Social Network Analysis

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Abstract— This paper is an attempt to explain the meaning of social network in a simple manner. The types of social network and the metrics used to analyze it are also explained in detail. Measures to quantify the performance of a social network are also explained.

Keywords— Social Network, Egocentric Network, Full Network, Unimodal Network, Multimodal Network, Centrality, Betweenness etc.

I.   INTRODUCTION

Social network basically comprises finite number of nodes connected to form a network. There have been many social theories on how people interact with each other in society. All these studies have focused on the behavioural aspects of an individual. More or less these studies have been theoretical & philosophical in nature. We want to analyse a network empirically so that we can quantify the relationships. This new paradigm shift has brought the focus on the relationship rather than an individual. We want to stress on the relationship between two individuals (known as dyad) and study what factors influence the information flow between them [1].

To achieve this Network theory & Graph theory have been used as they provide visualization of network. Our aim is the perfect dissemination of information & to find best path for knowledge sharing.

II.   TYPES OF NETWORKS

Social network has been broadly categorized as Unimodal, Multimodal & Affiliation networks [2].

Unimodal: This type of network connects the same type of entity which means that an actor will be connected to another actor. An example of this network is the" friend list "of facebook. Unimodal can be further subdivided into Complete & Egocentric social network.

Complete social network

When we talk about complete network it means that we study the network as a whole .All the actors or entities with their respective connections are studied. Equal importance is given to each "ego". This type of network comes into existence when a single system acts as a "hub" or interface to connect various entities. One such example is twitter. Generally this type of network is sliced and the individual portions are then studied as studying full network is impractical. Such "portions "of full networks are known as partial networks.

Egocentric Network

In this network "ego" & its connections is the centre of attention. Here we study the effects of social context on individual attitudes, behaviours and conditions. Data comprising the interactions of "ego" and its connections in all social settings is studied.

Multimodal Networks

The network which connects different types of entities such as users to documents or vice versa is termed as multimodal network. Generally, these multimodal networks are converted into unimodal networks to perform meaningful analysis as most of the network metrics are designed for unimodal networks. A bimodal network is a common type of multimodal network .It connects exactly two different types of vertices .A bimodal network can be transformed into two unimodal networks that is a user to user and an affiliation to affiliation network. Affiliation to affiliation network can be perceived as a connection between event, activity or content with which they are affiliated. For example article to article network in a wiki.

Multiplex Networks

 It is a network with multiple types of connections or edges [2].

III.   METRICS TO ANALYSE SOCIAL NETWORKS

The metrics used in social network theory have been derived using both Network as well as Graph theory. Some of the metrics are:

- Closeness: It is the measure of a node's proximity to other nodes (directly or indirectly).It reflects the ability of a node to access information through the "grapevine "of network members.
- Network Density: It measures the connectedness of a network. It is defined as the actual number of ties in a network, expressed as a proportion of the maximum possible number of ties. It varies between 0 and 1.0.For a network to be dense, the density has to be close to 1 while for a sparse network it is close to 0.
- Centrality: This indicates the "social power" of a node based on how well they connect a network."Betweenness", "closeness" & "Degree" are all measures of centrality. It comprises of two levels which are local & global. If a node has a higher number of ties with other nodes then it is said to have local centrality otherwise it is considered to have global centrality. Local centrality considers only direct ties while global centrality can also consider indirect ties.
- Betweenness: This measure basically reflects the number of people who a person is connecting indirectly through its direct links.
- Bridge: An edge is said to be a bridge if deleting it causes its endpoints to lie in different components of a graph.
- Degree: The count of number of ties to other nodes or actors in a network.

There are several other metrics such as cohesion, density, Eigenvector centrality etc. [3].

IV. SOCIAL NETWORK PERFORMANCE

The performance of a social network can be measured using a combination of Robustness, Efficiency, Effectiveness and Diversity of a network [3].

- Robustness: It is measured as an estimate of the tendency of individuals in networks to form local groups or clusters with which they share similar characteristics. If the measure of the clustering of individuals is high for a given network, then the robustness of that network increases.
- Efficiency: It is measured by the number of non - redundant contacts and the average path length .Shorter the path length & lower the number of redundant contacts, the more efficient is the network.
- Effectiveness: It targets the cluster of nodes that can be reached through non- redundant contacts.
- Diversity: It focuses on the history of each node in the network. It emphasizes on the nodes which are diverse in nature.

Software Tools

We have several open source software available for the analysis of social network. We can use them to visualize and mathematically analyse a given network. Some of the tools are Gephi, Inflow, Cytoscape etc.

V. CONCLUSION

Social network analysis is the study of not only nodes/actors in a network but also their connections and interactions. Based on different criteria social networks have been categorized. To quantify a social network several metrics have been designed. The social network theory still has a long way to go as the metrics used are not sometimes sufficient to measure the vast data & connections.

REFERENCES
[1]   Stanley Wasserman and Joseph Galaskiewicz, *Social Network Analysis in the Social and Behavioral Sciences ,Advances in Social Network Analysis: Research in the Social and Behavioral Sciences,* SAGE Publications, Inc , 1994, vol. 171.
[2]   Marc A. Smith, Ben Shneiderman,Derek Hansen , *Social Network Analysis Measuring, Mapping, and Modeling Collections of Connections ,Analyzing Social Media Networks with NodeXL: Insights from a Connected World ,* 1st ed., Morgan Kaufmann, 2010.
[3]   Ajith Abraham , *Social Networks Analysis: Tools, Measures and Visualization.Computational Social Networks: Mining and Visualization ,* Springer, 2012.