Location Aware Recommendation System

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Abstract: Recommender systems are used in almost all applications today, both for commercial and educational purposes. We propose a location aware recommender system for restaurants which not only takes into consideration the user’s location but also the user’s profile. This profile is basically the user’s reviews, liking and preferences. We use a travel penalty system to narrow down user search and provide the user with the most optimum recommendation considering both his location and profile (which includes likings/preferences). Recommender systems are tools for interacting with large and complex information spaces. They provide a personalized view of such spaces, prioritizing items likely to be of interest to the user.

1. Introduction

Between 1998 and 2013, more than 300 researchers published more than 200 articles in the field of research paper recommender systems. We reviewed these articles and found that content based filtering was the predominantly applied recommendation concept (53%). Collaborative filtering was only applied by 12% of the reviewed approaches, and graph based recommendations by 7%. Other recommendation concepts included stereotyping, item-centric recommendations and hybrid recommendations. The content based filtering approaches mainly utilized papers that the users had authored, tagged, browsed, or downloaded. TF-IDF was the most applied weighting scheme. Stop-words were removed only by 31% of the approaches, stemming was applied by 24%. Aside from simple terms, also n-grams, topics, and citations were utilized. Systems implementing a content-based recommendation approach analyze a set of documents and/or descriptions of items previously rated by a user, and build a model or profile of user interests based on the features of the objects rated by that user. The profile is a structured representation of user interests, adopted to recommend new interesting items. The recommendation process basically consists in matching up the attributes of the user profile against the attributes of a content object. The result is a relevance judgment that represents the user’s level of interest in that object. If a profile accurately reflects user preferences, it is of tremendous advantage for the effectiveness of an information access process. For instance, it could be used to filter search results by deciding whether a user is interested in a specific Web page or not and, in the negative case, preventing it from being displayed. Online location aware recommender system will be a mobile and website based application which will be based on data mining, text mining and recommendation system. Its main aim is to provide accurate recommendations to users based on spatial and non-spatial properties of the user and item requested. Item maybe a certain food item or a certain restaurant providing a type of item. Users may be able to review both restaurants and items. The user reviews would be examined to create a profile of the user. The product will consider the users history (from the previous likings and reviews) and/or location before providing a recommendation. The application will take the users search request and provide the relevant recommendation.

2. Design and Implementation of the System

A. System Architecture

System architecture is the conceptual model that defines the structure, behavior, and more views of a system. An architecture description is a formal description and representation of a system, organized in a way that supports reasoning about the structures and behaviors of the system.
Implementation Details:

Android software development is the process by which new applications are created for the android operating system. Applications are usually developed in Java programming language using the Android software development kit (SDK). In our project we use Android Studio. It is the official integrated development environment (IDE) for developing for the Android platform. Based on JetBrains IntelliJ IDEA software, Android Studio is designed specifically for Android development. It is available for download on Windows, Mac OS X and Linux, and replaced Eclipse Android Development Tools (ADT) as Google's primary IDE for native Android application development.

MONGODB

MongoDB (from humongous) is a cross-platform document-oriented database. Classified as a NoSQL database, MongoDB eschews the traditional table-based relational database structure in favor of JSON-like documents with dynamic schemas (MongoDB calls the format BSON), making the integration of data in certain types of applications easier and faster. MongoDB is developed by MongoDB Inc. and is published as free and open-source software under a combination of the GNU Affero General Public License and the Apache License. As of July 2015, MongoDB is the fourth most popular type of database management system, and the most popular for document stores.

Languages Used:

Java:

Java is used in a wide variety of computing platforms from embedded devices and mobile phones to enterprise servers and supercomputers. While less common, Java applets run in secure, sandboxed environments to provide many features of native applications and can be embedded in HTML pages. In our project we use java for developing an android application. Various events are handled in application by java. It helps to process information received from GUI of application.

XML:

Extensible Markup Language (XML) is a markup language that defines a set of rules for encoding documents in a format which is both human-readable and machine-readable. XML files are encouraged because it makes your app more closely follow the Model-View-Controller programming strategy. Having each part as separate from each other as possible makes it easier to develop and maintain your overall program. The performance difference seems to be minimal, although others have said that XML is preprocessed. It helps organize and visualize the layouts very nicely. It provides a backbone to the GUI that allows multiple devices to be supported by much less code.

HTML:

Hypertext Markup Language, commonly referred to as HTML, is the standard markup language used to create web pages. Along with CSS, and JavaScript, HTML is a cornerstone technology used to create web pages, as well as to create user interfaces for mobile and web applications. Web browsers can read HTML files and render them into visible or audible web pages. HTML describes the structure of a website. Semantically along with cues for presentation, making it a markup language, rather than a programming language.

CSS:

CSS is used to define styles for documents, including the design, layout and variations in display for different devices and screen sizes. We attach a separate CSS file in the <head> of a document that defines styles with an external style sheet. CSS stands for Cascading Style Sheets.

Styling can be added to HTML elements in 3 ways:

- Inline - using a style attribute in HTML elements
- Internal - using a <style> element in the HTML <head> section
- External - using one or more external CSS files

Algorithms used:

Travel Penalty: for narrow down the searches and provide user with the exact location.
Classification: For classifying positive and negative preferences given by user.
Sentiment analysis: for generating the user’s profile and maintaining it.

B. Mathematical Model

Pyramid algorithm we allow user to narrow down to hotels based on location the user prefers. The
user may provide reviews to the restaurant. This review is then sent for sentiment analysis. Here we take a count of positive and negative sentiments. Now generate/update user profile (liking/preferences). Match hotel profile most suitable with user profile. Provide recommendation in order of most suitable to least suitable.

3. Results and Discussions

By use of Location Aware Recommendation System we provide a reliable, fast and efficient way for users to not only search for hotels and restaurants but also provide their reviews. These reviews are then exploited using sentiment analysis and the user sentiment is gauged. Based on these reviews both hotel and user profile generation and updating takes place. Thus we are then able to match users to the restaurant he is most likely going to prefer and then provide a recommendation keeping in mind the user and hotel location. We have seen that these recommendations are successful and accurate. This helps us build both hotel and user profile which can be used in the future for commercial purposes as well. The Pyramid algorithm to narrow down search is very efficient as we move down states, cities and then areas within a city thus provide an easy way for user to search a restaurant based on the location of his choice. Sentiment analysis helps us determine the sentiment behind a user review; sentiment analysis is carried out using open NLP class. Thus recommendation is provided based on what user is most likely going to prefer and displaced in the order where the closest match is displayed first and then subsequent matches.

4. Conclusion

By Using a Recommendation system we conclude that this provides an easy way for user to search based on location and preference. User profile generation is effective in helping us provide recommendation to the user. Thus the user may find new restaurants provided to him to useful. Proposed recommendation system works better than traditional recommendation systems. It gives optimum and efficient way of recommendation considering users location, his preferences and his choice of restaurant location. The purpose is to not only make users experience better but also help him find excellent choices closer to his liking. This system may be used in the future by organizations and companies to make successful revenue generating recommendation system.

The type of the user profile derived by a content-based recommender depends on the learning method employed. Decision trees, neural nets, and vector-based representations can be all used. In this project I have used decision vector based representations constructed with the help of user ratings. At this step, my system uses explicit data collection. Specifically, after each recommendation, user can explicitly state whether the recommendation is satisfying or not. The next recommendations will be mostly based on this user feedback.

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6. References

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