



INDRAPRASTHA INSTITUTE of
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INFORMATION RETRIEVAL(CSE508 - WINTER 2023)
MID PROJECT REVIEW

Music to Book Recommender

REPORT

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Problem Formulation:

The project aims to take into account the intrinsic interests of users in music and recommend books of similar interest. The user will have to input a song of their choice and the model will then analyse the song to recommend books of similar genre to the song.

Literature Review:

Penha et al.[1] analysed the amount of factual knowledge that is already stored in the parameters of the heavily pre-trained BERT transformer, in the domain of books, movies, and music recommendations. They studied how much a simple BERT, without any fine-tuning, knows about recommendation items. This was tested by using different probes which require different types of knowledge, - context-based and collaborative-based. These two pieces of knowledge were then infused in BERT during the fine-tuning step to help develop a conversational recommendation system.

G. Ramakrishnan et al.[2] reviewed the collaborative filtering techniques for a book recommender system, wherein instead of using the user ratings explicitly, the idea was to incorporate implicit information in the user ratings and the similarities between the items rated. The user ratings were assigned as a weighted average of all the similar book ratings. For books with no other book of significant cosine similarity, a standard deviation with the average rating was used. Based on RMSE, the technique presented proves to be better than other methods.

Avi Rana and K. Deeba[3] presented an online book recommendation system that uses collaborative filtering with Jaccard similarity (measures similarity between the preferences of different users in the collaborative filtering algorithm, i.e., the ratio of the size of intersection of the two sets of books to the size of union of two sets). The system collects user's ratings and preferences to books, then uses Jaccard similarity to evaluate the similarity between users in this system, based on which, a list of books is generated by the system which may be of interest to that user whose Jaccard similarity was just evaluated.

Cho et al.[4] compared 3 approaches for creating an efficient book recommendation system: (i) content-based, (ii) collaborative filtering, and (iii) hybrid approach. The hybrid system used the confidence levels of the results predicted by both the former approaches and performed their weighted sum to arrive at a result. They used reviews from various platforms to curate their dataset. The final results indicated that the hybrid model gave better results as it reduced the issues that both the approaches would otherwise face individually.

Kaminskas et al.[5] discusses various tools and techniques to address the research challenges posed by context-aware music retrieval and recommendation. It covers topics from classical music information retrieval and recommender system techniques to contextual music retrieval, emotion recognition in music, and social computing. It also considers user-related context such as activity, demographics, and emotional state. The approaches that relate music to context are data driven and are dependent on multiple fields.

N. Pelchat et al.[6] covered how various NNs can be used to classify songs according to their genres. They improvised upon a CNN for the same. The input to the CNN was short time segments of the spectrograms of the songs. It had six convolutional layers followed by a fully connected layer and then a softmax function. The results obtained were 85% accurate on the test data.

Singh et al.[7] released a new dataset comprising different Indian Song genres, namely, Bollywood Rap, Bollywood Romantic, Ghazal, Folk(Garhwali), Sufi, Bhojpuri and Bhajan. The authors proposed an automatic genre classification model for Indian songs using machine learning. They compared the performance of different ML algorithms and concluded that the Light GBM classifier gives the best accuracy of 77.2%.

Hungund [8] proposed a machine learning model for genre classification of books by using multi label binarizer and Logistic Regression. The dataset used had 227 different types of genres.

Updated Baseline Results

For our baseline results, we had developed the model to find out the genre of the song provided. The songs could be classified into one of the 7 genres, namely, Bollywood Rap, Bollywood Romantic, Ghazal, Folk(Garhwali), Sufi, Bhojpuri and Bhajan. The accuracy achieved by the model was 68%

Another model was developed for predicting the genres of books. The accuracy achieved with this was 16.54%. This low accuracy was due to the fact that in multilabel classification, the accuracy_score function returned 1.0 only if the complete set of predicted labels for an instance strictly matches the true set of labels. Otherwise, the accuracy was 0.0. The classification of the books into one of the 227 genres was also difficult as these genres were very similar.

For updating our baseline results, grouping of the genres of the book was done. This grouping reduced the number of genres to just 121 genres which provides better results.

```
def group_genres(ls):
    if 'Utopian' in ls:
        ls.remove('Utopian')
        ls.append('Speculative fiction')
    if 'Vampire' in ls:
        ls.remove('Vampire')
        ls.append('Horror')
    if 'Vampire fiction' in ls:
        ls.remove('Vampire fiction')
        ls.append('Horror')
    if 'War' in ls:
        ls.remove('War')
        ls.append('Action')
```

Snapshot of the grouping of some genres wherein the genre of Utopian, Vampire, Vampire fiction and War were removed and merged into Speculative fiction, Horror, Horror and Action respectively .

For the end-to-end model, both the music genre classification model and book genre classification model were connected. Using this model, music is input and books of similar genre are given as output.

Methodology

Input: Songs in opus format

Output: Recommended books based on the input songs

1. Music feature extraction:

Our input dataset contains Indian songs from 7 different genres, such as bhajan, ghazal, romantic songs, etc. After ingesting the input, we extract 12 essential features from the songs. The features include onset strength, chroma stft, spectral centroid, mel spectrogram, etc. We do this with the help of various methods provided in the librosa package. At the end of the feature extraction process, we are able to generate 7 different csv files, one for each genre, containing the values corresponding to these 12 features for each song in that genre in our dataset.

Next, we join these 7 different files into one common CSV file. This file has the 12 feature values for every song in the dataset and a label for each song, stating the genre to which the song belongs. After splitting the features and labels into X and y, this file acts as the training data for our classification model.

2. Classification of songs into genres:

Using the previous work of other people in this domain as our basis (mentioned in references) and comparing the accuracy values given by various models, we select Lightgbm as our classification model. The model results in 68% accuracy on the test dataset, obtained from splitting the above-mentioned dataset into training and testing data.

The selection of accuracy as our evaluation measure for the performance of the classification is based on the fact that our training dataset is almost balanced across all seven genres.

Once the genre classification of the input song is obtained in this stage, we move to the next stage of mapping this genre with the genres of the bibliographical world.

3. Music to book recommendation:

This is the step where we give book recommendations to the user based on his preferred music genre.

Firstly, we import the Lightgbm model trained in the previous step for the genre prediction of previously unseen audio files.

After that, we have used the CMU book dataset which contains plot summaries of more than 15000 books along with their genres. The genre is a multivalued attribute which contains the various genres that a particular book might fall in. Thus, we had to clean the genre column and convert it such that it has the genre that is most descriptive and gives a broader category for the book.

Then, we perform the mapping from the genre of music to the genre of book. So far, we have done this mapping for the following genres of music: Bollywood rap, Bollywood romantic and Sufi. For example, we have mapped Bollywood rap to the following book genres: Young adult literature, Dark and Dark fantasy.

This mapping created above is then used to essentially translate a music genre to a book genre and then subsequently recommend a range of books to the user. We used various hindi songs, and were successfully able to predict books that would match the interest of the user.

4. **UI:** As a further addition to our application, we have built an interactive user interface that would allow the user to upload multiple favorite songs of the user at once and, in turn, the UI would present a list of books as per our recommendation system working in the background.



References:

- [1] Penha, G., & Hauff, C. (2020, September). What does bert know about books, movies and music? probing bert for conversational recommendation. In *Proceedings of the 14th ACM Conference on Recommender Systems* (pp. 388-397). <https://dl.acm.org/doi/pdf/10.1145/3383313.3412249>
- [2] Ramakrishnan, G., Saicharan, V., Chandrasekaran, K., Rathnamma, M. V., & Ramana, V. V. (2020). Collaborative filtering for book recommendation system. In *Soft Computing for Problem Solving: SocProS 2018, Volume 2* (pp. 325-338). Springer Singapore. https://doi.org/10.1007/978-981-15-0184-5_29
- [3] Rana, A., & Deeba, K. (2019, November). Online book recommendation system using collaborative filtering (with Jaccard similarity). In *Journal of Physics: Conference Series* (Vol. 1362, No. 1, p. 012130). IOP Publishing. <https://iopscience.iop.org/article/10.1088/1742-6596/1362/1/012130/pdf>
- [4] Cho, J., Gorey, R., Serrano, S., Wang, S., & Watanabe-Inouye, J. (2017). *Book recommendation system* (Doctoral dissertation, Bachelor's thesis. Carleton College). https://cs.carleton.edu/cs_comps/1617/book_rec/final-results/paper.pdf
- [5] Kaminskas, M., & Ricci, F. (2012). Contextual music information retrieval and recommendation: State of the art and challenges. *Computer Science Review*, 6(2-3), 89-119. <https://www.sciencedirect.com/science/article/abs/pii/S1574013712000135>
- [6] N. Pelchat and C. M. Gelowitz, "Neural Network Music Genre Classification," in *Canadian Journal of Electrical and Computer Engineering*, vol. 43, no. 3, pp. 170-173, Summer 2020, doi: 10.1109/CJECE.2020.2970144. <https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9165253>
- [7] Music genre classification reference: [https://github.com/ujjwalIII/GACMIS/blob/master/Final%20Manuscript/ML__GACMIS__Version__1%20\(5\).pdf](https://github.com/ujjwalIII/GACMIS/blob/master/Final%20Manuscript/ML__GACMIS__Version__1%20(5).pdf)
- [8] Book genre classification reference: <https://www.analyticsvidhya.com/blog/2019/04/predicting-movie-genres-nlp-multi-label-classification/>
<https://www.kaggle.com/code/iamhungundji/book-summary-genre-prediction/notebook>

