MOOD-BASED RECOMMENDER: MUSIC AND BOOK RECOMMENDATIONS

Neeraja Krishnakumar
Computer Science and Engineering Vidya Academy of Science and Technology
Thrissur, India

Nandhana A R
Computer Science and Engineering
Vidya Academy of Science and Technology
Thrissur, India

Musharaf K K
Computer Science and Engineering Vidya Academy of Science and Technology
Thrissur, India

Meenakshy N S
Computer Science and Engineering
Vidya Academy of Science and Technology
Thrissur, India

Mr Sivadasan E T
Associate Professor, Computer Science and Engineering
Vidya Academy of Science and Technology
Thrissur, India

***Abstract*—This work presents a comprehensive system which analyses user's mood based on sentiment analysis and recommends suitable songs and books based on it. It can overcome the limitations of existing recommendation systems, which mostly does not consider user's mood in recommending songs and books. Different from conventional genre-centric techniques, our system effortlessly includes analysis of mood via logistic regression giving a tailored experience. Utilizing *Spotify API* along with the *Google Books API*, the system is able to recommend tracks along with publications aligned to the user's current mood. In addition to this, aesthetically attractive publication referrals can also boost the general user experience. This innovation in recommendation systems not just links the books and songs but also helps the users to recognize what they need with a choice of exploration. Compared to the prevailing systems, the advantage is that both books and songs are recommended in a single system which is efficient enough to act according to user's preferences as it caters the capabilities of two most strong and efficient API's.**

***Index Terms*—recommendation systems, mood analysis, logistic regression, personalized experience, API (Application Programming Interface), Spotify, Google books, collaborative filtering.**

I. INTRODUCTION

Mood based recommendation systems that reciprocates human tastes and preferences are very important in today's world. This paper discusses how to construct a comprehensive recommendation system that acts as a catalyst to improve user experiences via personalized suggestions. The model provides this by including personal choices into the process of determining recommendations which makes it possible for tailored recommendations to be made based on the moods of individuals.

The main aim of this paper is to present a mood analysed recommendation system for providing customized music and book suggestions according to user's current mood. Besides the songs, the system also offers book previews that aligns with user's different interests and moods.

An essential aspect of the design is its accessibility. The paper also shows how the system will be able to generate personalized *Spotify* playlists while allowing user's seamless transition to the

recommended tracks thus making it easier for them to dive into the suggested content.

In conclusion, this paper aims at going beyond existing recommendation systems in terms of accessibility, customizability and accuracy by integrating mood analysis for better user experience.

II. Related Work

A. Graph-Based Attentive Sequential Model With Metadata for Music Recommendation

Weng et al. (2022) introduces a Graph-based Attentive Sequential[8] model with Metadata (GASM) to address the issues in personalized music recommendations. Comprising of music metadata, these approaches operate by using listening graphs and graph neural networks to map relations between users, music, singers and albums . Through the application of personalized attention network, the model classifies the preference of users into variable components which can result in the significant improvement of its performance than when it relies on conventional methods thus making music recommendations completely personalized.

B. To Cluster or Not to Cluster: The Impact of Clustering on the Performance of Aspect-Based Collaborative Filtering

For sparse user-item rating matrices Al-Ghuribi et al. (2023) introducing an innovative collaborative filtering based on aspect clustering [9] where they utilize user reviews to extract different aspects. The method uses pre-trained Word2Vec models for aspect representation and groups aspects together based on similarity of semantics by employing k-means clustering algorithm. An Amazon movie dataset has been used to estimate this particular model's superiority over other baseline methods in terms of accuracy measures thereby improving its efficiency as well.

C. An Intelligent Hybrid Neural Collaborative Filtering Approach for True Recommendations

Ibrahim et al. (2023) presents a Hybrid Neural Collaborative Filtering (HNCF) [10] model that combines[1] deep learning techniques and deep interaction modelling to efficiently provide what user wants. The model utilizes an overall rating derived from the Deep Multivariate Rating (DMR) by accumulating votes, likes, stars, and sentiment scores from diverse external data sources by addressing the cold start problem. Experimental results on IMDb, Yelp2013, and Yelp2014 datasets indicates the efficiency of the proposed HNCF model over other models.

D. Dtree2vec: A High-Accuracy and Dynamic Scheme for Real-Time Book Recommendation by Serialized Chapters

Zhao et al. (2020) presents the DTree2Vec plan[11] for dealing with the difficulties of suggesting serialized publications in real-time. The design shows an unified depiction of semantic functions that can be made use of to evaluate exactly how relevant the literary jobs remain in regards to their definition or material enabling an extensive analysis with time. The ordered tree framework is dynamically upgraded, and also a cosine-type regional restoration design is utilized to make certain real-time suggestion high quality. The design also considers insufficient details in serialized publications revealing greater referral precision.

III. Methodology

The methodology involved in the study includes a well-defined procedure to implement a smooth-functioning mood-based recommendation system. Here is the outline of the step by step process employed to develop this recommendation system.

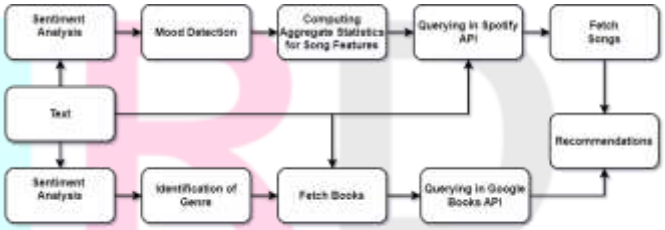

Fig. 1. Methodology.

1. *Sentiment Analysis* - Sentiment analysis is a natural language processing (NLP) technique, here employed to analyze the user-provided text and infer the user's current mood.
2. *Mood Detection* - The mood analyzer, powered by machine learning, predicts the user's

current mood based on their text input for song recommendations. It accurately discerns emotions by leveraging a dataset of varied sentiments and corresponding moods. This allows for personalized recommendations tailored to the user's emotional state within the system.

3. *Spotify API* - The *Spotify API* is used in this system as to fetch songs based on both user's mood and preferences. The API's advanced algorithms ensure that the recommendations are personalized and tailored to the user's tastes. Additionally, the integration with *Spotify* allows users to listen to recommended songs directly within the system, making the experience seamless and convenient.
4. *Computation of Aggregate Statistics* - A method is employed to find songs with similar characteristics, such as danceability, acousticness, energy, and more. This technique involves analyzing these features and fetching tracks from a music database or API that share comparable attributes. By using this approach, the recommendation system can suggest songs closely aligned with the user's preferences or mood based on these specific qualities.
5. *Genre Identification* - The process of genre identification is accomplished through a dataset that maps title of the books to specific genres. By leveraging this dataset, the system can accurately determine the appropriate genre of literature that aligns with the user's mood or preferences.
6. *Google Books API* - The Google Books API is utilized to retrieve previews of books fetched from dataset. By passing the name of the books to the API, the system can fetch book previews that. This functionality enables the recommendation system to provide tailored book previews aligned with the user's preferences or mood.
7. *Recommendations* - *Spotify API* used to fetch the most suitable items based on user's preferences or mood while *Google Books API* is used to fetch previews of books that is obtained from the dataset. These items are shown as recommendations to the user.

IV. Design and Implementation

A. System Architecture

Fig. 2. System Architecture.

The user can get both music and book recommendations in two ways. That includes: (i) based on the user's current mood which is analyzed from the text provided in order to provide suitable recommendations and (ii) based on the user's personal preferences[17] and specific song/book names to recommend similar content.

Any of these options can be selected by the user from the home page. The working of both these options are as follows.

The mood analyzer component[13] is developed on a model based on Logistic Regression. The dataset used includes sentiments with corresponding mood labels like joy, fear, anger, sadness, disgust, shame and surprise enabling the application of supervised machine learning techniques for sentiment analysis[18][19]. From this, the mood with the highest percentage is selected based on the input sentiment from the user. This mood is then parsed to a function to select songs. This song selection is done with the help of another dataset which has the values of certain features of songs such as danceability, acousticness, energy, instrumentalness, liveness, valence, loudness, speechiness, tempo along with its corresponding mood.The mean value of each individual feature for the already selected mood is calculated and passed to *Spotify API*. Songs with similar field values are fetched and filtered. The best fitting songs are recommended to the user.

Mood analyser gives songs based on user's current mood and if the user wants to get songs similar to any other song, the user can just get it by simply providing the song name in the field displayed. This song will be passed to the *Spotify API* to get the song ID. On getting the song ID, the values of features of that song are taken from the Get Track Features module as a Json object and are again passed to the API, particularly to the End point of Get Recommendations (one of the modules in *Spotify API*) for getting songs that have similar values. These songs are then recommended to the user.

For mood-based book recommendations, the mood is taken by asking questions. We use another dataset which has titles, authors, genres, and number of pages in it. Genres and maximum number of pages are taken as input from the users. These are then used to get random titles from dataset. These chosen titles are passed to *Google Books API*) for fetching previews of books and details of authors. These are shown as recommendations to the user using *streamlit* framework.

As for the recommendation for similar books, from the book provided by the user, genre of the book is obtained from the dataset using functions. Randomly chosen 5 books with this same genre are taken and are passed to *Google Books API*. Details such as authors, preview links and preview images are obtained which are then recommended to the user.

Therefore, in general we make use of both *Spotify* and *Google Books API* to fetch the most suitable items based on user's mood and preferences.

B. Algorithms

Logistic regression [22] is employed as a classifier to predict the user's mood. The logistic regression model is trained with a dataset that includes sentiments with corresponding mood labels, creating a model that accurately predicts the user's mood using sentiment analysis.

Grouping and Aggregation[13] is a technique that uses the groupby function in pandas to efficiently group the dataset by mood categories and calculates the mean of each feature within each group. The mean values of each feature for the corresponding mood are calculated.

Content-based filtering[7][12][20] in the context of fetching books from the *Google Books* API involves using the content (features) of books, such as their titles, descriptions, and other textual attributes, to recommend or retrieve similar books based on user preferences or specified criteria.

C. Data Collection

The database involved in the study comprises two primary datasets. The first one involves text-based mood detection and was used in an experiment uploaded to *Microsoft's Cortana Intelligence Gallery*. It consists of 40000 instances of sentiments labeled to their corresponding moods like joy, fear, anger, sadness, disgust, shame and surprise. This facilitates the utilization of supervised machine learning techniques like Linear Regression.

The second dataset downloaded from *Kaggle* comprises 700 data items, linking attributes like danceability, acousticness, energy, instrumentalness, liveness, valence, loudness, speechiness, tempo etc with distinct moods. The dataset is crucial for extracting the range of values of each feature associated with each mood.

To expand the pool of instances to choose recommendations, the system integrates external datasets from *Spotify* and *Google Books*. Their APIs enable efficient accesses, simplifying the application of filtering techniques.

The main datasets are divided into train and test datasets. The train set is used to develop the model and will be constantly updated based on user feedback. The results are validated using the test set.

V. Results and Implementation

The web application "Mood-Based Recommender: Music and Book Recommendations" boasts a user-friendly interface meticulously divided into four main sections, each catering to distinct user needs. Initially, users are greeted with music recommendations tailored precisely to their current mood, achieved through analyzing input text to offer highly personalized suggestions. The application further enhances the tailored experience by suggesting music closely aligned with the user's stated preferences, ensuring resonance with their musical inclinations.

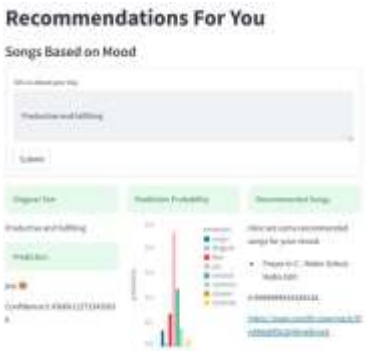

Fig. 3. Mood Based Song Recommendation

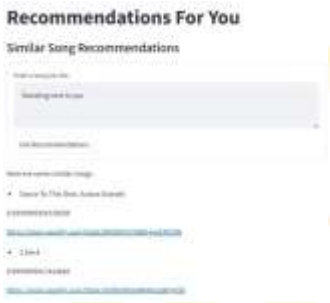

Fig. 4. Similar Song Recommendation

Transitioning to literature, the app provides mood-based book recommendations by leveraging sentiment analysis. This ensures personalized reading lists that evoke desired emotional responses, thereby enhancing the overall reading experience. Users also have the option to explore books similar to those they specify, diversifying their reading options. Recommendations based on the book name provided by the user is done by leveraging the datseet and *Google Books API*.

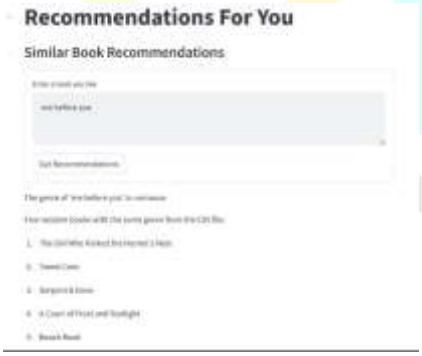

Fig. 5. Similar Book Recommendation

Fig. 6. Preview of Books

Fig. 7. Mood Based Book Recommendation

The mood analyser has an accuracy of 75 percent. The accuracy of the recommended songs and books are calculated using cosine similarity between the mean value of features and actual values. The values are in the range of zero to one with zero showing no similarity and one showing high similarity.

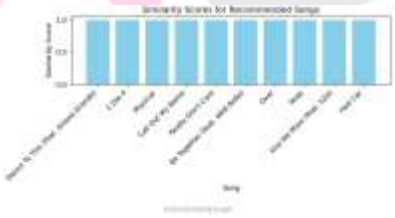

Fig. 8. Cosine Similarity

VI. Conclusion

In summary, this research paper is a huge step toward the evolution of user interactions with technology. It focuses on personalized recommendations based on emotions and individual preferences, and hence it redefines the usual user experience. It provides a more immersive and empathetic user interaction than conventional content recommenders. The research commits to understanding the user on a personal level and then dynamically responding to their emotional needs. It aspires to positively impact their overall well-being by delivering content based on their mood. Innovative techniques and a user-centric approach are used to combine relatability and enjoyment. This creates a profound and meaningful connection between users and the system.

References

[1] Z. Wang, A. Maalla and M. B. Liang, "Research on E-commerce personalized recommendation system based on big data technology", Proceedings of the 2021 IEEE 2nd International Conference on Information Technology Big Data and Artificial Intelligence (ICIBA), pp. 909-913, 2021.

[2] K. Chen, B. C. Liang, X. S. Ma et al., "Learning audio embeddings with user listening data for content-based music recommendation", Proceedings of 2021 IEEE International Conference on Acoustics Speech and Signal Processing (ICASSP), pp. 3015-3019, 2021

[3] T. C. Shen, J. Jia, Y. Li et al., "PEIA: personality and emotion integrated attentive model for music recommendation on social media platforms", Proceedings of the 34th AAAI Conference on Artificial Intelligence, pp. 206-213, 2020.

[4] A. Elbir and N. Aydin, "Music genre classification and music recommendation by using deep learning", Electronics Letters, vol. 56, no. 12, pp. 627-629, 2020.

[5] S. H. Chang, H. Abdul, J. H. Chen et al., "A personalized music recommendation system using convolutional neural networks approach", Proceedings of 2018 IEEE International Conference on Applied System Invention (ICASI), pp. 47-49, 2018.

[6] B. Li, Z. G. Chen, R. Huang et al., "Music recommendation algorithm based on LDA model", Computer Engineering, vol. 42, no. 6, pp. 175-179, 2016.

[7] Y. H. Jiang, S. Y. Yan, P. Qi et al., "Adapting to user interest drifts for recommendations in scratch", Proceedings of 2020 International Wireless Communications and Mobile Computing (IWCMC), pp. 1528-1534, 2020.

[8] He Weng, Jianjiang Chen, Dongjing Wang, Xin Zhang, Dongjin Yu, "Graph-Based Attentive Sequential Model With Metadata for Music Recommendation", IEEE Access, Vol: 10, 2022.

[9] Sumaia Mohammed Al-Ghuribi, Shahrul Azman Mohd Noah, Mawal A. Mohammed, Sultan Noman Qasem, Belal Abdullah Hezam Murshed, "To cluster or not to cluster: The impact of clustering on the performance of aspect-based collaborative filtering", IEEE Access, Vol: 11, 2023.

[10] Muhammad Ibrahim, Imran Sarwar Bajwa, Nadeem Sarwar, Fahima Hajjej, Hesham A. Sakr, "An intelligent hybrid neural collaborative filtering approach for true recommendations", IEEE Access, Vol: 11, 2023.

[11] Huaxuan Zhao, Hongchen Wu, Jingzhi Li, Huaxiang Zhang, Xinjun Wang, "Dtree2vec: A high-accuracy and dynamic scheme for real-time book recommendation by serialized chapters", IEEE Access, Vol: 18, 2020.

[12] Ruowei Zhang, Shengxia Tu, Zhongzheng Sun, "A hybrid music recommendation method based on music genes and collaborative filtering" ,2022 IEEE Intl Conf on Dependable, Autonomic and Secure Computing, Intl Conf on Pervasive Intelligence and Computing, Intl Conf on Cloud and Big Data Computing, Intl Conf on Cyber Science and Technology Congress (DASC/PiCom/CBDCom/CyberSciTech).

[13] Vijay Prakash Sharma, Azeem Saleem Gaded, Deevesh Chaudhary,Sunil Kumar, Shikha Sharma, "Emotion-Based Music Recommendation System", 2021 9th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO).

[14] Tisha Negandhi, Purval Dhumale, Mishika Vachhani, Kiran Gawande, "Bookbuddy: A mood based book recommendation system", 2023 7th International Conference On Computing, Communication, Control And Automation (ICCUBEA).

[15] Takumi Fujimoto, Harumi Murakami, "A book recommendation system considering contents and emotions of user interests", 2022 12th International Congress on Advanced Applied Informatics (IIAI-AAI).

[16] PV Devika, K Jyothisree, PV Rahul, S Arjun, Jayasree Narayanan, "Book recommendation system", 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT).

[17] Cynthia Jayapal, Gokul S, Harshavardhan S.V., "Book recommendation system using hybrid filtering", 2023 2nd International Conference on Advancements in Electrical, Electronics, Communication, Computing and Automation (ICAECA).

[18] M. Birjali, M. Kasri and A. Beni-Hssane, "A Comprehensive Survey on Sentiment Analysis: Approaches Challenges and Trends", Knowledge-Based Syst., pp. 1-26, 2021.

[19] M. Kasri, M. Birjali, M. Nabil, A. Beni-Hssane, A. El-Ansari and M. El Fissaoui, "Refining Word Embeddings with Sentiment Information for Sentiment Analysis," in Journal of ICT Standardization, vol. 10, no. 3, pp. 353-382, 2022, doi: 10.13052/jicts2245-800X.1031.

[20] N. Khouibiri, Y. Farhaoui and A. El Allaoui, "Design and Analysis of a Recommendation System Based on Collaborative Filtering Techniques for Big Data," in Intelligent and Converged Networks, vol. 4, no. 4, pp. 296-304, December 2023, doi: 10.23919/ICN.2023.0024.

[21] Naina Yadav, Anil Kumar Singh Bi-directional Encoder Representation of Transformer model for Sequential Music Recommender System

[22] Haoye Tian, Haini Cai, Junhao Wen, Shun Li, Yingqiao Li ”A Music Recommendation System Based on logistic regression and eXtreme Gradient Boosting” July 2019 DOI:10.1109/IJCNN.2019.8852094 Conference: 2019 International Joint Conference on Neural Networks (IJCNN)