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### Survey on Social Network Community Detection and Ranking

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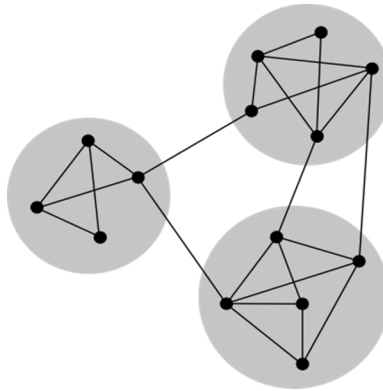
**Abstract:** Community detection in a Social network is a trending issue in the network system and it helps to understand and learn the overall network structure in detail. These are basically the dividing wall of network nodes into some subgroups in which nodes within these subgroups are densely connected, but between the subgroups, the connections are sparser. In the method of community detection, the main intend is to partition the network into dense regions of the graph, and those regions in general correspond to entities which are closely related, and can hence be said to belong to a community. The definition is based on the principle that pairs of nodes are more likely to be connected if they are both members of the same communities, and less likely to be connected if they do not share communities. The ever growing variety of social networks necessitates detection of minute and scattered communities which are vital problems across various research fields. In this paper, a literature survey on the problem of community detection over time is recognized, and some basic concepts are stated with the exhaustive way where the research fields arise from social networks.

**Keywords:** Community detection, social network, entities, community.

#### 1. INTRODUCTION

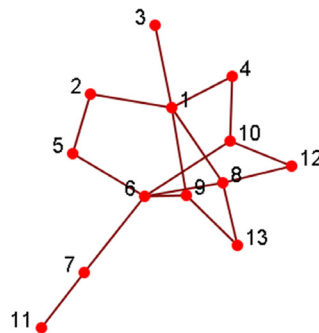
Community is created by individuals such that those within a group interact with each other more frequently than with those outside the group. A network is said to have community structure if the nodes of the network can be easily combined into sets of nodes such that each set of nodes is densely connected internally. In the case of non-overlapping community finding, it implies that the network divides obviously into groups of nodes with dense connections internally and sparser connections between groups. Social network analysis consists of the learning and analysis of graphs in order to provide and identify with the patterns and structures of a social network. Social network analysis provides both visual and mathematical analysis of human relationship. Community detection is identifying groups in a network where individuals, group memberships are not explicitly given.

In this paper, comprehend of a literature survey on the issue of community detection over time, and we present some basic concepts about networks modeled as graphs, then we state in non comprehensive way the research fields arising from social networks. We present some of the existing methods to track communities over time. Community detection in networks is a established subject in the area of social network analysis. There exist abundant methods and algorithms in the literature that have been dealing with that issue.



**Figure 1: Network with three communities**

Communities have a vital role in accepting a network. Communities are on the whole those that form group of nodes that are strongly organized sharing many common features. Communities mostly arises in the social networks where different individual with common properties based on various kinds of relationship like family, school, friends, works and sports etc. form random groups. The determination of communities in different networks has various compensation. It can disclose surprising behaviors. For example India is divided into various regions on the origin of different languages. Community detection problem has applications beyond the scrutiny of social behaviors e.g. in metabolic networks, in image processing and criminal networks etc. [8]



**Figure 2: Nodes (students of same family)**

If Figure 2 shows different students (nodes) from same family and each student takes different groups in colleges where it is divided into four departments. And the groups are as follows.

GROUP 1: {1, 2, 3, 5} [CSE]

GROUP 2: {4, 8, 10, 12} [EEE]

GROUP 3: {6, 7, 11} [ECE]

GROUP 4: {9, 13} [CIVIL]

In order to differentiate, the communities are highlighted with different colours according to the groups. Group 1 {1, 2, 3, 5} who are taking CSE is highlighted with yellow, Group 2 {4, 8, 10, 12} who are taking EEE is highlighted with violet, Group 3 {6, 7, 11} who are taking ECE is highlighted with blue and Group 4 {9, 13} who are taking civil is highlighted with red.

Communities in social networks are used since they are easy-to-use social media, allows people to extend their social life in unprecedented ways and when it is difficult to meet friends in the physical world, but much easier to find friend online with similar interests and interactions between nodes can help determine communities.

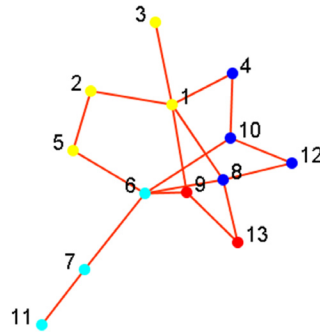


Figure 3: Colored according to the community (students taking different departments)

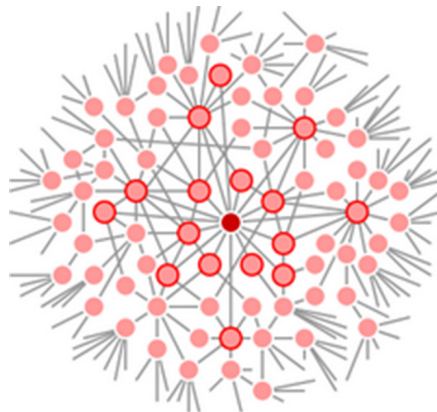


Figure 4: Structure on social networks connects everyone on earth. ● = a person and ○ = people whom the person knows and the straight lines show the relationship between 2 persons

## Taxonomy of Community Criteria

**Node-Centric Community:** Each node in a group should satisfy certain properties.

**Group-Centric Community:** Consider the connections within a group as a whole. The group has to convince different properties without looking deeply into node-level.

**Network-Centric Community:** Partition the whole network into various disjoint sets.

**Hierarchy-Centric Community:** Construct a hierarchical structure of different communities.

## 2. RELATED WORK

### Community Detection Method Based on Overlapping Communities

Along with community structure, overlap is also one of the attributes of social networks. These overlapping communities are detected when a person used to belong, to more than one social group or to more than one community. A person may belong to more than one community because usually he or she has connections to several social groups like friends, family and in workplaces. Till now many overlapping communities have been proposed, which can be divide into two categories, node based and link based overlapping community detection algorithms. The node based overlapping community detection algorithms categorize the nodes of the network, and the link based overlapping community detection algorithms classify the edges of network in clusters. For detection of overlapping communities researchers have proposed a parliamentary optimization algorithm which also helps to analyze to community structure. [1]

### **Community Detection Method in a Social Network**

It was experimental that the mining of knowledge is also possible from the community graph, using graph mining techniques. For detection of communities in a social network, graph mining techniques has been used. In this proposed approach, a community or a group is detected based on complete mutuality, nodes reachability and nodal degrees. In complete mutuality a group can be shaped if a sub-graph is formed by considering more than two nodes and all are adjacent to each other which are termed as a clique. For reachability condition between two actors or nodes to be in a community, if there is a path between these two nodes. For nodal degrees it checks actors within a group to be adjacent to a relatively large number of group members or not. [2]

### **HOC Tracker: Tracking the Evolution of Hierarchical and Overlapping Communities**

Challenging part in the community detection is the detection of overlapping communities which exist when a particular node of a network simultaneously belong to various communities. Hence in this paper, it is proposed a unified framework, HOC Tracker, for tracking the evolution of hierarchical and overlapping communities in social networks. Most of the dynamic community detection methods have a common limitation to study community identification and community evolution problems separately.

In this paper it is been proposed a novel density based framework called as HOC tracker to track community evolution in social networks. Unlike other existing HOC tracker it uses an efficient log based approach to map evolutionary relations between communities identifies at two successive time steps of a dynamic network. Moreover, the proposed framework is applicable to directed/undirected and weighted/unweighted networks. Considering time complexity, the main part of HOC Tracker involves examining the local neighborhood of each node in the network, and for each node this cost is proportional to its out degree. [3]

### **Node Centric Detection of Overlapping Communities in Social Networks**

When research focus was only on detecting disjoint communities, in recent years there is a great attention in the detection of overlapping communities, where a node may belong to several communities. This paper presents NECTAR a node centric overlapping community detection algorithm where it generalizes node centric local search heuristic, so that it can be applied also for network processing overlapping community structure. The unique feature of NECTAR is that it chooses dynamically where to use weighted overlapping community clustering algorithm which is applied for overlapping community detection, depending on the structure of the graph. This algorithm provides good result on graphs on both high and low community overlaps. It is the first community detection algorithm that selects dynamically which objective function to use based on the graph on which it is invoked. This detection algorithm outperformed all other algorithms in terms of average detection quality and was best or second best for almost all networks. [4]

### **Overlapping Communities in Networks using Evolutionary Method**

In this paper, the presentation of an programming scheme for an overlapping partition of a network is done. Measure for a node is proposed and presents an evolutionary scheme between two segments over the population. This method was for detecting overlapping community structure in the network. For the demonstration of the overlapping part of the network, there has been developed an encoding scheme composed of two segments, the first one represents a disjoint partition and the other represents an extension of the partition which allows the multiple membership. The work has been done to give two measures for the node and then present a co evolutionary scheme between two segments over the population which ultimately solve the overlapping partition of the network. In later stage the experimental results reveal that this method can give a better result to the network

and showed that a best overlapping partition of the network might not be rooted from a best disjoint partition. The variation of overlapping modularity is also presented and the experiments done on this study point out that through optimizing the measure, the method can give way a better result. When the method has to be applied to a large network, the focus has to be given to the efficiency of the evolutionary method. [5]

### **Ranking Features in Facebook to Detect Overlapping Communities**

The large data in social networks has increased the risk of fake discoveries, identifying communities in facebook requires simple and effective fast technique. The detection and analysis of communities in graphs is one of the most accepted topics within the social network analysis. Existing community detection methods suffer from high computational cost which is caused by huge structure. Based on the homophily property new approach called as RELNA is been proposed to rank attributes of social network. But comparing the two algorithms namely RELNA and LINKREC (ranking algorithm) with facebook datasets the results were almost same. In order to make it precise CESNA (overlapping detection community algorithm) were used to detect communities and this results show that this approach is much faster when comparing with other algorithms. [6]

### **A Novel Algorithm for Community Detection and Influence Ranking in Social Networks**

Community detection and influence analysis are important notions in social networks. It is been developed the inherent knowledge of influence-based connectivity and proximity encoded in the network topology, and proposal is made by a novel algorithm for both community detection and influence ranking. Here the inspiration is drawn from the Page Rank algorithm in the sense that we cannot rely solely on the node degree. It is been proposed a new influence diffusion model that embeds influence into a node and passes it around in the network. Moreover, not only the total influence a node spreads is found out, but also keep track of where and how much its influence is distributed so as to build its influence vector for community detection. This algorithm is tested on real world datasets and a set of simulated networks using the LFR model and evaluated the performance by comparing with the ground truth and a set of representative algorithms. [7]

## **3. CONCLUSION**

Community detection is a way to discover the structure of networks in which the interconnection between the nodes is found to be denser than the intra-connection between the communities. Identifying meaningful community structure in social networks is a hard problem, and severe network size or sparseness of the network compound the difficulty of the task. Existing methods are limited by their computational works and depend heavily on the network topology, which fails in scale-free networks. The survey on various papers gave an idea how community detection is made with various algorithms and what was the pitfalls of each algorithms. Even though algorithms shows results in a different accuracy point there are drawbacks in each survey. Still overlapping detection is a challenge. So many graph based algorithms can be tried so that the efficiency can be made more accurately when comparing to the other methods. Therefore Soemphasis should be given to effective algorithms which will be able to detect communities in a huge social network in allowable time.

## **4. FUTURE WORK**

The introduction study suggested several interesting problems that were worth further exploring. Comparing algorithms of few reference paper, the experimental results has shown that these algorithm not only can get a higher precision and effective for community structure, but also has a performance than others. Hence with this study of literature review, ideas are extracted and it can be used in the proposed work in future.

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