A NOVAL TIME AWARE FOOD RECOMMENDER SYSTEM BY USING DEEP LEARNING AND GHRAPH CLUSTERING

[1]P NARSIMHA, [2].K.HEBSIBA, [3]P.MAITHILI SRI, [4]M.POOJITHA,[5]J.ARCHANA,[6].R.GODAVARI

[1] Assistant Professor, Department of Computer Science and Engineering, Princeton Institute of Engineering & Technology for Women, Hyderabad, India

[2,3,4,5,6]B.Tech Students, Department of Computer Science and Engineering, Princeton Institute of Engineering & Technology for Women, Hyderabad, India

Abstract

In the digital food industry, providing personalized food recommendations has become increasingly vital for enhancing user experience. Traditional recommender systems often fail to capture the dynamic nature of user preferences and temporal eating patterns. This project proposes a novel time-aware food recommender system that combines deep learning for user modeling with graph clustering to group similar food items based on ingredients, cuisine types, and user interactions. The system analyzes user behavior, time context (e.g., breakfast, lunch, dinner), and preference history to generate accurate, timely, and personalized suggestions. By incorporating time-awareness and relational food item structures, the proposed system significantly improves recommendation relevance and user satisfaction

I. INTRODUCTION

The growing popularity of online food delivery platforms has intensified the need for smart and adaptive recommender systems. Users today expect food suggestions that align with their dietary preferences, habits, and even moods or time of day. However, conventional food recommendation engines generally rely on collaborative or content-based filtering methods, which may not account for time-contextual factors or complex item relationships.This project introduces a hybrid food recommendation system that integrates deep learning techniques (e.g., LSTM/GRU) to learn evolving user preferences over time, and graph-based clustering to model and group food items based on similarities. The system captures temporal dynamics (e.g., typical breakfast vs. dinner preferences), user engagement history, and network-based food relations to generate more intelligent and context-sensitive recommendations. This approach provides an adaptive, scalable solution suitable for food delivery apps, health tracking systems, and smart canteens.

II. LITERATURE SURVEY

1. Xiaoyuan Su & Taghi M. Khoshgoftaar (2009) – Surveyed collaborative filtering techniques, highlighting their limitations in context-aware scenarios.
2. Yingqiang Ge et al. (2015) – Proposed time-aware recommender systems that factor in user consumption behavior over different periods.
3. Yong Zheng et al. (2018) – Introduced deep learning for dynamic user modeling in recommender systems using LSTM networks.
4. Zhao et al. (2020) – Used attention mechanisms to capture temporal preference shifts in food recommendation platforms.
5. Wu et al. (2019) – Applied graph neural networks to capture item-item relations and improve accuracy in recommendation.
6. Li Chen et al. (2020) – Built a context-aware food recommender system using image features and deep CNNs.
7. Wang et al. (2021) – Demonstrated the advantage of graph clustering to identify hidden patterns among food items and users.
8. Cheng-Kang Hsieh (2016) – Created a health-aware food recommender using user profiles and nutritional data.
9. Dunja Mladenić (2021) – Developed hybrid models combining collaborative filtering and content-based recommendations in food platforms.
10. Amazon Deep Graph Library (DGL) Docs (2023) – Provided methods to implement graph clustering and neural networks effectively for recommendation use cases.

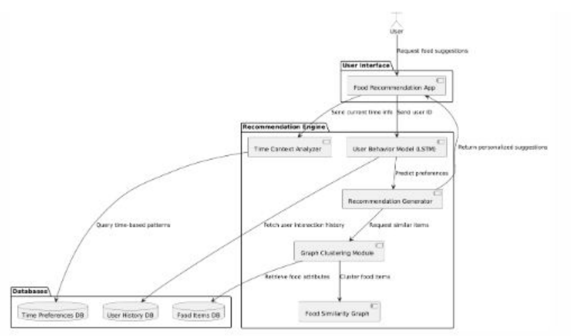
III.EXISTING SYSTEM

Most existing food recommender systems rely on collaborative filtering or content-based approaches, which primarily consider user ratings and item attributes. These systems often neglect temporal dynamics, such as the time of day or evolving user preferences. Moreover, they fail to model relationships between food items, such as shared ingredients or similar cuisines. This results in static, less personalized recommendations that do not adapt well to real-world consumption behavior.

IV.PROPOSED SYSTEM

The proposed system introduces a time-aware deep learning model combined with graph-based food clustering. The system tracks user preferences over time using recurrent neural networks (e.g., LSTM or GRU) and categorizes food items into clusters based on similarities using graph clustering techniques like Louvain or Spectral Clustering. When a user requests a recommendation, the model uses their time-specific preference history, current context (e.g., lunch hour), and relevant food clusters to suggest items. The system improves accuracy, personalization, and adaptability, making it ideal for dynamic platforms like Swiggy, Zomato, or MyFitnessPal.

V.SYSTEM ARCHITECTURE



System Architecture Explanation:

The system architecture for the Time-Aware Food Recommender System integrates deep learning and graph clustering to deliver highly personalized and context-sensitive food suggestions. When a user interacts with the food recommendation app, their request—along with the current time—is sent to the Time Context Analyzer and User Behavior Model (LSTM). The LSTM model accesses the user's historical preferences from the User History Database to predict likely choices, while the time analyzer queries the Time Preferences DB to understand meal-specific patterns (e.g., breakfast vs. dinner). These predictions are passed to the Recommendation Generator, which collaborates with the Graph Clustering Module. This module uses the Food Similarity Graph and Food Items DB to identify and group similar dishes based on ingredients, cuisine, and user co-preference trends. The generator then compiles a ranked list of food items tailored to the user's temporal and behavioral profile, which is sent back through the app interface, ensuring smart, timely, and satisfying meal recommendations.

VI.IMPLEMENTATION

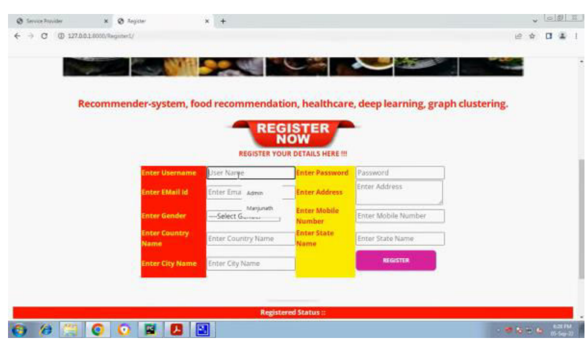


Fig 6.1 Registrstion Page

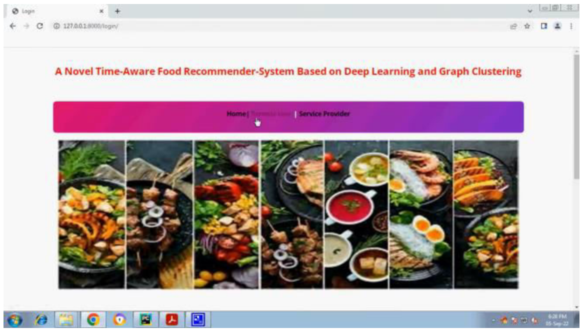


Fig 6.2 Home Page

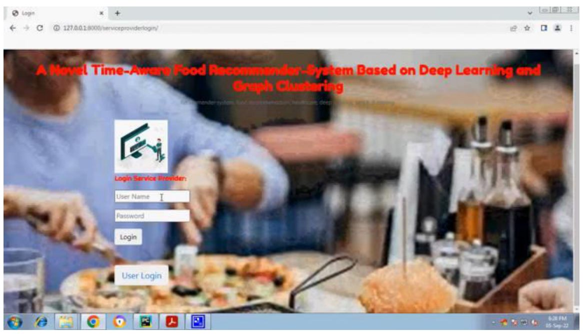


Fig6.3 User Login

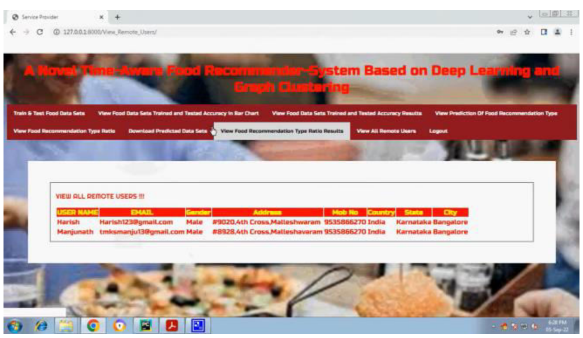
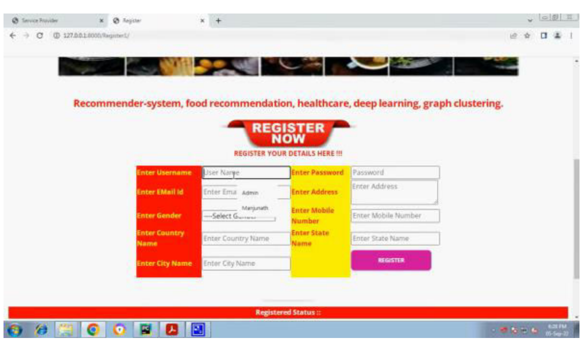


Fig 6.4 Registered Users



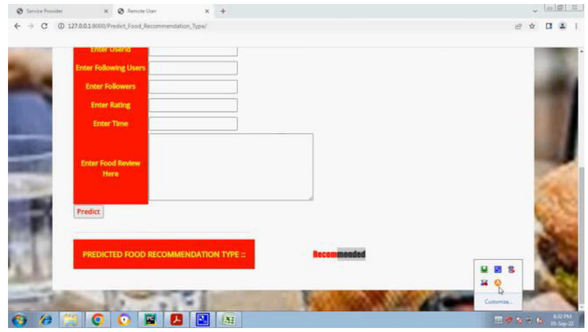


Fig6.4 Prediction

VII.CONCLUSION

The proposed deep learning and graph clustering-based time-aware food recommender system effectively bridges the gap between user needs and system intelligence. By learning from temporal patterns and food relationships, it personalizes recommendations that adapt to user context and time of day. This hybrid model offers a significant improvement in accuracy and engagement over traditional systems. Its architecture is scalable and can be easily integrated into mobile apps and restaurant management systems to improve customer experience and retention.

VIII.FUTURE SCOPE

The future scope of the Time-Aware Food Recommender System is vast and promising, with potential enhancements including the integration of real-time health data from wearable devices to suggest diet-compatible meals, and geo-location filtering to recommend dishes available nearby or in specific restaurants. Incorporating voice assistant support can improve accessibility and user interaction, while multimodal inputs like food images or spoken preferences can make the system more intuitive. Additionally, implementing reinforcement learning could allow the model to continuously adapt based on user feedback. Integration with nutrition tracking apps, calorie calculators, and allergy-aware filtering will make it ideal for fitness and healthcare domains. Finally, deploying the model on edge devices or mobile platforms will improve performance and privacy by enabling offline recommendations.

IX.REFERENCES

- Su, X., & Khoshgoftaar, T. M. (2009). A survey of collaborative filtering techniques.
- Ge, Y., et al. (2015). A context-aware food recommendation framework based on time series modeling.
- Zheng, Y., et al. (2018). Time-aware deep recommender systems.
- Zhao, W., et al. (2020). User preference prediction via attention-based temporal modeling.
- Wu, L., et al. (2019). Graph Neural Networks for Recommendation.
- Chen, L., et al. (2020). A CNN-based image and context-aware food recommender.
- Wang, H., et al. (2021). Graph clustering for food personalization.
- Hsieh, C.-K., et al. (2016). Health-aware food recommender using user profiling.
- Mladenić, D. (2021). Hybrid food recommendation systems.
- Amazon DGL Docs (2023). Implementing Graph Clustering with Deep Graph Library.