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A Personalized Hybrid Restaurant Recommender System through Conversations

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Abstract: ***Providing accurate information from restaurants to make a decision on where to eat is becoming increasingly difficult as the amount of information and the number of options increases. The system treats the selection of restaurants of interest as an interactive and conversational process, with recommendation systems researching the attributes of restaurants and responding to the user. It was tested on a sample of 100 users.***

Keywords: Recommendation systems, artificial intelligence, machine learning.

1. Introduction

Most people still make their decision to buy based on the actions of others, usually taking information about their experiences [1]. The data available on the Internet continues to grow exponentially and the need to extract useful information is paramount. Recommendation systems provide customers with easy access to product/service information [2]. TripAdvisor is another company that leverages referral systems to give advice on a wide variety of travel options around the world, and Eharmony [3] helps bring people together.

This not only helps users in information overload situations, but they can also contribute significantly to the business success of driving service providers and e-commerce sales based on users' browsing history, searches, purchases, and preferences. Currently, recommendation systems are among the most successful research fields of Artificial Intelligence in practice [4]. Conversational systems incorporate artificial intelligence systems. Conversational Recommendation Systems support task-oriented dialogue and multiple feedback with users.

These devices have conversational systems for command recognition. Alexa, Siri, and Cortana are robust conversational systems that rely more on machine learning technology [5], rather than following predefined dialogue paths.

2. Literature Review

In [6], they proposed a food place recommendation system using social media information to determine group preferences in a multilingual context. Four different approaches of recommendation were evaluated. This includes (1) a reference approach (language-independent popularity) (2) the proposed approach (language-dependent popularity) (3) the proposed approach with explicit grading data and (4) the proposed approach with opinion data.

There are several recommendation techniques depending on what is required to be searched, most recommendation systems are single-targeted, which means that you are only looking for one thing in general. Such as groups, preferences, and restaurant atmosphere, it emphasizes the need to make multi-target recommendations and provides as a solution the use of hypertrophy ranking, using an attribute-context user data model [7]. The model shows through experiments to give a good recommendation, and improve the accuracy of other jobs.

There are many restaurants that serve a wide variety of foods looking to satisfy the different tastes of their customers, and they can decide where to eat, The, present a recommendation system based on the content of the restaurant. Its methodology is based on the correlation method, and the method of elimination of recursive characteristics. The second model is used for describing attributes of a restaurant such as price, type of cuisine, among others. Which show the impact of feature filtering that improves system performance [8].

Artificial Intelligence continues to grow in popularity on several platforms, becoming especially prominent in Chatbot technology. A chatbot is a program designed for the social and support context, and its technology has evolved over time. In [9] it develops a text-based Chatbot, which recognizes user input, as well as by matching patterns, access information to provide predefined confirmation. For example, if the user provides the bot with a phrase such as "What's their name?" The chatbot will most likely respond to something like "My name is Chatbot". Or the chatbot responds as "You can call me Chatbot."

3. Methodology

Figure 1 shows the schema of the proposed system, two blocks are shown below.

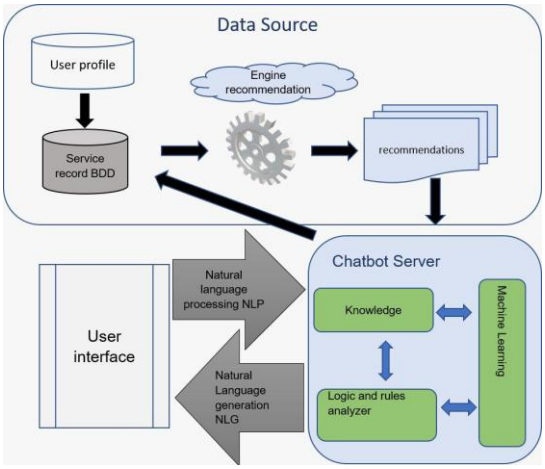


Figure 1: Diagram to blocks of the Conversational System

Within the Data Source block, there were 2 ways to obtain information: the first, that information provided by users when registering for the application. The user enters personal data, tastes, preferences of places, and dishes, in addition to the information of restaurants that offer promotions and services. The second is through learning that it is already registered in the database of responses to previously resolved technical problems. Also, there is the recommendation engine in which are the algorithms for the construction of recommendation systems.

In the second block, there is the Chatbot, allows interaction between the user and the recommendation engine; it is responsible for interpreting the knowledge generated by the recommendation engine, generated with each user search, and converting it to a natural language interpretable to the user and vice versa. Subsequently, it is interpreted as input data by the user, machine learning continues using the logic and rules analyzer by using word bag, and finally, generating the natural language that will be the response to the user. The methods and algorithms used to construct these blocks are detailed below.

Recommendation systems will suggest the most suitable restaurants based on related information about location, restaurants, users, and interactions between restaurants and users. The most important feature of the recommendation systems proposed here is their ability to discover a user's preferences and interests by analyzing the behavior of this user and/or the behavior of other users to generate personalized recommendations [10][11].

On the other hand, to process the language, its components: grammar, syntax and construct supporting structures that will serve as input for Linear Regression, Logistic Regression, Naive Bayes Classifier, Decision Tree Classifier or Neural Network Classifier based on the result you are looking for, the following common techniques can be used in NLP: Tokenize, Tagging Part of Speech, Shallow parsing/ Chunks, Meaning of words, Pragmatic Analysis, word2vect, and Bag of words. The technique used for this chatbot project is the Bag of words technique due to the simulation of words used in a conversation with the user that serves to give suggestions to their search.

In Bag of words, you need a way to render text data for the machine learning algorithm. In this approach, token words are used for each observation and discover the frequency of each token using the concept of deepening. Consider the following sentences:

- "It was the best of times"
- "It was the worst of times"
- "It was the age of wisdom"
- "It was the age of foolishness"

Each sentence is treated as a separate document and lists all words in the four documents, excluding punctuation. 'It is', 'was', 'he', 'better', 'of', 'times', 'worse', 'age', 'wisdom', 'foolishness'.

The next step is to create vectors. The first document is taken: "It was the best of times" and the frequency of the words of the 10 unique words is verified. "It was" s 1, "the" s 1, "Best" s 1, "From" s 1, "times" s 1, "worst" - 0, "age" - 0, "wisdom" - 0, and "foolishness" - 0.

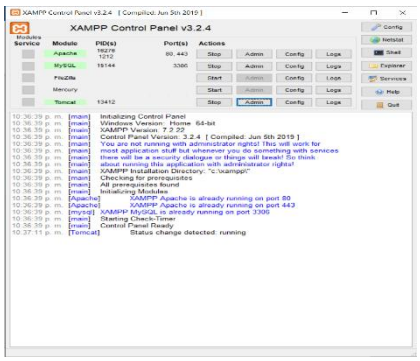
The rest of the documents will be:
"It was the best of times" [1, 1, 1, 1, 1, 0, 0, 0, 0]
"It was the worst of times" [1, 1, 0, 1, 1, 1, 0, 0, 0]
"It was the age of wisdom" [1, 1, 0, 1, 0, 0, 1, 1, 0]
"It was the age of foolishness" [1, 1, 0, 1, 0, 0, 1, 0, 1]

In this approach, each word or token is called "gram". You can also create a two-word pair vocabulary, called a bigram model. The bigrams in the first document: "It was the best of times" are as follows: "it was", "it was him", "the best", "of the times".

The process of converting text in Natural Language Processing (NLP) into numbers is called vectorization in Machine Learning. The different ways to convert text to vectors are: count the number of times each word appears in a document, and calculate how often each word appears in a document of all words in the document.

4. Results

There are 20 preference categories to select as default likes. Restaurant data was taken from the app. User data was generated by the authors. The software tools that were used were NetBeans 8.2, Xamp 3.2.4 and the Tomcat server. Figure 2 shows the execution of the project.



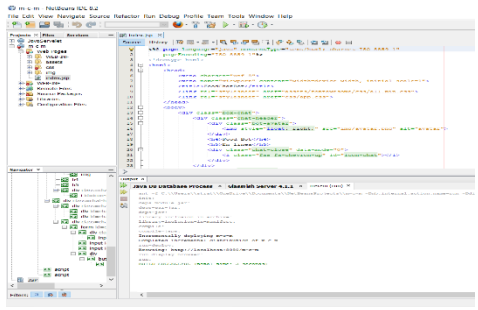
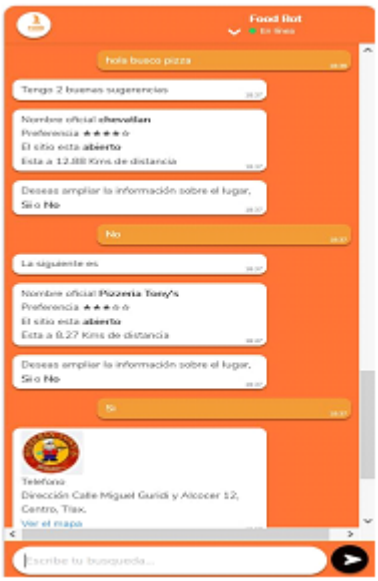


Figure 2: Running the project from NetBeans.

Figures 3a, 3.b and 3.c show the suggestions obtained by the three different recommending systems as a recommendation engine for the conversational recommendation system. In Figure 3a, it is noted that the value of the customer's preference for the restaurant over distance is predominant. Figure 3.b predominantly the restaurant with promotion and close to the current location. Figure 3.c is predominantly the nearest restaurant and has some of the user's preferences.



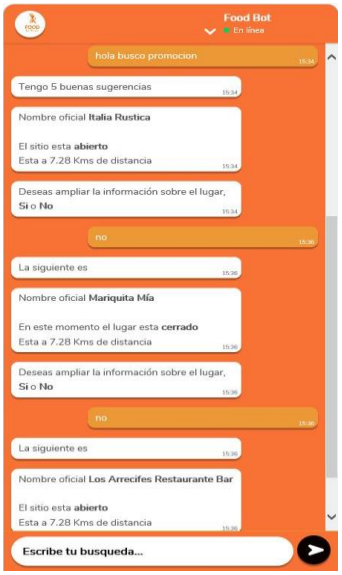


Figure 3: Departure from the Conversational Recommendation System by a) user preference, b) promotion and c) geographic location

5. Conclusions

This work has presented a Conversational Recommendation System, which in its recommendation engine uses a recommendation system based on geographical location, and two customized recommendation systems that suggest restaurants based on promotions and tastes. A collaborative filter-based recommendation system, a content-based recommendation system, and a geo-location-based recommendation system were used. In the first result obtained, it is demonstrated by an algorithm of K-media, that there are well-defined groups among the data of dishes and restaurants used for testing this work. Then the promotion recommendation system is located, as it only filters if you have the restaurant offers promotion and discount rates. Finally, the lowest performer was the referral recommendation system.

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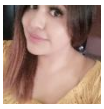
Author Profile



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