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Ontology-based Social Recommender System

Abeer El-Korany[1], Salma Mokhtar Khatab[2]
[1,2]Computer Science Department, Faculty of Computer & Information, Cairo University, Giza, Egypt
Email: a.korani@fci-cu.edu.eg[1], skhattab@sandcti.com[2]

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ABSTRACT

Knowledge sharing is vital in collaborative work environments. People working in the same environment aid better communication due to sharing information and resources within a contextual knowledge structure constructed based on their scope. Social networks play important role in our daily live as it enables people to communicate, and share information. The main idea of social network is to represent a group of users joined by some kind of voluntary relation without considering any preference. This paper proposes a social recommender system that follows user's preferences to provide recommendation based on the similarity among users participating in the social network. Ontology is used to define and estimate similarity between users and accordingly being able to connect different stakeholders working in the community field such as social associations and volunteers. This approach is based on integration of major characteristics of content-based and collaborative filtering techniques. Ontology plays a central role in this system since it is used to store and maintain the dynamic profiles of the users which is essential for interaction and connection of appropriate knowledge flow and transaction.

Corresponding Author:

Abeer El-Korany
Computer Science Department, Faculty of Computer & Information, Cairo University
5 Dr Ahmed Zoweil St., Orman, Giza, Egypt
Email: a.korani@fci-cu.edu.eg

1. INTRODUCTION

Nowaday's computerized systems are playing a very valuable role in every walk of life. Information technologies can facilitate social and community activities work by making processes, knowledge more explicit, sharable, and maintainable. Knowledge management aims to provide the right knowledge to the right person at the right time. In community and social work, application of knowledge management would target the improvement of the quality of life for the majority of persons who rarely access appropriate community services, and are socially isolated. Many slums dwellers lack basic services such as provision of healthcare services; food reduction, unplanned housing, sanitation low community cohesion save due to lack of identity. Providing these services could be accomplished either through social associations or volunteers who aim to help persons who rarely access appropriate community services.

This paper proposes a Social Recommender System for Community Services (SRSCS) that is used to recommend the best candidate to apply a specific community work. This system is based on the integration of the characteristics of content-based recommendation algorithms into a semantic social network. It aims at improving the recommendation process by considering the modeling of profiles of users. This mechanism is applied within a framework called *"society in hand"* which is a web application that is used in the community/social field to facilitate the activities of community services within the society. One objective of the proposed semantic recommender system is to enhance traditional content-based filtering in which the user profile is built based on the static information that represent the likehood of users to those items. By monitoring information exchanges as well as the interaction of users with the system, we start by modeling of

user profile. Definition of member profile is intended to provide all information identifying the main structural characteristics of the participants. A member's profile is represented as a merge between static and dynamic aspects. Static profile contains information related to personal information and interests, while dynamic profile refers to the usage, interaction and behavior of a member. The main purpose of this definition of user's profile is to find actual similarities between profiles of interest with candidate items (in our case community services) in order to overcome the problem when there exist no user ratings as in traditional recommender systems. For this goal, we specified ontology for community service domain that decompose the volunteers, social association profiles as well as community services ontology. The developed ontology is the key to establish a standard of sufficient knowledge for modeling the users and automatically predict links between participants and one or more community services. Establishment of these links would enable the system to provide different recommendation such as:

- It recommends list of community services requested by more than one social association to volunteer (s) based on their profiles.
- It recommends list of volunteer(s) needed to accomplish a specific service asked by any social association considering volunteer's preferences as well as volunteer historical record (associated with that service).

The proposed knowledge share and transfer platform has two main categories of users. The first category is: volunteers who would provide their voluntary services but they don't know suitable scheme to apply their work. The other category is charity or social association whose work is to provide different types of community services to society but sometimes they need community help to accomplish their mission. It encourages community of people who are interested to provide community services. Furthermore, it helps to foster voluntary-related initiatives at all levels of community. To make this work more concrete, the system has been tested over a group of 300 volunteer who could collaborate with 100 social associations. We compare the accuracy of our approach in recommending volunteers based on semantic of the user profile with traditional methods that depends on static measuring values. The structure of the paper is as follow, section2 discuss different models for knowledge sharing and recommendation mechanism. Next, the framework semantic knowledge sharing is introduced. Then, the general architecture of the proposed system is presented in section 4. The matchmaking process details are described in section 5.

2. RELATED WORK

Capturing, representing and sharing knowledge from informal communication exchanges has been a topic of research in the knowledge management and in the information seeking behavior communities for many years. Different types of knowledge could be shared such as tacit knowledge which is often very specialized and precise and is not shared with anyone else than the immediate recipient of the informal communication exchange. Different techniques have been explored in previous works to extract, represent, and share knowledge, often focusing on one special type of communication exchange and recommendation. This section provides a background of different knowledge sharing frameworks and recommender system techniques.

2.1. Knowledge sharing framework

Knowledge sharing is an activity through which knowledge (i.e. information, skills, or expertise) is exchanged among people, friends, or members of a family, a community (e.g. Wikipedia) or an organization [2]. Knowledge sharing frameworks could be in form of environment that used to connect people for social activities like social networks or that connect groups of people to enable them who learn collaboratively like community of practice .

2.2. Social network

Many studies have shown how powerful social networks are for knowledge sharing. On line social networks would result to construct forms of relationships between individuals through communications mediated by computers [14]. Social networks are considered powerful tools to share information across organizational and geographical boundaries. In particular they are crucial to share tacit knowledge that can with difficulty be formalized through documents [27]. A social network is a social structure consisting of individuals (or organizations) called nodes and ties that connecting nodes by different types of interdependency, such as friendship, affiliation relationship, communication mode or relationship of religions, interest or prestige [31].

Social network graphs is constructed using information found in different places, such as the contact lists from social networking sites, the phonebook from mobile devices, and blog rolls. Social network graphs help to recognize how members overlap and be able to use information to synchronize the contacts on

different social networks. This information can then be used to enable communication with the people found in the other social networks. Social network sites could be classified into two main categories. The first category provides open memberships so that anyone can become a member, while the other category focus on particular interests such as research gate, ScienceStage, etc target a specific category of people to emphasis their activities. Social knowledge sharing system (SKSs) is social knowledge networking which are virtual environments where content combines with human resource assets and subject matter expertise (SME) to address critical business initiatives and problems ranging from product innovation and proposal development to competitive intelligence and consumer insight [13].

SKSs span enterprise silos and merge relevant content, search, and community insight, improving individual and organizational problem. The Social Knowledge website or system like Facebook, twitter, hi5 considers themselves a collection of peer community networks. They foster online communities so that people with similar interests can connect to harness the distributed expertise of the members. They state "The participants collaborate and manage their community while constantly providing feedback that is used to shape and extend the features of each Social Knowledge Network™ . Currently mobile social networks [20] took place to support location-based, personalized, interactive mobile social network services using mainly metropolitan Wi-Fi networks in the context of social services [9]. The idea is based on mobile communications that could be used to increase the closeness of one's social networks [21].

2.3. Community of practice

Effective work groups engage in external knowledge sharing the exchange of information, know-how, and feedback with customers, organizational experts, and others outside of the group [12]. Community of practice is defined as a community of people who share the interest regarding an issue or problem and learn from regular interactions [13]. Communities of practice as an informal organization which is different from the formal organization, has an important influence on improving organization's performance [30]. According to Wenger [32], communities of practice must has the following three features: the domain, that communities of practice must be related to one or some areas; the members through participation in community activities, share their experiences, and learn from each other; the practice, the members according to their areas of interest to exchange and to maintain sustained interactions.

Several approaches exists to build communities of interest, one of them is to profile the users interest based on the content they read which is used in the GALILEI framework that is used to manage digital information (electronics documents). Providing users with a platform which enable them to share documents, browse a collection of documents, the system constitute a community of users based on their area of interest as well as the document they read. The system applies similarity based clustering genetic algorithms (SCGA) to cluster the users [23]. Another approach is to model active user activities using web usage mining techniques, and applying personalization techniques such as recommendation and filtering which is also used in social networks and social media, such as the recommendation of new friends [22]. The work described by [8] apply web usage mining to discover web usage pattern in term of web user profile and web page groups from web log file in order to support web recommendation. Latent semantic analysis is used to recommend the customized web contents to students at university.

2.4. Recommender systems

a. Content-based recommendation

Content-based recommendation is a textual information filtering approach based on users historic ratings on items. In a content-based recommendation, a user is associated with the attributes of the items that rated, and a user profile is learned from the attributes of the items to model the interest of the user. The recommendation score is computed by measuring the similarity of the attributes the user rated with those of not being rated, to determine which attributes might be potentially rated by the same user. Content-based recommendation is helpful for predicting individuals preference since it is on a basis of referring to the individuals historic rating data [29] .

b. Collaborative filtering recommendation

Collaborative filtering recommendation is probably the most commonly and widely used technique that has been well developed for recommender systems. As the name indicated, collaborative recommender systems work in a collaborative referring way that is to aggregate ratings or preference on items, discover user profiles/patterns via learning from users historic rating records, and generate new recommendation on a basis of inter-pattern comparison. In the context of collaborative filtering recommendation, there are two major kinds of collaborative filtering algorithms mentioned in literature, namely memory-based and model-based algorithm [10].

2.5. Hybrid content based and collaborative filtering

There are works that propose ways to combine both filtering techniques collaborative and content-based such as the one developed in [24] proposed a similar method to the one mentioned here by applying the content based profile for estimation of user similarity. However, only trivial profiles were used .i.e . content-based, demographic-based The lack of explicit ratings is addressed in [15]. They proposed using implicit feedback from the user to fill the rating matrix. Other systems were developed to overcome the problem of cold starts of content based approach by combining user and item meta data with users' historical ratings to predict the users' interaction on items such as[1] was able to combine both item features and user features for Collaborative filtering. It identified some inner features for items through which they were able to define an implicit rating of each items without user interfering. Our proposed approach combines both sources of explicit features and extracts other features that reflect amount of dynamic information about the user. It suggests to maintain profiles for both contents and users, where temporal characteristics of contents,
are updated in real-time.

2.6. Semantic Knowledge Sharing Framework

Knowledge sharing within a specific community is critical to success of that community. The flow and transaction of appropriate knowledge within socio-economic groups is crucial in order to facilitate communication and cooperation between people working in the same field. In order to exploit synergies in a community to maximum, semantic of users would be added in order to enhance interactions between members working in the same community (either individual or organizations). Modeling of user's interest is vital in delivering appropriate knowledge to appropriate members. This section illustrates the framework of modeling user behavior in order to enhance dissemination of knowledge.

2.7. Semantic user profile

User profiles allow users to define and update their personal and professional information by supplying personal information such as, name, qualification, email, address, and gender. Profiles of users reflect user interest through her/his personal information as well as other aggregated information which is collected based on their interaction with the system. This work proposes an approach to utilizing user expertise and interest in order to enhance the recommendation process. Modeling of people's expertise and interests is accomplished through monitoring informal exchanges of information among users which reflect the semantic part of profiles. First, the content of exchanges is semantically annotated and used to derive user profiles. Second, the frequency of this exchange reflects the strength of ties between users. In the community field, charities and social associations used to provide specific set of community services to society but sometimes they require help from other entities such as volunteers. The proposed system, society in hand, provides its members (volunteers and social associations) a suitable environment to share information related to their field of interest, which is community services. This type of environment provides its user with specific characteristics that help to model them as indicated above. First, members of that environment tend to share the relevance contextual knowledge related to their explicit defined information in different forms. Such as allowing users to publish information in form of discussion, holding event, sending messages, and others that are all related to their pre-defined community service. Second, shared knowledge (related to community service) is given additional features that could be extracted such as tendency of applying a specific community service by each volunteer, implicit relationship that ties users to each other's such as volunteers and social associations. Those characteristics play a vital role in management; dissemination; and recommendation of appropriate knowledge since it allow the system to semantically model users' profiles. Transferring of knowledge can be dependent upon continuously flowing information based on dynamically changed parameters stored in the user profile.

2.8. Knowledge dissemination

Knowledge dissemination federates, transforms, and relates right information to appropriate individual/community based on semantic modeling of system users. It is evident that transferring of knowledge can be dependent upon continuously flowing information based on dynamically changed parameters stored in the user profile. Dissemination of knowledge would be oriented either to one or more users which we classified to individual and community knowledge dissemination as shown in Figure 1.

2.9. Individual knowledge dissemination

Individual knowledge dissemination enhances communications within the social network, since it reduce the number of upcoming item to user input profile. Every user receives only specific information. Peer-to peer interaction such as sending and receiving message, commenting on one's wall is managed through explicit user profile. While semantic user profile is used to generate (recommend) the candidate set

of community service to a volunteer that would take place within a specific time. Currently, society in hand allows social association to define two types of services: ordinary service and emergency services. Ordinary services are the community services that a social association used to perform while emergency services are defined as the services that are needed to be applied in an urgent manner. Therefore, the user receives two types of recommended services and s/he free to select any of them. Furthermore, discussion that matches target user' interest would only appear for each user.

2.10. Community knowledge dissemination

Nowadays, it is recognized that users within a community tend to communicate repeatedly with the same groups of contacts. This observation has prompted many online communication platforms to provide their users with tools for creating and saving groups of contacts [7]. Unlike those tools, the proposed semantic social recommender system enables communication and interaction between people even they are not aware of each other but share the same interest. For example, when target user *x* starts an activity such as a discussion or creation of an event, the system measure the strength relation among the target user x and an actor y in her network to allow y to participate in this activity. Activity related to a specific community service would be shared among members who show interest to this service through their semantic profiles which enhance sharing of knowledge. In this case, users either volunteers or social association, will be able to share knowledge related to community service through posting their comments or accepting to participate in that event. Community knowledge dissemination involves functions that are delivered to a group of people based on common interest that is calculated based on their similarity.

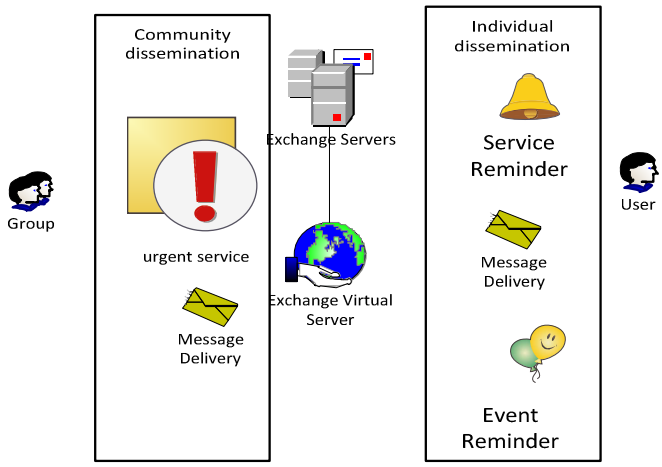

Figure 1. Types of knowledge dissemination across the system

3. ONTOLOGICAL USER MODELING

The critical issue for a good recommender system is how to constitute user's preferences [16]. To deal with this critical issue, in this paper, user's preferences are defined based on the semantic of information exchange within a cooperative environment. User models are constructed by merging explicit information such address, age and preference community services with implicit knowledge such as those represent the tendency of applying a specific community service (which is the main concern of the people working in that environment). This information is determined by soliciting feedback or gleaning implicit declarations of interest (e.g., through monitoring user behavior in discussion or posting). The basic idea is that in order to measure the interest of a target user *x* for an item i to be recommended, the proposed technique generates this measurement by integration of: first the strength of the relation among the target user *x* and this item through user behavior. Second, how much every user *y* in the target user's x social network likes that item, *independently* of the similarity between the target user *x* and user *y*. In our approach, we propose the usage of ontology as a main source of semantic knowledge upon which similarity is determined. Considering those factors, the system would recommend the candidate volunteers to the social association whenever a social association requires helps in a specific community service and vice versa based on their relation to a specific community service (s). In this section, we present the community ontology which is essential for defining the user models and recommendation process.

3.1. Ontology-based recommendation

An ontology is an explicit specification of concepts and relationships that can exist between them. It can be described by defining a set of representational concepts. When constructing ontology, not only concepts and relationships are defined, but also the context in which the concept applies. Therefore, ontology defines a set of representational terms which are called concepts with its associated properties, and the interrelationships among the concepts. In any web community, representation of a member's profile is related to personal, professional information, and interests [17]. However, a member could be distinguished either by the expertise in a specific area of interest as well as the relevance of his/her contributions in collaborative interactions [28]. This type of implicit and tacit knowledge could be extracted and dynamically stored in user's profile in order to be used to drive adequate information to users based on (closeness) how similar this information to dynamic members profile. Community ontology is used here as the fundamental source of semantic knowledge for user profiling.

According to [19], ontological approach to user profiling has proven to be successful in addressing the *cold-start problem* in recommender systems where no initial information is available early on upon which to base recommendations. The proposed ontological-based recommendation technique is used to recommend items to users of social network by measuring the similarity of item to the user profiles. Similarity is measured based on relation similarity [18] which is used to compute the similarity between two instances of two different concepts on the basis of their relations to other objects by considering the "closeness" (or distance) of that object. We incorporate community service ontology to relate the system' user profiles (volunteers and social association). As shown in Figure 2, community service could be classified into taxonomy of concepts such as in kind assistance, providing cloths, school/ university payment, grant distribution, providing job opportunities, support productive family projects, free health care services, eradication of illiteracy, care for orphans and street children and so on. Users of the systems are identified by their closeness to one or more community services. This identification is further used to recommends candidate volunteers to social association and vice versa using a hybrid method that combines content-based and ontological-based filtering techniques.

3.2. Community Ontology

The community ontology contains all data about volunteer, social associations, as well as community services. Community ontology plays vital role in the recommendation process since it is used to determine the similarity values upon which the recommender engine applies filtering technique. As shown in Figure 3, community ontology contains three main classes: Volunteers, Social association, and Services. These abstract concepts provide a wide and flexible range for the capture of knowledge about community field. The concept *sih: service* declares all available community services in form of taxonomy as shown in Figure 2 such as: as in-kind assistance, health care services, provide health care and the full nutritional, care for orphans, street children, care of handicapped, special needs, etc.

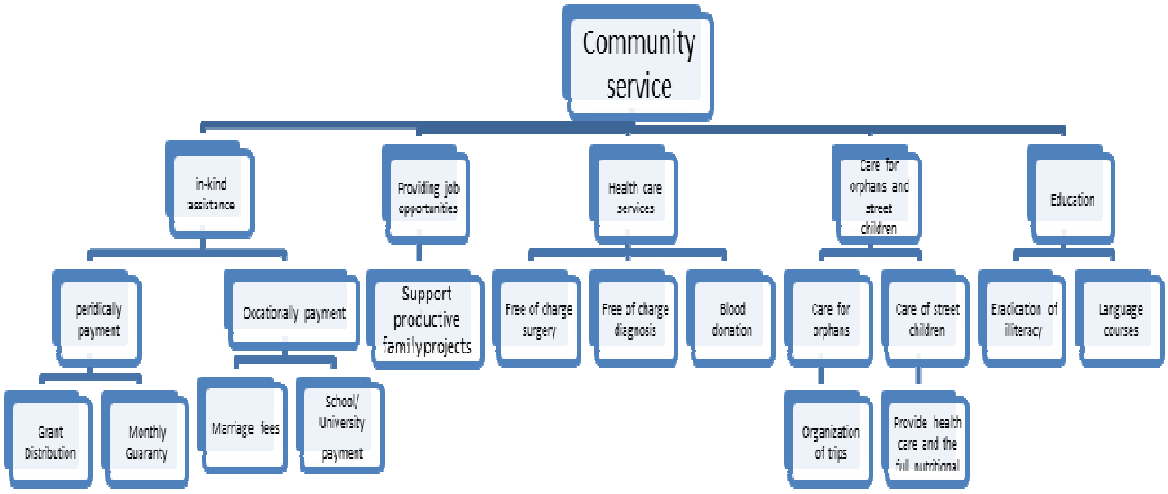

Figure 2. Taxonomy of community service

The concept *sih: charity* is described by the following attributes: charity-name, address, contact person, email, phone number, and offered-services which refer to aset of services concepts that charity offers. The

concept *sih: Volunteer* is the central point for the ontology. A volunteer begins by describing himself or herself during signing up, listing key identity attributes such as name, gender, age, address and has-services. The has-services property is sub-concept of service concept refers to community service that the volunteer can offer. Volunteer concept also has relationship with service concept such as assigned-services and has-discussed. The *assigned-services* relationship describes the service instance that is already assigned to a volunteer upon a recommendation process. The *assigned-services* relationship contains information regarding the following attributes: status, rank and frequency. Status attribute may have one of three values represent the status of the service (complete, in progress, canceled). The rank attribute contains an accumulated rank which is calculated based on the charity(s) feedback upon completion of that service. This rank represents the degree of excellency in applying this type of service and is used to increase the score of the volunteer which is used to group similar volunteers together. The last attribute is the frequency which contains the number of times that the volunteer applied this service. The other relationship with the service concept is called *has-discussed* which is used to decompose post and discussion information related to each instance of service concept. It contains two attributes, has-post and has-comment. Has-post attribute contains the number of time the volunteers post discussion while has-comment contains the number of time the volunteer comments on discussion. It also contains relationship called *has_charity* with charity concept that points to the charity instance that the volunteer deals with. It is used to keep record between social associations and volunteers used to deal with it.

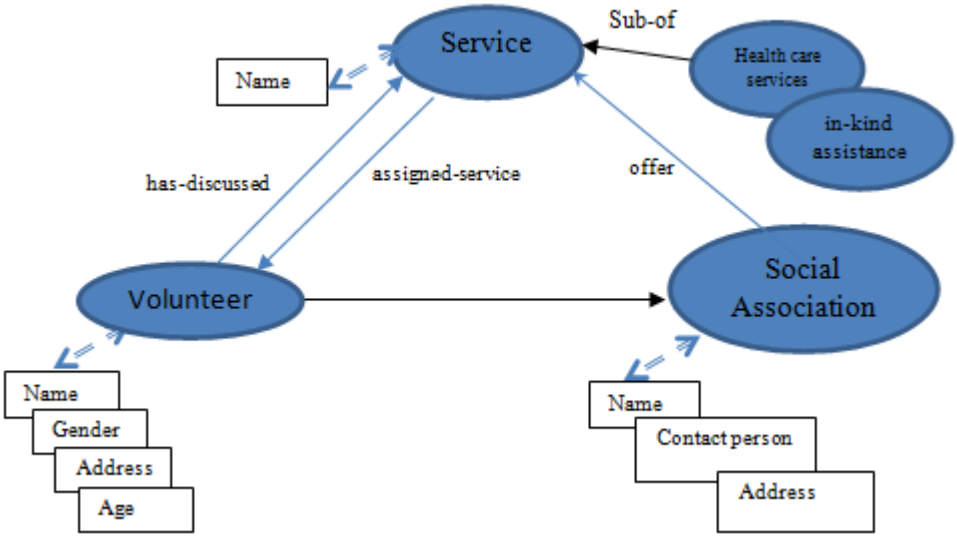

Figure 3. Community Service ontology

4. SEMANTIC RECOMMENDATION PROCESS

Recommender Systems (RSs) are software tools and techniques that aim to provide suggestions of items to users [5, 25, 26]. The proposed recommender engine applies hybrid technique which integrates content-based filtering which recommends items that are similar to the ones that the user liked in the past, and knowledge-based systems that recommend items based on specific domain knowledge about certain item features. The proposed approach overcomes the problem of content-based filtering which doesn't consider the change of user interests over time due to new items of interest emerge. User's profiles are effectively adapted to interest changes by considering the actual behavioral of the user. Therefore, we consider the ontological aspects which are used to adopt user profiles over time.

The proposed technique builds a separate profile for each subscribed volunteer and uses it to evaluate the relevance of community services that the volunteer has subscribed through proposed-services attribute. It then produces an aggregated ranked list with the most relevant items appearing at the top of the list. Therefore, the user' profiles are represented as wieghted term vectors with term frequency normalized by the total number of terms used for a term's weight. The user profile contains a list of proposed-services that is annotated with an *interest score* which has an initial value of *zero*. As the user interacts with the system by accepting to apply this service, user profile is updated by changing the score value which set to a weight (numbers from 0 to 1) representing the intensity of the user interest for each service concept which is used to derive two types of recommendation:

- Social association to volunteers recommendation

- Volunteers to social association recommendation

Semantic recommendation process is applied through two main steps the modeling of user and matchmaker

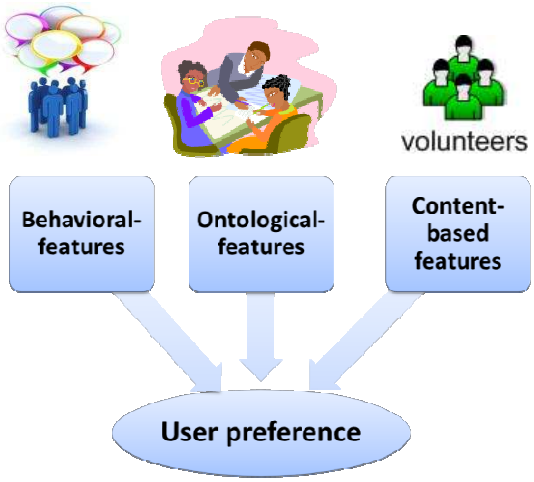

Figure 4. Components of users profile

4.1. Semantic User Modeling

The main function of the user modeling is to extract dynamic features of the users and stored it in the profile associated with a measure of relevancy. Context plays a crucial role when measuring the similarity of two items. To develop a useful context model, "we must attain a better understanding of what context is" [6]. In this paper, we are interested in a definition of context model that is used to describe the user profile which is application-driven, i.e. that allows us to figure out what context parameters are important for a particular application. Unlike other approaches such as SIOC[3] and FOAF[4], our approach does not intend to describe only personal identification, but also to aggregate all interaction and user activities within the same socio-economics group. As shown in Figure 4, our approach integrates what we call a "dynamic profile" which is described in form of behavioral features and ontological features. Considering this context, would generate more entries into user profile which will be used to specify hidden links between users and items (community service). Therefore, a user profile is distinguished into:

a. **Static Profile:** It **represents e**xplicitly defined preferences that are stated by user such as: name, proposed- service(s), and address. Each of these features is initially defined by each volunteer/social-association and therefore they are considering having static effects on the recommendation process.
b. **Dynamic Profile:** It represents all observed user's behavior rather than explicitly stated preferences. User behavior is measured using *activity data* and *semantic relationship*. Activity data is the most reliable way to judge users closeness to specific item based on the actual interaction within the system. This is calculated by considering different features that is specific to each domain and represents the tendency of the users to items. Semantic relations, on the other hand, consider the semantic relationship between items in the ontology. Therefore, dynamic profile of the user is decomposed of the following features:
   - **Content-based features**: for each user, the system considers the following property/value from volunteer ontology: geographical location of users (volunteer/social association), and names of proposed-services.
   - **Behavioral -features:** For each assigned-services in the volunteer concept, the system use the following property/value data: frequency of applying each services, accumulated rank she/he obtained, number of post/comments s/he applied related to that service
   - **Ontological-features:** For each assigned-service in the volunteer concept, the system considers other sub concepts within the same super concept. For example a volunteer may be interested in applying, free of charge surgery so the system also consider free of charge diagnosis and free of charge medicine as they are all sub-concept to healthcare service.

4.2. The Matchmaker

The proposed recommender engine applies hybrid technique which integrates content-based which recommends items that are similar to the ones that the user liked in the past, and knowledge-based systems

that recommend items based on specific domain knowledge about certain item features. Furthermore, the system adapts the traditional content-based filtering by considering other the actual behavior of the users that changes its profile. In content-based filtering the user profile is built based on the actual content of information items that the user found interesting (typically Content-based features mentioned before). It is then used as the start of the recommendation process in order to evaluate the content of incoming interaction and assess its relevance to the user interests. Therefore, in order to recommend the best volunteers to social association whenever a social association requires helps in a specific community service and vice versa), this is applied through two main steps: The first one consider the static profile' features and the second one consider the dynamic profile' features. Finally the technique aggregates both lists.

4.3. Adapted content-based recommendation

The proposed recommender engine is used to recommend services to volunteers whenever a social association asks for someone who is needed to accomplish this service. As mentioned a volunteer profile is represented as a vector contains a set of all proposed-service with associated weights that have an initial value of *zero*. This value is incremented based on similarity function for each features.

$Uj = [_{Sj1, Sj2, Sj3, S\ j4,.....SjM}]$ where $sj \in [01]$

The value of weight is determined based on two main items static and dynamic. Static value is binary which indicate whether the volunteer offer to apply this service (1) within the same geographical location as asked by social association or not (0). While dynamic value is calculated as an average of the following items, the frequency of user post a discussion about this service, the number of times the user had previously apply this service, and the trust score accumulated from social association he deals with. This indicate the affinity of the volunteer towards that service which is multiplied by the static value in order to obtain the overall similarity value for that proposed-service as shown in Table 1 which represents the status of volunteer1.

Table 1. Data stored in profile of Volunteer1

service / feature	Static	Dynamic					total
	0ffered/l ocated	post	discuss	frequency	Trust	total	
Grant distribution	1	0.5	0.2	0.4	0.4	0.375	0.375
School/ University payment	1	0.3	0.2	0.5	0.3	0.325	0
Free of charge surgery	0	0.2	0.6	0.1	0.3	0.3	0.3

The proposed matchmaking algorithm that recommends service(s) to volunteer works as follow:

Step 1: Weight allocation for static features

Identify the list of services that is located within the geographical location of the volunteers and appear in the proposed-service attribute. Each service is assigned initial value of 1

Step 2: Weight allocation for dynamic features

For each proposed-service calculate the following:

Dynamic features value= ∑ Number of applying service/ total number of applying all services + rank + number of post for that service /total number of posts+ number of discussion for that service /total number of discussions

Weighted rank (WR) which represents the accumulated rank gained by social association upon completion of that service which is calculated using the following equation:

$$WR = \sum (v \div (v+m)) \times R + (m \div (v+m)) \times C$$

where:

R = average score given to volunteer
v = number of ranking for the service
m = minimum number of score to be considered
C = the mean across the list

Ontology-based recommendation

In an ontology-based approach, similarity measure of user preferences (features) is computed based semantic relationship and distance; we comprehensively consider the inheritance relations and semantic distance relations between services according to the service taxonomy in Figure2. In the processing of similarity

measure, we extended the concept matching [11] that allocates the weight value of a concept according to its closeness with other concept in the hierarchy. i.e two sub-concepts are related to each other as long as they are located within the same super-concept. Therefore, other ontological subservices would appear in the recommendation list for that volunteers if and only if they are located within the same super proposed-services. For each one of this subservice, the technique calculates a trust value for only subservice based on the following heuristics:

- if this subservice is offered by more than 3 social associations that the volunteer has previously deals with(which is identified through *has_charity* attribute)
- if this subservice is applied by more than 3 friend appearing within the friend list of that volunteer

Step 3: Weight allocation for semantic distance services (heuristic ontological features)
Identify other sub-services that are proposed within the geographical location, have inheritance relationship according to the concept taxonomy of Figure 2, and match the stated heuristics, Then, compute semantic similarity which represents indirect relationship that states that each two specialized concepts are less similar than general one. Therefore, it is considered as having a half trust value than other subservice (so that we multiply it by ½).
Heuristic Weight (sub1) = ½[number of approved service by social association/ total number of services + number of friends apply sub1 /total number of friends]
Step 4: Arrange the service in ascending order according to their score and present it to the volunteer to select.

Usage Scenario
In this section, we show an instantiation of the proposed Ontological Recommender technique that is applied within Society in hand. Society in hand is a social network that has been developed using java (J2EE) integrated with MySQL database to implement the backend while css , javascript and Yui tool are used to implement the front end. Society in hand is available in both English and Arabic language Figure 5 represents a snapshot for the system that shows the recommended services to a specific volunteer.

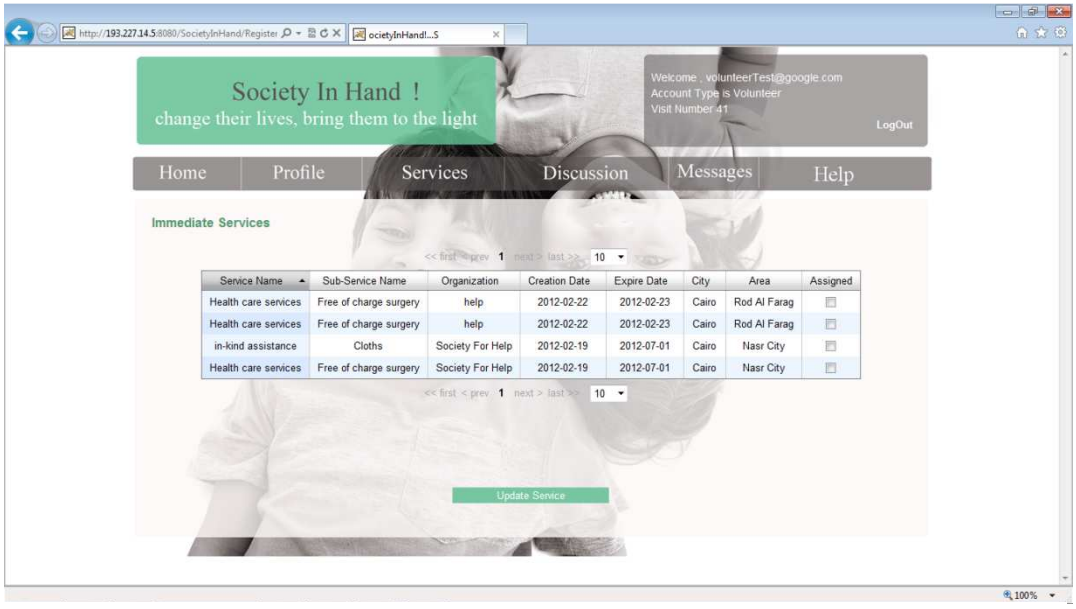

Figure 5. List of recommended services

It is interesting to briefly present a naive usage scenario of our system. First, a volunteer signs in to the system identifying her/his personal information as well as proposed-services. Then, his service page could contains a set of recommended services that he could assigned or deny. This set of recommended services is generated based on the static features. Next, when the volunteer applies the service he could confirm applying this service and accordingly the social association could rank the work of the volunteer. All this information is used to update the user profile and therefore whenever the user accesses the system again, he would obtain another list of recommended services based on her/his updated profile. According to the developed algorithms, the number of recommended services to the volunteer and number of recommender

volunteer to a social association increase using semantic matching compared to static matching as indicated by Tables 2, 3 respectively.

Table 2. Comparison between static and semantic matchmaking for volunteers

	Number of Recommended Services	
	Static matchmaking	Semantic matchmaking
Vol1	2	9
Vol2	0	5
Vol3	4	11
Vol4	7	9
Vol5	9	15

Table 3. Comparison between static and semantic matchmaking for social association

	Number of Recommended volunteers	
	Static matchmaking	Semantic matchmaking
Org1	10	30
Org 2	5	20
Org 3	6	10
Org 4	9	25
Org5	7	15

5. CONCLUSION AND FUTURE WORK

Knowledge sharing within a specific community is critical to success of that community. The flow and transaction of appropriate knowledge to appropriate member(s) is crucial. Enabling semantic for knowledge sharing would enhance interactions between members working in the same community (either individual or organizations).This paper describes an ontological based social recommender system. It targets utilizing social network to help the society to collaborate and provide dweller with adequate services that would help to face their daily challenge.

Accordingly, knowledge sharing and transfer among volunteers, and social association would be applied in an effective way with the aim to provide social and community services to people needed it. The basic idea is to help social associations, which are sometimes not able to serve the huge number of dweller due to limitation in its resources, with suitable volunteers who intended to provide their help in different domains such as (health care, education, etc). Our approach is oriented to utilize user modeling within social network environment through which different entities such as volunteers and social associations could interact. Therefore, the proposed system would connect those parties with each other's in order to aggregate the overall activities to help poor people. Applying society in hand would raise the effectiveness of the voluntary work within the society and contribute to enlargement of charity network since it offers volunteers, appropriate channel through which they would carry out their effort and encourage them to participate in community services. One of the expected impacts of the system is to involve diverse citizens of the society in the social work and to bridge the gap between different levels of community which is required from people living in the same country. Currently, the field of cloud computing has developed options that allow capturing different types of information using social networking. Therefore, we aim to extend this work and utilize cloud computing technology to extract more knowledge about the users of the systems that enrich the dynamic profiling of the users. Also, in order to expand the usability of the system, we intended to enable not only communication through web but also through mobile device and add other location based features such as allowing volunteer to interact with each other according to their current location.

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