Music to Book Recommender : Baseline Results

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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.

Baseline Results:
For baseline results, 2 models were developed. One for music genre classification and another for book genre classification. For this, the models were trained on datasets which had genres of different songs and books respectively. Using the trained models, the genres of new songs and books can be predicted.

Music Genre Classification Model:

Dataset: A new dataset having Indian songs from 7 different genres - Bollywood Rap, Bollywood Romantic, Ghazal, Folk(Garhwali), Sufi, Bhojpuri and Bhajan.

The model is trained on a dataset that has Indian songs from 7 different genres. The songs are almost equally divided into these genres. The system is trained by first extracting various numerical features from every song in the training set, and then applying the LightGBM model for classification task.

The system takes an Indian Song as input and classifies it into one of these 7 genres with 64.71% accuracy. The work may be expanded and modified later on a need basis to include even more genres, or to remove the ones that may not be very relevant in the context of books.

This system will act as a basis for our IR system as we first need to classify the genre of the input song in order to be able to recommend a book of the same or related genre to the user.

Music Genre Classification Accuracy : 64.71%.

Book Genre Classification Model:

Dataset: CMU Book Summary Dataset.

The model is trained on the dataset which has information about 16559 books. The information included are the names, description and genres of the different books. The model is trained using Logistic Regression and One vs Rest Classifier. The model can later be used for predicting genres of different books using the description of the book provided.

The accuracy recorded initially was lower than what was recorded finally. Therefore, to increase the accuracy, dataset analysis was done. Through data analysis it was discovered that there were many similar types of genres present which decreased the accuracy, for example, 'Autobiographical novel' and 'Autobiography'. To overcome this issue, we grouped some genres which indeed increased the accuracy. For example, 'Autobiographical novel' and 'Autobiography' were grouped under only one genre of 'Autobiography'.

Further, for our next step, we will be applying data manipulation. Considering the 227 different genre labels, it is required for us to group the labels of similar context, so as to increase overall accuracy of the model. As mentioned above, a sample test that we did, has resulted in improved results of the model. This will enable us to map music of a certain context to books of a related genre.

In multilabel classification, the accuracy_score function returns 1.0 only if the complete set of predicted labels for an instance strictly matches the true set of labels. Otherwise, the accuracy is 0.0. Thus, we need to change the evaluation metric to a better metric that takes in the correct subset accuracy. A custom function can be defined, wherein, if a threshold number of labels is valid, the accuracy is not 0 for such cases.

Book Genre Classification Model Accuracy : 16.54%.

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