Food Recommendation System

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1 ABSTRACT

From the earliest stages of foetal development to old age, nutrition is the most important factor in human health and growth. Healthy diet and nutrition are unquestionably necessary for survival, physical development, mental growth, performance and productivity, as well as health and well-being. With increasing cases of health related problems as well as malnutrition/obesity and lack of nutrition related guidance it is imperative to have a system to recommend diet based food/meals. We propose a system which can recommend meals based on nutritional requirements/preferences as required by the user.

2 INTRODUCTION

Individual's health is known to be affected and influenced by many factors. physical exercise, nutrition, heredity, sleeping, are among some of the important factors that influence it. from which nutrition being one of the most easily modifiable, impactful factor.small changes in these nutritional values can induce significant outcomes.having our diets strong cultural ties and nutritional attachments with them it seems feasible to identify around the world a big number of cuisines and dishes.the most common nutritional values in each one is closely related to the characterstics of place of its belonging.some ingredients are known to have a positive effect on health. being able to identify which cuisines contain the suitable nutritional values which may have an overall positive impact on our body , physical well being and will help us in treating and preventing various diseases. moreover clubbing/including these with the cuisine preferance like north-indian/french/italian and individual taste's preferances.overall it can effectively contribute in shifting of nutritional habits of the general population. with increasingly more data being published/available online be it from research projects or from individual studies there is an opportunity to examine and create a new unique food recommendation system that takes into account all the above factors. this would empower the individual to make best decisions depending upon their meal requirements.

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3 LITERATURE REVIEW

3.1 Min et al.[2016]

Nowadays a major portion of the population is becoming physically unfit due to unhealthy eating patterns. Thus, food recommendation is of immediate need of the hour. Eating requirements can be calculated keeping in mind various health conditions of the person through tracking through smart-watches, health bands. System aims to suggest list of ranked food items for users to meet their needs specifically based on the personal needs. These suggestions also need medical and dietary knowledge. But it also has to keep in mind the personal interests so that the suggested diet is practically adaptable. In building the personal model learning user's food preference is a vital as if provides personalized information. While building a personal system we need to keep in mind the history records of the food items and how they have been consumed in the past over the last 5,000 years. Many people are facing the problem of making healthier food decisions in order to avoid the risk associated with the same and it becomes essential to make a model that balances the core problem of health along with the taste of individual. Because of subjectivity and uncertainty of visual perception from users these methods these methods could not accurately learn. Hence it has become very essential in the modern world to keep track of health, digestion, nutrition along with taste. Therefore, these systems will prove to be helpful in the future times

3.2 Gaikwad et al.[2017]

Gaikwad et al.[2017] focuses on the market/industrial use of the food recommendation system unlike the previous paper in which these systems were majorly focussing on health related disorders

and suggesting proper diets majorly focussing on helping users to decide over a wide choice. In addition its uses can be extended to get a list of food items we can make with available food items/ingredients. The main idea behind was the data mining over massive database to extract patterns. The current system available trains over various recipes and outputs are quite unfeasible also the results are not much oriented with the taste preferences. Also, as the dataset is global thus the outputs are not largely accepted by the Indians. the system provides a user friendly interface which would interactively receives information from approached system which gives optimal solution for end user.

3.3 Toledo et al.[2019]

A Food Recommender System Considering Nutritional Information and User Preferences Noncommunicable diseases, such as cardiovascular diseases, cancer, chronic respiratory diseases, and diabetes, are estimated to account for 63 percent of all deaths worldwide, according to the World Health Organization. Furthermore, it emphasises that such diseases can be avoided by implementing effective interventions that address common risk factors such as poor diet. In this context, personalised nutrition, rather than a one-size-fits-all approach, can help consumers stick to a healthy, pleasurable, and nutritional diet when it is closely linked to individual parameters. Recommender Systems (RSs) generates individualised suggestions as an output or guides the user to interesting or useful objects in a broad range of possible possibilities in a personalised fashion. Although alternative categories such as knowledge-based recommendation and constraint-based recommendation have been proposed, one of the most prominent classifications groups them into demographic filtering, collaborative filtering, content-based filtering, and hybrid filtering. The information gathering layer is responsible for capturing any nutrition-related relevant data linked with the user. This data comprises physiological data like the user's height and weight, heart rate, burned calories, and daily physical activity level, as well as information explicitly provided by the user such as daily food intake and expert knowledge like meal composition tables and food exclusion criteria. As a result, this study has developed a food recommendation method that generates daily tailored meal plans for individuals based on their nutritional needs and previous food preferences.

3.4 Trattner et al. [2017]

Food recommender systems not only recommend food suiting users' preferences but also suggest healthy food choices, keep track of eating behavior, understand health problems, and persuade to change user behavior. Few approaches that are taken into consideration to build a food recommendation system are 1)Content based-To adapt suggestions to the user's specific likes, content-based techniques have been developed by breaking recipes down into individual ingredients and scoring based on the ingredients contained within recipes, which users had rated positively 2)Collaborative Filtering-Based Methods (CF) 3)Hybrid Method 4)Group based Method-In this setting, a list of items is produced for a group of people rather than for an individual user 5)Health-Aware Methods-Improving nutritional values in diet is highly recommended. There are many reasons which make food re- commendation challenging, not only in terms of encouraging healthy behavior but also in predicting what people would like to eat. Some challenges are listed as follows:- 1)User preference sources 2)User preference scarcity 3)Offline and online evaluation of recommendations 4)Beyond accuracy.

3.5 Rehman et al.[2017]

Rehman et al.(2017) talks about a smart food recommendation system which uses an algorithm based on Ant Colony Optimization (ACO). The corpus uses a database of 3400 food items, with 26 entries for most common nutrition indices and uses a self designed database of 345 pathological test reports and their normal ranges. The 'Diet-right' system(the application) is trained on various types of age groups and their respective ranges of parameters. This allows the system to suggest diets as per needs of the users. The paper then talks about the architecture of the model. One of the major features of this application was the usage of cloud computing to increase the efficiency and speed. It essentially uses the following algorithm:- After initialization, each ant constructs its local solution by visiting nodes which provide best cost in terms of low error compared to targets. Target vector represents the amount of food ingredients required against the particular disease. The challenges that the model could encounter would be recommendations depending on the time of the day, as well as determining and analyzing the amount of nutrition in different food items as per timing.

Figure 1: image of the corresponding wordcloud.

4 METHODOLOGY

We developed various baselined models and tested them on our generated dataset. The dataset was generated by joining 2 datasets, one containing food reviews and the other containing important nutritional and physical attributes of food items. We first cleaned the textual data by applying several cleaning techniques like - removing stop words, removing punctuations, stemming, etc. Then, we tested out different baseline embedding techniques like Tf-Idf vectorization, Count vectorization, Fast-Text embeddings, Pre-trained BERT embeddings, etc and compared their performance of recommendation. This was done by finding the closest K vectors (using cosine similarity) to the query vector. As each of the generated vector represented a food item, We got K recommendations corresponding to our query vector. Now, We tested several metrics to

test out the performance of out baseline models. Finally, We used 4 different types of metrics - MAR@K (Mean Average Recall @ K recommendations), Prediction Coverage, Catalog Coverage, and Novelty Score respectively. Now we developed a SOTA model by doing a weighted ensemble of the baseline embeddings. We then compared the performance of our model with other baseline models. In the end We developed the 2nd part of our pipeline that gives the best recommendation considering the features like - nutrients, food category, diseases/allergies, diet, and ingredients used etc. This is done by first binarizing these features and then findiung the closest K neighbours to our input query.

5 EVALUATION

We have used the MAR@K(Mean Average Recall at K) comparison to rank and compare the models used in the system. The baseline models, BERT, Tf-idf, Count, FastText and Random embeddings have a poor performance as compared to our State of the Art(SOTA) embedding model. We have printed the MAR@K score for each model(for each of the 10 suggested dishes), the best score for each model is as follows, Bert: 0.0319444444, Tf-idf: 0.153, Count vector: 0.1526, FastText: 0.095694, SOTA: 0.1626, Random: 0.01047. This clearly depicts that the SOTA model performs the best amongst all the models. Another metric used is 'catalog coverage' wherein the lowest value is of the SOTA embedding depicting less scattered output predictions which in turn means a better and an accurate output. 'Prediction coverage' is yet another metric which returns the coverage of each model in the dataset while sampling, herein the random embedding has the highest value. SOTA embedding performs decently well on this metric as well coming in fourth in the comparisons. On the Novelty score(depicting the novelty value of our embedding), the SOTA model takes into account the previous preference of the user and hence does not predict a variety of unseen items and therefore comes in fifth place with the BERT embedding model topping the list.

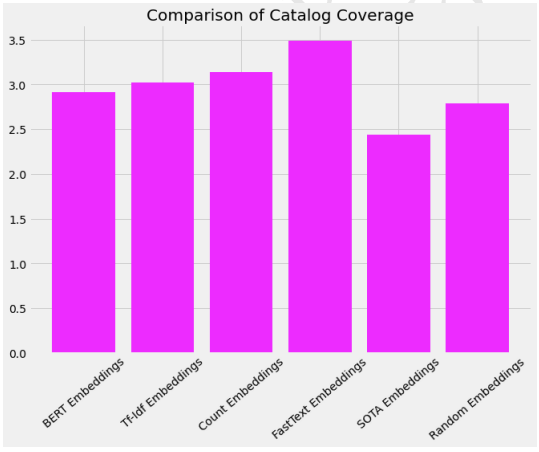

Figure 2: This image shows catalogue coverage comparison.

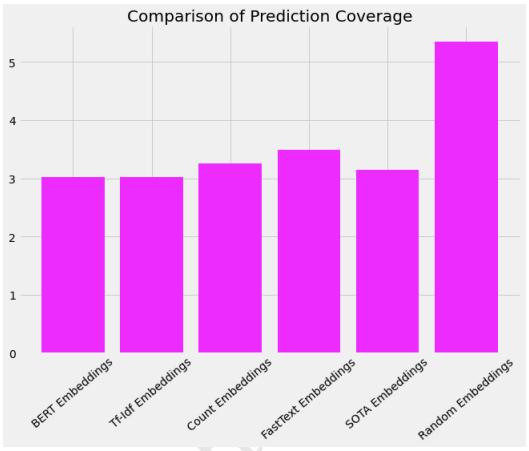

Figure 3: This image shows prediction coverage comparison.

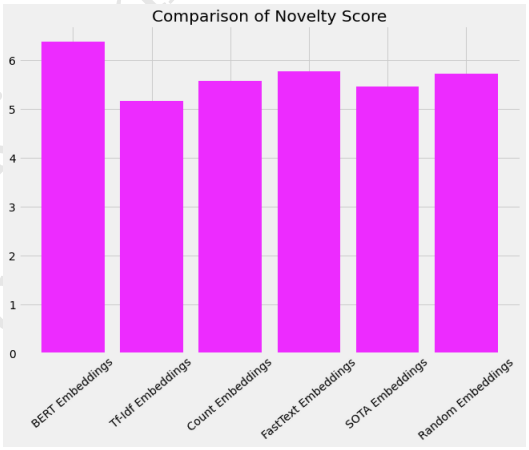

Figure 4: This image shows catalogue coverage comparison.

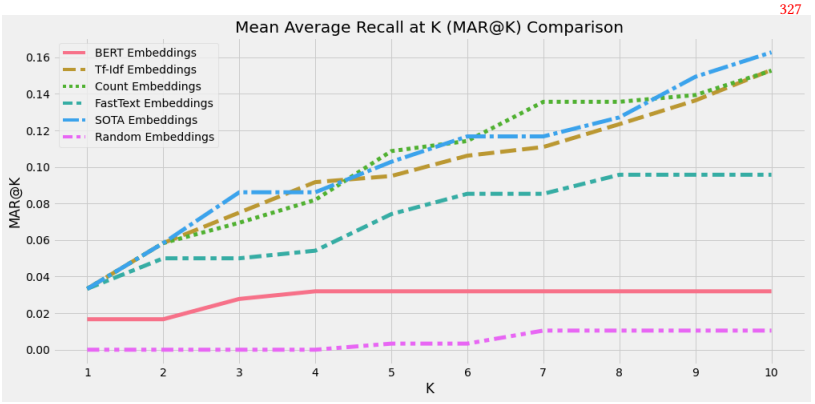

Figure 5: This image shows mark score comparison.

6 CONCLUSION

Our model successfully suggests a diet based on the nutritional as well as cuisine preferences. It suggests an entire table of cuisines/dishes

with their nutritional values, their categories, their ingredients among other descriptors according to the preferences entered by the user . This table is in a ranked order of the cuisines/dishes suggested by the system. This model can be used professionally to aid doctors as well as nutritionists suggest a healthy diet to their patients. It can also be used at a personal level by individuals who, perhaps, do not have the resources or the means to contact a professional, and require advice due to some medical or physical condition. If used on a wider scale, this would result in a significant increase in the number of physically fit and healthy individuals without taking any monetary advantage.

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