Social Network Influence Analysis

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Abstract—**Social networking platforms, such as weibo, WeChat, Twitter and Facebook etc. It have greatly changed people's daily life in the past. Compared with traditional media information dissemination, information dissemination based on social network has the characteristics of simplicity, speed and wide audience. Besides network technology, the influence of social network users is also a major factor. Under the influence, the behavior of a single user implicitly or explicitly affects the behavior of many other users, and may also affect the whole dynamic trend of social network. Therefore, social network influence analysis is one of the important contents of social network research. The this paper will expound the related concepts, mainly summarize the social network influence communication model and evaluation methods, and look into the future of social network influence analysis.**

Keywords—social network; social influence; influence communication model; opinion leader problem

I. OVERVIEW OF SOCIAL NETWORKING INFLUENCE

Social network influence, as its name implies, refers to the effect or power generated by the interaction between network users in the social network environment. Due to the special properties of the network, the communication between users is no only limited to face-to-face communication, but also can be through pictures, audio and video or network introduction and tags and other resources [1].

Wang biao proposed to divide social network influence into direct influence and indirect influence [2]. The direct influence causes the consequence to have the continuous time sequence generally, the affected performance is more obvious. In comparison, indirect influence has no obvious manifestation, and the consequences are gradual. In addition [2]to the above classification of influence, Dewey proposed that social network influence can be divided into local influence and global influence [1]. Local influence focuses on the influence of users on others in a group or region, while global influence focuses on the influence of users on other users due to their behaviors and comments in the whole social network, such as micro-blog posts, reposts and other status updates. Of course, as the scope of local influence gradually expands, it will be transformed into global influence.

Social influence is one of the reasons for the change of people's behaviors and thoughts. However there are numerous reasons for the change, and social influence is also related to many factors, which makes it difficult to identify and analyze social influence. In order to do a good influence analysis, it is necessary to understand the internal connection and difference between influence and related factors. For example: homogeneity, reciprocity and so on. Homogeneity means that different individuals have similar or identical essential characteristics and have the tendency to choose each other as partners [3]. Homogeneity has a strong correlation with influence. The manifestation and transmission mode of the two are very similar. The biggest difference is that the influence requires a long interaction to show its effect. However, in the specific application environment of analysis, we can combine the two considerations to improve the accuracy of user behavior prediction [4].

II. SOCIAL IMPACT COMMUNICATION MODEL

The influence propagation model describes the propagation mode of influence in the social network, that is, how each node in the social network activates the state of the neighbor node and spreads the active state in the network [5]. Among many propagation models, independent cascade model and linear threshold model are the most studied and widely used ones.

A. Independent cascade model

The independent cascade model expresses the possibility and strength of influence through probability values [6]. In the independent cascade model, any node u only attempts one activation opportunity for any v of its neighbors, and it occurs at the next moment when u is activated. The state propagation of multiple nodes in the model is independent of each other, which is similar to the characteristics of many actual data, such as independent interaction behavior between people, independent information propagation, and so on. Therefore, this model can be used to simulate the learning of these actual data.

B. Linear threshold model

In the linear threshold model, the directed edge $(u, v) \in E$ of each directed graph has a corresponding weight $w(u, v) \in [0,1]$, indicating the proportion of influence importance of node u in all the incoming neighbors of node v. At the same time, each node v has an affected threshold $\theta_v \in [0,1]$, which represents the node's acceptance tendency to a message. The higher the threshold, the more difficult the node v is to be affected; otherwise, the lower the threshold, the easier the node is to be affected.

The propagation process of the linear threshold model is similar to that of the independent cascade model. But the difference is that the inactive node v needs to calculate the linear weighted sum of all its activated incoming neighbors. If the weighted sum is greater than the affected threshold, the node can be activated, otherwise the node remains inactive.

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As it can be seen, in the linear threshold model, only the joint behavior can have influence [6]. It is to say, it is impossible for anyone incoming neighbor to activate the node alone. Only when the influence of multiple neighbors on node v exceeds the affected threshold, the node can be activated. Such characteristics correspond to people's herd behavior when faced with complex choices, such as buying goods and voting in elections. Therefore, when the social network influence analysis research is applied to the above situation, the linear threshold model is a suitable choice.

III. Social network influence evaluation model

The evaluation of social network influence is to analyze the size and evolution rule of user influence in social network, so as to provide theoretical basis and support for relevant research and application [7]. Common evaluation models are based on grid structure and user interaction information.

A. Model based on network topology

Network topology is the result of people's interaction in social network and the most direct data source to analyze the influence [8]. The measurement based on network node can be divided into three methods based on node degree, shortest path and random walk characteristics [9].

These three measures are all around the degree of association between a node and adjacent nodes, which can express the meaning directly, simple model, and easy to apply and expand. But the network topology is static and represents only the user state of the social network at a certain moment. If the user state of multiple moments satisfies the same probability function, it means that the user influence of these multiple moments is the same [3]. Obviously, this is inconsistent with the actual situation, and the reason for the deviation is that this method does not fully utilize the information of the user's interaction behavior.

B. Model based on user interaction information

User interaction information in the network keeps all records of user activities, which is very important for influence analysis. Wu based on tags and short readings in the network can be used to measure the influence of users based on the topic [10]. In the establishment of the analysis model, the invisible link between users and topics is built directly according to the user's participation in the topic and the topic content, without considering the social network topology built between users.

In addition to hashtag-based metrics, there are also information-based metrics. User communication is based on information, and there is an "interaction force" between the mode and scope of information dissemination and user influence. Therefore, studying the information spread in social networks can also accurately reflect the influence of users. In general, information in the network is spread in a tree structure. For example, if a microblog is published by a certain big V, the microblog information will be distributed with the user as the peak and the number of followers as the branch node. Therefore, users in the center of communication mode will have a greater influence; The greater the spread, the greater the representative's influence. Tang proposes the changing rule of influence with time.

The rule indicates that the influence will increase rapidly in the early stage of transmission, then decrease with the increase of transmission time, and finally become stable. Therefore, the spread time of the information published by users in the network can also reflect the far-reaching degree of the influence of users, which is also an important index to measure the influence.

IV. conclusion

Social network touches every aspect of people's life, and is a social platform for users to make friends, read news, spread information and generate influence etc. Analysis and modeling of influence in social networks is an important part of analyzing social networks.

At present, there are many studies on the dissemination and analysis of social network influence, but there are still some problems and challenges. For example, the accuracy and effectiveness of impact learning. For the influence of the social network analysis must be built on the basis of analyzing huge amounts of data, as well as analysis of more complex interaction between the user data, and the network data is mostly meaningless noise, and the article mentioned, from the data to distinguish the influence and factors related to homogeneity is also a difficult point, all of these hindered the influence learning effectively. On the other hand, the dynamics, complexity and randomness of social network put forward higher requirements on the modeling and optimization of various models. At present, social network influence research has been relatively mature, and has been widely used in many fields. It is believed that with the development of big data technology and in-depth study of influence analysis, the application prospect of social network influence analysis will be even broader in the future.

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