Restaurant Recommendation System

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Introduction

- With the increasing information available online it can be difficult to navigate through different sources and make a decision.
- To deal with this problem, recommender systems automatically suggests the item to the particular user according to the user's profile or the ratings.
- Recommendations are a part of everyday life where people rely on external knowledge to make decisions about an object of interest.

Problem statement

The significance of recommender systems originates from the vast amount of available information, which makes it difficult for users to find relevant items especially new users.The main objective of the project is to reduce the issue of cold start problems faced due to scarcity in user data.

System Design
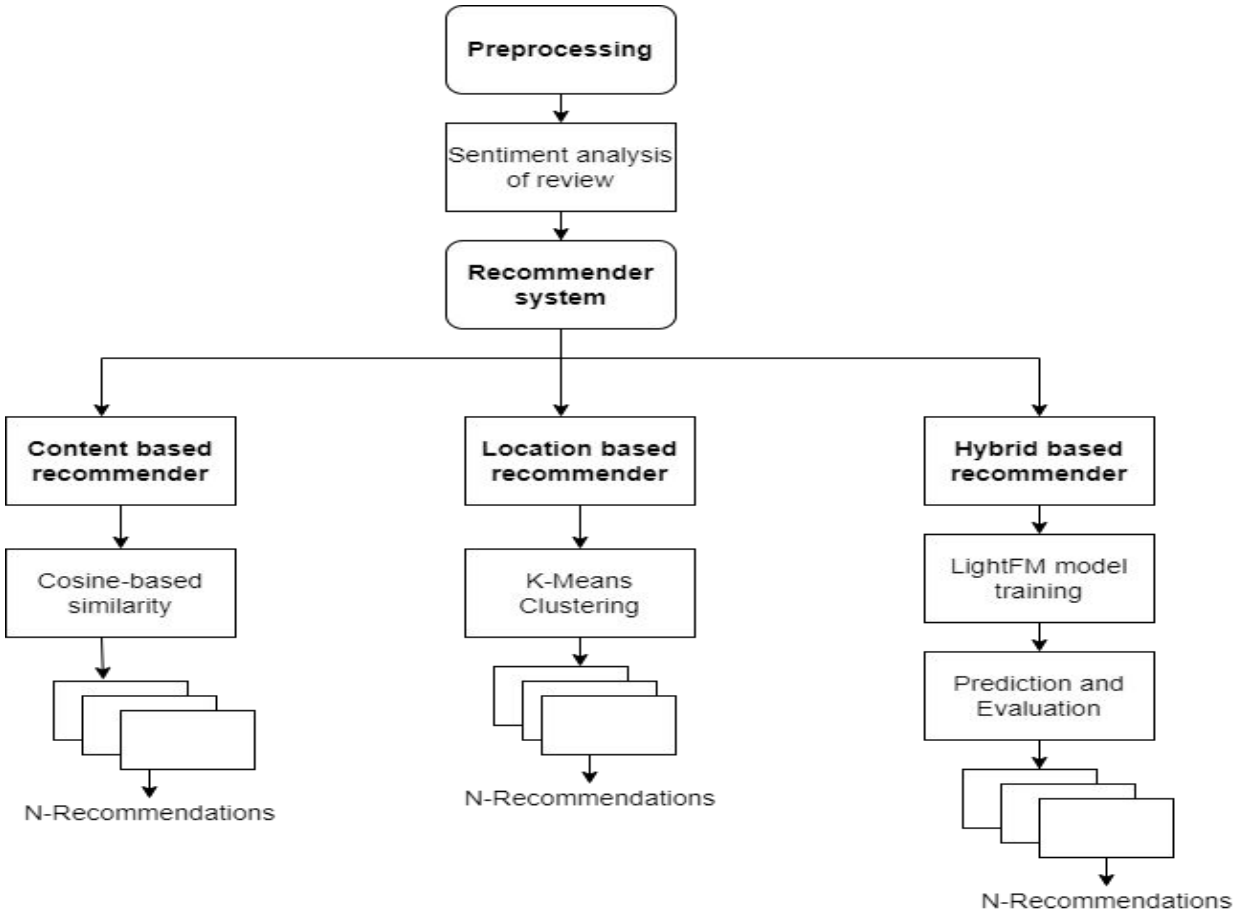
Preprocessing and Sentiment Analysis

There are mainly 3 datasets that are used;

- yelp_academic_dataset_business.json
- yelp_academic_dataset_reviews.json
- yelp_academic_dataset_user.json

❏ Initially all datasets were cleaned separately and then merged together

❏ Sentiment analysis of reviews were performed.

❏ Text classification was done using textblob which calculates polarity and subjectivity

❏ Compound score is calculated using vader sentiment analysis

❏ Most of the reviews were noted to be positive

❏ On average, the majority of reviews are balanced between being subjective and objective.

❏ Based on this a super score has been generated

Super score = stars + (polarity x compound)

Content based Recommender

- Content-Based Recommendation recommends restaurants based on similar categories and keywords.

- This recommendation system was built based on similar restaurant categories and dominant topic keywords which then suggests restaurants that align with a user's preferences.

- Cosine similarity is used to calculate the similarity between items

- Cosine similarity is a mathematical computation that tells us the similarity between two vectors A and B.

$$\cos(\theta) = \frac{A \cdot B}{\|A\|\|B\|}, \text{ where } \|A\| = \sqrt{\sum_{i=1}^{n} A_i^2} \text{ and } \|B\| = \sqrt{\sum_{i=1}^{n} B_i^2}.$$

Location based Recommender

- K-Means clustering algorithm is used to group restaurants together based on geographical locations.

- This algorithm predicts the cluster where the user is located in and pulls out the cluster's top 10 restaurants and recommends them to the user.

- Geolocator is used to find corresponding address of recommended restaurants.

Hybrid Based Recommender

LightFM

- LightFM is a hybrid matrix factorisation model representing users and items as linear combinations of their content features' latent factors.
- A hybrid recommender is a special kind of recommender that uses both collaborative and content based filtering for making recommendations.
- LightFM can use the normal user-item interactions for making predictions for known users.
- In the case of new users, it can make predictions if it knows some additional information about these new users.
- It also makes it possible to incorporate both item and user metadata into the traditional matrix factorization algorithms.
- It represents each user and item as the sum of the latent representations of their features, thus allowing recommendations to generalise to new items (via item features) and to new users (via user features).

Experimental Results

Metrics Used	Score
Hybrid train AUC	99.3
Hybrid test AUC	98.5

Output

User 1

length of known_positives: 8

Known positives:

Urban Pantry | Do-It-Yourself Food, Restaurants, American (Traditional), Active Life, Grocery, Food,
Ocean King Market | Food, Seafood Markets, International Grocery, Specialty Food, Ethnic Food
Brian's Brew | Food, Coffee & Tea
Take Five Café | Food, Coffee & Tea, Restaurants, Cafes
Zaika Indian Contemporary Cuisine | Restaurants, Indian
HOTLIPS Pizza - Hawthorne | Food, Beer, Wine & Spirits, Restaurants, Fast Food, Pizza, Gluten-Free
Greater Goods Coffee Roasters | Coffee Roasteries, Cafes, Food, Coffee & Tea, Restaurants
A Thai Basil | Food Stands, Food, Thai, Food Trucks, Bubble Tea, Restaurants

Recommended:

Let's Roll Custom Sushi Bar | Restaurants, Canadian (New), Sushi Bars, American (New)
Nana's Ice Cream Scoop Shop | Food, Ice Cream & Frozen Yogurt
Brian's Brew | Food, Coffee & Tea
This one clicked
Taqueria So Mexican | Restaurants, Mexican, Food Trucks, Food, Food Stands
Jackson's Poultry | Food, Specialty Food, Farmers Market, Butcher, Meat Shops

k_p: 8

precicion at k : 0.2

Conclusion and Limitations

- Recommendations for existing users based on cuisine have been generated.

- The recommendation system helps new user sort restaurants based on location.

- LighFM model can be further explored for suggesting recommendations for new user.

References

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