

COOKBETTER: A Bot for Personalized Recipe Recommendation

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ABSTRACT

Recommendation systems have become quite an integral part for majority in the 21st century. This paper intends to focus on the Recommendation System for Personalized Recipes. Current websites and applications incorporate the factors of ingredients available to the user, rating of the user and the recipe, but not on preferences and requirements of the user. We concentrate on a Personalized Recommendation System that takes into account the health conditions and dietary restrictions over and above what the present Recommendation Systems offer. We propose to deliver recipes engineered to an individual preference level by means of a slack bot with an aim of providing users with a convenient and easy-to-interact-with interface.

Categories and Subject Descriptors

H.2.8 [Database Management]: Database Applications — Data mining; H.3.3 [Information Storage and Retrieval]: Information Search and Retrieval—Information Filtering; D.2 [Software Engineering]

General Terms

Slackbot, Algorithms, Performance

Keywords

Recommendation System, Ingredients, Personalization, Recipe

1. INTRODUCTION

Busy schedules and hectic lifestyle has led to numerous conditions on the health front. Moreover, time as a resource has become more constrained than ever. Relating the aforementioned factors with everyday meal selection and preparation poses quite a dilemma. With an increased number of people concentrating on balancing body weight, taking precaution towards heart related ailments and maintaining a healthy physique in general, it becomes essential for recipe

recommendation systems to consider these preferences at an individual level. Allrecipes with 1.5 billion visits per year and 95 recipe views per second and Supercook with a recipe database of over half a million recipes indicate the popularity of recipe recommendation systems. However, these sites solely depend on the ingredient data that the user inputs ignoring the constraints of health and time.

The culinary domain is extensive and complex which increases the difficulty for the Recommendation Systems. The number of ingredients and their possible combinations coupled with the number of techniques to prepare them results in a considerably large amount of data to be handled. As a consequence, user's opinion on food items can vary quite significantly depending on whether he/she likes savoury to sweet, if they have specific allergies, prefers protein to carbohydrates etc. We try to incorporate such preferences and few others into our application thereby giving a more personalized experience to the user.

Plenty of work and research has been carried in the sector of recipe recommendation on making the system more exclusive and individualistic to the user. The Paper by Mino et al. described a method considering the schedule of the user and calculating the calorie intake or release in each event which determined the next meal of the user[1], or the study by Yajima et al. on what a user will consider an easy recipe taking into account numbers of ingredients and seasoning in the recipe and its cooking time[2]. Paper by Freyne et al. entails the results of their investigation by comparing three main recommendation strategies: content-based, collaborative, and hybrid[3].

Under this scenario, we have proposed a recipe recommendation method based on the user's food preferences and dietary restrictions. The method first creates the profile of the user based on their health conditions, health goals and allergies they presently have. So for every session that the user begins, he/she is asked for the ingredients they possess and only those recipes that help them maintain their health goals are displayed for them. And this is all done by means of a slack bot for the ease of use. The user will not be required to navigate through a large number of complicated website pages instead it will be interfaced in form a chat which makes the system quick and efficient.

2. PROBLEM DESCRIPTION

All the current recipe recommendations systems emphasize on the ingredients and their suitable combinations but with more people putting their focus on health, it becomes a mandate of sort for recommendations systems to consider



Figure 1: Results from Google Ngram Viewer.

their health and diet preferences. This is the problem we are trying to bring a solution to in the form a slack bot which uses the Microsoft Bot framework and gives personalized recipe solutions.

3. LITERATURE STUDY

3.1 Methodology

For the purpose of our literature study, we made use of 2 tools: Google Scholar and Google Ngram Viewer. We used Google Scholar for searching scholarly literature and finding papers relevant to our work. We made use of Google Ngram Viewer for charting the frequencies of our search keywords mentioned in the vast amount of books available in the Google Books library.

3.2 Summary of papers

After perusing various research papers, we discovered that a lot of research has been done in the area of recommendation systems, including recipe recommendation, and that there is a growing interest in this field. With the advent of machine learning, it has become possible for the system to learn the preferences of the user and improve the recommendation results. Although most of these papers proposed systems that solved one particular purpose, the methodologies adopted in each were significantly different. Although we gained useful insights from these papers, we decided to try a different method to solve this problem - using chatbots.

In 2011, Ueda et al proposed a personalized recipe recommendation system based on the user's preference[4]. This system is personalized in the sense that it recommends recipes that are similar to recipes the user has browsed in the past, in terms of ingredients. While this is a good way of personalizing the recommendation system, we have chosen to prioritize the user's health conditions and dietary restrictions over past preferences.

In 2012, Kuo et al investigated a menu planning mechanism based on user-specified ingredients[5]. This experiment obtained positive results for the effectiveness of a recommendation system based on ingredients.

3.3 Results of n-gram viewer

We chose the following keywords for our study: recommendation system, personalized recommendation and chat-

bot. The frequencies of mentions of these keywords in books published between the years 1900 and 2018 are shown in Figure 1. This time frame was chosen as there was either negligible or no mentions of our keywords in books prior to 1900.

We observed that the concept of recommendation systems was written about as early as 1902, and has been on a steady increase since 1992. However, we can see that personalized recommendation has only been mentioned since 1992, and has the least number of mentions among all our keywords. This indicates the need for further research and works on this subject. We found that chatbots, although researched upon ever since the 1960s by MIT professor Joseph Weizenbaum, have been popular in books only since 1996. We observed that the work on chatbots increased rapidly since then, hitting a peak in 2003.

4. USER RESEARCH

4.1 Survey

In order to understand this particular problem and if our proposed solution will be perceived well by the wider public, we conducted an online survey which comprised of 6 questions. The questions and the reasoning behind them are discussed below.

Question 1: How often do you look for recipes online?

This question was asked to get an idea about how many people look for recipes online, as these people would be our user base.

Question 2: Would you like to find recipes that you can make using only the ingredients that you already have?

This question was asked to determine if people would like one of our features - searching recipes based on available ingredients.

Question 3: Would you like recipe recommendations that are personalized for your dietary restrictions?

This question was asked to determine if people would like an important feature of our project - personalized recipes based on dietary restrictions.

Question 4: Do you find Slack user-friendly?

Since the chatbot proposed in this project is used through

the Slack app, this question was asked to find out if the users found the application user-friendly and like using it, as the users of our chatbot are all going to be Slack users.

Question 5: Would you prefer using a chatbot over a conventional website?

This question was asked to find out if users will adapt to our new proposed system of using a chatbot over the existing systems that use websites.

Question 6: Will you use a Slack bot for personalized recipe recommendation?

We finally asked a direct question to figure out how many people were inclined to use our Slack bot based on the proposal, even before trying it.

4.2 Results

The survey received close to 40 responses and the participants were mainly students. We targeted this user base as we felt that students would be the ideal users of our bot, considering that they spend a lot of time on messaging applications and have more restrictions when it comes to cooking, in terms of ingredients, time available to cook, etc.

Figure 2 depicts the frequency of searching for recipes online. 41.7% of the participants responded that they search for recipes online all the time, 50% of the participants said they look for recipes online sometimes and only 8.3% of the participants said they never look for recipes online. We found these results to be favorable as the 91.7% of participants who look for recipes online are more likely to use our bot.

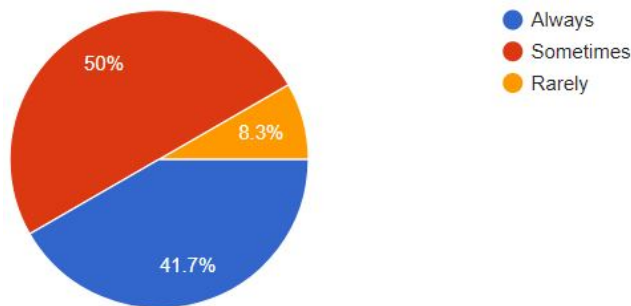


Figure 2: How often do you look for recipes online?

Figure 3 shows that 94.4% of the participants would like to search for recipes based on the ingredients that they already have. This indicates a problem with the current systems to look for recipes, which may display recipes with ingredients that the user may not possess, making the recipes unacceptable for the user.

Figure 4 shows that 88.9% of the participants require recipe recommendations that take into account their dietary restrictions. We assume that the remaining 11.1% do not have any strict dietary restrictions or are not particular about this feature. However, majority of the participants have indicated their approval of a system that considers their health factors.

We find from Figure 5 that 69.4% of the participants find the application Slack to be user-friendly. 30.6% of the participants have said that Slack is not user-friendly. This indicates the need to extent our chatbot to other messaging

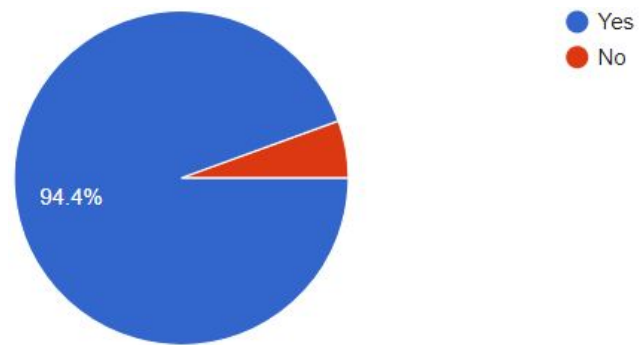


Figure 3: Would you like to find recipes that you can make using only the ingredients that you already have?

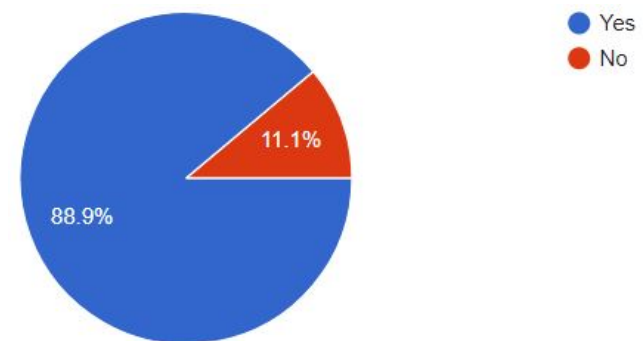


Figure 4: Would you like recipe recommendations that are personalized for your dietary restrictions?

platforms which support chatbots in the future.

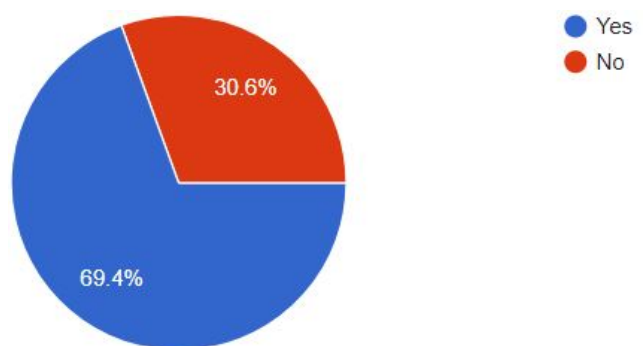


Figure 5: Do you find Slack user-friendly?

Figure 6 depicts the percentage of users who would prefer using a chatbot over a conventional website that is available in most existing systems. 72.2% of the participants responded positively to this question.

This final question, asking the participants if they would use our proposed chatbot, received a mixed response. 41.7% of the participants indicated that they would use it, 47.2% indicated that they might use it, while only 11.1% indicated that they will not use it.

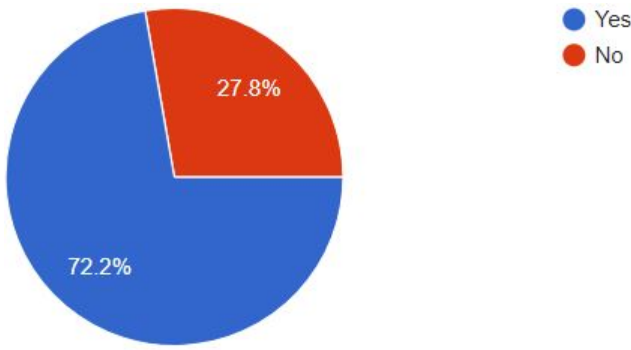


Figure 6: Would you prefer using a chatbot over a conventional website?

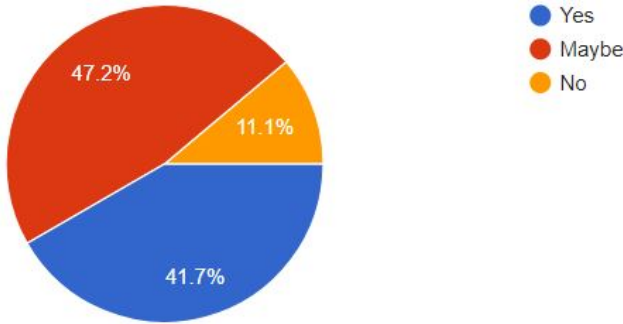


Figure 7: Will you use a Slack bot for personalized recipe recommendation?

5. PROPOSED PROJECT ARCHITECTURE

In this section we have shown the proposed architecture of our project. Proposed model is shown in Figure 8.

From figure 8 we see that this project uses Slack API for creating application bots. User uses slack and chats with slack bot to interact with in the application. User will use slash commands to enter into recipe recommendation function. At this point user will have to put in the filters he/she intends to use for the desired recipe. The bot then puts the desired request to the database. When the request is processed user will receive step by step instructions on how to cook the recipe.

The database connected to slack bot comprises on integration of a recipe database along with recommendation module, which is basically a prioritizing model which selects recipes from the recipe database based on past selections by the user and sorts out all the common filters for the recipe which are being repeated in order to have faster rendering of results as well as a personalized recommendation. We intend to use MySQL and Amazon Web Services for all the database applications purposes.

User initially will need to fill up a form which will create the basis of recommendation module will set up. User will also have to option to negate these presetting and search for a recipe he desires by just typing its name. User can also search for recipes bases on parameters like Time Constraint, Occasion or ingredients presently available to the user.

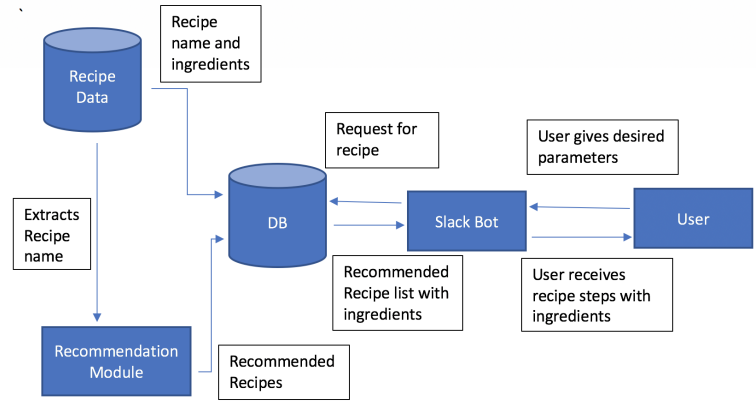


Figure 8: Proposed Model

The two factor recommendation setup takes in global parameters Health, Allergies, Restrictions and Goal. These parameters will be one time fill ups and would be by default applied while user searches for a recipe. Here, Health is if the user is healthy or suffers a disease like diabetes or not. Restrictions include dietary habits like vegan, non- vegetarian, etc. Goal indicates what user wants to achieve with the diet like reduce weight.

The second layer would be the session filter which would include local parameters like time taken to cook, occasion, type of food, ingredients, etc. Here, occasion includes suggestion recipe for Halloween, Diwali, etc. Type of food corresponds to cuisine of choice of user. Ingredients indicate the list of available ingredients by the user.

All these parameters together constitute in fetching a recommended list of recipe for the user.

6. EVALUATION PLAN

This application can be evaluated on basis of following metrics:

1. Reliability
2. Scalability
3. Cooperativity

6.1 Reliability

Our model needs to be reliable with the prediction of the recipe which user has entered or using the parameters user is filling. It is imperative that user correct option of recipe is shown to the user, otherwise user might end up getting improper results which in worst case could be life threatening for the user, in case user has allergies or some disease. Recommendation module needs to function properly.

6.2 Scalability

This application is not limited in scope and can be expanded to involve many more use cases and functions. We could use the data and recommendation module to give recommendations of food with what friends of user are having

and the same database could be used to add complexity of cooking a specific recipe.

6.3 Cooperativity

The slack bot is connected to databases which is connected to the recommendation module, which in turn modifies the database from which the slack bot will be accessing the data to give to the user. Hence, the cooperation between the recommendation module and both the modified and original database need to be proper otherwise the resulting recipe suggestion to the might be faulty.

7. FUTURE SCOPE

Our proposed model only contains itself to domain of recipe, ingredients and at home cooking. It can be future updated to add features like looking for nearby restaurants for the input parameters by user. Adding functionality of mood recipe, which could suggest recipe to cook for a given mood of user. Make the bot learn user habits and create a healthy diet schedule for the user. Given the database this application can amass and the recommendation module scope of this application to perform multiple features is high and could be developed.

8. CONCLUSION

In conclusion our project aims at improving lifestyle of the users by giving them option to find a healthy meal to have using something they have access easily, a phone or laptop. The slack bot is easy to use and has great for interaction with user. Finding a meal to cook which right for you can be a tedious task and this application just aims to solve that using the latest technology.

9. ACKNOWLEDGMENTS

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