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Movie Recommendation System

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Abstract -In this decade, the recommendation systems have become more popular in many commercial websites like Amazon, Netflix, etc. It helps the user by suggesting the product according to their interest. In the movie recommendation system, emotion plays a vital role. The face gives important features to detect emotions. This approach aims to develop an efficient movie recommendation system by incorporating the facial emotions of the user and provide the recommendation accordingly. This system captures the video stream by a USB camera in real-time. The face is extracted using the Haar cascade classifier. The facial expression recognition is developed using Convolutional Neural Network (CNN) for six emotions. The proposed system achieved the training accuracy of 98%. Once the emotion is recognized, the movies are recommended to the top 5 movies from the IMDB dataset.

Key Words:CNN, IMDB, Haar cascade, Face detection, Facial recognition, Movie recommendation

1.INTRODUCTION

Recommended Systems (RSS) can be described as the software tools and techniques offering recommendations for items to be of use to a user. With the advancement in the internet, there is an explosion of information and users facing the problematic situation for the selection of interesting data from that too many options. Right from looking for a restaurant to looking for a good investment selection, there is huge information available. As assisting the users as they can deal with this information burst, companies have organized RSs to direct them. The research in the area of RSs has been going on for several decades now, but the interest remains elevated due to the plenty of practical applications and the problem rich domain. There are different examples of online examples of recommendation systems such as books at amazon.com, movies at Netflix, Hotstar, and CDs at CDNow.com.

The recommendation system is now common in the research as well as a commercial field where the number of methods has been used for providing a recommendation. In some cases, developers employ the recommendation system must choose the list. The first step for the selection of the best algorithm is to decide the application on which to focus. Indeed, the system has different attributes that may affect the user experience such as accuracy and robustness. The movie recommendation system recommends the movie based on the personal information and their answer provided.

Due to advancements in multimedia devices, it is easy to access the private content of multimedia such as how the people enjoy the movies. The decision of which movie to watch is most of the time taken from friend's suggestions. Nowadays, one can take the benefit of the media recommender system [4, 5] which can suggest the video content based on a person's current affective state, social experiences, and profile. The psychologist has investigated the emotional properties of the film media in terms of empathy with situations and characters and also in terms of the director's establishment of film making techniques which provide the emotional cues. The understanding is not with the characters which provide the sentimental cues with movie media while movie makers make the use of techniques such as editing, musical scores, the lighting to emphasize the particular emotional interpretation by the viewer. This is referred to as connotation which gives the path of communication and influences how the meaning is transmitted to the audience which is conveyed by the director.

An expert system MovieGEN is used for the recommendation of movies. The user's information is taken as input and their movie preferences are predicted using the support vector machine and based on prediction movies are selected from the dataset and generate some questions for the users. On the user's answer it the movie is recommended for the user. Recommendation systems are the expert system where the knowledge of experts is combined with the user's preferences to sort out the information and make available users with the information. There are two main approaches to filtering collaborative and content-based approaches. Most of the recommendation systems use the hybrid approach of these two approaches. The model using SVM based learning techniques [7, 8] is used in MovieGEN. With the help of this model, one can predict genres and periods of movies that the user prefers.

The proposed system is organized as; In section II, the survey of recent approaches of movie recommendation system and face recognition system has been explained in detail with their research gap. In section III, the block diagram of the proposed system with a detailed explanation is explained. The

implementation of the system with software details is presented in section IV, Results of the proposed facial expression-based movie recommendation system is explained in section V using qualitative and quantitative analysis. Finally, the proposed system is concluded in the Conclusion section.

2. LITERATURE SURVEY

Ahmed Muyeed, Mir Tahsin Imtiaz and Khan Raiyan [1] designed a movie recommendation system using the K-means clustering algorithm for separating users with the same choice of movies. The system is proposed using publicly available data from the MoveLens Database. User's behavior is analyzed by building a separate neural network to predict the rating value given by the user depending on the cluster, the system showed 95% accuracy on average in predicting rating from the user and analyze which movie should be recommended to the new user. User rating, user consumption ratio and user preference have been considered for the development of the system.

Bagher Rahimpour Cami, Hassanpour Hamid and HodaMashayekhi [2] proposed a content-based movie recommendation system. The proposed model is user-centered and creates a profile for individual users. The user profile consists of user activities as userId, activity1..., activity, where each activity indicates the content and access time of selected items denoted as itemId, itemDesc, accessDate. The main focus is to design the temporal preferences model which is based on the Bayesian non-parametric framework having three main components: interest extraction, inferring of preferences, and prediction.

Md. Tayeb Himel, Mohammed Nazim Uddin, Mohammad Arif Hossain, and Yeoung min Jang [3] Developed a movie recommendation system in two different ways. Either a user can use the input attributes such as genre actor, year and rating. Based on the user's liking and preferences the movie will be recommended. Or in the second way the movie is recommended using the user's activity log. For the recommendation of the movies, the top 20 movies are shown to the user. The primary focus has been given to calculating the weight of the movies and the movie list is sorted according to it. The Weight of the movie is calculated by summing up the weights of the attributes. k-means algorithm is applied to display a cluster of movies having the highest mean cluster rating.

Aurobind V. Iyer, Viral Prasad and kananprajpati [4] have designed a system known as ‘EmoPlayer’, which is an Android-based application. This system captures the user's image using a camera and detects the face from this image. After face detection, it identifies the emotion and captured emotion is sent to the music server. The server will fetch a suitable playlist according to emotion. In EmoPlayer the main focus is on face detection which is performed using two methods i.e. Canny Edge Detection and Viola Jones Algorithm. Emotion Recognition is carried out using the Eigenface method and Fisherfaces method. Proposed system is designed to process the facial image and recognize basic emotions and then play music based on these emotions and also suggest music that enhances the mood of the user.

Ching-Seh (Mike) Wu, Deepti Garg and Unnathibhandary [5] designed a movie recommendation system that focuses on the past movie ratings given by various users to provide suggestions to the user. Implementation of this system is done using collaborative filtering and the Apache Mahout framework. The focus of this system is to compare the performance and efficiency of the user-based recommender and item-based recommender systems.

Yibo Wang et al [6] proposed the mobile-based movie recommendation system. This system recommends the movie by carried out the user's preferences reviews and emotions. The sentiments are analyzed using the Spark platform to improve the accuracy and timeliness of the mobile-based movie recommendation system. First, the primary recommendation list has been presented then sentiment analysis is used to optimized the list. Finally, a hybrid recommendation system with sentiment analysis is implemented.

3.PROPOSED SYSTEM

In this approach, the movie recommendation system based on emotions is presented. The proposed system is divided into two parts, Facial expression recognition, and Movie recommendation system. Each section is explained in detail below.

A. Facial Expression Recognition system

The block diagram of Convolutional Neural Network (CNN) based facial expression recognition is shown in Fig.1.

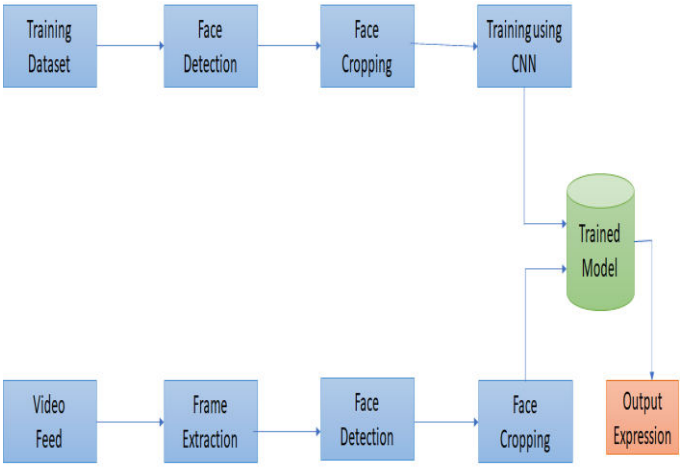

Fig-1:Block diagram facial expression recognition system

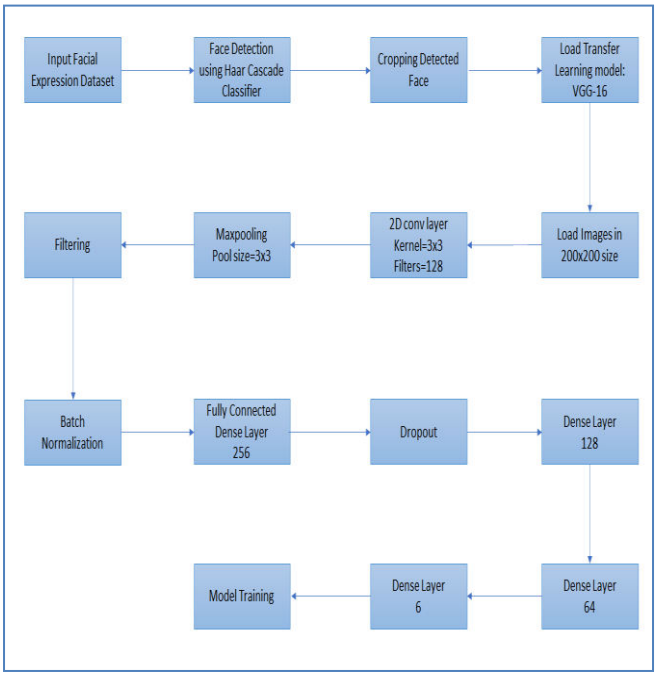

Fig-2:Detailed Block Diagram of face recognition system training

The explanation of each block of the facial expression recognition system is explained in detail below

- Database

For this approach, a self-generated dataset of six different emotions is prepared. Datasets were preprocessed using appropriate methodologies in python. The first stage of implementation comprises of emotion detection of the user with the help of a preprocessed dataset. The training dataset is divided into six parts. The database distribution of the database for each emotion is tabulated in Table 1.

Table -1: Data Distribution

Emotion	Training	Testing
Anger	684	229
Disgust	768	256
Happy	769	257
Neutral	771	257
Sad	890	270
Surprise	714	239

Dataset was divided into training and test data in the ration of 75:25.

- Face Detection

For detecting face, we are using Viola-Jones Algorithm. The algorithm has the following stages:

1) HAAR features:

Face Detection is detecting relevant features like eyes, nose, eyebrows, lips in the human face. Haar features are square shape rescaled functions and are applied to all relevant parts of the face to detect the face.

2) Integral Image:

Performing intensive operations like detecting features in the input image can be expensive and time-consuming. Input images converted into Integral images can help to reduce these intensive operations and achieve faster execution of the face detection model.

3) Adaptive Boosting:

Finding out the best feature for recognizing the face is achieved in adaptive boosting. It selects the feature which will be best for detecting the face. With the optimization of the algorithm, we will able to increase true positives and true negatives of the image.

4) Cascading:

Cascading is another method to improve the speed and accuracy of the model. We take sub-window and in that sub-window, we check for our best feature is present or not. If the feature is not present we discard that sub-window. We repeat this process for all features and reject the sub-windows.

- Emotion Recognition:

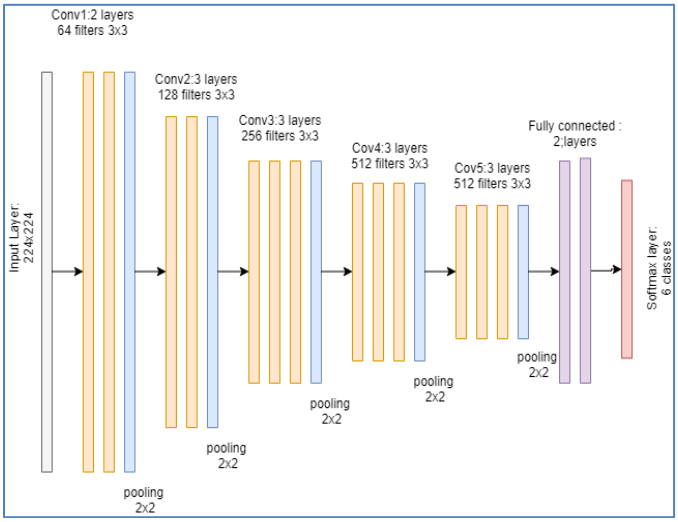

Fig-3: VGG-16 model

VGG-16 model a convolutional neural network used for emotion recognition based on the user input.VGG-16 is one of the convolutional neural networks which is used for large scale image recognition. The model achieves high accuracy for classifying large dataset into different classes.

VGG -16 model architecture consists of a stack of convolution layers through which the input image is passed, it utilizes 1×1 convolution filter, which can be used for linear transformation of the input channels. The convolution stride is fixed to 1 pixel; the spatial padding of convolution layer input is such that thespatial resolution is preserved after convolution. Spatial pooling is completed by five max-pooling layers, which follow some of the Conv. layers. Max-pooling is performed over a 2×2-pixel window. Three Fully-Connected (FC) layers are followed by a stack of convolutional layers. The final layer of the model is the softmax layer. Hidden layers are fitted out with rectification (ReLu) non-linearity.

B. Movie Recommendation:

IMDb is a database of movies, series, streaming content, games information that is available online. It also contains information about the cast, production crews, plot summaries, fans, and critics rating. IMDb has about 83 million registered users which can contribute information to the site and free access available information. IMDb database information can be accessed through their web-portal and apps. Based on the recognized emotion list of movies are recommended. Movies recommended are taken from the IMDb database. Movies Recommendation is based on content-based filtering. Different movie genres are associated with recognized emotion.

4.IMPLEMENTATION

A. SoftwarePlatform

The libraries and software used for this approach are presented below.

- Anaconda

Anaconda is an open-source distribution of the python libraries. It includes data processing and predictive analysis. This distribution provides the number of libraries within the single package called conda.

- Python

Python is a high-level programming language widely used for programming. Python, an interpreted language, supports several programming scripts and a syntax that allows you to use programs in most languages such as C ++ or Java. The language provides constructions designed to permit clear programs at each scale. Python is easy and simple to know, the python code is way easier than alternative languages.

- OpenCV

Open source Computer Vision (OpenCV) is an image processing and computer vision library mainly developed for artificial vision. OpenCV was originally written in C but currently, it's a whole C++ interface and there's additionally a full Python interface to the library. Open-source computer Vision Library, also called OpenCV, is associated with a freeware software package that is aimed toward computer vision. It is used in this project because of its versatility as well as the fact that it has a C++ interface.

- Spyder

Spyder is an Integrated Development Environment (IDE) used in computer programming, especially for Python language. For the programming part, we need to install an extra three important libraries i.e. OpenCV, Scikit-learn, and Keras.

B. Flowchart

The flowchart of the proposed system is given in Fig 4.

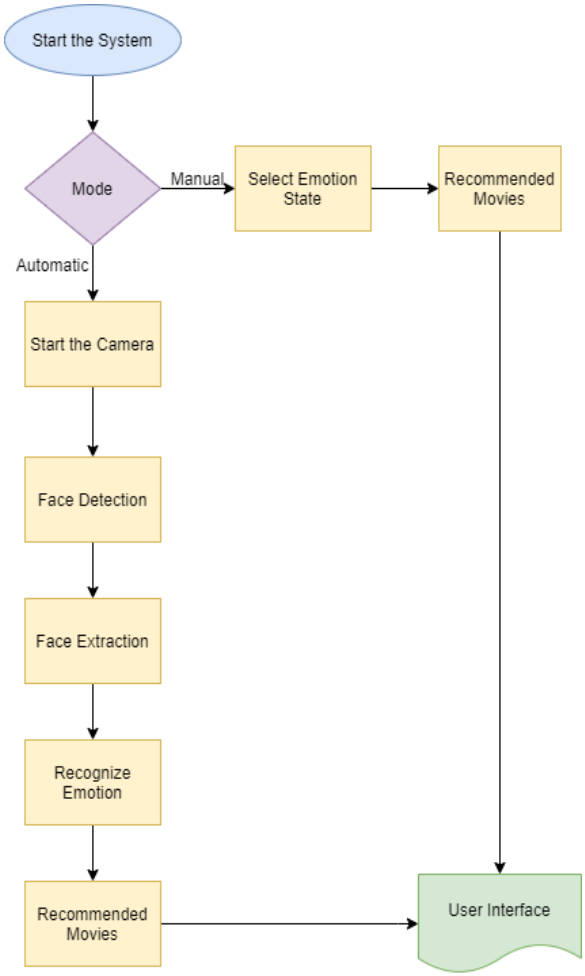

Fig-4: flowchart

5. RESULTS AND DISCUSSION

The system determines the emotion of the user and provides movie recommendations based on emotions. The results of the proposed emotion recognition system are explained by qualitative and quantitative analysis.

C. Qualitativeanalysis

The results are carried on the six emotions anger, disgust, happy, neutral, sad and surprise of four samples. The images from the testing folder are tested on the training model. Almost all the images show accurate output for this approach. The inputimage and its output image are as shown in Table II. The table shows the Emotion in a row and samples in the columns. different samples are tested on the proposed trained model some of them are illustrated in Table -2.

From the qualitative analysis of the proposed system, it is observed that the proposed system accurately recognizes the emotions.

D. Quantitative analysis

Qualitative analysis is the statistical and mathematical approach to the research. The training and validation accuracy and loss of the proposed system during the training process is as shown in Fig.5. and Fig.6. respectively. The convolutional neural network with VGG 16 transfer learning model has been used to train the network for six classes. For the training process, 10 epochs were set. From the graph shown in Fig.5, it is observed that the training accuracy goes on increasing with the increase in the epoch. In the same manner, validation accuracy also increasing parallel. From the loss graph, as shown in Fig.6, It is also observed that the as epoch goes on increasing loss is decreasing.

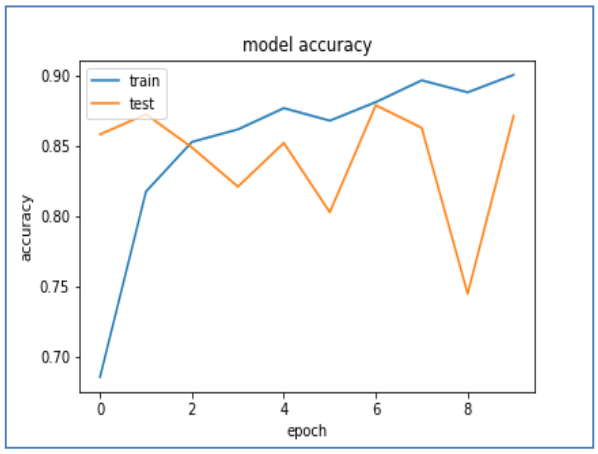

Fig- 5: Accuracy progress during the training process

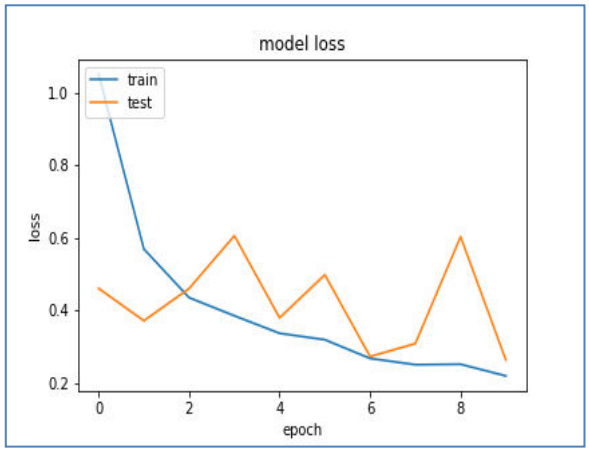

Fig-6: Loss progress during the training process

Table -2: Data Distribution

Emotion	Sample 1	Sample 2	Sample 3	Sample 4
Anger				
Disgust				
Happy				
Neutral				
Sad				
Surprise				

The testing accuracy for each class is given in Table -3.

Table -3: Quantitative Analysis

Emotion	No. of Testing Image	Correctly detected	Accuracy (%)
Anger	120	107	89.16
Disgust	146	121	82.87
Happy	216	191	88.42
Neutral	208	185	88.94
Sad	166	154	92.77
Surprise	103	81	78.64
Overall	**959**	**839**	**87.48**

From Quantitative analysis (as shown in Table III and Fig.7), it is observed that the proposed approach shows promising results for the Sad, Anger, Happy, and Neutral emotions but it underperforms for Disgust and Surprise emotions. Mostly disgust images were classified as sad because there is a small visual difference in these classes.

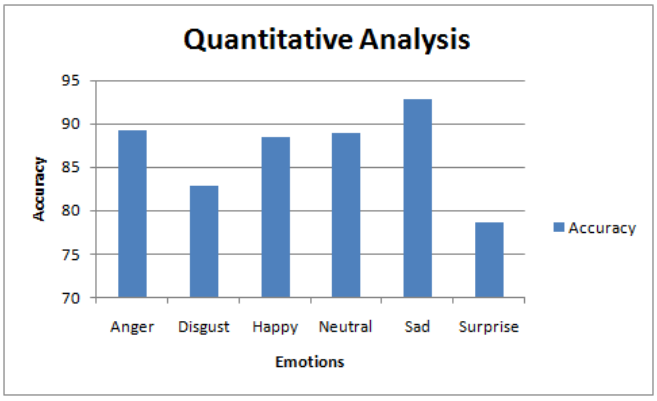

Fig- 7: Quantitative Analysis

6. CONCLUSION

A movie recommendation system can incorporate a user's emotions into the user's profile to provide users with well-recommended movies based on their emotional state. Based on the user's estimated emotional state system will able to recommend movies based on the appropriate genre that the user might be interested in IMDb online database. The proposed approach achieved the training accuracy of 90.07% and validation accuracy of 87.48% for emotion recognition on the self-generated dataset.

As part of the future work, we would like to use the user's social media data to extract the user's current emotion automatically. For a better understanding of the user's preference, we will consider the user's data from other sources such as YouTube, Facebook, Twitter, and so forth. The recommendation system can be scaled by adding more emotions.

REFERENCES

[1] M. Ahmed, M. T. Imtiaz, and R. Khan, "Movie recommendation system using clustering and pattern recognition network," *2018 IEEE 8th Annual Computing and Communication Workshop and Conference (CCWC)*, Las Vegas, NV, 2018, pp. 143-147.

[2] B. R. Cami, H. Hassanpour and H. Mashayekhi, "A content-based movie recommender system based on temporal user preferences," *2017 3rd Iranian Conference on Intelligent Systems and Signal Processing (ICSPIS)*, Shahrood, 2017, pp. 121-125.

[3] M. T. Himel, M. N. Uddin, M. A. Hossain, and Y. M. Jang, "Weight based movie recommendation system using K-means algorithm," *2017 International Conference on Information and Communication Technology Convergence (ICTC)*, Jeju, 2017, pp. 1302-1306.

[4] A. V. Iyer, V. Prasad, S. R. Sankhe and K. Prajapati, "Emotion based mood enhancing music recommendation," *2017 2nd IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT)*, Bangalore, 2017, pp. 1573-1577.

[5] C. M. Wu, D. Garg, and U. Bhandary, "Movie Recommendation System Using Collaborative Filtering," *2018 IEEE 9th International Conference on Software Engineering and Service Science (ICSESS)*, Beijing, China, 2018, pp. 11-15.

[6] Zhang, Yin, Wang, Yibo, Wang, Mingming, Xu, Wei, "A Sentiment-Enhanced Hybrid Recommender System for Movie Recommendation: A Big Data Analytics Framework" Hindawi Wireless Communications and Mobile Computing, pp.1-9, 2018.