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An algorithm of friend recommendation for Fetion Robot

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ABSTRACT

Social networking services （SNS）is a service which based on the theory of six degrees of separation to construct a friend group associated with its community and expand its network of people via "friends of friends"[1]. Up to present, however, there exists lots of problems like, low user authenticity, week reliability, lack of social stability and the function of recommending potential friends is still imperfect .Based on the above issues, in this paper we present a social networking system called mobile SNS which based on China Mobile "Fetion rebort" to construct a real, stable and reliable network. The core ideology of this paper is one algorithm which based on the social network and then use "Sim Rank algorithm" to calculate the degree of similarity in the community between the user and the tightness of individuals finally catch sight of the potential friends and recommend him or she to the user in need.

Key words: Social networks, Fetion rebort, Sim Rank algorithm, Person tightness, similarity, the recommendation of friends;

INTRODUCTION

With the development of social networking, the image of a person on the network more perfect, this time the social network has emerged. Everyone plays different roles and personnel within the social network are inextricably linked. This social network has a lot of hidden potential buddy relationship which woven by the huge network of relationships .The Fetion robot has a high degree of user information is true , high reliability and strong social circle stability which produced by China Mobile . There are a lot of potential friend's relationships in the users of Fetion robot, whomay have a common friend of the user or possibly with common interests of users. However, in this network,the massive potential friend relationship has not been tapped. This paper presents an ideology by Fetion robot and the cornet cluster network to construct a true, stable, reliable network, and implementing a friend recommendation system by calculating the similarity between users in cornet cluster network.

COMMUNITY DISCOVERY

Social network is a unique group of units or individuals closely linked together. These groups have common interests, often, share identical theme; they represent the social activities of users in the network [2]. Hence, in depth study of the community helps to excavate information and organization structure of the network, service provider benefit also, for it provide a technical support to effectively organize the portal and accurately locate the interested groups. Community network is divided into 2 types: artificial network and potential network. Artificial network rely on manual discovery and maintenance. The number of potential network greatly exceeded the artificial one and is continue to grow. In conclude, there is a need for the technology which can deal with the potential community network.

At present, community discovery algorithms include spectral bisection method [3], Radicchi algorithm [4], GN algorithm [5], hierarchical clustering algorithmand the corresponding improved algorithm. Some of these algorithms utilize the characteristics of node matrix, such as spectral bisection method, it divides the community into two groups according to the positive and negative eigenvalues of a matrix. Some other algorithms use edge clustering

coefficient to divide the community, such as Radicchi algorithm, it divides the community by maximize the edge clustering. GN algorithm based on the feature of graph structure, it segments the image suing dielectric number andgets the two separated group by deleting concentrated sides. These algorithms often require established amount and type of community network, therefore, have some limitations in practical application. This paper propose a method which takes china mobile fetion robot as the model and divide the community network by clustering the users who pay close attention to the same WeChat public number. If we take one object in the social network as one node, relationship between objects as one side, then a undirected graph G=(V,E)[8] is achieved. In this graph, V represents a collection of objects and E represents a collection of relationship.

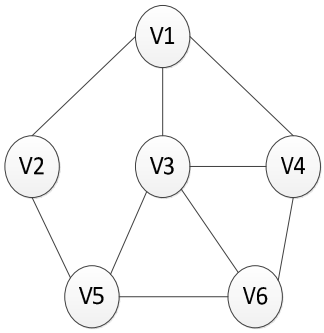

Fig.1 undirected graph

USER SIMILARITY

Currently, the similarity has been applied in many fields, such as: Google website ranking, collaborative filtering, and so on. Google identified the importance and rank websites in order to improve the search quality based on the value which derived from the similarity. Collaborative filtering will use a variety of things for user evaluation and most are used to calculate the similarity score between two users, and then recommended that users might like things. Users also need to recommend friends to take advantage of the similarity between users generate a recommendation list to improve the recommendation accuracy. Users in the same community, although formed a circle , but also the existence of a social circle Relationships between people . Circles also have affinities exist between people, although this circle by the user community of the same composition. For example, even in the same social circles, but the number of friends of both sides together is different, andresulting in the possibility that they may become friends is different.

The current mainstream of user similarity measure method [9] in social network: similaritymethodwithcosine similarity, Pearson Correlation Coefficient, and SimRank algorithm.

3.1 cosine similarity

Similarity calculation is to measure the cosine value of the angle between two vectors in inner product spaces. Cosine value of 0 degree angle is 1, any other cosine value is less than 1, and the minimum value is -1. Cosine value of the angle between two vectors determines whether they point to the same direction. If they have the same orientation, then the value is 1. If the angle is 90 degree, then the value is 0. If they have the opposite direction, then the value is -1. In the process of comparison, size of the vectors are ignored, orientation of the vectors is the only factor we take into consideration. Similarity calculation is usually used in the condition where the angel is less than 90 degree; therefore, the cosine value should between 0 and 1. This method is applied into social network contacts recommendation [14].

3.2 Pearson Correlation Coefficient

Pearson correlation coefficient [9] evolves from the idea which is put forward by Carle Pearson from Francis Galton in the nineteenth Century. Now the main application field is linear regression model which is used to measure the linear correlation of two vectors. It is a dimensionless index, ranging from -1 to 1. Value of 0 indicates no correlation of two vectors. Value of a negative number represents a negative correlation. In contrast, value of a positive number represents a positive correlation [6]. As a method to measure vector correlation, it is often used to calculate entity similarity in computer science. One practical application is the similarity calculation for potential friend recommendation [7].

3.3 SimRank algorithm

SimRank is a model to measure the degree of similarity between any two objects based on the topology graph. It is proposed by Glen Jeh and Jennifer Windom in MIT laboratory [1]. The core idea of SimRank similarity algorithm is that if two objects are referenced by the similar objects (which means they owns the similar structure of adjacent

edges), then we get the conclusion that the two objects are similar. It has attracted growing attention in the field of information retrieval and successfully applied into webpage ranking, collaborative filtering, outlier detection, network graph clustering, approximate query processing [13][15]. The main point of SimRank algorithm is to calculate similarity using associated objects whose similarity is a datum. Research shows that, objects similarity which is calculated by SimRank algorithm is more consistent with human intuition. One practical application is the similarity calculation for friend recommendation [10]. If two objects relate to the same or similar objects then they are similar. In detail, one vertex represents one object; one side represents relation between objects, and a directed graph G= (V, E) is a collection of objects and relationships. SimRank algorithm is based on the graph G to calculate similarity.

The initial case,the similarity between any twodifferent nodesis 0, and 1 for the same nodes. For example, node a, b in the directed graph G=(V,E) ,S(a,b)[0,1] represent the similarity between a and b, and the initial values are:

$$s(a,b)=\begin{cases}1 & if\ (a=b)\\ 0 & if\ (a\neq b)\end{cases} \quad (1)$$

For any node, if there exists one side <a, b>E, we call node anassociated with b. Suppose, $|I(a)|$ represent the collection of nodes associated with a, $|I(a)|$ represent the amount of nodes associated with a, $I_i(a)$ represent the number i node associated with a, constant d (0, 1) is 0.8 by default, so the S (a, b) which represent the similarity between a and b is :

$$s(a,b)=\begin{cases}1 & if\ (a=b)\\ \dfrac{d}{|I(a)||I(b)|}\sum_{i=1}^{|I(a)|}\sum_{j=1}^{|I(b)|}s(I_i(a),I_j(b)) & if\ (a\neq b)\end{cases} \quad (2)$$

(1) and (2) are the recursive form of SimRank , the iterative formula of SimRank is shown as follows:

$$R_0(a,b)=\begin{cases}1 & if\ (a=b)\\ 0 & if\ (a\neq b)\end{cases} \quad (3)$$

$$R_0(a,b)=\begin{cases}1 & if\ (a=b)\\ \dfrac{d}{|I(a)||I(b)|}\sum_{i=1}^{|I(a)|}\sum_{j=1}^{|I(b)|}R(I_i(a),I_j(b)) & if\ (a\neq b)\end{cases} \quad (4)$$

The (a, b) similarity in the k+1 iteration is composed of the similarity accumulation by all adjacent point in k iteration.To update $R_k(*,*)$ is monotone and none decreasing, its value will converge to a fixed value

$s(*,*)$ eventually,
For any a, b∈ V,

$$\lim_{k\to\infty}R_k(a,b)=s(a,b)=s(a,b) \quad (5)$$

Note the adjacency is not the adjacent point on graph G, but the adjacent points of G^2.

However, the use of SimRank algorithm only in individual mutual friend of the community, taking into account the similarity computing users. In this paper we present a social networking system called mobile SNS which based on China Mobile “Fetion rebort” to construct a real, stable and reliable network. TheUsers within the community not only have a common friend but also with the common attributes such as: interests, hobbies, location and so on. Therefore, the proposed system is a combination of community friends recommended user community similarity and Person tightness to recommend a friend to the user. The person tightness which means, the degree of similarity between two nodes in the community interests, hobbies and ideas and so on.

The person tightness $D_{na}(i,j)$ of the community between nodes i andj:

$$D_{na}(i,j)=\frac{1}{N}\times\sum_{k=1}^{N}(1-|i.a_k-j.a_k|) \quad (6)$$

Where N represents the total number of properties，k represents the attribute number and a_k represents the k value of the property. If the node i has the property of k then the $i.a_k=1$, otherwise the $i.a_k=0$. If node i and node j are not connected, the Person tightness between them is 0.From the above calculation method, the Person tightness user range [0,1].If the two nodes are non-neighbor nodes or the two neighbor nodes not have the same properties then the Person tightness of them are 0.If the two nodes have the same property then hen the Person tightness of them are 1.

According to experiments, combined with user similarity algorithm SimRankalgorithms and person tightness recommendation algorithms enable more accurate results.

CONCLUSION

Discovery and recommendation of potential friends in the social network has important research significance and application values. This paper is based on the China Mobile “Fetion robot”. We proposed the concept of user closeness degree. By combininguser similarity algorithm, the“SimRank” algorithm, and the user closeness algorithm we construct a stable and reliable SNS social network. We hope that this work might influence future studies in the cases that recommendation of friends are incomplete, inaccurate and inconformity with reality.

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