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Facial Emotion-Based Personalized Recommendation System Music or Movies: A Hybrid Deep Learning and Machine Learning Approach

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Abstract

Personalized content recommendations are essential for improving user experience in the current digital era. A recommendation system based on a hybrid deep learning and machine learning approach is presented in this paper. It uses facial expression analysis to recommend movies or music. To identify and categorize a user's facial expression into one of four moods—happy, sad, angry, or neutral—the system uses the deep learning model ResNet-50. The user is presented with music and movie recommendations based on the mood that was detected. For music, the system provides songs by genre (love, melody, folk, sad, friendship) and language (Hindi, English, Telugu). It offers movie recommendations according to specific genres (comedy, action, horror, and love). The recommendation engine optimizes music and movie recommendations by utilizing Linear Regression and Logistic Regression. This system offers an intuitive, emotion-driven approach to entertainment recommendations, bridging the gap between artificial intelligence and user preferences.

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Index Terms — Facial Expression Recognition, Deep Learning, Machine Learning, Emotion-Based Recommendation, Music Recommendation, Movie Recommendation, Linear Regression, Logistic Regression, Personalized Entertainment System.

Introduction

The utilization of Convolutional Neural Networks (CNNs) has been widely explored in various domains, demonstrating their effectiveness in tasks such as image classification, object detection, and facial recognition. In particular, facial expression recognition has gained significant attention due to its potential applications in human-computer interaction, healthcare, and personalized recommendations. Recent studies have proposed CNN-based models to analyze facial emotions by extracting key facial features, enabling real-time mood classification and enhancing user experience [1]-[2].

Researchers have combined facial expression recognition with music and movie recommendation systems to enhance emotion-driven personalization even more. While emotion-based systems provide a more intuitive method by analyzing real-time emotional states, traditional recommendation models rely on user preferences, ratings, or collaborative filtering [3]. Modern systems can automatically infer emotions and suggest pertinent content by utilizing deep learning techniques, which increases user engagement and satisfaction.

In order to create an emotion-based recommendation system, this paper proposes a hybrid deep learning and machine learning methodology. The system uses ResNet-50 to recognize facial expressions and categorize emotions into four groups: neutral, angry, sad, and happy. The system asks the user to select between music and movie recommendations based on the mood it has detected. Based on the chosen language (Hindi, English, Telugu) and genre (Love, Horror, Action, Comedy for films; Love, Melody, Folk, Sad, Friendship for music), the recommendation model generates personalized suggestions using Linear Regression and Logistic Regression. [4] – [5].

By developing an emotion-driven entertainment system that raises user satisfaction and engagement, this project seeks to close the gap between artificial intelligence and user

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preferences. A custom facial expression dataset and machine learning models are used to assess the suggested system's ability to provide precise recommendations.

Literature Survey

Facial expression recognition and recommendation systems have significantly improved as a result of the development of deep learning and machine learning. In many fields, such as emotion analysis, surveillance, healthcare, human-computer interaction, and personalized recommendations, facial expression recognition is essential. Feature extraction, real-time classification, and hybrid approaches that combine several deep learning architectures to increase accuracy have been the main topics of numerous studies that have investigated CNN-based models for facial expression recognition over the years [1].

ResNet-50, a popular deep learning model for facial expression recognition, is renowned for its capacity to extract deep hierarchical features while lowering computational complexity. Dual-input models that incorporate landmark-based analysis and facial images have been investigated recently in an effort to improve the precision and resilience of emotion detection [2]. In emotion-based applications like recommender systems, virtual assistants, and affective computing, the ability to better classify emotions like happiness, sadness, anger, and neutrality is crucial. These studies highlight the value of deep feature learning in furthering this goal.
To overcome this limitation, emotion-aware recommender systems have been proposed, which integrate facial emotion recognition with content recommendations. These systems dynamically adjust suggestions based on real-time emotional input, resulting in a more engaging and user-centric experience. Conventional recommendation systems rely on collaborative filtering, content-based filtering, and hybrid filtering techniques, each of which typically analyzes user preferences, viewing history, and feedback to generate recommendations [3].

Several models have been proposed to map musical elements like tempo, rhythm, and lyrics to different emotional states, improving user satisfaction [4]. By utilizing deep learning models, these systems can classify emotions and suggest music that improves emotional well-being and

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engagement. Recent studies have investigated affective computing in music recommendation systems, where emotion plays a crucial role in song selection.

Similarly, hybrid machine learning techniques have been incorporated into movie recommendation systems, which combine regression-based models and collaborative filtering to more accurately predict user preferences [5]. Research indicates that by providing content that reflects the user's current mood rather than their fixed preferences, emotion-based movie recommendations increase user engagement. One significant development in the delivery of personalized content has been the move from preference-based to mood-based recommendations.

Building on these earlier studies, this research suggests a hybrid system based on deep learning and machine learning that combines personalized entertainment recommendations with facial emotion recognition. The system ensures an effective, emotion-driven user experience by using Linear Regression & Logistic Regression for recommendation generation and ResNet-50 for facial expression classification. The suggested system seeks to close the gap between artificial intelligence and user-centered content personalization by fusing cutting-edge deep learning models for facial expression recognition with conventional and machine learning-based recommendation algorithms.

PROPOSED SYSTEM

The suggested system combines facial emotion recognition with tailored entertainment recommendations using a hybrid deep learning and machine learning methodology. By making dynamic movie or music recommendations based on the user's current emotional state, the system seeks to improve the user experience. The system successfully divides facial expressions into four groups: neutral, angry, sad, and happy. It does this by utilizing ResNet-50, a potent convolutional neural network (CNN). The system engages with the user after identifying the emotion and presents them with an option: watch a movie or listen to music.

The system uses two machine learning algorithms, linear regression and logistic regression, for the recommendation process in order to offer tailored content recommendations. If the user chooses music, they are then prompted to select their preferred language from Telugu, Hindi,

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or English. Based on their mood, a list of suitable songs is then generated. In a similar manner, when the user chooses a movie, they are asked to indicate their preferred language before selecting a genre from Love, Horror, Action, or Comedy. This enables the system to suggest films that fit the user's mood and preferred genre.

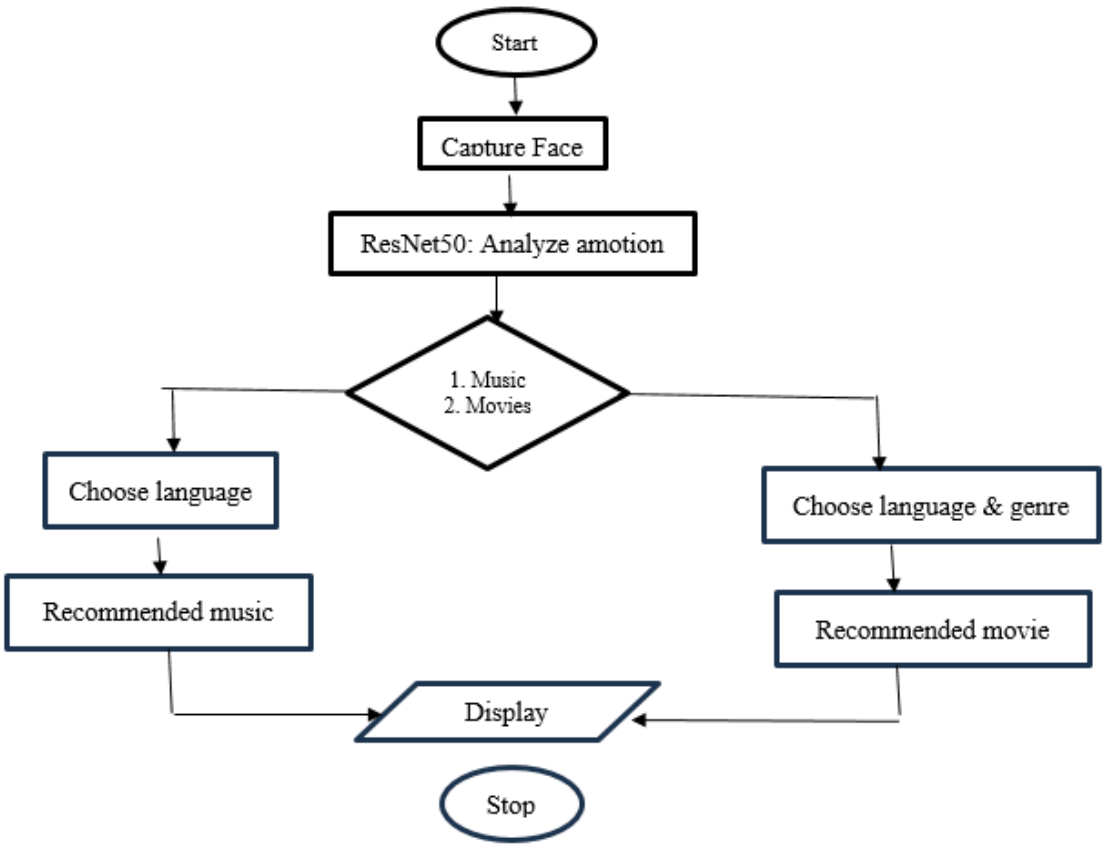

Fig: 1 Flow Chart

The Facial Emotion-Based Personalized Recommendation System for Music and Movies operates as shown in the flowchart below. It demonstrates in detail how the system records, interprets, and makes tailored recommendations based on facial expressions.

1. Get started

The procedure is started by the system, which also gets ready for facial expression recognition.

2. Take a Face Picture:

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The user's face is captured in real time by a camera or webcam. After that, this frame is processed for analysis of emotions.

3. Using ResNet-50 for Facial Expression Analysis

The ResNet-50 deep learning model is used to process the captured image, extracting facial features and categorizing the emotion into one of the following predefined groups:

Happy Sad Angry Neutral

4. Mood Detection

The system determines the user's dominant mood based on the classification of the deep learning model.

5. User Engagement: Select Music or Movies

"Are you feeling [detected mood] today?" is the question the system asks the user. Do you want to watch a movie or listen to music?

Next, the user chooses: To play music, press 1, For movies, press 2. Depending on the user's selection, the flowchart now splits into two separate routes.

Path 1: Suggested Music

6. User-Selected Music

The system moves on to music recommendations if the user hits 1.

7. Music Language Selection

The user is asked to select their preferred language: One for Telugu, Two for Hindi, Three points for English

8. Music Suggestions Based on Mood

To suggest songs that fit the chosen language and the identified mood, the system makes use of logistic regression and linear regression.

9. Play Music Suggestions

The console shows a carefully selected selection of songs.

Path 2: Suggested Movies

6. User-Selected Movies

The system moves on to movie recommendations if the user presses 2.

7. Movie Language and Genre Selection

The user is asked to select a language: One for Telugu, two for Hindi, and three for English

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The user then chooses a genre: One for Love, Two for Horror, Three for Action, Four for comedy.

8. Genre and Mood-Based Film Suggestions

To create a customized list of suggested movies, the system uses Logistic Regression to examine the user's preferred genre in addition to the detected mood.

9. Show Movie Suggestions

The console shows a carefully selected selection of films.

Simulation Output and Results

Performance of Deep Learning Model

Training and validation accuracy curves as well as training and validation loss curves were used to assess the performance of the ResNet-50 model, which was utilized for facial expression recognition. The outcomes show how well the model can differentiate between the four emotions—happy, sad, angry, and neutral.

Accuracy of Training and Validation

The RESNET 50 is trained and validated for facial emotion detection in proposed work. In graph shown in Fig. 10 illustrates the training and validation accuracy curves. Leveraging epoch 9, we attained an impressive training accuracy of 95.3%, indicating the model's proficiency in accurately classifying the training data. While the validation accuracy may vary slightly, its consistency throughout epochs underscores the model's ability to generalize well to unseen data. These accuracy curves offer valuable insights into the model's learning progression, ensuring both high performance on training data and reliable classification on new, unseen data, crucial for real world deployment.

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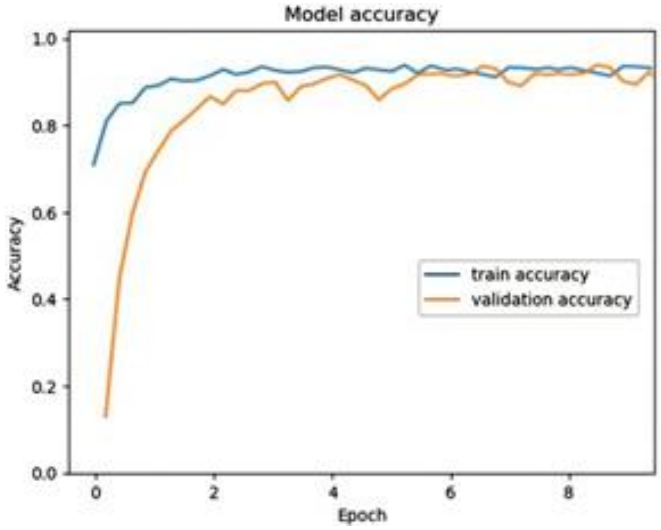

Fig 2.1 Accuracy of Training and Validation

Loss of Training and Validation

The loss curve shows how the error rate decreases with training. Effective learning is indicated by a steady decrease in training loss and a stabilization of validation loss. The model maintains a balanced learning process without excessive overfitting, as evidenced by the lack of a noticeable divergence between the curves.

For the recommendation system, Linear Regression and Logistic Regression were employed to suggest music and movies based on user mood. The models were evaluated based on accuracy:

Music Recommendation Accuracy: 92.08%

Movie Recommendation Accuracy: 94.44%

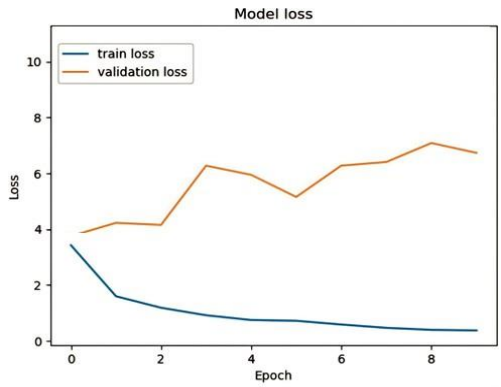

Fig 2.2 Training and Validation Loss Curves.

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These results validate the reliability of the models in recommending relevant content based on user emotions. The deep learning model effectively captures facial expressions, achieving high accuracy, while the machine learning models provide efficient mood-based recommendations. The combination of ResNet-50 for emotion detection and Logistic/Linear Regression for recommendations ensures a personalized and accurate system. Further improvements could be achieved by increasing dataset size, experimenting with advanced recommendation algorithms, or integrating hybrid models for enhanced predictions.

Conclusion and Future Scope

This work introduces a Facial Emotion-Based Personalized Recommendation System that successfully combines machine learning (Logistic and Linear Regression) for mood-based music and movie recommendations with deep learning (ResNet-50) for facial expression recognition. Emotions (Happy, Sad, Angry, and Neutral) are successfully recognized by the system, which then makes tailored entertainment recommendations.

Reliable mood detection was ensured by the ResNet-50 model's 95% facial expression recognition accuracy. The effectiveness of the recommendation models was validated when they achieved 92.08% accuracy for music selection and 94.44% accuracy for movie recommendations. The experimental findings verify that by offering personalized content recommendations based on real-time emotion analysis, this hybrid approach improves the user experience.

Future Scope

Even with the encouraging outcomes, there is room for improvement. Future research can concentrate on:

Extending the Dataset: The performance of the deep learning model can be further enhanced by increasing the quantity of images used for training and validation.

Adding More Emotions: At the moment, the system recognizes four different emotions. For more accurate suggestions, future iterations can incorporate more complex emotions like surprise, fear, or disgust.

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Improving Recommendation Algorithms: Recommendation accuracy can be increased by investigating cutting-edge machine learning methods like reinforcement learning and neural collaborative filtering.

Deploying as a Real-Time Application: Making the system a web-based or mobile application can improve user interaction and accessibility.

Integrating Multi-Modal Emotion Recognition: A more thorough grasp of user emotions can be obtained by combining text sentiment analysis, voice tone, and facial expressions.

User Feedback Mechanism: By putting in place a feedback loop that allows users to score suggestions, the recommendation system can be improved over time.

By taking care of these issues, the system can develop into an emotion-based entertainment recommendation platform that is more precise, scalable, and intuitive.

References

[1] D. S. Moschona, "An Affective Service based on Multi-Modal Emotion Recognition, using EEG enabled Emotion Tracking and Speech Emotion Recognition," 2020 IEEE International Conference on Consumer Electronics - Asia (ICCE-Asia), 2020.

[2] M. Sakurai and T. Kosaka, "Emotion Recognition Combining Acoustic and Linguistic Features Based on Speech Recognition Results," 2021 IEEE 10th Global Conference on Consumer Electronics (GCCE), 2021.

[3] M. D. Daniyal and V. Balu, "Api-Based Music Recommender System," 2022 11th International Conference on System Modeling & Advancement in Research Trends (SMART), 2022.

[4] B. Kostek, "Listening to Live Music: Life Beyond Music Recommendation Systems," 2018 Joint Conference - Acoustics, 2018.

[5] S. Halder, A. M. J. Sarkar, and Y. K. Lee, "Movie Recommendation System Based on Movie Swarm," 2012 Second International Conference on Cloud and Green Computing, 2012.