

Personalized Tourism Recommender using Hybrid Filtering

Harshal Vikhe¹, Krushna Sudke², Atul Waghmode³, Aditya Vile⁴, Abhishek Randhe⁵,

Prof. A. A. Pund⁶

Students, Department of Information Technology Engineering, Dr. Vithalrao Vikhe Patil College of Engineering,
Ahilyanagar, Savitribai Phule Pune University, Pune, Maharashtra, India^{1,2,3,4,5}

Professor, Department of Information Technology Engineering, Dr. Vithalrao Vikhe Patil College of Engineering,
Ahilyanagar, Savitribai Phule Pune University, Pune, Maharashtra, India⁶

ABSTRACT: Today's global economy depends heavily on tourism, yet travelers frequently struggle to select appropriate locations, lodging options, and services because of the deluge of information and shaky evaluations. Conventional recommendation systems may not always produce precise or tailored recommendations because they primarily rely on user ratings or demographic data. This research suggests a Smart Tourism Recommender System that uses a hybrid model that combines several filtering techniques to improve suggestion quality in order to overcome these restrictions. The system offers dependable and personalized recommendations based on user preferences by combining User-Based Collaborative Filtering (UBCF), Demographic Filtering (DF), Aspect-Based Sentiment Analysis (ABSA), and Content-Boosted Collaborative Filtering (CBCF). The system is a web application built on Java that gathers and examines historical information on tourists, such as products, users, reviews, and ratings. Whereas the DF module takes demographic variables like age, location, or interests into account, the UBCF module looks for patterns in user behavior. By examining opinions regarding particular elements, such as lodging, cuisine, or services, ABSA is able to glean valuable data from user feedback. Lastly, by improving collaborative filtering using content data, CBCF fortifies the recommendation and guarantees higher accuracy. This combination guarantees sentiment-aware and data-driven recommendations, making the system more comprehensive and reliable. The project's overall goal is to develop a customized, effective, and scalable travel recommendation system that lessens the impact of information overload and assists travelers in making more informed choices. It can be used practically to enhance consumer satisfaction and experience in travel agencies, booking platforms, and tourist service providers. Because of the hybrid framework's flexibility, the system can manage expanding datasets and changing user preferences in the travel industry.

KEYWORDS: Smart Tourism, Hybrid Recommender System, User-Based Collaborative Filtering (UBCF), Demographic Filtering (DF), Aspect-Based Sentiment Analysis (ABSA), Content-Boosted Collaborative Filtering (CBCF), Java Web Application, Personalized Recommendations, etc.

I. INTRODUCTION

With more and more tourists seeking individualized experiences, the tourism industry has grown to be one of the most popular in recent years. However, it can be challenging for consumers to select the best options depending on their interests when there are so many tourist locations, historical sites, temples, and picnic areas available online. Recommender systems are crucial in addressing this problem by recommending appropriate locations that align with the user's interests.

The goal of this project, "Smart Tourism Recommender System Modelling Based on Hybrid Technique and Content Boosted Collaborative Filtering," is to create a web application that uses Java and analyzes ratings, reviews, and historical data to suggest tourism destinations. To provide users with more precise and tailored recommendations, the system integrates several methods, including User-Based Collaborative Filtering (UBCF), Demographic Filtering (DF), Aspect-Based Sentiment Analysis (ABSA), and Content-Boosted Collaborative Filtering (CBCF).

The suggested system offers enhanced accuracy, a deeper comprehension of user preferences, and dynamic recommendations based on actual user feedback by combining these models. This hybrid strategy makes sure that the suggestions take user demographics and written evaluations into account in addition to numerical ratings.

Conventional tourism recommendation systems mostly rely on user ratings or straightforward collaborative filtering techniques, which frequently result in wrong suggestions, a lack of personalization, and cold-start issues. Travellers today need sophisticated platforms that comprehend their choices, evaluate reviewers' sentiments, and suggest destinations based on their travel history, age group, or personality.

The goal of this study is to get beyond these restrictions by employing a hybrid recommendation model that incorporates information from several sources, including user profiles, evaluations, and trip records. While Content-Boosted Collaborative Filtering (CBCF) enhances the recommendation process by fusing content information with collaborative filtering results, Aspect-Based Sentiment Analysis (ABSA) is included to assist the system in interpreting the emotional tone of user comments.

The goal of this project is to give people more reliable and significant travel recommendations. In addition to assisting travellers in discovering new places, it also helps travel agencies market lesser-known sites.

II. PROBLEM STATEMENT

Tourists often face difficulty in choosing the best destinations or services due to the large volume of options and scattered reviews. Current recommendation systems mostly rely on single techniques, which may lead to less accurate suggestions. There is no combined approach that uses multiple filtering and sentiment analysis for personalized travel recommendations. This project aims to solve this problem by creating a hybrid tourism recommender system for better and more reliable suggestions.

III. SYSTEM OVERVIEW

A Java-based web program called the **Smart Tourism Recommender System** was created to assist travelers in locating appropriate trip locations by taking into account their preferences, interests, and other users' prior experiences. Historical tourism data, including locations visited, user ratings, reviews, and comments, is used by the system. The technology makes tailored recommendations based on user behavior and preferences rather than making random ones.

By merging several methods, including User-Based Collaborative Filtering, Demographic Filtering, Aspect-Based Sentiment Analysis, and Content-Boosted Collaborative Filtering, this system employs a **hybrid recommendation strategy**. The system increases suggestion accuracy and gets over the drawbacks of single-method recommender systems by combining these techniques.

The software is helpful for suggesting tourist attractions like as temples, historical sites, picnic areas, and well-known locations. By providing insightful recommendations based on user similarities and content relevancy, it assists users in making more efficient travel plans.

System Overview – Key Points

- Java-based web application for tourism recommendations
- Uses historical user data, ratings, and reviews
- Hybrid recommendation model improves accuracy
- Provides personalized travel suggestions
- Suitable for multiple tourist categories

A. System Architecture: -

This project's primary objective is to create an intelligent and clever tourism recommendation system that makes recommendations for tourist destinations based on user preferences and historical behavior. Conventional travel websites frequently offer general recommendations that might not suit personal tastes. The goal of this project is to apply data-driven methods to solve that issue.

Tourist profiles, places visited, ratings, reviews, and demographic information are among the data that the system gathers and examines. To learn what users think about particular factors such as cleanliness, crowds, food, safety, and overall experience, **Aspect-Based Sentiment Analysis (ABSA)** is utilized. These feelings enhance the caliber of recommendations.

The method improves collaborative recommendations with content information such place type, location, and features by incorporating **Content-Boosted Collaborative Filtering**. Even with insufficient user data, this increases the system's dependability.

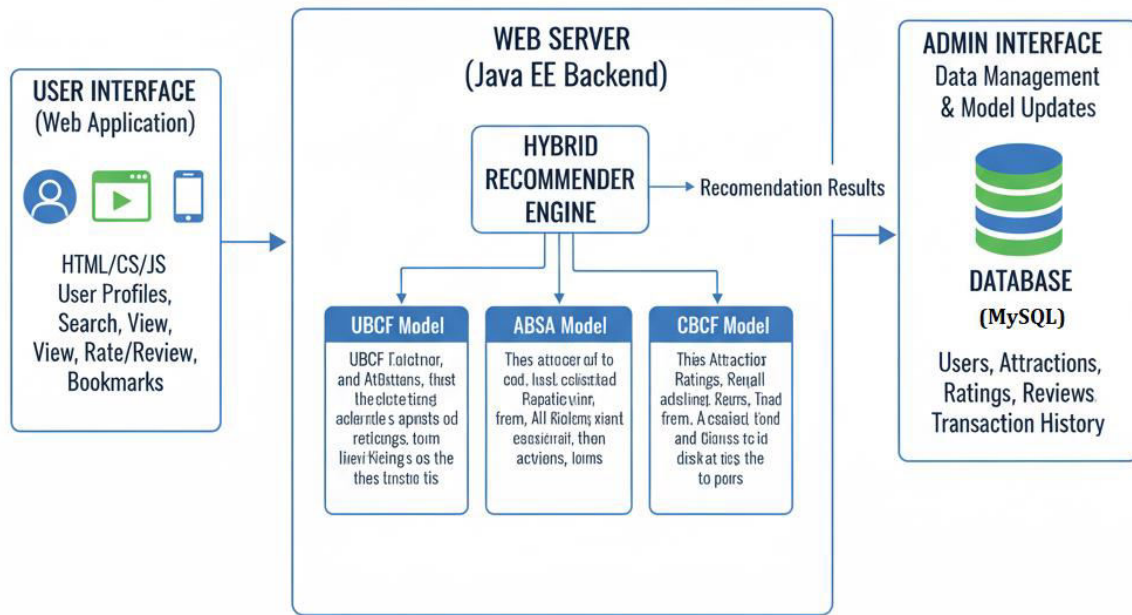


Fig.1: System Architecture Design

Project Description – Key Points

- Focuses on personalized tourism recommendations
- Uses reviews, ratings, and user history
- Applies sentiment analysis for better understanding
- Hybrid model handles cold-start problems
- Improves user satisfaction and travel planning

IV. SYSTEM IMPLEMENTATION

A layered design is used to create the system as a Java web application. A database contains user information, information about tourist destinations, ratings, and reviews. The system uses a hybrid model to process past interactions and provide recommendations when a user signs in.

By identifying people with similar tastes, the **User-Based Collaborative Filtering (UBCF)** system suggests locations that comparable users enjoy. **Demographic Filtering (DF)** divides people into groups according on their interests, location, and age. In order to get sentiment scores for various elements of tourist destinations, **Aspect-Based Sentiment Analysis (ABSA)** examines reviews. Lastly, to improve recommendations, **Content-Boosted Collaborative Filtering (CBCF)** blends content similarity with collaborative scoring.

Mathematical Representation:

1. User Similarity (UBCF):

$$Sim(u, v) = \frac{\sum(R_{u,i} \times R_{v,i})}{\sqrt{\sum R_{u,i}^2} \times \sqrt{\sum R_{v,i}^2}}$$

2. Predicted Rating:

$$\hat{R}_{u,p} = \bar{R}_u + \frac{\sum Sim(u, v)(R_{v,p} - \bar{R}_v)}{\sum |Sim(u, v)|}$$

3. Sentiment Score (ABSA):

$$Sentiment_{score} = \frac{Positive - Negative}{Total\ Reviews}$$

4. Hybrid Recommendation Score:

$$FinalScore = \alpha \times CF + \beta \times Content + \gamma \times Sentiment$$

Where $\alpha + \beta + \gamma = 1$

IV. RESULT ANALYSIS

This section explains the performance of the Smart Tourism Recommender System. The system uses a hybrid approach by combining different techniques like UBCF, DF, ABSA, and CBCF. These techniques help in giving better and more accurate recommendations to users based on their preferences, ratings, and reviews. The hybrid model performs better than individual techniques because it uses multiple methods together.

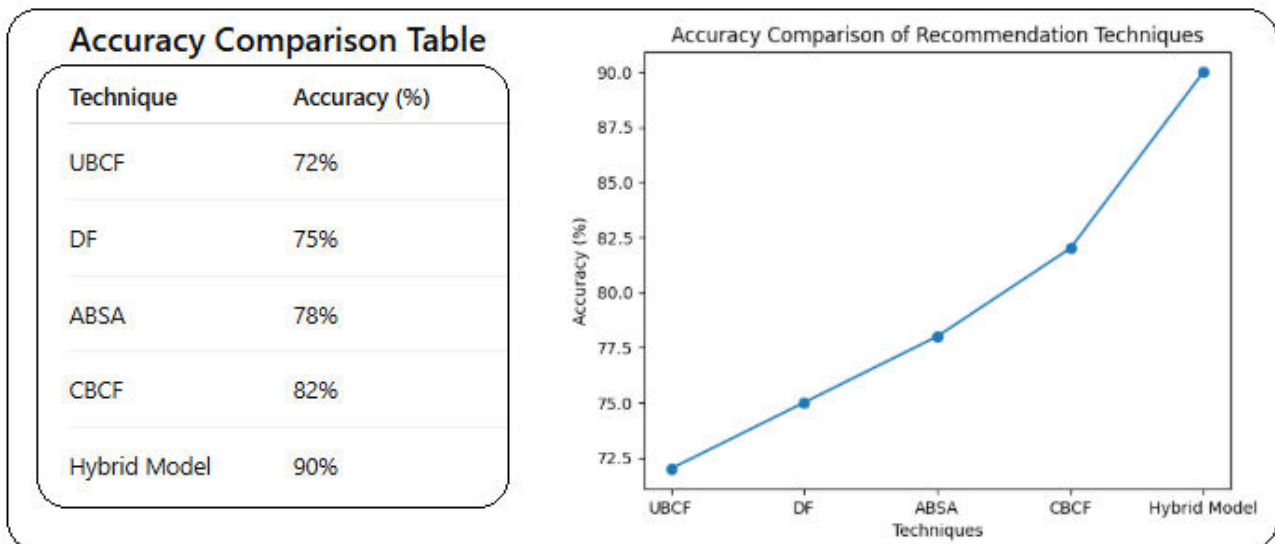


Fig.2: Result Analysis

Analysis:

- UBCF gives recommendations based on similar users.
- DF improves results using user information like age, location, etc.
- ABSA analyzes user reviews and understands opinions better.
- CBCF uses content features to improve recommendations.
- The Hybrid Model gives the best result because it combines all methods.

The graph clearly shows that:

- Accuracy increases step by step from UBCF to CBCF
- The Hybrid Model gives the highest accuracy (90%)
- This proves that combining multiple techniques improves performance

V. CONCLUSION AND FUTURE SCOPE

The Smart Tourism Recommender System was created to make it simple for consumers to find appropriate tourism attractions, like historical sites, temples, and picnic areas. The system offers precise, tailored, and varied travel suggestions by integrating several recommendation methods, including User-Based Collaborative Filtering (UBCF), Demographic Filtering (DF), Aspect-Based Sentiment Analysis (ABSA), and Content-Boosted Collaborative Filtering (CBCF).

To produce useful results, the hybrid model uses both textual information, such as reviews, and numerical data, such as user ratings. By using sentiment analysis, the system is also able to comprehend the user's thoughts and feelings regarding various locations, which aids in making more intelligent recommendations. The online application built using Java turned out to be responsive, easy to use, and effective at producing fast results. All things considered, this initiative effectively illustrates how data-driven methods and artificial intelligence may improve travelers' experiences.

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