

Review on Social Network Performance using Formal Metrics

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ABSTRACT

A social network is group of people, organization, computers, information, and knowledge processing entities grouped together by set of ties for information flow in social network. Social network analysis is the process of analyzing patterns of social relationships between social entities. Social network analysis mainly evaluated mathematically and visually. In this paper a literature review of formal metrics for social structural representation is elaborated. Main goal is to impart basic knowledge for researchers who are following various paths of social network analysis.

General Terms

Social networks (SN), formal measures, centrality, betweenness, degree, density, structural equivalence and structural holes.

Keywords

Social networks (SN), Social structure, Social networks Analysis (SNA), formal measures, centrality, betweenness, degree, density, structural equivalence and structural holes.

1. INTRODUCTION

Social capital alludes to the supply of social agree with, standards and structures that people will entice upon to determine basic issues; it infers associations amongst individuals moreover as the price gathered from these associations [9]. sometimes after want to consider what human beings utilize once looking for records multiple unique difficulty, also do not forget databases, the web, entryways, intranets or a ton of antiquated sources like books, reference books, manuals or statistics. Be that as it may, a noteworthy piece of facts utilized by absolutely everyone originates from his or her system of interpersonal connections [5]. Strategies of creation and usage of facts location unit impressively impacted by the way facts is shared and scattered through interpersonal groups. Those arrangements of social connections describe the manner a group or a social unit builds up its own specific movement. Interpersonal organization analysis (SNA) strategies supply a popular and deliberate proposes that for surveying casual structures by mapping and breaking down connections amongst humans [5] and is probably a substantial scientific device for looking at complex social strategies. In this way, SNA strategies boost the chance of interceding at important focuses at interims accomplice degree informal gadget [7]. Know-how the shape and waft of a set's interpersonal enterprise is critical in helping the execution of information administration strategies. a conservative administration is that the aftereffect of a strategy that necessities expertise that components have the capability to make and concentrate, so this price can be expanded by

way of the cooperation and pass-remedy of aptitudes, encouraging the circulate and change of revel in [4]. There may be simple move-sectional confirmation of execution partner with machine structure [9]. Endeavors to enhance institutions or to reevaluate association structure to expand the possibility of critical achievement ought to be strengthened machine facts. Via uncovering structure patterns and particular the main powerful individuals, the device facts avoids duplication of endeavors and encourages the appropriation of project amongst modified companions [8].

Interpersonal companies conjointly anticipate a vital element in studying situations as a key channel for facts sharing and as a wellspring of social backing. Gaining knowledge of physical games inclusive of bunch paintings and joint effort elevate learner-to-learner connections to bolster the co-development of records furthermore the sharing of facts and property [6]. An historical instructional style can even now critical, however additional weight on distinct multifaceted systems should be set to handle every the manner information exists in structures moreover the manner studying creates and frames [9]. From a social factor of view, learning will be a social and combination result achieved through regular discussions, shared practices, and systems of social associations [7]. Whilst freshmen do a gaining knowledge of task or movement, they on occasion hunt down a few statistics through their casual structures of partners and companions. for some human beings it's a giant measure of much less traumatic to gas encourage from an admirer or close accomplice than accomplice in Nursing grasp in the space who's totally obscure [11]. Normally they choose now not to visit the channel of the most improved nature of information, however as an alternative to go to the channel of absolutely the great openness [10]. it's miles expected to the factor that interpersonal agency shape may legitimize what makes a few individuals or groups greater 297 imaginative and powerful of their utilization of facts than others, and in this manner that casual corporation role and structure square degree identified with understudies' prosperity and execution.

So, it may be characterized as a casual community is a shape among hubs related to ties. The hubs are singular, bunches, association. Ties are bolster, change, kinship, connection, enrollment, battle, equal interest, budgetary, contribution in a movement and so on. The hubs in interpersonal enterprise are both homogenous or heterogeneous related. The casual corporation hubs show joined form of connection among hubs (homogeneous), but in real systems – a hub could have a few noteworthy associations with diverse hubs (heterogeneous). In bodily manner homogeneous structures hubs have same kind of dating inside gadget, i.e. college, basis, association. In

realistic means heterogeneous structures in which hubs might be developers or improvements and ties are courting of usage, e.g. an expert utilizing a content manager [8]. This qualification is integral on account that informal company specialists are mainly inquisitive about homogenous systems, although performing artist gadget pupils, e.g., Callon (2001).

A Social machine investigation is the mapping and estimation of dating which indicates streams among human beings, bunches, institutions, platelets, computers or diverse information/getting to know technique factors. The hubs in the machine are the humans and groups, while the relationship suggests connections or streams among the hubs. Casual enterprise investigation offers visual and a numerical examination of hubs collaboration with others with a good sized courting.

In this article it has a tendency to have practical revel in in comprehension and action the qualification initiative systems assemble. The precept notion of composing this paper is to get the general photo about the SNA with deferent execution level in a dispersed area. This paper incorporates the rundown approximately the SNA and how to do SNA, Formal degree of SNA and the way measurements (measures) in casual enterprise exam with the help of scientific figuring. Moreover, middle about the destiny extensions and what the present investigation about the SNA. At last, it will be inclined to complete up by way of speak me about problems and dangers of SNA and administration machine research, and delineating regions for destiny exam.

2. SURVEY ABOUT SN & SNA

2.1 Social network

A social community is development of social and professional contacts which offers with sharing of services and statistics amongst people with a commonplace hobby. The SN makes use of websites and online technology to speak with human beings and percentage information, resources among them. Social network categorized in four styles of community-group of actors related by a set of ties (Borgatti and Foster, 2003). The actors are people, teams, businesses, concepts, and so on. Ties join pairs of actors and can be directed (i.e., probably one-directional, as in giving recommendation to someone) or now not directed (as in being physically proximate) and may be having nil strength (gift or absent, as in whether or not or not two people are buddies or now not) or valued (measured on a scale, as in power of friendship) (Borgatti and Foster, 2003).

2.1.1. Why access the social network

A social networking carrier (also social networking internet site, SNS or social media) may be a platform to create social networks or social members of the family amongst human beings that share similar pastimes, sports, backgrounds or actual-existence connections. the variety of complete and critical social networking services currently on the market within the email residence introduces demanding situations of definition; but, there are a few common capabilities:[1] (1) social networking services are 2.0 internet-based totally packages,[1][2] (2) consumer-generated content (UGC) is that the lifeblood of SNS organisms,[1][2] (3) users produce carrier-specific profiles for the location or app which can be designed and maintained by using the SNS organization,[1][3][4] and (4) social networking offerings facilitate the event of email, social networks by way of connecting a user's profile with those of opportunity human beings and teams.[1][3][4] most social network services are internet-based totally and deliver approach that for customers

to transport over the net, like email and immediately electronic conversation.

2.1.2 Features of social network

Real-global networks share commonplace traits. As soon as developing with network models, the primary target of this paper is to plan models that may accurately describe these networks via mimicking those not unusual traits. To determine these traits, a preferred look at is to identify their attributes and display that measurements for these attributes are regular across networks. Especially, 3 attributes exhibit consistent measurements throughout real-global networks: degree distribution, cluster coefficient, and common direction length [3]. Because it needs to be tending to don't forget, degree distribution denotes wide variety of node dispensed across a community. The cluster coefficient measures transitivity of a network. Ultimately, average course length denotes the common distance (shortest course length) among pairs of nodes.

2.2 Social network analysis

Social network analysis, it's a information area methodology advanced chiefly by way of sociologists and researchers in mental technological know-how inside the 1960-1970, and processed with arithmetic, information and computing that crystal rectifier to a fast development of formal studying strategies that created as tool for distinctive disciplines like social science, economics, biological or generation. SNA particularly works on studying the pairs of edges among nodes which carries information and the way they laid low with structural assessment of social network. It's far combines formal arithmetic and graph concept.

2.2.1 How to do SNA?

When one wants to apply SNA to study social learning, four types of SNA applications can be applied. These four types, which increase in complexity respectively, are 1) network visualization, 2) network analysis, 3) simulation, and 4) network interventions [12].

In **Network visualization** it able to construct either a one-mode network that consists of just people, or a two-mode network that consists of people and, as an example, the tools that they use to find out. . A network may be visualized by a questionable sociogram (Moreno, 1934) within which have a tendency to connect nodes (individuals) by means that of edges (relationships). The sides is also directed (person A learns from B, however not the opposite manner around) or purposeless (persons A and B learn from one another, therefore no distinction). In apply; network visual image is commonly combined with network analysis.

In **Analysis** it can determine network at different level: network (whole) level, group level, ego (individual level).

In **Simulation** is also a welcome step before a network intervention. Interventions is also time and cash overwhelming, and it's going to pay off to style a simulation of the educational context at hand, to envision however learners would behave throughout a future intervention. Also, existing information and analysis regarding learners and their interactions may be wont to extrapolate behavior. When Associate in nursing initial analysis of a social network in a very learning context, activities may be found out to alter the structure of the network.

In **Network interventions** may be undertaken so as to extend the amount of connections in a very network, to strengthen bound varieties of ties between learners, or to support learners

(nodes within the network) with personalized data triggering network actions. Social Network Analysis here acts as a diagnostic tool to grasp the network structure, so as to form additional worth from it through Associate in nursing intervention. Namely, Social Network Analysis is also a part of a bigger system, as an example, graph- or network-based recommender systems.

2.3 SN Structure & Performance

Knowledge is formed and changed to an oversized extent through informal social interactions. Additionally, the data flows rely upon the connections between people and on their angle regarding sharing data. Informal networks are supported spontaneous contacts, by self-initiative and self-motivation and evolve consistent with mutual trust, reciprocity and friendly relationship grow. The physical proximity, frequent contact, similarity of languages, data and experiences moreover as beliefs and attitudes, facilitate data sharing. Informal networks additionally play a key role in facilitating coordination and avoiding potential conflicts.

Social network analysis is often applied in an exceedingly data management perspective with the aim of serving to organizations to higher cash in of the data and capabilities distributed across its members. in ref. paper [16] highlights 2 facts that were unconcealed by SNA empirical research: 1) individuals tend to cluster, forming teams consistent with their various establishments, comes during which they're concerned, sharing of physical areas or common interests, 2) the interaction is way a lot of common among a gaggle than inter teams, thus individuals within the same cluster tend to own identical concepts and opinions, to interpret the past within the same method and to own similar expectations for the long run.

3. FORMAL MEASURES IN SNA

3.1 Data Collection

To collect mastering it tends to utilize an informal network watching framework – KIWI (know-how Interactions to work and innovate). KIWI might be a digital software with 2 separate perspectives: one for getting to know series and distinctive for input. The framework furnishes clients with a get-together tool for enrolling their communications and routinely examinations and offers interpersonal employer statistics through a representation apparatus. It expresses interpersonal organisation data is separated from an information through casual employer exam (SNA) strategies. This system turned into created essentially to be linked in dispersed businesses (for added statistics, see [17]) and relies on upon dynamic cooperation of clients inside the information collecting approach.

In looking to manual casual community structure, the framework changed into included into corporations' internet stages and a discipline trial turned into directed in every organization. Individuals have been asked that solution to KIWI getting to know accumulating apparatus every week, unmistakable those human beings with whom they interfaced for inspiration and records sharing always. Individuals were clarified that every important association need to be exhibit, and also formal or informal interchanges and vis-à-vis or separation correspondences. Every week after week e mail was ship remaindering individuals (counting understudies, scholastics and chiefs) to get to KIWI and their gets to had been checked. In UPC human's institution, the framework became utilized amid an eighteen weeks sum and in EB human beings group it have been utilized for an 8 weeks sum. From the casual businesses data produced, it tend to processed

diploma, closeness, and betweenness spatial connection rankings for each person exploitation Ucinet [18] and net Draw [19].

3.2 Formal methods

Formal methods are techniques used to model complex systems as mathematical entities. By building a mathematically rigorous model of a complex system, it is possible to verify the system's properties in a more thorough fashion than empirical testing [9]. Formal strategies are techniques accustomed model advanced systems as mathematical entities. By building a mathematically rigorous model of a huge system, it's potential to verify the system's properties in an exceedingly additional thorough fashion than empirical testing.

3.2.1 Formal methods

One explanation behind exploitation numerical and graphical methods in informal organization investigation is to speak to the depictions of systems briefly and reliably. An associated explanation behind exploitation (especially numerical) formal courses for speaking to interpersonal organizations is that scientific representations empower us to utilize PCs to the investigation of system data. The last explanation behind exploitation "formal" ways (science and charts) for speaking to interpersonal organization data is that the procedures for diagram process furthermore the standards of math themselves prescribe things in the genuine system.

3.3 Metrics (measures) in SN analysis:

There are many major metrics which used in social network analysis. Listing out some of them are Centrality, Transitivity, Reciprocity, Similarity, Density, Structural cohesion etc.

3.3.1 Centrality

This measure offers a rough indication of the social power of a node supported how well they "connect" the network. Spatial relation defines how necessary a node is among a network.

3.3.1.1 Degree Centrality

Degree position transfers identical plan into a measure. The degree position measure ranks nodes with additional connections higher in terms of position. The degree centrality C_d for node V_i in an undirected graph is:

$$C_d(V_i) = d_i$$

Where d_i is the degree (number of adjacent edges) of node v_i .

3.3.1.2 Betweenness Centrality

Another way of staring at position is by considering how important nodes are connecting different nodes as in fig. 1. One approach to node v_i , is to compute the number of shortest paths between other nodes that pass through v_i ,

$$C_d(V_i) = \sum_{s \neq t \neq V_i} \frac{\sigma_{st}(V_i)}{\sigma_{st}}$$

where σ_{st} is the number of shortest paths from node s to t (also known as information pathways), and $\sigma_{st}(v_i)$ is the number of shortest paths from s to t that pass through v_i .

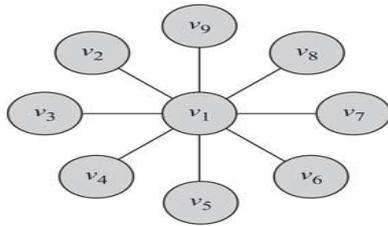


Fig. 1: Sample graph of Degree Centrality.

3.3.1.3 Closeness centrality

In closeness position, the instinct is that the extra focal hubs are, the extra rapidly they'll achieve elective hubs. Formally, these hubs should have a littler normal most limited way length to option hubs. Closeness centrality is characterized as

$$C_c(V_i) = \frac{1}{\bar{l}v_i}$$

Where $\bar{l}v_i = \frac{1}{n-1} \sum_{v_j \neq v_i} l_{i,j}$ and is node v_i 's average shortest path length to other nodes. The littler the normal briefest way length, the higher the centrality for the hub.

3.3.1.4 Eigenvector Centrality

Eigenvector spatial connection tries to sum up degree spatial connection by consolidating the significance of the neighbors (or approaching neighbors in coordinated charts). It's plot for both coordinated and undirected diagrams.

3.3.2 Transitivity

In transitivity, the framework will dissect the connecting conduct to figure out if it exhibits a transitive conduct. In arithmetic, a transitive relation $R, aRb \wedge bRc \rightarrow aRc$. The transitive linking behavior can be described as follows in fig.2.

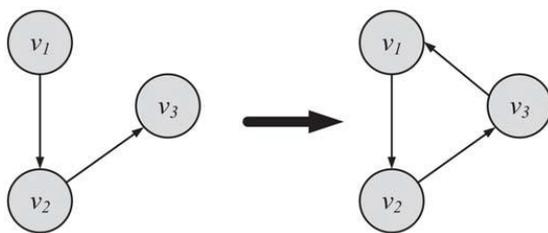


Fig. 2: Transitive Linking

3.3.3 Reciprocity

Correspondence is a disentangled adaptation of transitivity, since it considers shut circles of length 2, which can just happen in coordinated charts. Formally, if node v is connected to node u , u by connecting to v exhibits reciprocity. Reciprocity can be computed using the adjacency matrix A :

$$\begin{aligned} R &= \frac{\sum_{i,j,i < j} A_{i,j} A_{j,i}}{\frac{|E|}{2}} \\ &= \frac{2}{|E|} \times \frac{1}{2} Tr(A^2) \\ &= \frac{1}{m} Tr(A^2) \end{aligned}$$

Where $Tr(A) = A_{1,1} + A_{2,2} + \dots + A_{n,n}$ and m is the number of edges in the network. Note that the maximum value for $\sum_{i,j} A_{ij} A_{ji}$ is m when all directed edges are reciprocated.

3.3.4 Similarity

This paper call attention to the survey measures used to register similitude between 2 hubs in a system. In online networking, these hubs will speak to individuals in a well-disposed relationship system or stock that are associated. The similitude between these associated individuals are regularly registered either upheld the system amid which they're inserted (i.e., system comparability) or bolstered the closeness of the substance they create (i.e., content likeness).

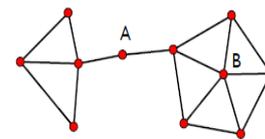
3.3.5 Structural Equivalence

To process auxiliary proportionality, it takes a gander at the area shared by two hubs; the extent of this area characterizes how comparable two hubs are. The comparability measures itemized in this area depend on the cover between the areas of the hubs. Let $N(v_i)$ and $N(v_j)$ be the neighbors of nodes v_i and v_j , respectively. In this case, a measure of node similarity can be defined as follows:

$$\sigma(V_i, V_j) = |N(V_i) \cap N(V_j)|$$

3.3.6 Centralization

Centralization is the procedure by which the exercises of an association, especially those in regards to arranging basic leadership, get to be concentrated inside a specific area or gathering.



A is high in betweenness centrality.

B is high in degree centrality.

3.3.7 Density

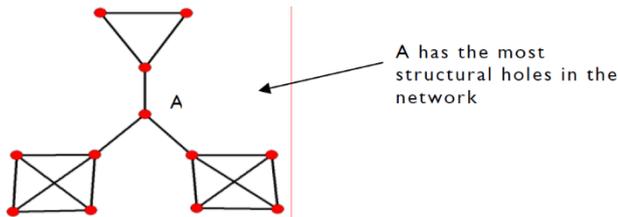
Thickness catches how intently a gathering or subgroup is weave. It is an extent that shows the quantity of real ties present in the gathering in respect to the quantity of conceivable ties in the gathering (i.e., if everybody had an association with other people in the gathering). Thickness can be ascertained inside a gathering or between two gatherings. While computing the thickness of an individual's system, SNA takes a gander at how firmly associated a man's companions are to each other.

3.3.8 Structural cohesion

There are a few measures of attachment, including thickness. Be that as it may, one normal measure is the normal number of ties it takes for a man in the gathering to "contact" someone else in the gathering. In the event that Adam is associated with Bill who is associated with Cindy, then Adam is at a separation of 2 from Cindy. The normal separation for the gathering gives a sign of the gathering's attachment.

3.3.9 Structural holes

A basic gap happens at whatever point a man (a) has an association with somebody who is associated with a different bunch of individuals and (b) has no other immediate or circuitous association with the general population in that group. As a result, the individual is associated with a particular gathering through one individual.



4. ISSUES AND RISKS OF SNA

In the former areas of the paper it have incontestable however SNA will be acclimated valuate the effect of initiative advancement abuse four styles of administration systems. The use of SNA isn't, be that as it may, while not chances. Watchful thought must be to those issues by any individual who utilizes SNA as an investigation device. It tends to highlight four of them here: absence of security and associated moral issues; making assessments from deficient information; over suggestion and misreading; and abuse of system measures. Our classification of issues and dangers is undifferentiated from it of in authority. Paper[8]. Beneath it tend to briefly expand on each class.

Table 1: Lack of privacy in network surveys.

	Traditional survey	Network survey
Questions: 1st-person vs. 3rd-person	Each individual reports information about himself.	Each individual reports information about others by name.
Results: averages vs. specifics	Responses are aggregated so that individual respondents and non-respondents cannot be distinguished.	The presentation of results reveals specific responses attributed to specific individuals.
Visibility: informed consent vs. leap of faith	Survey results allow each individual to compare himself silently with the group average. Each individual can then decide what to share about himself with whom.	Survey results expose how each individual is seen by others. Each individual has no ability to preview what others have said about him before published.

4.1 Lack of privacy and related ethical issues

In Table 1, it tends to highlight 3 particular courses in which arrange reviews need protection contrasted with old overviews. It tends to center and its dialog absolutely on the third issue, perceivability; then comment on the inverse 2 issues. The objective of the on top of 3 stages is to create system individuals the adaptability to practice assent. Clarity and straightforwardness expand cooperation inside the overview and acknowledgment of the outcomes. Fig. twelve appears large utilize the presentation and introductory inquiry of a system study to actualize these strides and regard protection with clarity and straightforwardness.

4.2. Making Evaluations From Incomplete Data

System overview results are a considerable measure of delicate to data oversights than different types of reviews. So as to give a system guide that has system individuals with right photographs of crossing over and holding, a study reaction rate of at least seventy fifth is frequently required. Littler populace tests will be studied in a few things, however evaluators here and there can't evaluate an outsized system by measure minimal randomized specimens inside the same technique they will with non-system reviews.

4.3 Misuse of network measures

Some system measurements are at danger of abuse. One among the first normal missteps it tends to watch is that the abuse of thickness that might be an obviously natural metric that is if frankly frightfully essentially misconstrued. Thickness is extremely at danger of mixing up once examination systems of different sizes.

5. CONCLUSIONS

This paper has described social networks and characteristics. The formal metrics contained in the paper are useful both for understanding relationships in a large amount of data and also as a tool for analyzing social networks. As social network analysis is dependent on communication between nodes; attribute specific metrics have limited impact on network analysis this leads to development of various SNA specific formal metrics. This special issue will help other researchers to evaluate complex formulas of social network analysis involving these basic metrics.

The SNA analyzer can execute the numerical expression basically with the help of formal measurements. Interpersonal organization examination might be directed as an approach to spot and see rising social structures and cooperative examples that progressively may give valuable insights to directors and teachers, allowing them to act and propose very surprising ways once making an endeavor to overhaul social foundations in conveyed learning groups. it tend to conjointly trust that this sort of information concerning interpersonal organization may well be a hearty instrument, amid which the execution of the officials taught inside the system structure of social capital appeared to upgrade when contrasted with an impact bunch, it's achievable that improving understudies' mindfulness concerning structure will affect their execution.

6. ACKNOWLEDGMENTS

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Your social media metrics should help you determine the performance of your social media campaigns and the ROI from them. The only way to ensure this (or even just get started), however, is by tracking the right social media KPIs -- beyond your fan, follower, or "like" counts. That being said, there are four main areas your social media KPIs should be focusing on. Social media is a valuable tool for building personal relationships with your audience, but it can also be a very helpful factor in increasing your revenue, reach, and overall ROI. The only way to ensure this (or even just Social media metrics are important because they prove you can measure how successful a campaign is, how well your social strategy is performing, and ultimately if you will have an impact on your overall business. Not only does having these metrics give you an opportunity to showcase the impact of your work to executives, but providing consistent social media metric reports can lead to major shifts for your social team, including budget increases and increased access to resources. We've been pretty focused on the performance of posts and social media accounts but what about your customer's experience with your brand? Additionally, what about your own performance?