Social Network Analysis

Social network analysis (SNA) is a process of quantitative and qualitative analysis of a social network. SNA measures and maps the flow of relationships and relationship changes between knowledge-possessing entities. Simple and complex entities include websites, computers, animals, humans, groups, organizations and nations.
The SNA structure is made up of node entities, such as humans, and ties, such as relationships. The advent of modern thought and computing facilitated a gradual evolution of the social networking concept in the form of highly complex, graph-based networks with many types of nodes and ties. These networks are the key to procedures and initiatives involving problem solving, administration and operations. SNA usually refers to varied information and knowledge entities, but most actual studies focus on human (node) and relational (tie) analysis. The tie value is social capital.
SNA is often diagrammed with points (nodes) and lines (ties) to present the intricacies related to social networking. Professional researchers perform analysis using software and unique theories and methodologies.

SNA research is conducted in either of the following ways:

- Studying the complete social network, including all ties in a defined population.
- Studying egocentric components, including all ties and personal communities, which involve studying relationship between the focal points in the network and the social ties they make in their communities.

Examples of social structures commonly visualized through social network analysis include social media networks, memes spread, information circulation, friendship and acquaintance networks, business networks, knowledge networks, difficult working relationships, social networks and collaboration graphs. These networks are often visualized through sociograms in which nodes are represented as points and ties are represented as lines. These visualizations provide a means of qualitatively assessing networks by varying the visual representation of their nodes and edges to reflect attributes of interest.

Background of SNA

Social network analysis has its theoretical roots in early sociologist such as Georg Simmei and Emile Durkheim who worked and wrote about the importance of studying patterns of relationships that connect socially. Some social scientists have used the concept of "Social Networks" in early 20th century to connect the relationships between members of social systems.

In the 1930s Jacob Moreno and Helen Jennings introduced basic analytical methods. In 1954, John Arundel Barnes started using the term systematically to denote patterns of ties. Scholars such as Ronald Burt, Kathleen Carley, Mark Granovetter, David Krackhardt, Edward Laumann, Douglas R. White and Harrison White have become part of it and expanded the use of systematic social network analysis.

It also has its root in mathematics. This idea was rediscovered many times in different areas of math and applied sciences. In statistics they developed the notion of markov probability chains. In physics they were used to understand molecules adjacent to each other in euclidean space. In operations research, graphs were used to map out the location of goods and channels of transmission.

Today, graph theory is a well-developed area located at the intersection of combinatorics and topology. Indeed, social network analysis has found applications in various academic disciplines, as well as in practical applications like marketing, social connectivity, criminal investigation and other various applications.

Basic Structure of SNA Connectivity

Social network analysis in general studies the behavior of the individual at the micro level, the pattern of relationships (network structure) at the macro level, and the interactions between the two. Social networks are both the cause of and the result of individual behavior. Social networks provide and limit opportunities for individual choices, whereas at the same time individuals initiate, construct, maintain, and break up relationships and by doing so determine the global structure of the network.

A social network consists of a set of nodes (referred to as actors or vertices in graph theory) connected via some type of relations, which are also

called as ties, links, arcs or edges. The nodes usually represent actors, be that individuals, groups, teams, communities, organization, political parties or even nation states.

Thus, social network either have nodes that are social beings or organization or ties that represent some form of social interaction. The relations between the nodes can be multidimensional and can include a whole array of different relationship types.

Once the data is collected, SNA software is used to create the maps for analysis. The maps draw incoming and outgoing arrows between people to show the number of ties coming into a person (contacts that the person receives) and the number of ties outgoing (contacts that the person initiates). There are three key roles in a network. Central connectors are people linked to the greatest number of people. Boundary spanners are people who connect one network to another within the company or even across organizations. Peripheral specialists have special expertise that can be drawn upon even though they often work independently of the group.

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Figure 1: Nodes

Social Media Connectivity

Computer networks combined with social networking software produces a new medium for social interaction. A relationship over a computerized social networking service can be characterized by context, direction, and strength. The content of a relation refers to the resource that is exchanged. In a computer mediated communication context, social pairs exchange different kinds of information, including sending a data file or a computer program as well as providing emotional support or arranging a meeting. With the rise of electronic commerce, information exchanged may also correspond to

exchanges of money, goods or services in the "real" world. Social network analysis methods have become essential to examining these types of computer mediated communication.

In addition, the sheer size and the volatile nature of social media has given rise to new network metrics. A key concern with networks extracted from social media is the lack of robustness of network metrics given missing data.

The social media is based on the principle of social network. Its ability to maintain and amplify is weak ties. Weak ties are defined as social connections between people that require little or no emotional attachment, some agreement on basic terms (but low overall similarity), low frequency of communication—in short, they require little or no personal time and energy to maintain—yet are extremely powerful.

The weak ties in an interpersonal network can carry information across vast distances both physical and social (in terms of income, class and attitudes). Low emotional content of such ties allows people to hold very different opinions on many topics without engaging in a conflict; low frequency of communication means that the two people are usually desynchronized in terms of what information they receive and when. Thus, when two people do communicate across a weak tie, the information that passes through it is usually novel, and comes from a different point of view. These weak ties are extremely important in a job search; people that one was strongly tied to tended not to possess any novel information about job openings, but people across weak ties had access to very different information and could make far-ranging connections.

Marketing Through SNA

Many businesses use networking as a key factor in their marketing plan. It helps to develop a strong feeling of trust between those involved and play a big part in raising the profile of a company. Suppliers and businesses can be seen as networked businesses, and will tend to source the business and their suppliers through their existing relationships and those of the companies they work closely with. Networked businesses tend to be open, random, and supportive, whereas those relying on hierarchical, traditional managed approaches are closed, selective, and controlling.

Now-a-days marketers use social networking for increasing brand recognition and encouraging brand loyalty. Since it makes a company more accessible to new customers and more recognizable for existing customers, social networking helps promote a brand's voice and content.

For example, a frequent Twitter user may hear of a company for the first time through a news feed and decide to buy a product or service. The more exposed people are to a company's brand, the greater the company's chances of finding and retaining new customers.

Marketers use social networking for improving conversion rates. Building a following provides access to and interaction with new, recent and old customers. Sharing blog posts, images, videos or comments on social media allows followers to react, visit the company's website and become customers.

Customers may complement the company's offerings and encourage others to buy the products or services. The more customers are talking about a company on social networking, the more valuable the brand authority becomes. As a brand grows stronger, more sales result. Increased company posts rank the company higher in search engines. Social networking can help establish a brand as legitimate, credible, and trustworthy.

A company may use social networking to demonstrate its customer service level and enrich its relationships with consumers. For example, if a customer complains about a product or service on Twitter, the company may address the issue immediately, apologize, and take action to make it right. However, criticism of a brand can spread very quickly on social media. This can create a virtual headache for a company's public relations department.

Every business is unique and has a different target demographic, history, and competitive marketplace, no single marketing strategy works for every business. These fact that social networking is constantly evolving also makes keeping up with changes challenging, and influences a company's marketing success rate.

Some facts regarding business associated with SNA:

- Social networking provides robust marketing opportunities for companies but can also put them at risk for PR disasters.
- The most popular social network as of early 2019 is Facebook.
- Marketers use social networking for increasing brand recognition and encouraging brand loyalty.
- 44 percent of local businesses said they depend on social media to generate brand awareness, and 41 percent depend on it to drive revenue.
- More than 1 in 3 Internet users say they go to social networks when looking for more information about a brand or product. The likelihood of doing this is linked very strongly to age.
- More than 50 percent of marketers who have been implementing social media marketing tactics for two years have reported improved sales.

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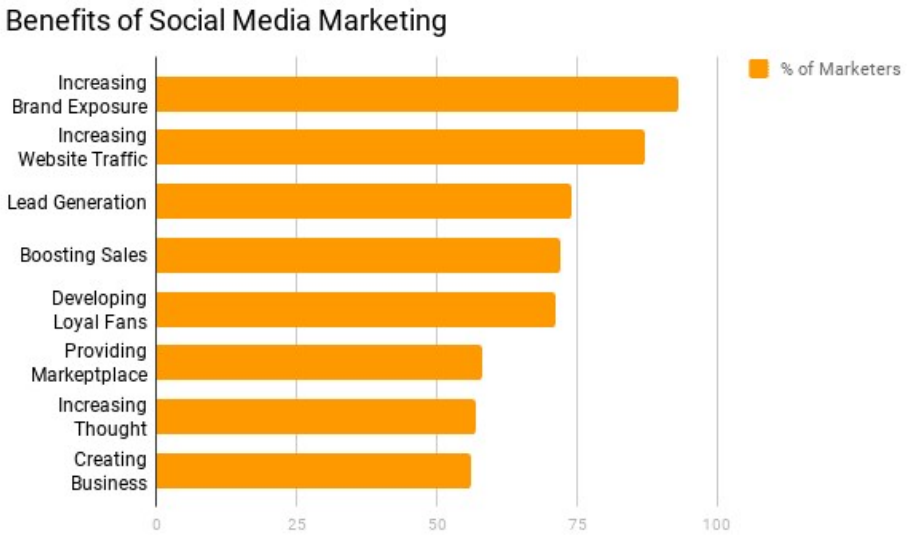

Figure 2: Benefits of SMM

Criminal Activity

The rapid development of social networks and ability to collect information from them led to a noticeable increase of interest to social network analysis and the occurrence of its new methods become increasingly popular and they are used in various fields expert search system, gathering a team of specialists, social recommendations, search engines people and documents, marketing, communications, advertising, and many others. Nowadays social network analysis (SNA) is used to study a variety of economic and organizational phenomena and processes.

The Social Network Analysis (SNA) is now widespread in the academic community in the study of organized criminal networks. It allows analyzing the network as a complex structure composed of actors or entities connected by links or relationship and in which a variety of resources is changed. This method, despite having capabilities and innovations at various levels, also has some limitations that need further attention. Nevertheless, the SNA is still taking its first steps in the fight against organized cybercrime.

Some threats regarding criminal activity:

- Social engineering is the most popular tactic for cyber criminals. Social networks allow attackers to find confidential information that can be used for property and moral damages.
- The trust to those who entered in the "friends" list is always higher than to random people. On the one hand, this is good, since forming a loyal audience around the company, brand or person. But on the other hand, it is an opportunity for attackers.
- Content with signs of incitement to racial, ethnic or religious hatred, propaganda of totalitarian sects.
- Propaganda and public justification of terrorism.
- Cyber humiliation and cyber bullying.
- Promotion and distribution of drugs.

Some Statistics of Cyber Crime:

- In January 2019 alone, 1.76 billion records were leaked from various data breaches around the world. (IT Governance UK)
- Malicious or criminal attacks are the cause of 48% of data breaches, human error accounts for 27%, and system glitch 25%. (IBM)
- The average size for a data breach is 25,575 records.(IBM)
- Email is responsible for 92.4% of malware. It is followed by the Web for a measly 6.3%, and others 1.3%. (Verizon 2018 Data Breach Investigations Report)
- 91% of cyberattacks and the resulting data breach start with a spear phishing email. (Cofense)
- 90% of verified phishing emails were found in environments using secure email gateways. (Cofense)

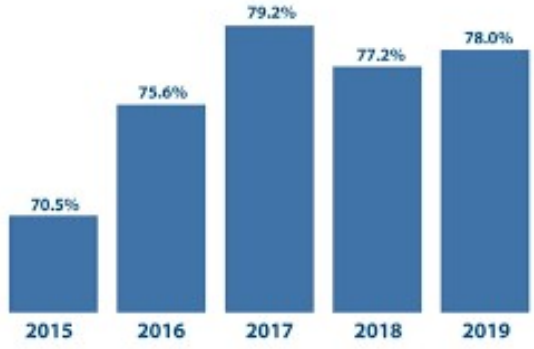

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Figure 3: Successful Attacks

Conclusion

There is a large amount of literature on social network analysis and its applications. This study has identified quantitative and qualitative results that help support SNA use for public engagement strategies. The use of SNA can allow an organization to better target its engagement efforts as well as identify key online stakeholders who are "influencers" of others online and can help expand the scope and exposure of a given project. This research will help further the use of SNA software to practical applications in planning firms and agencies. SNA can help organizations determine which of their posts have been most successful, and allow them to replicate this success by creating a strategy for their social media platform. The use of SNA software is also helpful for identifying key topics or emerging issues that the public finds most important. Many types of SNA software are open source and user friendly, giving planners the ability to do 'high level analysis' of their social network data with limited technical knowledge.