Social Networks and Social Network Analysis

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Abstract

Network concept is in the area of interest of scientists for many years and is increasingly gaining popularity as a study field. Especially in recent years a very large group of researchers varying from mathematicians to sociologists and computer scientists are trying to examine different aspects, features and types of networks. On the other hand, it is seen that numerous studies have been done about social networks from different disciplines. Social network analysis is a method that emphasizes the links between social assets and the meanings of these links and that investigates the structure of social networks with the concepts of graph theory. In this study, how basic concepts of graph theory have found significant provisions in social networks will be emphasized, how they reflected to social network analysis will be examined and also detailed examples will be given from relevant literature.

Key Words: Social Networks, Social Network Analysis, Graph Theory

1. Introduction

The study of networks has quite old historical roots. Both network studies and "graph theory" which has an important role in the analysis of network structures owe their birth and initial development to a famous riddle. In 1736, Leonhard Euler who was an important mathematician became interested in a mathematical riddle called the "Königsberg Bridge Problem". The city of Königsberg-which is called Kaliningrad today and lies in Russia-,was built on the banks of the Pregel River in that was then Prussia and on two islands that lie in midstream. There were seven bridges in Pregel River that connect the land masses. The question that has become quite popular in that time asked"Does there existany singlepath that crosses all seven bridges exactly once each?".So the problem is, by starting from the islands or any of the land masses in the shore, to pass each of these seven bridges only once without moving or flying around the terrestrial and to be able to come back to the starting point.

According to the rumors, the people of Königsberg have spent fruitless hours to find whether such a path exists. Euler proved that there is not, by observing that since any such path must both enter and leave every vertex it passes through, except the first and last, there can at most be two vertices in the network with an odd number of edges attached. Euler formed the basis of "graph theory" by putting forth of the properties of the graphs which is today called "Eulerian Graph" while searching for the solution of that riddle.Euler proved the impossibility of this path's existence by using a graph which is a mathematical objectconsisting ofpoints, also called*vertices* or *nodes*; and lines, also called*edges* or *links*. Thus, this famous bridge problem has become a mathematical expression as the question of whether there exists any "Eulerian Path" on the network. An Eulerian path is precisely a path that traverses each edge exactly once. Many consider Euler's proof to be the first theorem of graph theory which has become the principal mathematical language for describing the properties of networks and is now highly developed field of mathematics (Ceyhun, 1976: 78, Barabasi et.al., 2006: 1-2).

In its simplest form, a *network*consists ofa set of discrete elements (vertices) and a set of connections (edges) that link the elements. These elements and their links can consist of many examples as computer and communication lines, people and their friendships or scientific publications and their citations and so on. This indicates the wide range usage area and power of graph theory. As a result, especially within the last decades, graph theory diverged from just being a mathematical theory and started to apply in other disciplines as computer sciences and engineering, but especially it gained a wide acceptance in sociology.

2. Social Networks

Since 1950's, there has been an increasing interest for quantitative methods in sociology and anthropology, thus social scientists started to interest in mathematical language of graph theory in terms of examining the data obtained from ethnographic studies. A large part of the terminology that used in social network analysis has taken or adapted directly from graph theory. In similar, the structural properties and links of networks provide a useful tool for explaining the diffusion and impacts as well, like a possible diffusion of an epidemic or a global information transfer. Social network can be defined as a set of people -actor-, and the links and interactions between these actors. *Nodes* are the individual actors in a network; *links* are the relations between these actors. On the other hand, social network analysis can be expressed as examining the structure of social networks with the concepts of graph theory.

In the center of network analysis, there are some key concepts which are fundamental for thediscussionof social network.Some of these concepts are*actor, relational tie, dyad, triad* and *subgroup.* The social entities are referred as the concept of "actor". These actors can be discrete individual, corporate or collective social units. Individuals in a group, departments within a corporate or nation-states in the world system can be the examples of the concept of "actor". Most of social network applications focus on the same type of actor collections as people in a work group. These kinds of collections are called as *one-mode network.* Actors are linked to one another by social ties which can be handled as *relational tie.* A tie establishes a linkage between a pair of actors.

The most common examples of ties can be expressed as behavioral interactions like talking together-sending messages, biological relationships like kinship, evaluation of one person by another like expressed friendship, liking, respect and transfers of material resources like business transactions etc. A relationship establishes a tie between two actor at the most basic level. So this tie is a property of the pair and it cannot be handled as a property of just an individual actor. Hence, a *dyad* consists of a pair of actors and the ties between them. Dyads are defined as the most basic units in the statistical analysis of social networks. On the other a *triad* is defined as a subset of three actors and the ties among them. A *subgroup* which is another concept in social network is defined as any subset of actors and all ties among them (Wasserman and Faust, 1994:17-19).

At this point, it will be useful to mention about the study of Moreno.In 1930's, Moreno aimed to examine the choices and preferences in a group and he was especially interested in the structures that he called social configuration. These configurations are resulted as the concrete patterns of interpersonal choice, attraction, repulsion, friendship and other relations in which people are involved. According to Moreno, these configurations are the basis upon large scale social aggregates, such as the economy and the state, are the sustained and reproduced over the time.Moreno's main innovation is to devise the "sociogram" which is a way to present formal properties of social configurations. Sociogram can be defined as diagrams in whichindividuals represented by "points" and their social relationships represented by "lines" (Scott, 2000:9).

Actually, a sociogram is nothing more than the concept of graph which is used by mathematicians for a long time. But Scott stated that,before Moreno,even if the concepts like webs of connection or networks of relation were mentioned, social scientists hadn't attempted to systemize this metaphor into an analytic diagram. According to Moreno, social configurations are definite structures and mapping of these structures into sociogram allow researchers to visualize the channels like information flow from one person to another. Also Moreno mentioned that sociograms allow researchers to identify leaders and isolated individuals, to uncover asymmetry and reciprocity, and to map chains of connection (Scott, 2000:10).

Graph theory which is the basis of social network studies had first been systematically formulated by König in 1936, but its significance for the mainstream of intellectual effort was appreciated when König's ideas were developed in the work of Harary and Norman in 1953. These mathematical ideas made possible a crucial breakthrough in the theory of group dynamics. Also in the work of Cartwright and Harary (1956), the points in a graph represented individuals and the lines showed their relations with one another. The lines in a graph can be given signs (+ or -) to indicate whether they refer to 'positive' or 'negative' relations.

The direction attached to a line is a way of distinguishing, for example, person A's orientation to person B from B's orientation to A in a positive or negative way. In an undirected graph, the relation of A to B is assumed to be identical with the relation of B to A. This can occur, for example, because their attitudes are perfectly reciprocated or because they have a common involvement in the same activity (Scott, 2000: 12-13).

3. Basic Concepts of Graph Theory and Their Meanings in Social Networks

Adjacency which is one of the concepts of graph theory is an expression of the fact that two agents represented by points are directly related or connected with one anotherand two points which are connected by a line are said to be *adjacent*to one another. The *degree* of a point is a numerical measure of the size of its neighborhood. Because each line in a graph connects two points, the total sum of the degrees of all the points in a graph must equal twice the total number of lines in the graph. Points may be directly connected by a line, or they may be indirectly connected through a sequence of lines. A sequence of lines in a graph is a *walk*, and a walk in which each point and each line are distinct is called a *path*.The *length*of a path is measured by the number of lines which makes it up and the *distance*between two points is the length of the shortest path (the 'geodesic') which connects them. When the direction of the lines is defined in a social relation, the *degree* of a point which is called the *in-degree* and the *out-degree* expresses the direction of the lines. The *in-degree*of a point is the total number of other points which have lines directed towards it; and the*out-degree*of a point is the total number of other points to which it directs lines (Scott, 2000: 67-72).

One of the main usages of graph theory in social network analysis is the analysis related with the determination of the important actors in a social network. The most important and prominent actors are the ones who are located in the strategic locations in a network At this point, the concepts of *actor centrality* and *actor prestige* come into question. The concept of *centrality* was first developedduring the laboratory experiments on communication networks directed by Bavelas in the late 1940's and early 1950's and those studies lead many other studies in terms of understanding the group structures. The centrality is rather handled as an appropriate concept for nondirectional relations.

The prominent actors are the ones who have a common relation with other actors and this connection make them more visible than the others. Whether this prominence is due to being a recipient or being a source, it's not important; what is important here is that the actor is simply involved. On the other hand, the concept of *actor prestige* is especially handled for directional relations and is a concept in which there is a distinction between sended and received ties. Inthis manner, the focus point of the characterization of *prestigious actor* which is the subject of the intensed and common ties is that the actor is positioned as a receiver. The prestige of an actor increases when the actor becomes the subject of more ties, but it is not unconditionally necessary for the actor to be the starter of the connections (Wasserman and Faust, 1994: 169-174).

The *degree*is an important concept both for actor centrality and actor prestige. Because the central actors are the most active ones and they have the most ties to other actors in a network, a centrality measure for an individual actor, especially in the nondirectional networks,is the degree of the actor in the network. When directional relations are concerned, the concept of degree is handled asin-degree and out-degree. When the actor is considered as receiver, in-degree can be considered as the ties directed towards the actor from the other actors. For this reason, actor prestige is measured by examining the in-degree level of each actor. Out-degree can be considered as the ties which the actor directed towards to other actors (Wasserman and Faust, 1994: 179-202).

Another concept which is about centrality and is quiteimportant for social network is *sociometric star*that is one of Moreno's basic sociometric concepts. Sociometric star is defined as a leader actor who getschoices more and frequent than the others, hence has a high prestige and also has a directing effect because of its ties. According to Moreno, a sociometric star can easily be shown by a visualmapthat depicts the relations between the group members (Scott, 2000: 10).

Scott (2000) mentions that one of the important fields of interest in social network analysis is the studies about sub-groups.The informal social relations of people can connect them into an integrated sub-group which has its own norms, values and sub-cultures. The scientists who studied on sub-groups and tried to make mathematical measures of the numbers of sub-groups and their ties mentioned that these sub-groups cannot be limited only with the informal groups; there can also be politic, economic groups etc. as well. These groups can be considered as mutually connected groups of individuals or high-density cells. The starting point for measuring that kind of group structures is the idea of sub-group. Sub-group is the sum of the points-and the lines that connect those points-which are chosen from the entire graph of a network.

A sample of random points that selected from a graph can be defined as sub-group and its structural properties can be examined. But, a random sub-group does not generally refer to a significant social group.

The more useful approach for defining sub-groups is to split the network members according to the researcher's topic of interest, to define the significant point categories and to discover their differences within the network pattern.

The *component* which is one of the concepts of sub-group is defined as maximal connected sub-group. To define a sub-group as "connected", all of its points should be connected to each other through paths. All the points can reach to one another through one or more paths within a connected sub-group. Also, within a component, all the points are connected through paths, but there isn't any path that goes out of the component. When a connected sub-group is maximal, it is impossible to add a new member to the group without disrupt its connectedness. Actually, a connected graph consists of just one component. However, the other graphs contain one or more discrete components and some isolated points (Scott, 2000:100-102).

Another important concept that is used in sociological applications of graph theory is *clique* which is expressed as *maximal complete sub-group*. Clique is the sub-sets of points that each pair of points isdirectly linked through a line. Within the cliques, each point is in a direct and mutual relationship with the others (Scott, 2000:113-114).At this point, the difference between the component and the clique can be expressed as follows: In a component, all the points can reach to one another through one or more paths;on the other hand, in a clique, each pair of points is directly connected through just one line.

The *maximal complete sub-group* is a restrictive concept for real social networks due to the rarity of groups which have such tight patterns. Therefore, several recommendations have been made by making some additions to the basic idea of this concept. The concept of *n-clique* is one of those recommendations, and the expression of "n" refers to the maximum length of path that connects the members of clique to each other. For example, 1-clique is the maximal complete sub-graph itself, because all pairs of points are directly connected to each other through 1 line. On the other hand, 2-cliques arethe cliques in which the members are directly connected or indirectly connected through a commonadjacent. 3-cliques are more loosely groups than 2-cliques; therefore the rise in "n" is resulted with a gradual loosening in clique membership (Scott, 2000:115-116).

4. Online Social Networks

The developments in communication technologies which began to take placein the late1990's caused the occurrence of new digital platforms and emergence of new mass communication technologies. Because the Internet and the web eliminate the geographic barriers, theinformation sharing process became quite fast and those developments have led to the radical changes and transformations in many areas of people's lives.

According to Onat and Alikılıç (2008), the information technologies provide re-establishing of social networks in a different way from the real life and they mentioned that the employees who text to each other within a corporation's local network, the people in the e-mail lists and e-mail groups are the first examples of online social networks. Afterwards, online virtual communities in which the people communicate to each other and share contents have rapidly spread with the emergency of technologies that provide social cooperation as blogs, wikis and social networking sites (Onatand Alikılıç, 2008:1115-1117).

The web is formed around the content; on the other hand online social networks are formed around the user. Social networks provide the establishing of social relations and the organization of the users who have common interests, also social networks make possible for the users to contribute to the contents and information (Misloveet.al., 2007:1).Social networks which are accessed from computers and mobile communication devices can be gathered in several groups as e-mail groups, blogs (the links in the blogs and the communication between the bloggers), forums, corporate intranet, extranet, instant messaging services and social networking sites as Facebook (Onat and Alikılıç, 2008: 1118).

Internet and web are defined as a huge network which consist of connected computers, connected web sites or connected users (Scharnhorst, 2003). Therefore,the new developments in Internet caused the online restructuring of a huge social network and the properties of this new structure became the field of interest of many researchers. The rapidly growing popularity of social networks has let the sociologists and computer scientists to examine the properties of these networks. Based on previous knowledge it can be said that online social networks are consist of the actors and the links between these actors just like the other social networks. So, online social networks can also be analyzed by using the methods and concepts in graph theory and social network analysis.

5. Studies on Online Social Networks and Examples of Network Analysis

Online social networks have been and are being examined in many researches. In a very comprehensive study about online social networks (Misloveet.al., 2007), a large scale sample that has 11.3 million users and 328 million links is examined and structural analysis of four popular online social networks has been revealed.

According to the results of this study, it has been revealed that online social networks consist of actors with high degrees who are surrounded with many clusters that consist of the nodes with low degrees; therefore high degree nodes have critical roles in terms of links and flow of information.On the other hand, it has been revealed that there is a strong correlation between in-degree and out-degree of users in the directional ties.

As shown in this study, just like real social networks, an online social network can be seen as an area which has many nodes and ties and different types of ties between these nodes. Also, it is an area in which some of the actors have a quite central location, some of them are isolated, and some sub-groups may be formed in various types.

In an another study of Mayer and Puller (2008) which examines the structures and the compositions of the social networks in university campuses andthe processes that lead their formation, a large database has been used from Facebook.com and those data have been associated with the demographic information and academic success of each student. The researchers indicated that they documented the factors that are the strongest predictors of whether two students are friends. According to the study, race is strongly related to social ties even after controlling for a variety of measures of socioeconomic background, ability, and college activities. Especially Black and Asian students tend to have more common friends from the same race.

The researchers used a large new dataset from 10 public and private universities to describe social networks in college and their data were from Facebook.com, a student social networking website for each university. They stated that one feature of the Facebook identifies friendships between students and they exploited this information to measure students' social connections on campus.At all 10 universities, similar characteristics of two students make the formation of a friendship more likely. Despite the fact these schools were very different in size and type, they stated that similar overall patterns in social segmentation have been found.

According to the results of this study,two students are moderately more likely to form a friendship if they share the same major or political orientation or belong to the same cohort.However, friendships are much more likely to be formed within the same race for minorities. Additionally, relative to the baseline rate that any two students chosen at random are friends, students living in the same dorm are 13 times more likely to be friends, two Black students are 17 times more likely to be friends, two Asian students are 5 times more likely to be friends, and two Hispanic students are about twice as likely to be friends. Socioeconomic background and academic achievement affect the probability of a friendship formation to a smaller but statistically significant degree.

The researchers stated that even though observable characteristics such as race clearly play a role in friendship formation, they have very little explanatory power for the formation of a friendship between two specific students. However, common friends are a good predictor for the existence of a friendship between two students.They found that the main channels of meeting friends are being co-members of a school organization, meeting through another friend, attending to the same high school an taking a course together. The percentages of friendships through online interactions are very low.On the other hand, students from families with similar income levels are more likely to be friends. Campus activities also affect the probability of being friends; students are more likely to be friends if both participate but less likely if one participates and one does not.The researchers mentioned that the Facebook networks exhibit characteristics common to social networks and are strongly segmented by race, cohort, major, and political orientation (MayerandPuller, 2008).

In another research about an Internet community has been conducted by Holme et.al. in 2004 and they examined a Swedish Internet community called "pussokram.com" which primarily intended for romantic communication and targeted at adolescents and young adults. It is mentioned that the community had around 30.000 active users during the spring and summer 2002, the mean user age is 21 years, and approximately 70% of the users are women. In this website, the messages can only be seen by the sender and the receiver, no one in the community an access them. On the other hand, in guest book signing, each user has a guest book that every community member is free to write in. When a flirt or friendship request is sent from a user, if the other user accepts this request, then they can both easily see if the other is online whenever they are logged onto pussokram.com. Information on the friends of a specific user is private to the user only.

A friendship relation is established after acceptance of a friendship request. The friendship network is thus bi-directional. A friendship can becanceled by any of the friends.

Pussokram.com network is consists of all registered users and the communication flow between these users. So, communication is conceived of as directed links between users. When it is thought in terms of "graph language", vertices (users) are added to the network the first time a registered user is active, for example the first time the user sends or receives a message, signs a guest book, or sends or accepts a friendship request. Each of these interactions in the network can be considered as "edges" .

According to the results of the study, it is determined that the degree distribution of this online social network has a continuous growth. The reason of this continued growth in the cumulative degree distribution is explained as it's relatively costless to have a high turnover on ones contacts in an online community. Contacts are established without much investment, and can also be dropped without much sanctioning. The researchers indicated that the interaction online is exposed to less structural forces than what is typically the case in most other social settings. Neither does geographical space constraint communication. Also, that social signifiers are less visible (compared to face-to-face interaction), and therelative ease with which you can conceal your identity and transform your appearance inonline interaction, are factors reducing the structure forming forces at work in offlinesocial activity.Additionally, the geodesic length initially increases as new vertices are added to the network. But asthe network settles the increase is limited by the growing average degree (Holme, et.al., 2004).

Boyd and Ellison (2008: 211) defines social network sites as "the web based services that allow individuals to construct a public or semi-public profile within a bounded system, articulate a list of other users with whom they share a connection, and view and traverse their list of connections and those made by others within the system".According to the authors, the thing that makessocial network sites unique is not that they allow individuals to meet strangers, but rather that they enable users to articulate and make visible their social networks. It is stated that on many of the social network sites, participants are not necessarily looking to meet new people; instead, they are primarily communicating with people who are already a part of their extended social network.

In another ethnographic study of Boyd (2008) which focuses on MySpace, it is stated that since the beginning of 2006 social network sites developed significant cultural resonance amongst American teens in a very short period of time. Boyd expresses the main aim of the study as to understand why teenagers flock on these sites, what they are expressing on them, how these sites fit into their lives, what they are learning from their participation and whether these online activities like face-to-face friendships or not. Boyd examined how teenagers are modeling their identity through their social network profiles and stated that social network sites are providing teens with a space to work out identity and status by letting them to hang out amongst their friends and classmates.

In her study, the ethnographic data has been collected during two-year study of United States-based youth engagement with MySpace and through qualitative interviews, participant observation, documenting and talking to youngs about their practices and attitudes. Primarily, the interviews and direct observations were realized with urban youth in different age, sex, race, sexuality, religion, ethnicity and socio-economic class. On the other hand, the profiles, blogs and commentary of teens throughout the U.S. have been analyzed. The majority of people that observed and interviewed within the study are consist of high-school students between the age of 14-18 who are living with a parent or guardian. In her study about MySpace, Boyd examined the reasons behind the teenagers' existence or absence in this social network site. Boyd tried to understand why some teens use MySpace actively and why some of them don't prefer to participate in this social network site. In the study; the issues as teens' profiles in MySpace, their comments, their common and popular sharings and values, their expression and usage styles, how theyestablish their identity through MySpace and how MySpace affects their friendships are examined by associated with their demographic data and presented in detail with their remarkable comments (Boyd, 2008).

In another study, the role of Internet Discussion Groups in informal academic communication has been analyzed by Matzat (2004) from Eindhoven University of Technology. In the study, the claims in the literature that there are general benefits of academic mailing lists and newsgroups for researchers are examined by using data of a random sample of English and Dutch university researchers (Ph.D. students and postdoctoral researchers) within the humanities, the social and natural sciences. Within the research, a questionnaire has prepared whichcontained items relating to the general communication behavior of the researchers, detailed questions about their contact networks, their use of Internet Discussion Groups and other communication tools and also questions about their research activities. This questionnaire has applied to the researchers from 13 universities within the Netherlands and 23 universities within England.

It is stated that a total of 1063 out of 2688 researchers returned a usable questionnaire.The respondents were asked to mention the names of at most five important mailing lists or newsgroups that they use for professional reasons. Also, for every Internet Discussion Group the respondents had to estimate the average monthly number of messages sent to the IDG and the duration of their own membership in months. Additionally, whether the used IDGs had any relevance at all for their research field was asked to the researchers.

According to the results of the study, it is indicated that almost one in four of all English or Dutch university researcher used at least one Internet Discussion Group. Only a very small minority of researchers uses newsgroups, whereas academic mailing lists are much more popular in every discipline. Researchers build up weak contacts that make their research more visible and that make them more aware of other researchers' work. It is stated that these weak contacts are useful for the reception of new research papers. On the other hand, it is mentioned that contrary to what is stated in the literature, the data shows no evidence for expectations about equalizing effects on the general structure of academic communication and Internet Discussion Groups do not reduce inequalities in the opportunities to use informal communication channels (Matzat, 2004).

In another study, Golbeck and Rothstein (2008) from Maryland University have examined 11 different social networking sites and it is mentioned that social networking is a large movement on the web and many traditional webbased social networks share their members' information in FOAF (Friend of a Friend Format). In the study, they present a study of the intersection of FOAF data found in many online social networks and how frequently user profilesfrom multiple social networks can be merged using thesemantics of FOAF is shown.

Within the study, 11 active social networking websites that output FOAF files with an approximate total of 13,120,000 members among them are handled. It is mentioned that the researchers used all of these networks in their research and for each network they gathered as many profiles as possible.For every member they were able to include in the study, they have accessed their FOAF file. They mentioned that, for the purpose of their study, they were interested only in the member's friends and unique identifiers. Since they were specificallyinterested in how data is repeated in multiple sources, they identified on which and how many social networks a member has accounts, as well as the sources for each friendship.

According to the results of the study, it is determined that 8,047 of unique people they found (approximately 0.2%) had accounts on multiple networks. While the number of members who have accounts on multiple networks is a small percentage of everyone they found, it is mentioned that this is typical of patterns identified in social networks. Of the 8,047 people with accounts on multiple social networking websites, the vast majority, 7,849 (97.5%), had accounts on only two websites.There were 198 users with accounts on more than two networks, 7 members have accounts in 4 networks. The remaining 191 members have accounts on 3 networks.Users who have multiple accounts also tend to have more friends with multiple accounts. According to the results, a small percentage of users have multiple accounts, but they tend to be well connected withfriends who also have multiple accounts. It is mentioned that this core group is sufficient to serve as a bridge between multiple social networksand act as hubs in the aggregated FOAF network (Golbeck and Rothstein, 2008).

In the study of Swamynathan et.al. (2008), to evaluate the potential effects of social networks on online markets, the networks have been analyzed in Overstock which is an online shopping website by auction as eBay or eBid.The authors stated that Overstock differentiates from other websites and its unique feature is to integrate a social network to market community. Overstock is a platform in which its users can show an online presence with their personal pages, photos and friendship networks as other social networks, but different from the familiar social networks, the users of Overstock can add their shopping preferences and tax policies to the website as well.

It is stated that Overstock consists of two different networks. Users can become the members of the social network by being friends with other users. On the other hand, the users who buy or sell something become the part of the business network. Overstock represents the user information about how the users connect to each potential business partner in order to guide their financial decisions. Within the study, a huge database consists of more than 400.000 Overstock users examined and the users' social and business connections with others are analyzed. It is mentioned that within the study, Overstock social network has been examined in terms of the level of adoption, the connections of business partners in social network and the satisfaction differences of the usersabout their business relationships who connect to each other via social connections.

According to the results of the study, socialnetwork consist of 85.200 users, business network consists of 398.989 users. 52.484 users have both social and business network. On the other hand, 86% of business network users of Overstock mentioned that they don't have a socialnetwork.

According to the researchers, this results show that the majority of the usersprimarily interested in financial shopping and they are not aware of social network of Overstock or they are not interested in. The researchers claim that if the users are informed about the benefits of the social network, Overstock can become a much more successful platform. Also, it is stated that %38 of the users don't have any business relationship but they have a social presence in Overstock. According to the researchers the first reason of this situation is Overstock has an active message board system for any topic or the discussions about the merchandises. So, it is stated that some users may participate to the website because of they are interested in these message boards and they may be about to make their first shopping. The second reason is, social network users can form the social connections as a popularity indicator and they may exist in this social network in order to gain popularity in terms of both business and social connections. In Overstock, the users can rate each other and a user can increase his/her popularity by inviting new friends or by supporting them. So, reliability and attractiveness can also cause an increase in sales.

According to the researchers, another interesting result is that %70 of all users in Overstock social network have friends less than 40; %32of all users have just 2 or less friends. The most social 4 users in social network have respectively 30.450, 21.629, 19.753 and 16.582 friends. The researchers mentioned that Overstock social network consists of a high number of new ones who have few friends and the social butterflies who have very high connections. It is stated the data obtained from the users who have quite high connections doesn't reflect the real social connections.

In summary, the study shows that the users have quite less business relations with their friends in their social networks. But, the business relationships between the partners who have connected in social network are resulted with a high user satisfaction. The researchers stated that social networks have very positive affects in terms of online market eras (Swamynathanet.al., 2008).

In the study of Warmbrodt et.al. (2008) from Missouri University, it is stated that video blogs (vlogs) are gaining an increasing popularity in the last few years and for this reason it is important to examine the structures of video blogger communities and the interactions between them. In this study, social network analysis has been used and a sample of vloggers from VlogDIR which is a kind of well-known and popular vlogger guide that has thousands of registered users have been examined. Vloggers can add themselves to this guide voluntarily and they can determine which categoriesare convenient to them.It is stated in the study that a sociomatrix has been established based on the connections between the vloggers. The relation between the points has been showed as the link from one vlog to another and the directions of the links haven't been taken into consideration. This sociomatrixhas been used as a database for UCINET software which is used for social network analysis and hence, the network could be visualized.

According to the results of the study, network structure of the vloggersis core/peripheral. The researchers stated that in terms of understanding the vlog community, it may be useful to reach and define the vloggers who are in the core and especially for the business world that targets the vloggers,to define the core vloggersis important in terms of providing an awareness about their products and better service for their customers. The researchers mentioned that their study is one of the primary studies that explore the structure of the vlog communities. It is stated that vlogs allow a more personal communication and serve a new way for the interaction between people; through vlogs individuals can have more awareness about themselves or about other issues. It is mentioned that especially for the politicians it is better to use vlogs rather than TV commercials to reach their voters and to provide a more direct connection withthem (Warmbrodtet.al.,2008).

In another study which is about Youtube (Cheng et.al.,2008), it is stated that Youtube which is the pioneer in terms of video sharing since 2005 has a very serious effect on the Internet traffic. Due to the fact that it is important to understand the features of the websites like Youtube in terms of improve and organize the network traffic, the researchers examined Youtube and gathered over than 3 million video data. In the study, the statistics of Youtube videos have been systematically measured and it is mentioned that Youtube videos have very different statistics in terms of length, access and active life cycle. The social network of Youtube videos which exists with the help of links between videos has been examined and it is revealed that this network has "small world" characteristics which the average lengths of path between different network nodes are about 5-6.

In the study of Abbasi et.al. (2011), the correlation between the structure of a social network which consists of the scholars in the field of informatics and their success to get citation is examined. The nodes of this social network are the scholars and if two scientists have a joint paper as co-authors, it is considered as there is a link between these two nodes; also it is considered as there is another link for every joint paper.

The researchers observed that the nodes which have higher degrees in the network are getting more citations. According to the findings of this study, it is revealed that scholars, who maintain strongco-authorship relationships to only one co-author of a group of linked co-authors perform better than scholars with relationships to many co-authors of a group of linked co-authors. The researchers stated thatit is possible to make predictions about scholars' performances by analyzing these social networks.

In the study of Catanese et.al. (2011), Facebook which has more than 500 million users at that time has been examined by using social network analysis.The researchers gathered the data by examining two large network samples that have approximately 10 million links.Firstly, the node degree distribution functions and then the diameter of the networks are examined. The diameter of a network is defined as the maximum length of path between two nodes as referred to "small-world networks". The researchers mentioned that they ignored the existence of relatively isolated nodes due to the fact that they unnecessarily represent the diameter of a network bigger and when the nodes which have the lowest degrees (%10) in the network samples are ignored, it is revealed that the rest of the Facebook network has the characteristics of a small world network. Another interesting finding is about the determination of the largest connected components of the Facebook network samples. Accordingly, the largest connected component of the first network sample covers %99,98 of the nodes and for the other network sample, the largest connected component covers the %94,96 of the nodes. As a result, Facebook network can be considered as almost a connected network.

6. Conclusion

The popularity and the importance of social networks are increasing day by day as a consequence of the developments in communication technologies which diffuse every part of people's lives and as a result of Web 2.0 transformation in Internet era. In this context, to put forward the structural features of a social network by using the methods of social network analysis gain importance in terms of being able to make better evaluations and interpretations about networks. Because of social network analysis means to analyze a social network by using the concepts of graph theory;concepts as *degree, component, clique, path* etc. which are used to examine graph structures findtheir natural equivalents in social networks as well and they transform social network analysis to an objective method. It is seen that concepts of graph theory as *degree distribution* or *the largest connected component*which gradually became more refined aresuccessfully applied to even quite large networks as Facebook. So, it can be said that this trend will continue and the instrumental repertoire of graph theory will keep on to be the main tool for analyzing the structures of social networks.

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