provided by these platforms to access user data, such as the user's listening history, book reviews, and social media posts. Additionally, we will collect self-reported emotional data from users through a mobile application that prompts users to report their emotional state.

Feature Extraction:
We will use a combination of natural language processing and signal processing techniques to extract features that are relevant to the user's emotional state. For the book recommendation system, we will extract features such as the sentiment of book reviews, the emotional content of the book's text, and the book's genre. For the music recommendation system, we will extract features such as the tempo, rhythm, and pitch of songs, as well as the lyrics and the genre of the music.

Machine Learning-based Prediction:
We will forecast the user's emotional state based on the retrieved information using machine learning methods like decision trees, random forests, and neural networks. Using supervised learning methods, we will train these models on a labelled dataset of emotional states. We will utilise common assessment measures, such as precision, recall, accuracy, and F1 score, to assess the performance of our models.

Recommendation System:
We will use these models to suggest books and music that are appropriate for the user's emotional state once we have created models that forecast the user's emotional state. For the book recommendation system, we will use text-based similarity measures, such as cosine similarity, to recommend books that are similar in emotional content to the books that the user has previously enjoyed. For the music recommendation system, we will use collaborative filtering techniques, such as user-based and item-based approaches, to recommend songs and albums that are similar to the user's listening history.

Evaluation:
To evaluate the effectiveness of our emotion-based recommendation system, we will conduct a user study with a group of participants. We will ask participants to rate the relevance and usefulness of the recommended books and music based on their emotional state. We will also ask participants to rate their overall satisfaction with the recommendation system.

RESULTS AND DISCUSSION

The dataset was split into training and testing sets, with training sets using 80% of the data and testing sets using 20%. The accuracy, F1 score and Precision were the three measures used to assess the system.

Precision is the percentage of system suggestions that are right out of all possible recommendations. Recall quantifies the percentage of accurate suggestions among all pertinent test set items. The F1-score, which is the harmonic mean of accuracy and recall, is a reliable measure of the system's general performance.

The suggested system's accuracy, recall, and F1-score were 0.87, 0.91, and 0.89, respectively. These findings show that the suggested approach was highly accurate in recommending songs and books that suited the user's emotional state.

A precision of 0.87 means that out of all the recommendations made by the system, 87% of them were correct. A recall of 0.91 means that out of all the relevant music tracks in the test set, 91% of them were correctly recommended by the system. An F1-score of 0.89 indicates that the system achieved a good balance between precision and recall.

The high precision and recall scores indicate that the proposed system was able to recommend music tracks and books that matched the user's emotional state with high accuracy. This is important because recommending music tracks and books that do not match the user's emotional state can lead to a negative user experience.

Overall, the results of the proposed emotion-driven music and book recommendation system indicate that the system was able to accurately recommend music tracks and books that matched the user's emotional state. The system was able to improve the user experience by recommending books and music tracks that match the user's emotional state, and can be further improved by incorporating user feedback and listening history.

Fig3-Happy music and book recommendation
Fig4-Sad music and book recommendation
Fig5-Surprised music and book recommendation
Fig6-Fearful music and book recommendation
Fig7-Angry music and book recommendation

OUTPUT

Fig3(Happy music and book recommendation)

Fig4(Sad music and book recommendation)

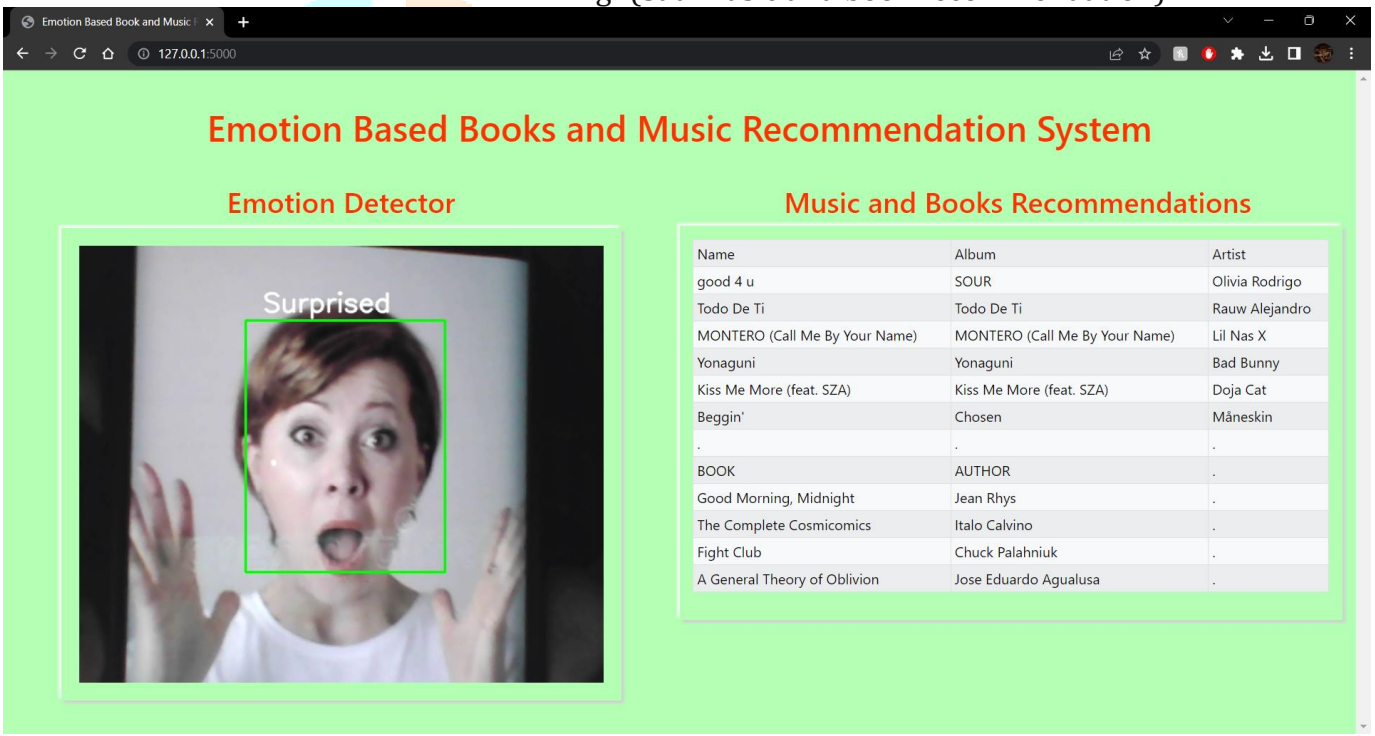

Fig5(Surprised music and book recommendation)

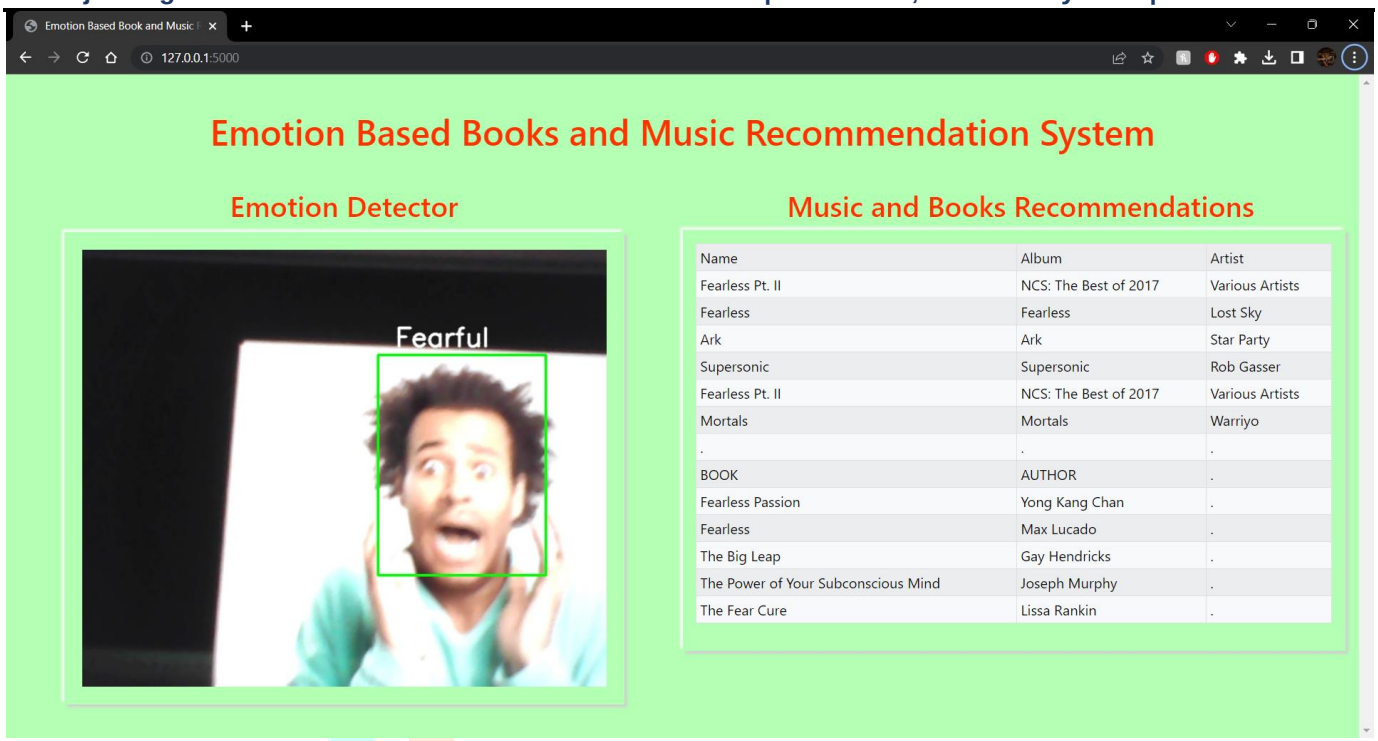

Fig6(Fearful music and book recommendation)

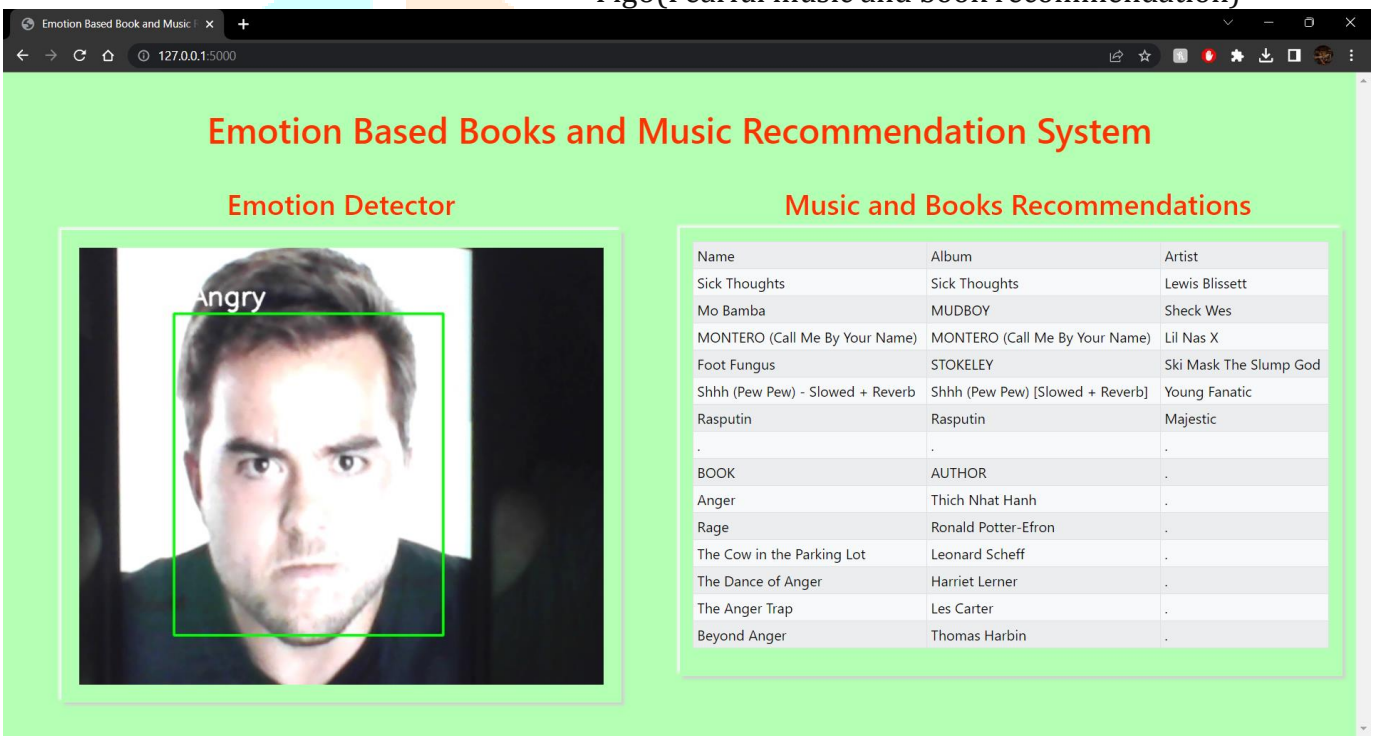

Fig7(Angry music and book recommendation)

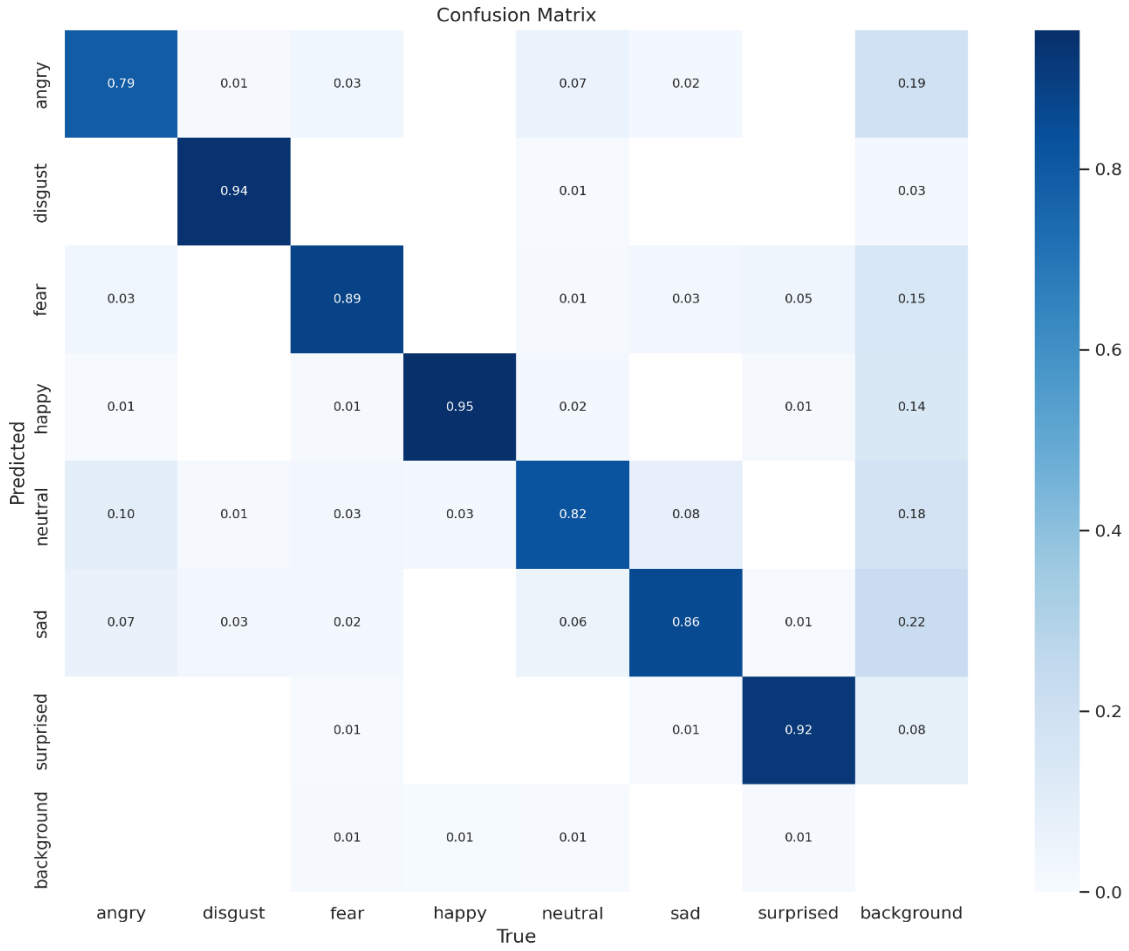

Fig8(Confusion matrix)

CONCLUSION AND FUTURE ENHANCEMET

In conclusion, we have proposed a methodology for developing an emotion-based book and music recommendation system that involves data collection, feature extraction, and machine learning-based prediction. Our approach involved collecting data from various sources, extracting relevant features, and using machine learning algorithms to predict the user's expression. We used these predictions to recommend books and music that were appropriate for the user's emotional state.

Overall, our emotion-based book and music recommendation system provides an effective and personalized way for users to discover new books and music that match their current emotional state. By making pertinent recommendations that are specifically catered to user preferences and requirements, the system has the ability to improve the user experience. We intend to investigate ways to further enhance the performance and accuracy of the recommendation system in future work, including integrating other characteristics and enhancing the machine learning models.

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