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Evaluation of macro and parallel data processing tools affecting the improvement of performance to extract user interests

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Abstract

Since knowledge mining is used as one of the ways to extract knowledge from large volumes of data, the present study was carried out with the aim of evaluation of macro and parallel data processing tools affecting the improvement of performance to extract user interests. Recommending systems use the method of automatic recommendation to users based on their interest and use statistical techniques and knowledge discovery to recommend products / services to users to face information overload. The advantage of recommending system is that makes user to not get tired of dealing with repetitive and non-useful information and quickly find right and interesting information among the items. In this research, an approach of content recommending system was provided based on existing log s of users on proxy server based on their interest which was effective in both the speed of search in sites intended by users to achieve their demand and significantly reduced the network traffic throughout the organization and network bandwidth was able to have less traffic.

Keywords: User Interests, data mining, macro data processing tools, and performance of extraction speed

Introduction

In the present era, the extraction of interests of the users is very important that is a very useful e-commerce. In general, data mining is an interdisciplinary movement which contains field such as databases, machine learning, quick calculations and visualization. In particular, data mining is a branch of artificial intelligence which uses automated processes to find information. Even though the usage of data mining in libraries is somewhat limited, it has been successfully used for several years in scientific and business communities to track the behavior of individuals and groups, process medical data, customer support services, decision support, and several other matters.

Web usage mining discovers hidden and engaging data patterns of web with the aim of understanding the behavior of users and increasing the profit from web-based applications. Most of this approach involves three stages: pre-processing, information discovery, analysis of data. Server logs work in form of an entry to process web usage mining. Data of log have practically no structure and a little vague and confusing. Preprocessing procedure must be carried out in order to extract appropriate pattern of Web logs which deletes ambiguity and unbiased data. Thus, data mining algorithms can be used to develop appropriate patterns. Modeling of undefined behavior based on actions of users is generally very difficult. For example, the group visiting the site of university includes students, parents, bankers, book publishers and bookstore owners. In addition, a user in the field of working group can have different purposes. For example, a banker may visited the website and have access to links on the date of acceptance and prepare the bank to grant student loans. Also, the banker may visit the website only to have information about work or home loan details. Hard clustering algorithms usually cannot register such overlap functions or the interests of users when such algorithms devote each object exclusively to a cluster. Hence, Fuzzy Clustering algorithms are the most suitable option for range of application of web mining [1]. Thus, the number of functional plans in the area of data mining is growing exponentially and it has been predicted that a type of sudden upsurge in data mining plans will occur in the next decade to improve customer relations and customer support. One of the application which has been highly regarded based on data mining of using web is personalization of web pages. Based on this technology, services needed for users are personalized based on interest and characteristics of the user without their expression [2]. Web personalization is a series of operations which organize web experience for a specific user or set of users and provides dynamic recommendations based on behavioral patterns of users. Web personalization can be used as a process to customize the content and website structure based on specific individual needs of each user. Types of data that are used during the personalization process is divided into 4 categories [1]. The first category is usage data of users which includes data collected from registration file which is automatically done by the web server. The second category is content data which includes data on the pages. The third category is the user's history which can be used in form of profile and requires direct interaction with the user. The next category is structural data which includes hyperlinks between pages of site. Most of the researches in the field of privatization are based on content analysis (Content Mining) or information about the user behavior (using logs on Web servers or applications on the client side) [4, 5]. Although structural features of the web graph (data mining structure) has been greatly used for personalizing web search results [6], it has attracted less attention in the personalization process of web pages while in addition to information obtained from these two methods, the information about structure of graph can be used to recommend pages and personalize services such as web. The algorithm presented in [7] is based on link analysis which models site's Web pages and users in form of node and hyperlink and uses HITS algorithm to evaluate its importance in the graph and its purpose is measuring user's expertise and importance of web pages. Two separate grading methods have been presented in [8] based on link analysis. The recommending system uses the level of connections between the pages of the site as a determining factor to recommend based on exploring repetitive items or finding ordinal patterns [9] not none of the methods has completely combined analysis techniques with personalization process by extracting validity or importance of web pages on the graph. Personalization systems which only use the behavior of users to provide recommendations usually have low accuracy due to the following problems and some valuable pages may be forgotten in the recommendation page.

Along with the dramatic growth of the World Wide Web which lacks and integrated structure, access to relevant information is becoming increasingly difficult for users. In the meantime, an increasing number of websites also created a challenging task for webmasters to organize web content and meet the needs of users. Analysis and modeling of web navigation performance could induce a good understanding to online users. Subsequently, the results of analysis has been presented in form of a general knowledge in the field of online applications website design correcting and web-based customization system. However,

online navigation performance will improve over time and thus, intelligent data extraction from it has been considered as a very difficult issue. In general, the process of predicting Web mining is organized with two active components in online and offline forms corresponding to web server activities. Offline component essentially provides a knowledge through analysis of past data such as log file of reaching to server or web logs which have been registered by the server. Web logs in online component are generally used to record the user's list of intuition. Thus, recommended pages tell users when they are going online the next time [10]. The obtained results show the improvement of accuracy of these theories over time.

2. A review of the literature

The Knowledge discovery is related to the entire process of extracting knowledge including method of availability and storage of data, method of analyzing massive datasets using massive datasets, method for interpretation and visualization of results and method of modeling and supporting interactions between humans and machines, it is also related to support for learning and analysis in some functional areas [11]. Data mining and knowledge extraction from data bases are among issues which arose with creation of databases. Researchers and computer, artificial intelligence, machine learning, etc. scientists carried out researches in this field. The term "knowledge discovery in databases" is attributed to a workshop in 1989. This term means that the final results of data mining should be usable in knowledge discovery [12].

Web structure mining: hyperlinks provide information about other documents on the Web which are important. These links add a depth to the document and create multidimensional mode which is among the Web properties. Exploring this link structure is like exploring the web structure which is in terms of exploring URLs and other web links to achieve their structure [13]. The Web usage mining is also used to support e-commerce. There are two aspects here. One is extraction of information about competitors and the other is exploring customer data.

In the present ear, data mining has turned the global Internet into a more functional environment in which users can find their required information faster and more conveniently which includes: exploring and data analyze, documents and Multimedia of global Internet. Data mining uses the details of document and the structure of hyperlink to help user to observed required information [13].

In the research of [14] Whoa Taav and his colleagues introduced an algorithm based on integrated planning for mining web transaction and also convert the number of deliberate reviewing data to understandable language items using the concept of fuzzy set. The main algorithm of Web transaction mining (WTM) considers a product on a web page which is shown with B {li} which means a webpage named B and an item named li. The objective of this algorithm which focused on the purchased items is showing that the average level of user interest can be shown by browsing a series of Intentional Browsing Data (IBD). On the other hand, unpurchased and not intended items are used to search pages without purchasing with Intentional Browsing Data which was not possible with original Web transaction mining without Intentional Browsing Data.

There are two main methods for evaluating the algorithms which use the information related to survey data of users. The first method is sing real web pages and actual data of users in logs of websites. The set of standard data which have been extracted from several reputable sites are available to use this method. The second method is the method presented in [15]. In this method, Louie and his colleagues determined the order in behavior of users in the web environment using model based on factor and confirmed the validity of their model using the information of usage of several major web sites like Microsoft. This set includes the collection of session data of users for two weeks in citydopal website in 2002 [7].

In the study of [16], Karthik Bom Pali and his colleagues discussed about design and implementation of the proxy analyzers which have been formed of three main components named: input analyzers, database loaders and data analysis.

Recommending systems are those systems which have the ability to analyze past behavior and provide recommendation for current issues. Simply, the efforts in recommending systems is to identify and recommend best and the closest product to taste of user using user's way of thinking [18].

Extensive sale of products has become much easier with the arrival of online stores and retailers in a way that these stores have higher sales percentage compared to physical stores but customers must search many products and ranks of these stores to find their intend products [18]. In other words, customers spend plenty of time to see the store's website and gather valuable information while the content of many websites does not match the customers' needs which affects the confidence and interest of customers for online shopping [19]. Selection of a store which has the most suitable products is difficult for customers. One off the effective marketing strategies is providing recommendations specific to each user to attract them in a way that they become encouraged buy from the intended encouraged from all online stores. On the other hand, these recommendations required identification and analysis of characteristics of users [20]. Many things must be considered when users are trying to find and select the products, services and information and a system to support users is required [21]. One of the ways to overcome the above-mentioned problems and help customers to decide is development of recommending systems. These systems are implemented in the online shop and provide personalized recommendation to suit the preferences and interests of users [22]. Recommending system is a powerful mechanism to solve the problem of information overload in internet stores.

3. Method of research

Products with similar characteristics are uniformly graded in filtering based on content [18]. This approach depends on availability of specification products and user profiles associated with these characteristics. This approach, the characteristics of user profiles are obtained by analyzing the content of products which have been previously viewed or ranked and a keyword is considered for each of them and the products with the highest similarity to existing products are recommended to the user. In fact, cases similar to what the cases has previously preferred are recommended to him/her [23].

Collaborative filtering method is composed of two parts: 1) Refinement of data and selecting correct data from datasets and 2) the common part which insures that data extracted from the previous part is common between all users. This method is based on this assumption that users with similar tastes have similar ranks [23].

Collaborative filtering method is a commonly used method for recommending systems and recommendation in them are created based on ranking of other users in the system [22].

Algorithms of this method are divided into two categories: model based algorithm and memory based algorithm. In model based algorithm, the data of user’s profile are reviewed and processed offline which leads to improved computing [23]. In this method, model is created based on ranking of the set of data. Model-based approach is used when the volume of dataset is very large. The recommending system initially uses statistical methods to predict the model using a part of set of data which is related to previous activities of users and uses it to make recommendations. Algorithm used for model-based approach are: Bayesian probabilistic method, clustering and grid dependency models and neural networks [24].

In this research, user behavior on the Internet is extracted using content analysis and their interests and priorities will be expressed using large-scale web proxy log data.

The overarching theme of recommending system is as follows which will be explained in the following:



Figure 1: The overarching theme of recommending system

The stored logs must be called in the first step which is done in open log tab. Log is then placed in a variable named sr by selecting text file of user's log.

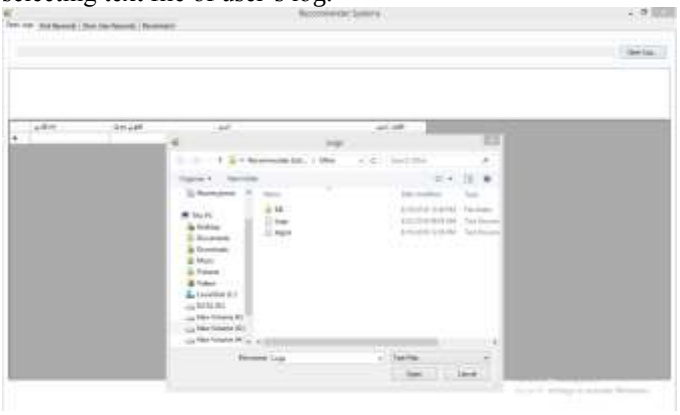


Figure 2: Calling stored logs

```
private void btnOpen_Click(object sender, EventArgs e)
{
    if (openFileDialog1.ShowDialog() == DialogResult.OK)
    {
        path = openFileDialog1.FileName;
        textBox1.Text = path;

        sr = File.OpenText(path);

        dt.Clear();
        label2.Visible = true;
        timer1.Enabled = true;
    }
    // Thread t = new Thread(mainjob);
    //  t.Start();
```

Figure 3: Function for calling stored logs

Timer_Tick function runs after this step. Timer is a function which places and returns the data stored in log in a variable named string. The named of user in this step by running this function.

```
private void timer1_Tick(object sender, EventArgs e)
{
    string s = "";
    if ((s = sr.ReadLine()) != null)
    {
        int firstchr = 0;
        int lastchr = 0;
        string status = "user";

        listBox1.Items.Add(s);
        for (int i = 90; i < s.Length; i++)
        {


            if (status == "user")
            {
                if (firstchr == 0)
                {
                    if ((s[i] >= 'a') && (s[i] <= 'z'))
                        firstchr = i;
                }
                else
                {
                    if ((s[i] == ""))
                        lastchr = i;
                }
                if ((firstchr != 0) && (lastchr != 0))
                {
                    user = s.Substring(firstchr, lastchr - firstchr).Trim(); //
                    status = "title";
                    firstchr = 0;
                    lastchr = 0;
                    i++;

                    //  If you need chek user and insert to db
                }
```

Figure 4: Timer_Tick function

For example, log of different users contains the following information:

```
[02/May/2016 11:48:10] 172.17.9.22 Fakhara@int.ir "ثبت نام در باشگاه فرهنگیان" http://chaharfasl.net/
02/May/2016 11:48:10] 172.17.7.8 rezaeia@int.Fars.ir "۲۴ساعت- ساعت ۲۴ | آخرین اخبار حوادث و رویدادهای ایران و جهان" http://www.saat24.com/news/151661
[02/May/2016 11:48:11] 172.17.8.186 ehteramis@int.fars.ir "توافق نهایی برجام؛ پایان یک عبارت پرتکرار یا فصل جدید" http://www.shahrekhabar.com/sport/
[02/May/2016 11:48:11] 172.17.8.186 ehteramis@int.fars.ir "دایره شرافتمندانه هلال استقلال بازی میکند" http://www.shahrekhabar.com/sport
[02/May/2016 11:48:11] 172.17.8.187 broomandin@int.Fars.ir ".:TSETMC:. :: شرکت مدیریت فناوری بورس تهران" http://www.tsetmc.com/Loader.aspx?ParTree=15
[02/May/2016 11:48:11] 172.17.8.186 ehteramis@int.fars.ir "ورزش سه - صفحه اصلی" http://www.varzesh3.com/
[02/May/2016 11:48:11] 172.17.3.202 hosseinis@int.fars.ir "آرمین عصوم به بازیکن هلاشیام کلید - ورزش۳" " http://www.varzesh3.com/news/1322147
[02/May/2016 11:48:12] 172.17.8.205 sharifih@int.Fars.ir ".:TSETMC:. :: شرکت مدیریت فناوری بورس تهران" http://www.tsetmc.com/Loader.aspx?ParTree=15
[02/May/2016 11:48:12] 172.17.8.186 ehteramis@int.fars.ir "دایره شرافتمندانه هلال استقلال بازی میکند - ورزش۳" " http://www.varzesh3.com/news/1322312
[02/May/2016 11:48:12] 172.17.8.186 ehteramis@int.fars.ir "  جام نوین :: IranNews - توافق نهایی برجام؛ پایان یک عبارت پرتکرار یا فصل جدید" http://www.jamnews.ir/detail/News
[02/May/2016 11:48:12] 172.17.8.191 abadin@int.Fars.ir "ورزش سه - صفحه اصلی" http://www.varzesh3.com/
[02/May/2016 11:48:13] 172.17.8.38 nazarpour@int.fars.ir ".:TSETMC:. :: شرکت مدیریت فناوری بورس تهران" http://www.tsetmc.com/Loader.aspx?ParTree=15
[02/May/2016 11:48:13] 172.17.9.22 Fakhara@int.fars.ir "Stats" http://engine.webguzar.ir/counter/xstat.aspx?t=stat
[02/May/2016 11:48:14] 172.17.3.200 saboorish@int.fars.ir "  تی جارتر - جستجوگر ثبت ارزان هواپیما | خلبان و فروش آنلاین تکه و پرنا" http://tcharter.ir/
[02/May/2016 11:48:16] 172.17.8.186 ehteramis@int.fars.ir "دایره شرافتمندانه هلال استقلال بازی میکند - ورزش۳" " http://www.varzesh3.com/news
[02/May/2016 11:48:20] 172.17.8.132 safarisa@int.Fars.ir "TCT" http://salaryweb.tcll.ir/account/sign_in
[02/May/2016 11:48:22] 172.17.8.191 abadin@int.Fars.ir "روزنامه ایران ورزشی - دوشنبه ۱۲ اردیبهشت ۱۳۹۵ | ورزش۳" http://www.varzesh3.com/newspaper/IranVarzeshi
[02/May/2016 11:48:22] 172.17.8.205 sharifih@int.Fars.ir ".:TSETMC:. :: شرکت مدیریت فناوری بورس تهران" http://www.tsetmc.com/Loader.aspx?ParTree=15
[02/May/2016 11:48:23] 172.17.8.111 taghipourm@int.fars.ir "  سیستم جامع اعتبارسنجی تکفل ثبت" http://172.16.2.161/
[02/May/2016 11:48:25] 172.17.8.186 ehteramis@int.fars.ir "شهرخبر - صفحه اصلی خبر ویژه" http://www.shahrekhabar.com/header.jsp
[02/May/2016 11:48:27] 172.17.8.38 nazarpour@int.fars.ir ".:TSETMC:. :: شرکت مدیریت فناوری بورس تهران" http://www.tsetmc.com/Loader.aspx?ParTree=15
```

Figure 5: Format of users' log

In the next step, the title related to each line of log is determined when the status is equal to title using timer_Tick function.



Figure 6: Title deterring function

When url is determined by timer_Tick function, its validity is checked using Remote file exists function which responses with true and false in case of validity or lack of it

After determination of url, title, user and lang are placed in a table named data table.

Then it is determined whether data related to user has been already stored in the database or not using by searching in the table of user. The data related to the new user is stored in the database and then title and ID of user is placed in the Title_Site table.

Address and user characteristics are taken using method shown in Figure 7 and source url is extracted.

```
label2.Text = "Insert KeyWords";

if(url !="")   GetMetaUser(code(url), NewID);


label2.Text = "Please Wait ...";


user = "";
title = "";
url = "";
lang = "";
dataGridView1.DataSource = dt;
```

Figure 7: Source URL extractor function

In the next step, the keywords of pages visited by the user are pages visited by the user using code and GetMetaUser functions. After determination of keywords, the number of times each user has returned the sites with each keyword are stored in the database.

```
//---- Open Source Web
public static String code(string Url)
{
    HttpWebRequest myRequest = (HttpWebRequest)WebRequest.Create(Url);
    myRequest.Method = "GET";
    WebResponse myResponse = myRequest.GetResponse();
    StreamReader sr = new StreamReader(myResponse.GetResponseStream(), System.Text.Encoding.UTF8);
    string result = sr.ReadToEnd();
    sr.Close();
    myResponse.Close();

    return result;
}
```

Figure 8: Code function

In the recommendation section, the Recommender table of database in which each keyword has a URL, a website is recommended to user based on each of the keywords searched by user.

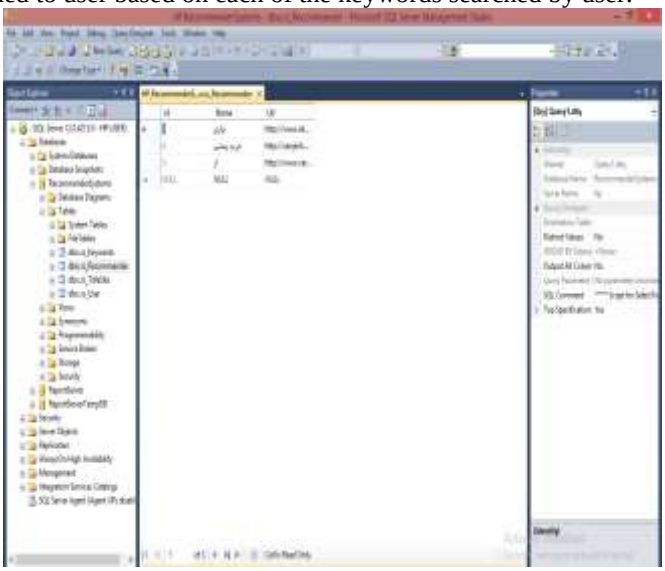


Figure 9: Recommender table of database

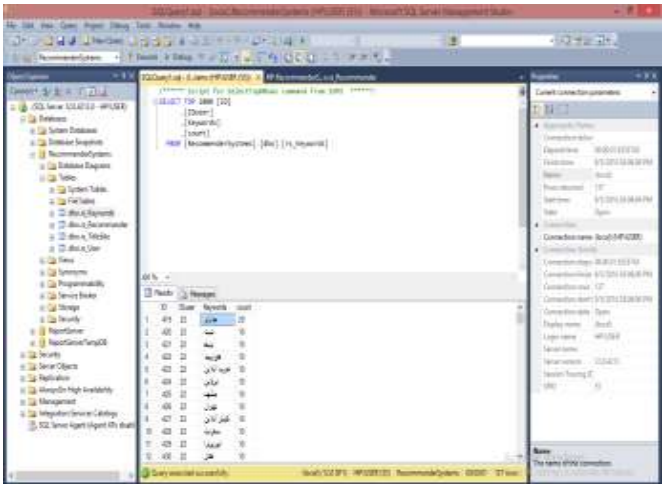


Figure 10: Data of recommender table of database

Recommendations will be shown to the user if they exist and www.google.com will be shown to user if there is no recommendation.

4. Findings

This section is related to showing and explaining the results of implemented system. First, we will have a glimpse of different parts of the system.



Figure 11: Overarching theme of recommender system

The format of logs stored in the system is as follows: Username, date, Internet Protocol (IP) address, time of access and links Search which have been shown in the following figure.



Figure 12: Format of user's logs stored in the system

A window opens by selecting open log button as shown in the following figure and address of the storage place for server logs will be requested from the user.

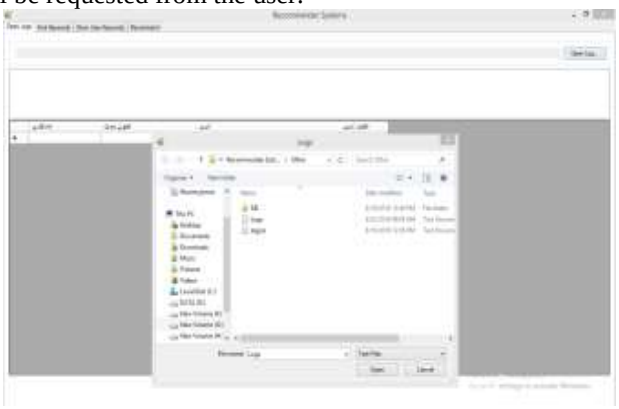


Figure 13: Window for selecting storage place for server logs

After loading called logs, the system begins to check information such as accuracy of entered addresses, usernames in the defined domain and links searched by each user (figure 14).



Figure 14: Windows for opening stored logs

In the next step, all keywords of each site are extracted in find keywords tab to determine the content of the site for better understanding of user interests (Figure 15).



Figure 15: Finding keywords

In the next step, the largest number of keyword search from user is shown in show user keyword tab. To do this, the intended user is initially selected and the list of keywords will be automatically displayed in the table (figure 16).

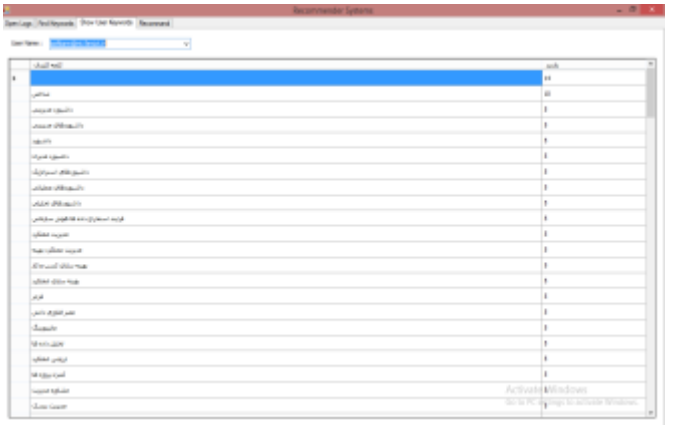


Figure 16: Showing the keywords of user

After extraction of keywords related each site, we must be able to correctly show intended site for user to him/her after extracting keywords related to each site searched by the user. To do this, we must initially put keywords along with the searched links in sql program and related tables so that the same site is shown to the user by default every time the user searches that intended word again (figure 17).

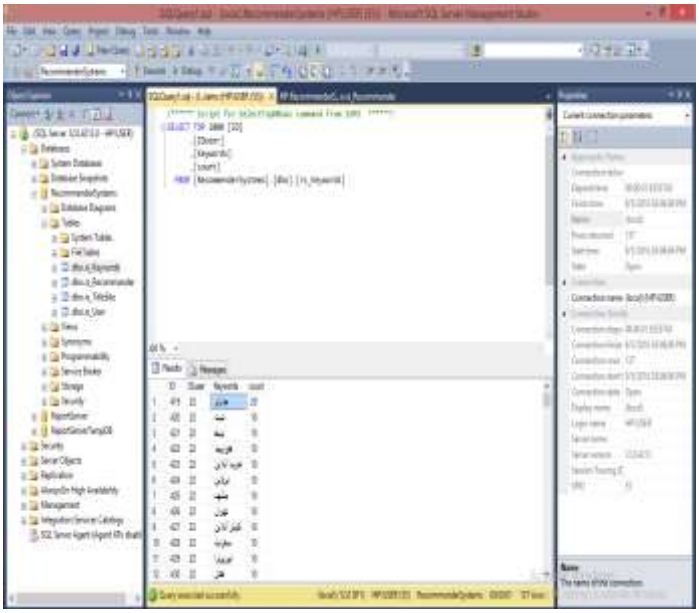


Figure 17: Recommender system's database table

In the final step, the recommended site will be shown to the user based on his/her interest in sql table in the Recommend tab (figure 18).



Figure 18: Recommendation window to user

5. Conclusion

Recommending systems use the method of automatic recommendation to users based on their interest and use statistical techniques and knowledge discovery to recommend products / services to users to face information overload. The advantage of recommending system is that makes user to not get tired of dealing with repetitive and non-useful information and quickly find right and interesting information among the items. There are a variety of sources and methods for gathering information and an explicit method of collecting information in which user explicitly expresses the things he/she is interested in. in

this method, user enters and determines the level of interest in the system and increases level of information of system and the system is able to predict users' interests and priorities based on these rankings. The other method is implicit method which is a bit more difficult in which system must control user interests and follow-up actions and activities. These information includes the user clicks, time spent on each page, the pages that closes and more. In addition to the implicit and explicit information, some systems use the personal information of users. The studies show that recommender systems perform this task in a good way but have shortcomings at the same time. Thus, the performance of system and organization and ultimately their results must be improved by providing more efficient algorithms. In this research, an approach of content recommender system was provided based on existing logs of users on the proxy server based on their interest which affected the speed of search in sites intended by users to achieve their demand and significantly reduced the network traffic throughout the organization and network bandwidth was able to have less traffic.

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