Movie Recommendation System Using Facial Emotion Detection

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Abstract- This paper discusses a Movie Recommendation System that uses Facial Emotion Detection. The system captures the user's facial expressions with a webcam and recognizes emotions like happy, sad, angry, or neutral through computer vision techniques. Based on the detected emotion, the system suggests appropriate movies from a movie dataset. This system is built with Python, OpenCV, and machine learning methods to offer personalized movie recommendations.

Index Terms- Movie Recommendation, Facial Emotion Detection, Machine Learning, OpenCV.

I. INTRODUCTION

With the rapid growth of digital entertainment platforms, users now have access to a wide array of movies and web series. Choosing a suitable movie from thousands of options can be challenging and time-consuming. Movie recommendation systems assist users in discovering films based on their interests and preferences. These systems have become a key part of modern streaming platforms.

Traditional recommendation systems mainly use techniques like collaborative filtering, content-based filtering, and popularity-based recommendations. These methods look at user ratings, past viewing habits, or preferences of similar users to suggest movies. While useful, these methods often overlook the user's current emotional state, which can strongly affect the type of content a person wants to watch.

Facial emotion detection is a technology that applies computer vision and machine learning to analyze facial expressions and identify emotions. By recognizing expressions like happiness, sadness, anger, surprise, or neutrality, it can gauge a person's mood.

The proposed system combines facial emotion detection with a movie recommendation system. The system captures the user's face using a webcam, analyzes the facial expression with an emotion detection model, and recommends films that match the identified emotion. This method offers a more personalized and engaging experience for users.

The implementation of this system uses the Python programming language along with libraries like OpenCV and machine learning frameworks for face detection and emotion classification. The suggested movies come from a predefined dataset that includes various genres such as action, comedy, drama, thriller, and romance.

The goal of the proposed system is to cut down on the time spent searching for movies and improve user satisfaction by recommending films that fit the user's current mood.

II. NEED OFTHE STUDY

Due to the huge number of movies available in the streaming platforms, the user is often confused in choosing a movie according to his/her mood. The conventional recommendation system usually depends only on ratings or the history of the movies the user has watched. The user's emotions have not been taken into consideration. Emotions play an important role in choosing the type of entertainment. Identifying the emotions of the user through facial emotion detection can make the recommendation system more efficient. This study proposes to design a Movie Recommendation System through Facial Emotion Detection.

2.1 Population and Sample
The population of the study includes a large set of movies available in the movie dataset. These movies are of different genres like action, comedy, drama, thriller, and romance.

On the basis of the above dataset, a sample of movies is taken and categorized according to different emotional states like happy, sad, angry, and neutral. This system is used to recommend the appropriate movie according to the detected emotion using the facial expression of the user.

2.2 Data and Sources of Data
The data required for this study is the movie dataset and the facial images captured by the webcam. The movie dataset contains information such as the title of the movie, the genre, and the rating. This information is required to recommend the movies based on the d etected emotion. This data is obtained from public sources such as IMDb or the movie dataset available on the Kaggle platform. Facial images are captured using the webcam, and computer vision is employed to process the images. The system uses this data to identify the facial expression of the user. Based on the detected emotion, the movies are selected from the dataset and recommended to the user.

2.3 Theoretical framework
The theoretical background of the proposed system is based on the concept of facial emotion detection and movie recommendation It utilizes computer vision and machine learning techniques to analyze facial emotions and determine the emotional state of the user. In this system, the webcam captures the facial image of the user, and using OpenCV, it processes the image to detect the emotions of the user. After detecting the emotions of the user, it matches the emotions with the movie genres in the movie dataset and recommends movies to the user.

III. RESEARCH METHODOLOGY

The research methodology is the process adopted for the design and development of the Movie Recommendation System based on Facial Emotion Detection. This system uses computer vision and machine learning to identify the facial emotion of the user and recommend the movies accordingly.

3.1 Population andSample
The population for this study is the large quantity of movies available in the movie dataset for the recommendation system. This population of movies is divided into different genres, such as action, comedy, drama, thriller, and romantic movies. A sample of movies is then chosen from the population, which is then divided according to different emotional states, such as happy, sad, angry, and neutral. This sample of movies is then used by the system to provide recommendations based on the facial emotion detected by the system. This sample of movies helps the system provide the appropriate movie recommendations according to the user's emotions.

3.2 Data and Sources of Data
The data used in this study includes a movie dataset and facial images captured using a webcam. The movie dataset includes data such as movie names, genres, and ratings, and this data is used to recommend movies based on the detected emotion. The data is collected from various publicly available sources such as IMDb or any movie dataset available on Kaggle. Facial data is collected using a webcam and processed using computer vision techniques to detect the emotion of the user. According to the detected emotion, movies are selected from the dataset and recommended to the user.

3.3 Theoretical framework
The theoretical foundation of the proposed system is based on the concept of facial emotion recognition and movie recommendation systems. The main concept behind this proposed system is that human emotions play a vital role in determining their entertainment interests, and by recognizing their emotions, a movie recommendation system can be developed. Facial emotion detection is a prominent area in computer vision, and it plays a vital role in recognizing human emotions using facial expression detection techniques. Human faces are capable of expressing different emotions such as happiness, sadness, anger, surprise, fear, and neutrality through facial expressions. All these facial expressions can be recognized using image processing techniques. In this proposed system, a webcam is used to capture the facial image of a user in real time. The captured facial image is then processed using image processing techniques to identify the facial area of a human being.

Face detection is the first step in the overall emotion recognition system. For this purpose, computer vision libraries are employed, and OpenCV is one of the popular libraries being used in this system. Using this library, the system is able to detect the face in the image. Face detection algorithms are also employed in this system, and they are successful in detecting the location of the face in the image. As a result, the system is able to focus only on the face in the image and ignore the background. After detecting the face in the image, it is now ready to be sent to the emotion detection system.

Emotion classification is another step in this overall system of emotion detection. Machine learning algorithms are employed in this system, and deep learning algorithms such as Convolutional Neural Networks (CNN) are commonly used in this system of facial emotion detection. For this purpose, a dataset containing images of faces with different emotions is required. Using this dataset, a model is trained, and it is successful in recognizing different emotions through the features of a face, such as eyebrow movement, shape of the mouth, and position of the eyes.

Once the emotion is identified, the process moves to the movie recommendation stage. In the recommendation stage, a set of predefined data related to movies is used. This data includes the titles and genres of the movies, as well as their ratings. Each emotion is mapped to specific genres of movies that can be related to the user's mood or emotion. For example, if the identified emotion is happiness, the system may recommend comedy or adventurous movies. On the other hand, if the identified emotion is sadness, the system may recommend motivational or emotional movies.

Additionally, action or thriller movies may be recommended if the user is identified as being angry or excited. This is done by matching the identified emotion with the matching movie categories in the predefined data set. Then, a set of appropriate movies is chosen and displayed to the user using the user interface. This is done to enable the user to easily find a movie that is related to their identified emotion without having to search through large amounts of data.

The proposed theoretical framework seeks to improve the existing recommendation approach by introducing emotional intelligence into it. As opposed to basing a recommendation on a user's past behavior, this approach relies on the user's current mood, thus making it more interactive and personalized. By using facial emotion detection in conjunction with a movie recommendation algorithm, this system presents a fun and interactive way of choosing a movie. It not only increases user satisfaction levels but also presents a real-world example of computer vision and machine learning technology in entertainment systems.

3.4 Statistical tools and econometric models
Statistical tools are used to analyze the movie dataset. These tools are also helpful in the recommendation process. Basic statistical tools can be used to organize the genres of the movies. This will be helpful to the system in recommending the movies according to the emotions.

3.4.1 Descriptive Statistics
Descriptive statistics are used to summarize and describe the major features of the movie dataset used in the study. Descriptive statistics include information like mean, frequency, and distribution of the movie genres. Descriptive analysis is important in understanding the distribution of the movies in different genres like action, comedy, drama, thriller, and romance. This information is used to map the specific emotions with the appropriate genres of the movies and provide the recommendations accordingly.

3.4.2 Emotion Detection Model
The emotion detection model is one of the important components of the proposed movie recommendation system. The primary function of the emotion detection model is to identify the emotion of the user based on the facial expressions detected by the webcam. Human emotions are usually depicted through facial movements such as the movement of the eyes, eyebrows, mouth, and facial structure. By analyzing these features, the system can easily identify the emotional condition of the user. The emotion detection process involves the detection of the facial image of the user through the webcam. Then, the image is processed using computer vision techniques. The first step of the computer vision process is the detection of

the face. In this process, the facial image of the user is detected, and the facial area is separated from the background. This is an important step because it helps the system to identify the facial area alone, excluding other unnecessary features of the image. For this purpose, the OpenCV library is commonly used for the detection of faces.

Once the face is detected, the system performs a preprocessing operation on the image. This may include the following operations:
- Converting the image to grayscale.
- Resizing the image.
- Normalizing the image.
- etc.

This helps to enhance the performance of the emotion detection model by preparing the image for analysis by machine learning algorithms.

Once the preprocessing operation is complete, the facial image is fed into the emotion classification model. This model analyses the facial features to determine the emotional state of the user. Various machine learning algorithms, specifically deep learning algorithms like Convolutional Neural Networks (CNN), can be used for emotion recognition. These algorithms are trained on a large dataset containing thousands of images with different facial expressions.

3.4.3 Recommendation Model
The recommendation model is responsible for recommending movies based on the detected emotion. The system uses a rule-based mapping, where each emotion is associated with particular movie genres. For example, happy emotions may be associated with comedy movies, whereas sad emotions may be associated with motivational or drama movies. The model then selects movies from the dataset based on the detected emotion.

3.4.4 Performance Evaluation
Performance evaluation is an essential step to measure the effectiveness and accuracy of the suggested Movie Recommendation System with the incorporation of Facial Emotion Detection. This process helps to measure the accuracy of the detection of emotions

using the suggested system and the effectiveness of the movie recommendation based on the emotions detected by the system. This process ensures that the system functions correctly under real-time conditions and provides appropriate recommendations to the user. In order to evaluate the performance of the suggested Movie Recommendation System with Facial Emotion Detection, different facial expressions are used with the help of a webcam. Various emotions like happy, sad, angry, surprised, and neutral are given as input to the system to measure the accuracy of the detection of emotions and to provide appropriate recommendations based

3.4.4.1 Accuracy and Emotion Detection
The accuracy of the emotion detection model can be evaluated by testing the system with various facial expressions. The system will analyze the facial features and classify the emotion into various categories. Then the system will compare the detected emotion with the actual facial expressions to check whether the system can accurately detect the user's emotion.

3.4.4.2 Recommendation Relevance
Another significant factor in the performance evaluation is the relevance of the suggested movies. After the emotion is detected, the system suggests the movies that match the mood of the user. The suggested movies are checked for their relevance to the detected emotions. The suggested movies must belong to the appropriate genre.

3.4.4.3 Recommendation relevance
Another f actor that is important for the performance evaluation is the relevance of the suggested movies. After detecting the emotion, the system suggests movies according to the user's mood. The suggested movies are checked for the relevance of the genre of the movies.

3.4.4.4 System Response Time
The response time of the system is also examined to ensure that the recommendation takes place within a prompt time. The system must be able to identify the emotions of the user and provide the movie recommendations within a small time interval to ensure a smooth experience.

IV. RESULTS AND DISCUSSION

From the proposed Movie Recommendation System with the use of Facial Emotion Detection, the results show the successful implementation of the proposed system, which can detect emotions and provide the user with movie recommendations based on the user's emotions. To validate the proposed system, the Movie Recommendation System with Facial Emotion Detection uses different facial expressions to detect emotions using a webcam.

During the testing of the proposed system, the emotions provided to the system were happy, sad, angry, surprised, and neutral, among others. The proposed system successfully detected the emotions provided to the system by using the webcam to detect the emotions on the user's face through the analysis of the features of the eyes, eyebrows, and mouth.

Once the emotions were successfully detected, the proposed system provided the user with movie recommendations based on the emotions provided to the system. For example, the proposed system provided the user with comedy and adventure movies when the user appeared to be happy, and emotional and motivational movies when the user appeared to be sad.

From the results obtained, it is clear that the facial emotion detection system contributes to the improvement of the personalization of the movie recommendation system. Unlike the conventional system that relies on the ratings given by the users or the movies they watch, the system takes into account the emotional state of the user.

In addition, the system performs satisfactorily under the testing conditions set for a real-time system. The time taken to detect the emotions of the users and provide the relevant movie recommendation was relatively fast. However, there were a few limitations noted while testing the system. These limitations were noted when the facial expressions were not clear or the lighting conditions were not optimal.

Despite the limitations of the results, it is evident that the proposed system can effectively leverage the strength of computer vision and recommendation technologies to offer mood-based movie recommendations. The discussion of the results also reveals the potential of emotion-aware recommendation systems to enhance user engagement and entertain users.

V. ACKNOWLEDGMENT

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