Enhanced Role-Based Access Control Model for Mobile Recommender System

Rajendra Pawar, Prashant Yelmar, Namdev Matolkar

MITCOE Pune

Abstract- The use of mobile devices in combination with the rapid growth of the internet has generated an information overload problem. Recommender systems are a necessity to decide which of the data are relevant to the user. However, in mobile devices there are different factors who are crucial to information retrieval, such as the location, the screen size and the processor speed. This paper gives an overview of the technologies related to mobile recommender systems and a more detailed description of the challenges faced.

Keywords- Mobile Devices, Recommender System.

I.   INTRODUCTION

The evolution of computers in combination with the rapid development of mobile phone platforms such as the Google Android and the Apple iPhone in conjunction with the need for m-commerce need has brought up the use of personalization and recommendation systems. The use of the internet is moving forward with a direction towards mobile devices and although such devices come in various forms, in this paper we refer to Smart phones that can access the internet and have features to enable access to information through a suitable way. Moreover, mobile devices have limitations related to hardware capabilities, network connections and usability issues such as the screen size.

Mobile devices have become very popular nowadays and they are considered to be a primary access information environment. However, as the information on the internet grows and the people who use these devices become larger and larger there is a need to face the challenges that are tight related to mobile computing environments. The need to face the information overload is the most important nowadays in Combination with the limitations that most of these devices have directed us to the use of recommendation Technologies.

II.   LITERATURE SURVEY

The Paper by N Polatidis and CK Georgiadis from the University of Macedonia illustrates the use of a variety of Technologies in Mobile Recommender Systems applications [1]. It also gives a detailed description of the challenges faced. A novel solution of RBAC has been proposed to tackle the privacy problem. A classification of algorithms for Recommendation has been given as well.

F. Ricci [2] has mostly concentrated on the development of such systems and their practical applications in a variety of fields where recommendation is necessary. The paper revolves around a variety of approaches used to achieve this. The types algorithms mentioned by N Polatidis and CK Georgiadis [1] have been further explained in detail by Mr. Ricci.

III.   THEORETICAL BACKGROUND

3.1 Recommender Systems: Technologies and Challenges

Recommender systems are concerned with the dynamic customization of data received over the World Wide Web and are based to user preferences. The scope of the recommendations is to assist the user to decide what to buy, who to make friend to a social network or what news to read. Due to information overload on the internet, personalization systems are one of the most valuable tools. Additionally, it should be noted that it is a very demanding process to design and develop such a system, since it combines knowledge and skills from different computer science fields. Despite of that, a number of well-respected methods have been developed the past few years, with some of them being used in commercial environments. Moreover, in mobile devices the information access problem becomes even harder because of the difficulties found.

It is important to note that the algorithms applied to personal computers cannot be transferred directly to a mobile device, since there are different needs, special characteristics and limitations. The needs are about m-commerce, location based services found mainly in tourism and mobile financial services. Characteristics refer to the user interface; processor, memory capabilities and limitations are about the network boundaries found in GSM, Wi-Fi and GPS systems.

However,the advantages are more important. These include the ubiquity and the location-based service. These are the crucial factors that mobile recommender systems are based on most of the time. Furthermore, the need for privacy has become a very important aspect of mobile

phones that use personalization techniques. It is vital for the system to use some private data in order to provide accurate recommendations. However, it should be taken into consideration that privacy is a massive problem with negativity towards the use of recommenders in mobile environments. Most of the time simple users are not aware how e-commerce organizations use these data and they react in various destructive ways. We have reached a point that merchants want to improve their service and use unfair practices. However, there is a reconciliation point that could be reached if both parties are willing to work towards this road.

The research is focused on how the users can receive personalized content in their smartphones using current technologies. However, in mobile environments attributes such as location and time should be embedded to such algorithms but on the other hand there are privacy concerns that have to be taken into consideration. Moreover, a mixture of current recommendation technologies that study the special mobile characteristics and use data from social networking websites will be discussed, along with technologies that can be used to solve the privacy problem.

Additionally, there are still open questions that need extensive research to be answered. These include the goals of mobile recommender systems and the expectations of the users, if there are any type of implications associated with the location-based parameter and if this should be compulsory or enforced only when questioned. Also, it is not clear if there is a mobile domain or there is a number of e-commerce scenarios that is more suitable to mobile devices such as tourism. However, these questions are still open, because mobile computing is a relatively new field of study in computer science and the lack of surveys and results is obvious.

In addition to the above, an issue in mobile and ubiquitous computing is context awareness. By context is denoted the environment parameters and if they can play a role in recommendation results. The context usually adds additional parameters to the running algorithm which include demographics, objects, surroundings or other factors that could be considered relevant by the user such as health, mood, social activities and application context like web browser history and email mining. Also into consideration the sequence of visits can be taken in order to find a pattern and make predictions. The application areas that widely use context awareness at the moment include, but are not limited to, m-commerce and tourism.

Recommender Systems

Recommender systems are computer algorithms used widely in e-commerce to suggest items to a user. The recommendations are about what items to buy, news reading, social networking connections and what movies to rent among many others. Among the most popular websites that use recommender systems is Amazon.com, which provides a personalized web page to each individual user. Netflix is another example website that uses recommender systems to suggest movies and TV shows. Such systems in general suggest a list with N top items relevant to the user. The items are retrieved according to rules set by the algorithm and suggest the topmost from the list, depending on the interface. Recommender systems were developed to make daily decisions simpler. These decisions are mostly about low cost environments such as book and movie suggestions, with their primary scope being to relief the user from long searches.

IV.   AN OVERVIEW

It is to be noted that a recommender system despite the algorithm that uses, it takes as input personal information from the user it creates the recommendations either locally or in a distributed environment and it passes the predictions to the interface of the services the user is using. Furthermore, the three most important and widely used recommendation algorithms are the following:

4.1. Collaborative filtering

In collaborative systems the basic idea is to find which users share the same interests with you in the past. The main idea of these systems is that the users who had a taste similar to you, likely will have the same taste in the future. Pure collaborative techniques take a user-input matrix with ratings as the only input and generate a prediction value indicating similarities to other users.

4.2. Content based filtering

Content based recommenders are somewhat simpler to implement, since they are based on metadata of the actual data. This metadata can be some technical description of an item, the genre of a movie, the title, type, author or other defined set of keywords. This is done by maintaining a list of attributes andsearching within the list. Content based recommendations are a durable technique and the database is constantly updated with user preferences. Moreover, content based is used in systems like news filtering and information retrieval. Furthermore, systems like that, are used when there are not enough ratings to perform a collaborative based approach.

4.3. Knowledge based filtering

In practice most systems are based in collaborative filtering methods, a technique which is based on other user ratings only. On the other hand, content based approaches use metadata information, such as movie categories or

keywords. The main benefit of these methods is the low cost to acquire the data from the users. However, there are many circumstances that these methods are not sufficient. Collaborative and content based methods usually perform well in low cost environments such as books and movies, where other users provide ratings and information more often. In other situations, such as buying a personal computer or a digital camera a knowledge based algorithm shall be used. As it is distinct by its name, knowledge based systems rely on data provided by the user and use them as constraints in order to provide recommendations.

4.4. Hybrid Algorithms

Hybridization is the combination, or the use of all, features from different algorithms in order to make a recommendation. While each of the algorithms described above is dominant in their respective field, the need for Hybridization is gaining more attention. Moreover, hybrid algorithms have been categorized according to their design.

4.5. An Overview of Mobile Environments

In the internet era and with personal computers being everywhere the need for e-commerce and recommender technologies is essential. Likewise, smartphones and tablets use the same technologies in their respective environments with extra parameters taken into consideration. Such parameters include location, time and screen limitations. The information overload is so high nowadays, that recommender systems are necessary in almost every aspect of mobile devices. Furthermore, examples of recommendations include mobile commerce, news reading and finding related services (such as hotels or other tourism related information). Additionally, the personalization of the operating system itself has been taken into consideration.

Moreover, mobile devices have progressed so fast that tends to become the primary source of access to social networks. Users, who want instant access from everywhere and not use a computer to do that, tend to use a mobile device such as a smartphone or tablet. The network communication facilities such as the cellular, Wi-Fi and GPS have aided towards this direction.

The progress both in hardware and software have enabled mobile devices to offer extraordinary services and help people to achieve experiences that otherwise would be unknown to them. Context-awareness is the most important aspect that drives mobile devices. Mobile devices are based to services in order to support their users. These services are location-based, user-based (such as the use of personal profiles), device-based (such as the memory, processor speed and screen size), spatial attributes (such as day, night, mood and/or weather conditions) and social-based attributes based on communicating with other users.

In mobile devices there are other factors than the traditional, which should be taken seriously in order to improve recommendations. Such elements include access to the e-mail agent of the OS, to the call logs, SMS excavating, internet and online chat services history and the use of a user well-defined profile. Additionally, a very serious aspect is the use of data from social networks, which nowadays its use is put forward mobile operating systems that have integrated features of networks such as Facebook and twitter. Also, the use purchase history data from large auction sites such as EBay must be taken into consideration. A very important aspect in respect to the usage of mobile devices and recommendation system to be more specific is privacy. It is the main cause that mobile users avoid to use such technologies. It is a challenge to the use of recommenders in mobile environments and it is discussed further in the challenges section ahead.

V.   THE CHALLENGES

5.1 Challenges Faced by Mobile Recommender Systems

Below we discuss challenging topics found in mobile recommender systems literature. These areas are still under active research and serious future work is required.

5.2 Privacy

Privacy is about ensuring that the user data will be kept private whatsoever. Privacy policies in conjunction with the knowledge level of the users about the subject guide them towards a negative behavior when they are being asked about to pass data in order to receive more personalized content.

5.3 Mobile App Permissions

Mobile applications and their permissions is critical part of privacy as well. Apps have the ability to access and share user data and possibly amend them. Moreover, apps have the ability to communicate with each other, thus raising privacy and security concerns. Conventional privacy methods are not valid here and other aspects must be taken into consideration. To make it more clear, an app can use the permissions granted to another app in order to gain access to data that otherwise it wouldn't be able to. However, app with the same UID only can perform operations on each other's permissions.

5.4 Social Media Integration

The integration of social networks in mobile operating systems in conjunction with the growth and speed of internet has brought huge amounts of social networking

data. It is one of the easiest ways to collect data from users that they are willingly disclosed and can be very beneficial to e-commerce and businesses in general. However, it is a challenging procedure to collect and separate the necessary data used for e-commerce purposes. Data from social networks shall be used to assist customers by making more accurate recommendations. Social media allow the exchange of information in different categories, each one having special characteristics.

VI. A PROPOSED SOLUTION

6.1 Role Based Access Control (RBAC)

Enhanced Role-Based Access Control Model

An edge point that is directly related with privacy, whichat the moment is the highest challenge in mobileenvironments, is Role-Based Access Control (RBAC). A rolein an organization is a set of rules describing what actions aparticular person can take within. Therefore, it is clear that anovel role model is necessary to determine the access leveland constraints. Even though a satisfying number oftechnologies exist, due to an always moving forwardenvironment there are always new challenges. Role-Based Access Control is the fundamental securitymodel enforced nowadays. It is used in various ways to definethe ways that users will have access to resources. Moreover,with the right modelling can be used to control apppermissions as well.The two most important aspects of access control areauthorization and authentication. Authorization is if theuser has the permission to perform certain operation andauthentication is to identify if the user is the one who claimshe is.

An abundant challenge is the proposal of new modified RBAC model, which is essential at this point. This new model should be able to maximize the level of privacy of a mobile recommender system. The difficult part is to define the constraints that the new model should cover in terms of users, operations and permissions of both users and applications. Other important characteristics could be the least privilege technique and group access control relationships. In least privilege, the user should be able to perform only the operations required and not any other either at an above or at below level whatsoever. In group access, a user of a group could have additional permissions that other users in the same group do not. Furthermore, a number of crucial operations could be performed only if two users at the same time are logged in to perform the operation.

VII. CONCLUSION

Although recommender systems are in every personal computer and mobile device nowadays, there are a number of factors that users of mobile platforms in particular take into consideration and avoid their use. These factors are tight integrated to privacy. Additionally, a new trend in the internet era is social networks and its derivatives with huge amounts of data exchanged every day. These data should be used in recommender systems to improve personalization. As a final important point is the development of new Role-Based Access Control (RBAC) model that will improve privacy ambiguities found in app permissions and user access to data.

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