

Research of Wechat Network Information Transmission based on the Complex Network

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Abstract. In the recent three years, Wechat quickly developed into the most popular social networking platform. The topology structure of Wechat is analyzed through description of the basic data of the Wechat network and complex network analysis method. When building social networks Tencent Wechat, we get statistical properties such as the degree distribution, aggregation coefficient, and average path length complex networks. The scale-free characteristic of the Wechat network and small world properties are figured out.

Research of complex network

System is an organic whole made up of the parts of interdependence and interaction with specific functions. Network is constituted by nodes and the attachment, if express elements of the system in node, and use the connection between the two nodes to say the interaction between system elements, then the network provide a new way to study system. As a highly abstract of large number real complex systems, complex networks become a new research hotspot in the international academia in recent years; domestic scholars have started this research.

Development evolution process of classical complex network model

One of the simplest cases of network is regular net. It refers to the relationship between each element in the system can use some regular structure to represent, namely link between any two nodes in the network follow the established rules. But because of the complexity of the network itself, large scale network can not completely use rule to represent. In the late 1950s, Erdos and Renyi proposed a completely random network model, stochastic network, it is the network formed by randomly link in probability P of any two nodes in the graph, namely whether the two nodes connected is no longer a sure thing, but decided by the probability P . [1] Random networks and regular rules are two extreme situations. With the continuous development of technology, the scientists found that for a large number of real network systems, they are neither a network of rules nor random, but somewhere in between.

1) Small world network

In 1998, Watts and Strogatz proposed WS network model (small world network); its construction algorithm are as follows:

(1) From the beginning of the regular graph, considering a nearest neighbor coupled network containing N points, they round into a ring, in which each node is connected with nodes it around each $K/2$, K is even.

(2) Randomization reconnection: reconnect the network of each edge in probability P randomly; namely the edge of an endpoint remains unchanged, while the other one endpoint taken as randomly a node in a network. Which regulates, between any two different stages up to only by an edge, and each node can have side connected to itself.

2) Scale-free networks

In order to explain the mechanism of power-law distribution, BA network model is put forward by Barabasi and Albert in 1999, introducing two neglected important features in the network structure in the small world network:

(1) Growth: it refers to that constantly have new node in the network to join in. [2] For example, every day there a large number of new pages on the WWW are born.

(2) Preferential: it refers to that after the new node enters, it will connect to the node of big degree. For example, the new personal home page links are more likely to point to Sina, Netease, and other famous sites.

Based on the growth of the Internet and preference characteristics, the structure algorithm of the BA scale-free network model is as follows:

(1) Growth: starting in network with m_0 nodes, every time a new node is introduced, and connect to the m already exist on the node, here $m \leq m_0$.

(2) Preferences: the relationship between probabilities \prod_i of connecting a new node is to an existing node i and degree k_i of node i meet formula (2-1). After t step, the algorithm generates a scale-free networks $N = t + m_0$ nodes and $m * t$ pieces of sides.

Studies of the complex network evolution model

Evolution model put forward by Barabasi and Albert attribute the real system by the organization a scale-free network to two main factors: growth and preferences. [3] Lixiang and some others think the mechanisms actually won't have an effect on the whole network, and will only play a role in some local world, so promote BA network model with the introduction of the concept of local area of the world, put forward the concept of local network world evolution modes.

Brief introduction of Wechat

When enter the website of Wechat, we can see marked characteristics that "Wechat, a lifestyle". It seems that Tencent instead of using technology for micro letter footnote, but with the culture in the make way for the micro letter. Perhaps, this is also an important reason for the fast development of the micro message.

Rise and development of Wechat

Long before the micro letter abroad there is simple acme cross-platform instant messaging software that kik; it appeared in October 2010, which can be said to be the ancestor of micro message. Kik is also social software based on mobile phone contacts, able to establish connection with the contacts directly from the local address book, and realize the free text chat, call functions such as photo, personal status synchronization on this basis. It can't send photos, can't send attachments, but attracted 1 million users in 15 days after its launch.

Reason analysis of the rise of Wechat

1) Foundation - development of the terminal

Now we have entered the media age, important changes have taken place in the medium form, from PC to mobile phone client, from solid to mobility, from integration to fragmentation, cognitive habits and behaviors are affected in the osmosis, and increasingly important changes are occurring. Forms of media are in change, the human information demand is also changing, and development in information technology, information terminal form is in constant update. [4]In the all media era, fragmentation of information dissemination leads to audience fragmentation, audience fragmentation lead to the fragmentation of reading. Mobile terminal become a very important channel for the user's choice of access to information with its mobility and portability, interactivity, multi-function.

2) Core - function of the product

In terms of product features, Wechat integrate the basic function of the SMS, MMS and Fetion, on which basis, the upgrading and expansion are carried on, the user experience degrees is higher, the product function more humanized. In terms of the needs of users, users use integrated traditional micro letter and get better use effect and greater psychological satisfaction, more in line with the modern's social style and social psychology. Because of this, the new instant communication software Wechat stand out from the crowd in medium competition.

Topological structure characteristics of Wechat network

Basic statistical parameters of undirected non-weighted graph have degree distribution, weighted network, aggregation coefficient, average path length, etc. The statistical properties of the Wechat network are briefly analyzed in the following.

Parameter 1: Degree distribution.

Node degree k says the number of node that connected to this side, the average node degree is called a network average degree, expressed with $\langle k \rangle$, $\langle k \rangle = p(N-1) \approx pN$. Degree distribution of nodes in the network is represented by distribution probability function $p(k)$. It said the probability of that an arbitrary choice of nodes has k edge, also equal to the ratio of number of nodes with degree k by the total number of network nodes in the network. If the node degree distribution follows power-law distribution, namely $p(k) \propto k^{-\gamma}$, when the N is very big, the node degree

distribution approximation for the Poisson distribution: $p(k) \approx \frac{e^{-\langle k \rangle} \langle k \rangle^k}{k!}$, power-law distribution

graphics has no peak, which means that most of the node have only a small amount of connections, and a small number of nodes has a large connection. There is no characteristic scale of random networks is called scale-free network.

Parameter 2: Aggregation coefficient.

aggregation coefficient C_i of node i said the ratio between adjacent nodes number exist and the possible maximum connections, all the nodes average clustering coefficient referred to as a network of aggregation coefficient of, expressed in $\langle C \rangle$.

$$C_i = \frac{2E_i}{k_i(k_i - 1)} \quad (1)$$

$$\langle C_i \rangle = \frac{\sum_{i \in C_i} C_i}{N} \quad (2)$$

In micro letter network, clustering coefficient reflects the corresponding nodes in terms of contact between the adjacent nodes, such as star micro letter or number of micro letter public high indicates the degree of public concern. [5]Average of aggregation coefficient reflects the micro letter in terms of contact between all nodes in the network.

Parameter 3: Average path length.

In the network of the distance d between two nodes i and j is defined as the shortest path that connect two nodes on the number of edges. The diameter of the network was the maximum distance between any two points, remembered to D . For all nodes on the network, average path length L is the average distance:

$$L = \frac{2}{N(N-1)} \sum_{i,j \in G, i \neq j} d_{ij} \quad (3)$$

Studies found that real average path length of most of the large-scale network is much smaller than the imagination, which is called as small world effect.

Summary

Combined with complex network, topological properties of Wechat network are studied. The method of complex network is used to describe the Wechat network and the characteristics of micro letter network topology are analyzed. Application examples show that the Wechat network has scale-free and small-world characteristics, which provide valuable reference to find formation of Wechat network, recognize its development process and the way the information transmits. The next step is to study more characteristics of complex networks of Wechat. There are differences for the current complex network features to describe the actual network, even with two characteristics it

can't close to the reality very well.

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