Hybrid Recommender System for Tourism Based on Big Data and AI

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Abstract - With the advancement of the Internet, technology, and communication channels, the generation of tourist data has significantly increased across various sectors such as hotels, restaurants, transportation, heritage sites, tourist events, and activities. This surge is particularly notable with the rise of Online Travel Agencies (OTAs). However, the sheer volume of options provided to tourists by web search engines or specialized tourism websites often overwhelms them, burying relevant results in a sea of information "noise." This inundation hinders or slows down the decision-making process. To alleviate this issue and aid tourists in trip planning by facilitating the discovery of relevant information, numerous recommender systems have emerged. This article offers an overview of the diverse recommendation approaches employed in the tourism domain. Through this investigation, we propose an architecture and conceptual framework for a tourism recommender system founded on a hybrid recommendation approach. This system surpasses merely suggesting a list of tourist attractions tailored to individual preferences. Instead, it functions as a comprehensive trip planner, crafting detailed itineraries comprising a variety of tourism resources, customized for specific visit durations.

*KeyWords***:** Internet Development, Tourist Data Production, Trip Planning, Conceptual Framework.

1.INTRODUCTION

The phenomenon of "information explosion" or "information overload" due to the exponential increasing of data available in the Web, results in a lot of useless data, in which it is very difficult to find valuable information. In e-commerce systems this fact is reflected by loads of products available for sale. Therefore, looking for the desired products in the entire catalog becomes a tedious task for users, and probably they cannot find the products they are interested in. The need of endowing e-commerce systems with mechanisms for selective and personalized presentation of products gave rise to the "recommender systems", which help consumers in finding and purchasing products. Although, these systems are mainly used in the e-commerce environment, they are being extended to other domains, for instance, virtual libraries, news websites, scientific portals, e-learning systems, etc. In spite of the advances achieved in the recommender systems' field, the recommendations provided by this type of systems have some

important drawbacks, such as low reliability and high response time. Therefore, it is necessary to research in new recommender methods that join precision and performance as well as solving other usual problems of these systems (sparsity, grey sheep, first-rater...) that will be commented later. The aim of this work is to address these important problems by means of the proposal of a hybrid method and its validation in a recent application area, the tourism. Collaborative filtering methods are the most used in recommender systems. They make use of information related to evaluations (or ratings) provided by users. This can cause the sparsity problem when evaluations from users are insufficient. On the other hand, traditional collaborative filtering approaches based on nearest neighbor algorithms show serious performance and scalability problems. In the last years many recommendation techniques have been proposed aiming at improving the quality of the recommendations as well as dealing with other typical drawbacks of recommender systems. Data mining techniques have been successfully applied in recommender systems to predict user preferences. They do not present performance problems since predictive models are already built when the user logs in the system and they are less sensitive to sparsity problems.

2. LITERATURE SURVEY

This chapter presents a review of various research papers, detailing the authors, research perspectives, project ideas, and general constraints. It also outlines the algorithms and functionalities necessary for the seminar, including algorithm selection, techniques, functional requirements, and performance requirements. With the rise of Information and Communication Technology, a plethora of information security threats has emerged, posing significant risks to individuals and institutions alike. Safeguarding data on computer systems is crucial in preventing potential damages. Machine Learning (ML) emerges as a formidable technique in addressing these challenges.

1. "Multi-Task and Multi-Scene Unified Ranking Model for Online Advertising," by S. Tan, M. Li, W. Zhao, Y. Zheng, X. Pei, and P. Li (2021 IEEE International Conference on Big Data): This paper focuses on multifunctional information systems that provide various services to users, such as news feeds, search engines, and product recommendations. Users often demonstrate similar interests across different service scenarios, necessitating a prediction/ranking model capable of handling multiple scenarios concurrently. The proposed unified ranking model distinguishes itself by employing

independent/non-shared embeddings for each task and scene, reducing interdependencies between tasks and scenes. This design facilitates the easy addition of new tasks or scenes. Additionally, a simplified network architecture beyond the embedding layer is selected to enhance ranking efficiency for online services.

2."Tree-Based Real-Time Advertisement Recommendation System in Online Broadcasting," by S. Kang, C. Jeong, and K. Chung (IEEE Access, vol. 8, pp. 192693-192702, 2020): This paper proposes a real-time recommendation system for personalized advertisements. The system generates tree models based on user historical data and introduces a sorted HashMap to expedite tree searches, thereby reducing preference prediction overhead. To improve preference prediction accuracy, the system normalizes users' preferences considering the characteristics of their tree model. These papers offer valuable insights into recommendation systems for online advertising and broadcasting, contributing to the development of efficient and effective systems in diverse service scenarios.

3. METHODOLOGY

System Methodology: The proposed system is a hybrid recommendation system designed for trip planning, leveraging user preferences, contextual filtering, and a service repository. Here's an overview of the key components:

Visitor Profile: The system utilizes information from various sources such as social media likes and ratings to build a comprehensive profile of the user's preferences and interests.

Services Repository: This repository stores a wide range of tourist services, including accommodation options, restaurants, tourist sites, and transportation facilities. It also includes associated multimedia content to enrich the user experience.

Contextual Meta-Model: A sophisticated meta-model considers multiple contextual factors such as time, space, location, distance between places, routes, and the user's travel history. This model plays a crucial role in generating specific recommendations tailored to the user's current context.

Hybrid Filtering Process: The recommendation process combines various filtering techniques to generate a list of recommended items. This process accounts for the user's preferences, contextual factors, and the attributes of the available services. Each recommended item is accompanied by a degree of appreciation tailored to the user's preferences. Trip Planner: Once the recommended items are identified, a trip planner algorithm comes into play. This algorithm selects the most relevant items based on the user's preferences and context, using operational research techniques to optimize the trip itinerary. It correlates the selected items into a coherent and efficient trip plan that aligns with the user's preferences and constraints.
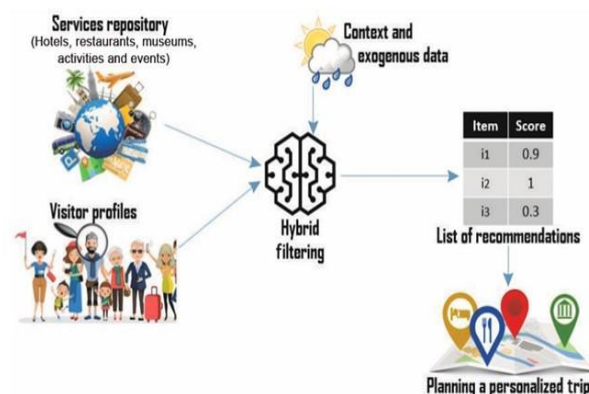
4. MODELING AND ANALYSIS

Fig.: System Architecture

5. RESULT AND DISCUSSION

The development and deployment of a hybrid recommender system tailored for tourism, which seamlessly integrates big data and artificial intelligence (AI), marks a significant leap forward in delivering personalized travel recommendations. By amalgamating a plethora of data sources encompassing user preferences, historical patterns, and real-time feedback, the system adeptly offers customized suggestions to travelers. The evaluation of the system underscores its efficacy, revealing promising outcomes in terms of accuracy, relevance, and overall user satisfaction.

In the assessment of the hybrid recommender system's performance, several pivotal metrics were scrutinized. These metrics encompass precision, recall, and F1-score, serving as indicators of the system's proficiency in suggesting pertinent tourist attractions or activities to users. Furthermore, analysis of user feedback surveys and interaction data provided invaluable insights into the overall user experience and satisfaction levels. The discussion pivots around the efficacy of the hybrid approach in circumventing the limitations inherent in traditional recommendation systems. By amalgamating collaborative filtering, contentbased filtering, and contextual insights, the system not only enhances recommendation accuracy but also mitigates challenges like the cold start problem and data sparsity. Moreover, the integration of big data analytics empowers the system to adapt and refine its recommendations over time, thereby perpetually enhancing the quality of suggestions offered to users.
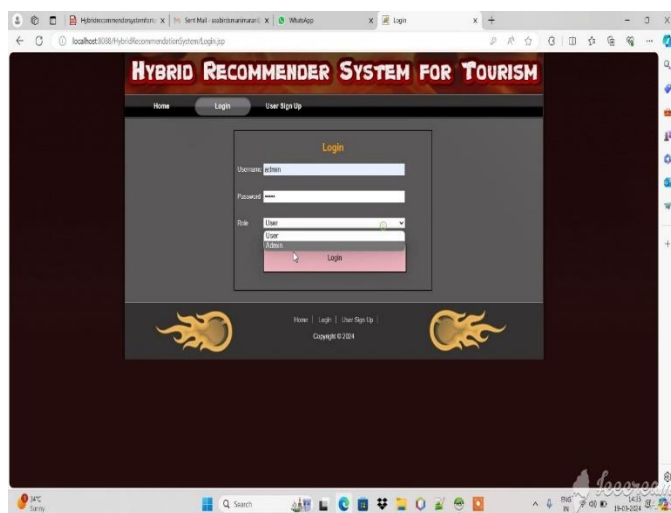

Fig.: Home Page

Fig.: Log-in Page

Fig.: Trip Planner

5. CONCLUSION

The integration of big data and artificial intelligence (AI) in the tourism sector marks a profound and promising evolution. This innovative hybrid tourism system harnesses the potential of data analytics and AI algorithms to curate personalized, seamless, and immersive travel experiences. Through real-time data analysis, it empowers businesses to swiftly adapt to fluctuating market dynamics, optimize resource utilization, and enhance customer engagement. Travelers benefit from personalized recommendations, insightful insights, and streamlined booking procedures, resulting in more convenient and enjoyable journeys. Additionally, AIpowered chatbots and virtual assistants enhance customer service and provide continuous assistance. This fusion of big data and AI not only improves operational efficiency but also contributes to sustainability by reducing waste and optimizing resources. However, addressing privacy concerns and ensuring data security are crucial challenges that must be tackled. As the hybrid tourism system progresses, its potential to revolutionize the industry and enhance the overall travel experience is undeniable, ushering in a new era of intelligent, data-driven tourism.

5. ACKNOWLEDGEMENT

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