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# A Survey of Personalized Recommendation Systems for Enhancing Student's Campus Experience

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Abstract - Students embarking on their college journey encounter an array of challenges as they step onto campus. Lack of adequate information is one of the biggest issues for new students on a campus. The basic necessities such as accommodation and food establishments are essential for students to focus on their academics. Although there are various platforms that provide these services, there are very few platforms that cater to the specific needs of students. The need for personalized discovery platforms is vital for betterment of the students' campus experience. Use of machine learning techniques solve the need for personalized recommendation. By analyzing students' profiles, preferences, and behaviors, these systems can offer tailored roommate matches, recommend suitable on-campus accommodation, and provide personalized dining options. This paper explores existing platforms designed for students and various methods to enhance the students' campus experience.

Key Words: Machine Learning, Recommendation Systems, Campus Platform, Personalization, Deep Learning, Social Platform

## 1.INTRODUCTION

Machine learning is revolutionizing personalization by analyzing user data to create tailored recommendations and experiences, shaping the future of individualized content and services. Machine learning's emergence in personalization is driven by its ability to process vast amounts of data, enabling companies to understand user preferences, behavior, and interests more accurately [1].

Machine learning-based recommendation systems are revolutionizing the way students navigate their campus experiences. These sophisticated algorithms are tailored to address the unique needs of students, offering personalized solutions across various aspects of college life. Whether it's matching roommates, recommending suitable on-campus accommodation, or suggesting dining options, these systems utilize data analysis and user behaviour patterns to make tailored suggestions. For instance, in roommate matching, machine learning assesses students' preferences and habits to create harmonious living environments [2]. In the realm of accommodation, it analyses individual profiles and budget constraints to recommend suitable housing options [3]. These systems not only streamline decision-making processes but also contribute to a more enriching and efficient campus life, fostering an environment in which students can focus on their academic journey while enjoying a more satisfying and personalized university experience

### 1.1 Roommate Recommendation

The implementation of a machine learning-based recommendation system for the purpose of matching roommates on a campus constitutes a significant advancement in the realm of student housing. These systems incorporate recommendation algorithms like collaborative filtering and content-based filtering, to provide a nuanced approach aimed at ensuring that students are paired with compatible roommates. Collaborative filtering assesses students' preferences and behaviours while also drawing insights from the experiences of their peers to suggest suitable roommate matches. Conversely, content-based filtering analyses the individual profiles of students, taking into account their habits, preferences, and lifestyle choices to make personalized recommendations. By integrating these algorithms, the system optimizes the roommate matching process, ultimately fostering more harmonious living environments and promoting positive social interactions. It streamlines the procedure for students, affording them a greater likelihood of identifying the ideal roommate with whom they can share their academic journey, thereby enhancing the campus experience [4].

1.2 Accommodation Rental Recommendation

A content-based recommendation system for campus accommodation rentals is a useful solution that assists students in finding the ideal living space that matches their unique preferences and requirements. This system evaluates a student's profile, including their housing preferences, budget constraints, and lifestyle choices. By analyzing these specific attributes, the recommendation system generates personalized accommodation suggestions. For example, it might consider whether a student prefers a quiet environment, proximity to campus facilities, or specific amenities like a kitchen or a private bathroom. This content-based approach streamlines the housing search process by presenting students with options that closely align with their individual needs, contributing to a more satisfying and efficient campus living experience. It empowers students to make well-informed housing decisions, ensuring that they secure a living space that complements their academic journey and personal lifestyle [5].

1.3 Food Establishments Recommendation

A collaborative filtering-based recommendation system for food establishments is a powerful tool designed to provide personalized dining suggestions to users. This system relies on the collective preferences and behaviors of a community of users to make informed recommendations. It evaluates the past dining choices and ratings of users with similar tastes and dining histories to offer tailored restaurant or food outlet suggestions [6]. This collaborative approach enhances the dining experience by presenting users with options that align with their individual preferences, thereby increasing the likelihood of discovering new and enjoyable culinary experiences. It not only simplifies the decision-making process but also encourages exploration of diverse dining venues, making it a valuable tool for food enthusiasts seeking to expand their culinary horizons [7].

A student-based campus platform for resource and service discovery is a valuable tool that can help students find the resources and services they need to succeed. This can include academic resources, such as libraries, tutoring centers, and research labs; student life resources, such as clubs, organizations, and athletic teams; and support services, such as counseling, financial aid, and health care [15]. There are a number of benefits to having a student-based campus platform for resource and service discovery. It can help students save time and effort. Instead of having to search for resources and services on their own, students can use the platform to find the information they need in one place. The platform can help students discover resources and services that they may not be aware of. By providing a centralized view of all campus resources and services, the platform can help students connect with opportunities that they may not have otherwise known about [16]. The platform can help students make informed decisions about the resources and services they use. By providing information about the different resources and services available, the platform can help students choose the ones that are most appropriate for their needs [17]. Finally, the platform can help students feel more connected to their campus community. By providing a way for students to discover and connect with resources and services, the platform can help students feel more supported and engaged in their campus life [18].

## 2. RELATED WORK

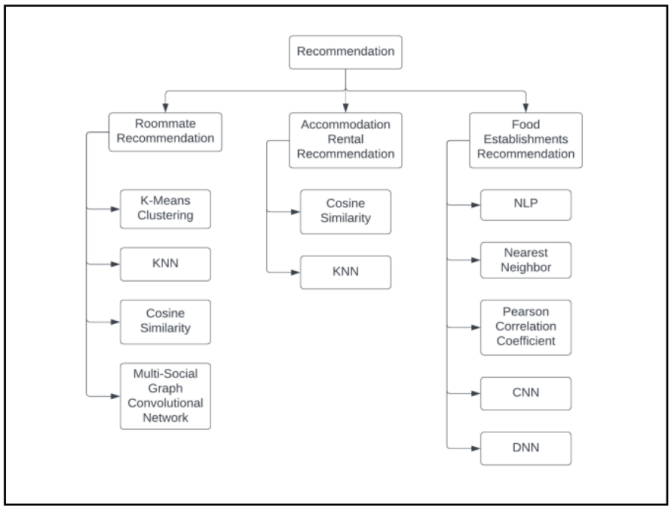


Fig. 1. Algorithms used in related work

[1] In this paper by Manvi Singh, Ankit Jain, and Divyanshu Sharma published in IEEE in August 2022, the authors propose a roommate matching application called DORMMATE that uses machine learning to match students based on their personality traits. It uses a hybrid recommendation engine that combines collaborative filtering and content-based filtering algorithms. Collaborative filtering recommends roommates based on the preferences of other students with similar personality traits, while content-based filtering recommends roommates based on a student's own personality traits. In a user study with 200 students, it achieved an average satisfaction rating of 3.8 out of 5, indicating that it was able to generate accurate roommate matches for most students. However, the authors note that it is limited by the quality of its training data and its inability to consider all factors that students may consider when choosing a roommate, such as budget and location.

[2] In this paper by Sharukh Rahman and Manoj Kumar D. S. published in SSRN in December 2021, the authors propose an optimal room and roommate matching system using the nearest neighbor's algorithm with cosine similarity distribution. The system works by first collecting data about students' preferences, such as their gender, sleep schedule, study habits, and social activities. This data is then used to train a nearest neighbors' model to predict how compatible two students are likely to be as roommates. The system achieved an accuracy of 95% in matching students with

roommates in a dataset of 100 students. However, the authors note that the system is limited by the accuracy of the training data and its inability to consider all factors that students may consider when choosing a roommate, such as budget and location.

[3] In this paper by Chenyang Zhang, Junwei Deng, and Xuanjing Huang published in IEEE in May 2023, the authors propose a friend recommendation system based on a multisocial graph convolutional network (MSGCN). The model integrates multiple social relationships, such as friendship, chat, and team relationships, to learn the latent characteristics of users. This allows the model to generate more accurate and personalized friend recommendations. The authors evaluated the performance of the model on two real-world social networks. The results showed that the model outperformed other state-of-the-art friend recommendation methods. However, the authors also note that the model is limited by the quality of the input data. If the social networks are not well connected or if the user profiles are incomplete, the model may not be able to generate accurate friend recommendations.

[4] In the paper by R. Ding, J. Zhu, Y. Tang, X. Lin, D. Xiao and H. Dong published in IEEE in 2016, the authors propose a novel feature selection strategy for friends' recommendation. The proposed strategy is based on a two-stage process. In the first stage, the authors use a mutual information-based feature selection method to identify features that are highly correlated with the target variable. In the second stage, the authors use a support vector machine (SVM) classifier to select features that are most discriminative between friends and non-friends. The proposed strategy was evaluated on two real-world datasets, and the results showed that it outperformed other state-of-the art feature selection strategies for friends' recommendation. The authors note that the proposed strategy is limited by the quality of the input data. If the data is not representative of the population of users or if the target variable is not well-defined, the strategy may not be able to identify the most relevant features.

[5] In the paper by Feng Liu et al. published in IEEE in 2019, the authors propose a new house recommendation model that uses cosine similarity and deep learning to improve the accuracy of house recommendations. The proposed model uses cosine similarity to measure the similarity between the user's preferences and the characteristics of the houses. The model then uses deep learning to learn the relationship between the user's preferences and the characteristics of the houses. The model is tested in a simulation experiment and is shown to be effective. The authors find that the proposed model outperforms other state-of-the-art house recommendation models in terms of accuracy. However, the model is still in its early stages of development and needs to be further evaluated on real-world data.

[6] This article by N. Shirisha, T. Bhaskar, A. Kiran and K. Alankruthi published in IEEE in May 2023, discusses a restaurant recommender system that uses sentiment analysis to generate personalized recommendations for users. The system extracts food preferences from users' comments and recommends restaurants that cater to those preferences. It takes into account other factors such as the restaurant's location, price range, and popularity. The system was evaluated on a dataset of over 2990 reviews from 100 different users. The results showed that the system was able to generate accurate and personalized recommendations for most users.

[7] In this paper by Arun Tripathi, Ashwani Kumar, and Divyanshu Sharma published in IEEE in June 2021, the authors propose a hybrid collaborative filtering approach to restaurant recommendation that outperforms both user-based and item-based collaborative filtering algorithms on their own. The hybrid approach combines the strengths of both user-based and item-based collaborative filtering to generate more accurate and personalized recommendations. However, the approach is limited by the quality of the input data.

[8] In the paper the authors propose a new restaurant recommendation model that combines multi-view visual features with a convolutional attention model. The model first extracts visual features from restaurant images using a convolutional neural network (CNN). The CNN is trained on a large dataset of restaurant images and labels, such as the food category and the restaurant's rating. The model was evaluated on a dataset of 1000 users and 2000 restaurants. The results showed that the model outperformed other state-of-the-art restaurant recommendation models. However, the authors note that the model is limited by the quality of the input data. If the restaurant images are not well-lit or if they do not contain enough information about the food and the restaurant, the model may not be able to generate accurate recommendations.

[9] In this paper by Xiaoyan Zhang, Haihua Luo, Bowei Chen, and Guibing Guo published in IEEE in September 2020, the authors propose a multi-view visual Bayesian personalized ranking (BPR) model for restaurant recommendation. The model combines multi-view visual features with the implicit feedback data to learn the personalized preferences of users. The model uses a deep convolution neural network (CNN) to extract visual features from restaurant images and a Bayesian personalized ranking (BPR) algorithm to learn the personalized preferences of users. The model was evaluated on two real-world restaurant review datasets. However, the authors note that the model is limited by the quality of the input data. If the restaurant images are not well-lit or if they do not contain enough information about the food and the restaurant, the model may not be able to generate accurate recommendations. Additionally, the model is computationally expensive to train.

[10] In this paper by Petrusel and Limboi published in IEEE in 2020 propose a restaurant recommendation system that improves rating predictions using sentiment analysis. The system outperforms systems that do not use sentiment analysis, but is limited by the quality of the input data.

Table -1: Summary of Related Work / Gap analysis

| Ref No | Paper | Algorithm and Accuracy | Limitations |
|---|---|---|---|
| 1 | DORMMATE - A Room-Mate Personality Matching Application | K-Means clustering algorithm – 76% | Accuracy dependent on questionnaire, limited factors considered |
| 2 | Optimal Room and Roommate Matching System Using Nearest Neighbours Algorithm with Cosine Similarity Distribution | K-Nearest Neighbor algorithm with Cosine Similarity – 95% | Computationally expensive, does not consider all factors |
| 3 | Friend Recommendation Based on Multi-Social Graph Convolutional Network | Multi-Social Graph Convolutional Network – 91.2% | Does not consider factors such as location, financial situation, gender; computationally expensive |
| 4 | A novel feature selection strategy for friends recommendation | Feature selection algorithm – 90.5% | Requires extensive dataset for high accuracy |
| 5 | Research on House Recommendation Model Based on Cosine Similarity in Deep Learning Mode in Grid Environment | Cosine similarity | computationally expensive, requires large dataset |
| 6 | Restaurant Recommender System Based On Sentiment Analysis | NLP | Approach is very basic resulting in lower accuracy |
| 7 | Recommending Restaurants: A Collaborative Filtering Approach | Nearest Neighbor Algorithm with Pearson Correlation Coefficient | Cold start problem |
| 8 | Convolutional Attention Model for Restaurant Recommendation With Multi-View Visual Features | CNN – 89.2% | Does not consider users' requirements; requires high quality and quantity dataset |
| 9 | Multi-view visual Bayesian personalized ranking for restaurant recommendation | DNN with Bayesian Personalized Ranking – 91.2% | Does not consider users' requirements; requires high quality and quantity dataset |
| 10 | Restaurant Recommendation System for User Preference and Services Based on Rating and Amenities | NLP – 87.2% | Cold start problem |

## 3. OBSERVATIONS AND FINDINGS

While there are a number of digital platforms that offer services that are relevant to students, such as academic resources, student life resources, and support services, none of these platforms cater specifically to the needs of students. This is a significant gap, as students have unique needs that are different from those of other users. For example, students may need help finding affordable housing, accessing food banks, or connecting with mental health services. In addition, students may be new to a city or country, and they may not know where to turn for help. Access to necessities such as accommodation and food is crucial for students' academic success. Students who are struggling to meet their basic needs are less likely to be able to focus on their studies and achieve their academic goals. However, many students struggle to find and access these necessities, especially when they are new to a city or country. This can be a major barrier to their success.

Personalization is key to a positive user experience. When users feel like a platform understands their needs and interests, they are more likely to use that platform and be satisfied with it. However, many digital platforms do not offer personalized recommendations or services to students. This is a missed opportunity, as students have diverse needs and interests. For example, some students may be interested in finding extracurricular activities, while others may be looking for academic support. There is a lot of scope for work in the domain of student-centric digital platforms. There is a need for platforms that can cater to the specific needs of students, provide them with personalized recommendations, and help them access the resources and

services they need to succeed. Such platforms could have a significant impact on the student experience by helping students to succeed in their academic and personal endeavors

## 4. CONCLUSIONS

This survey paper has highlighted the need for student centric digital platforms. While there are a number of digital platforms that offer services that are relevant to students, none of these platforms cater specifically to the needs of students. This is a significant gap, as students have unique needs that are different from those of other users. Student-centric digital platforms could have a significant impact on the student experience by helping students to succeed in their academic and personal endeavors. Such platforms could provide students with a personalized way to access the resources and services they need, such as academic support, financial aid, and mental health services. They could also help students to find affordable housing and food options, and to connect with other students and organizations. The development of student-centric digital platforms is a complex and challenging task, but it is one that is well worth pursuing.

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