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Movie Recommendation System using Machine Learning

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Abstract: *Movies are very significant in our lives. It is one of the many forms of entertainment that we encounter in our daily lives. It is up to the individual to decide whatever type of film they choose to see, whether it is a comedy, romantic film, action film, or adventure film. However, the issue is locating acceptable content, as there is a large amount of information created each year. As a result, finding our favourite film is really difficult. The goal of this research is to improve the regular filtering technique's performance and accuracy. A recommendation system can be implemented using a variety of approaches. Content-based filtering and collaborative filtering strategies are employed in this work. The content-based filtering approach analyses the user's history/past behaviour and recommends a list of comparable movies depending on their input. K-NN algorithms and collaborative filtering are also employed in this paper to improve the accuracy of the results. Cosine similarity is utilised in this work to quickly discover comparable information. The correctness of the cosine angle is measured by cosine similarity. People may quickly find their favourite movie content thanks to all of this.*

Keywords: *Movie recommender system, content-based filtering, collaborative filtering, cosine similarity, KNN algorithms, Hybrid recommendation system, SVD Algorithm.*

I. INTRODUCTION

Recommendation systems are a type of information filtering method that aims to predict the preferences of the user. These techniques are now extensively employed in a variety of fields, including movies, literature, music, cuisine, videos, and locations. The term "movie recommendation" is used in this study. Every year, a variety of films of various genres are released. Horror, action, animation, and adventure films, among others. As a result, individuals are having difficulties finding their favourite film material in these vast stores of film content. As a result, the Movie Recommendation System enables us to quickly find our favourite movies while also saving time. People used to go to a real store to shop. In which the number of goods available is limited. The amount of movies that may be displayed in a shop, for example, is limited. People nowadays, however, have access to a wealth of information via the internet. However, as time goes on, information becomes more readily available. As a result, a new issue developed. The issue is that more time is wasted trying to figure out what people's favourite movie is. This is where the system of recommendations comes into play. Recommendation systems can be implemented in a variety of ways. Content-based, hybrid recommendation system with collaborative filtering. In the collaborative technique, a vast quantity of data about user behaviours, preferences, and predictions of what users would enjoy based on their resemblance to other users has been collected and analysed. Users' information is used as an input in the Content-based approach to locate related movies.

The purpose of this article is to develop a Movie Recommendation System that analyses past movie ratings assigned by various users in order to make recommendations to the user.

II. LITERATURE REVIEW

Many recommendation systems have been made over the years. Authors developed and implemented these systems using various big data and machine algorithms.

- 1) *Movie Recommender System Using Collaborative Filtering, Proceedings of the International Conference on Electronics and Sustainable Communication Systems (ICESC 2020):* Authors developed movie recommendation system using collaborative filtering. K-NN algorithms is used to enhance the accuracy of results, at the same time removing the drawbacks of the content-based filtering. Authors also compared the existing systems to show that the system is more accurate and reliable.
- 2) *Movie Recommender System Based on Percentage of View, 5th Conference on Knowledge-Based Engineering and Innovation, Iran University of Science and Technology, Tehran, Iran:* A percentage of view approach is used to recommend movies to the users. The approach is used in a recommendation system for a media service provider named Namava. An Implicit Opinion Measure (IOM) improves performance of system on implicit feedback. Proposed system is works 5 times better than a random recommendation

- 3) *Movie Recommendation System Using Collaborative Filtering*, 2018 IEEE 9th International Conference on Software Engineering and Service Science (ICSESS): Apache mahout is used to implement the movie recommendation system. The system takes into consideration the ratings given to the movies and provides movie suggestions. Further Research indicates that hybrid systems are more effective and provide more accurate results. Apache Prediction 10 is a Machine Learning Server that uses Elastic Search and Apache Hbase
- 4) *A Content-based Movie Recommender System based on Temporal User Preferences*, 2017 3rd Iranian Conference on Signal Processing and Intelligent Systems (ICSPIS): A content based movie recommendation system is developed. Authors used a temporal preference model of the user to recommend movies. The method is then evaluated using Movie Lens dataset.
- 5) *An Improved Approach for Movie Recommendation System*, International conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC 2017): Author combined the content based filtering and collaborative filtering to improve the quality of the movie recommendation system. Author used support vector machine as a classifier. Author proposed hybrid approach and also compared the results with the existing pure approaches.

III.SYSTEM ARCHITECTURE

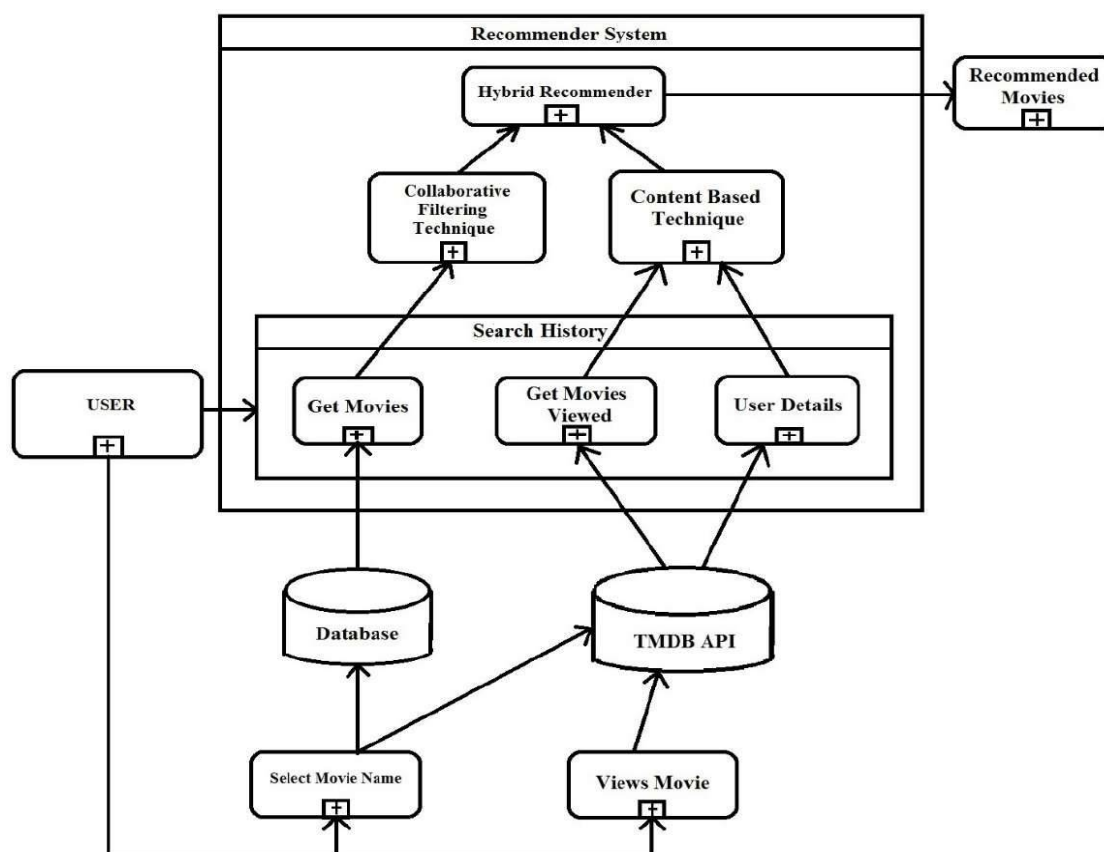


Figure 1: System Architecture

The movie suggestion mechanism is depicted in the diagram above. This system allows users to log in and view the many movies in the database. Additionally, the user may store his or her favourite movie genres to receive more tailored movie material. Several machine learning algorithms and approaches, such as Collaborative Filtering and Content-Based Filtering, are used to process the user's preferences in order to provide more tailored suggestions. The user may also examine movie data such as the cast, ratings, and reviews. In the collaborative technique, a huge quantity of data about user behaviours, preferences, and anticipating what users would enjoy based on their resemblance to other users has been collected and analysed. Users' information is used as an input in the Content-based approach to locate related movies. Because we are utilising the MovieLens dataset of 25 million ratings given to 62,000 movies by 162,000 viewers, the Singular Value Decomposition (SVD) algorithms provide more accurate findings. To generate comparable recommendations, the KNN collaborative approach with Cosine similarity is also used.

IV.IMPLEMENTATION

- 1) Importing the Libraries for Preprocessing of data : To analyze the data we need to import the libraries like pandas, matplotlib, etc.

```
In [1]: import pandas as pd
import numpy as np
```

```
In [2]: data = pd.read_csv('movie_metadata.csv')
```

```
In [3]: data.head(10)
```

Out[3]:

	color	director_name	num_critic_for_reviews	duration	director_facebook_likes	actor_3_facebook_likes	actor_2_name	actor_1_facebook_likes	gross
0	Color	James Cameron	723.0	178.0	0.0	855.0	Joel David Moore	1000.0	760505847.0
1	Color	Gore Verbinski	302.0	169.0	563.0	1000.0	Orlando Bloom	40000.0	309404152.0
2	Color	Sam Mendes	602.0	148.0	0.0	161.0	Rory Kinnear	11000.0	200074175.0
3	Color	Christopher Nolan	813.0	164.0	22000.0	23000.0	Christian Bale	27000.0	448130642.0
4	NaN	Doug Walker	NaN	NaN	131.0	NaN	Rob Walker	131.0	NaN
5	Color	Andrew Stanton	462.0	132.0	475.0	530.0	Samantha Morton	640.0	73058679.0
6	Color	Sam Raimi	392.0	156.0	0.0	4000.0	James Franco	24000.0	336530303.0
7	Color	Nathan Greno	324.0	100.0	15.0	284.0	Donna Murphy	799.0	200807262.0
8	Color	Joss Whedon	635.0	141.0	0.0	19000.0	Robert Downey Jr.	26000.0	458991599.0
9	Color	David Yates	375.0	153.0	282.0	10000.0	Daniel Radcliffe	25000.0	301956980.0

10 rows x 28 columns

- 2) After Analyzing the data we need to apply some preprocessing methods to extract some useful information.

```
In [41]: final_df
```

Out[41]:

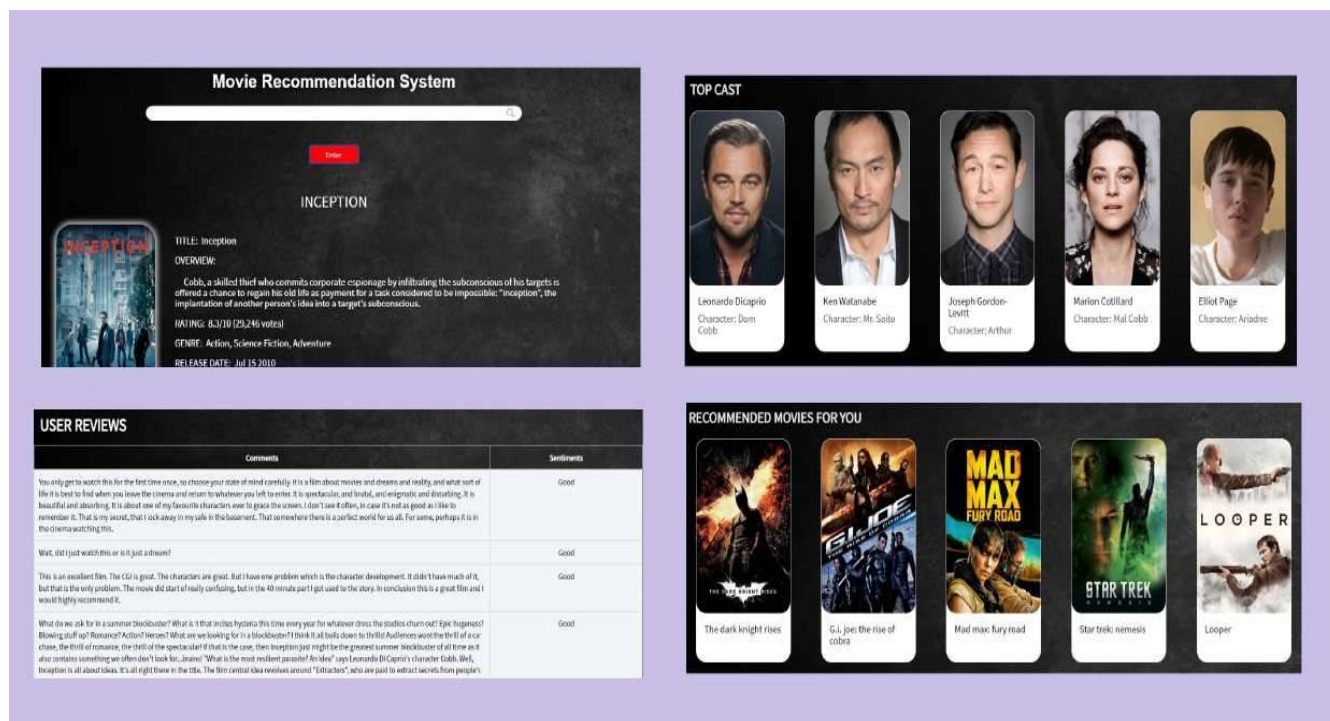
	director_name	actor_1_name	actor_2_name	actor_3_name	genres	movie_title	comb
0	James Cameron	CCH Pounder	Joel David Moore	Wes Studi	Action Adventure Fantasy Sci-Fi	avatar	CCH Pounder Joel David Moore Wes Studi James C...
1	Gore Verbinski	Johnny Depp	Orlando Bloom	Jack Davenport	Action Adventure Fantasy	pirates of the caribbean: at world's end	Johnny Depp Orlando Bloom Jack Davenport Gore ...
2	Sam Mendes	Christoph Waltz	Rory Kinnear	Stephanie Sigman	Action Adventure Thriller	spectre	Christoph Waltz Rory Kinnear Stephanie Sigman ...
3	Christopher Nolan	Tom Hardy	Christian Bale	Joseph Gordon-Levitt	Action Thriller	the dark knight rises	Tom Hardy Christian Bale Joseph Gordon-Levitt ...
4	Doug Walker	Doug Walker	Rob Walker	unknown	Documentary	star wars: episode vii - the force awakens ...	Doug Walker Rob Walker unknown Doug Walker Doc...
...
6005	Joseph Kosinski	Tom Cruise	Miles Teller	Jennifer Connelly	Action Drama	top gun: maverick	Tom Cruise Miles Teller Jennifer Connelly Jose...
6006	Joel Crawford	Nicolas Cage	Emma Stone	Ryan Reynolds	Animation Adventure Family	the croods 2	Nicolas Cage Emma Stone Ryan Reynolds Joel Cra...
6007	Liesl Tommy	Jennifer Hudson	Forest Whitaker	Marlon Wayans	Music Drama	respect	Jennifer Hudson Forest Whitaker Marlon Wayans ...
6008	Ridley Scott	Matt Damon	Adam Driver	Jodie Comer	Drama	the last duel	Matt Damon Adam Driver Jodie Comer Ridley Scot...
6009	Paul Greengrass	Tom Hanks	Helena Zengel	Neil Sandilands	Drama Western	news of the world	Tom Hanks Helena Zengel Neil Sandilands Paul G...

6010 rows x 7 columns

- 3) After completing the preprocessing steps we get the final data set. After getting the final dataset we feed this data to the different machine learning algorithms.
- 4) Flask framework is used to embed the machine learning with the web interact with the system.

Flask is a Python-based microweb framework. It is referred to as a microframework since it does not necessitate the usage of any specific tools or libraries. It doesn't have a database abstraction layer, form validation, or any other components that rely on third-party libraries to do basic tasks. Extensions, on the other hand, may be used to add application functionality as if they were built into Flask itself. Object-relational mappers, form validation, upload handling, several open authentication methods, and numerous framework-related utilities all have extensions.

V. RESULT ANALYSIS



The screenshot displays a web application titled "Movie Recommendation System". The main content area shows details for the movie "Inception":

- TITLE:** Inception
- OVERVIEW:** Cobb, a skilled thief who commits corporate espionage by infiltrating the subconscious of his targets is offered a chance to regain his old life as payment for a task considered to be impossible: "inception", the implantation of another person's idea into a target's subconscious.
- RATING:** 8.3/10 (29,246 votes)
- GENRE:** Action, Science Fiction, Adventure
- RELEASE DATE:** Jul 15 2010

Below the movie details is a "USER REVIEWS" section with a table of comments and sentiments:

Comments	Sentiments
You only get to watch this for the first time once, so choose your state of mind carefully. It is a film about movies and dreams and reality, and what sort of life it is best to find when you leave the cinema and return to whatever you left to enter. It is spectacular, and brutal, and enigmatic and disturbing. It is beautiful and absorbing. It is about one of my favorite characters ever to grace the screen. I don't see it often, in case it's not as good as I like to remember it. That is my secret, that I lock away in my safe in the basement. That is how there is a perfect world for us all. For some, perhaps it is in the cinema watching this.	Good
Wait, did I just watch this or is it just a dream?	Good
This is an excellent film. The CG is great. The characters are great. But I have one problem with it: the character development. It didn't have much of it, but that is the only problem. The movie did start off really confusing, but in the 40 minute part I got used to the story. In conclusion this is a great film and I would highly recommend it.	Good
What do we ask for in a summer blockbuster? What is it that makes this time every year for whatever cross the studios churn out? Epic fugues? Blowing stuff up? Romance? Action? Heavens? What are we looking for in a blockbuster? I think it all boils down to thrill! Audiences want the thrill of a car chase, the thrill of romance, the thrill of the spectacle! If that is the case, then Inception just might be the greatest summer blockbuster of all time as it also contains something we often don't look for...justice! What is the most modern parallel to the idea? says Leonardo DiCaprio's character Cobb. Well, Inception is all about ideas. It's all right there in the title. The film central idea revolves around "Inception", who are paid to extract secrets from people's	Good

On the right side, there is a "TOP CAST" section showing five actors with their character names:

- Leonardo DiCaprio (Character: Dom Cobb)
- Ken Watanabe (Character: Mr. Saito)
- Joseph Gordon-Levitt (Character: Arthur)
- Marion Cotillard (Character: Mal Cobb)
- Eliott Page (Character: Ariadne)

Below the top cast, there is a "RECOMMENDED MOVIES FOR YOU" section showing five movie posters:

- The dark knight rises
- G.I. Joe: the rise of Cobra
- Mad max: fury road
- Star trek: nemesis
- Looper

VI. CONCLUSION

The approaches of Collaborative Filtering and Content-Based Filtering are integrated in this article, resulting in a hybrid system that minimizes the error of discovering excellent suggestions. Because the system is given a dataset of 25 million ratings applied to 62,000 movies by 162,000 people, the KNN collaborative technique utilizing Cosine similarity produces comparable findings, while SVD produces more accurate results. These approaches improve the system's accuracy and efficiency. More features might be added in the future to improve the accuracy of the system. Additionally, a variety of alternative algorithms may be used to improve the recommendation system.

VII. ACKNOWLEDGMENT

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