

# An Adapted Approach Using Maximal Clique Graph Mining Technique

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**Abstract**—Social Network Analysis is measurement of relationship between people, groups and other connected entities. Through the Social Network Analysis we can investigate the social structure of network. Community Detection is very important to identify community structure in Social Network. In this paper ,an efficient algorithm of maximal clique community detection technique ,namely adopted maximal clique community detection algorithm, is proposed. Using this algorithm modularity will be improved and time complexity will be reduced by parallel approach.

**IndexTerms**—community detection, social network,Maximal clique algorithm

## I. INTRODUCTION

Data Mining is computational process of discovering patterns from large data sets involving methods at the intersection of artificial intelligence, machine learning ,graph mining and database systems. Among that, Graph mining focuses mainly on discovering the community structure among the social network using various graph mining algorithm. Data Mining is way to extract relevant information from large amount of data using suitable algorithms. Community Detection play very important role in understanding the network structure. Uncovering the community structure of complex networks is helpful for understanding complex systems. Researches on analyzing community structure thus gained growing attention during the past decades .

## II. COMMUNITY DETECTION

Detecting community structure is the basic issue in social network analysis. Uncovering the community structure of complex network is helpful for understanding complex system. Detecting and evaluating the community structure of real world network is an essential task in area of graph mining. Social network include community group based on common interest, location, occupation. Recognizing and assessing the community structure is a crucial task inside the area of graph mining and social community analysis. Network carries many structures and tightly connected organizations. Also referred as community, clusters, modules and so forth.

[6]

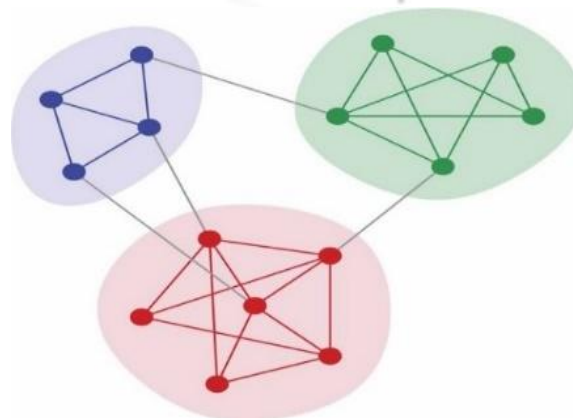


Figure 1 community Graph <sup>[6]</sup>

Detecting and evaluating the community structure of real-world graphs constitutes an essential task in the area of graph mining and social network analysis. The network contains many structures and tightly connected groups. Also referred as community, clusters, modules, etc.

The task of community detection is to find sets of nodes with lots of connections inside the sets and few edges outside the set.

In figure 1, depicted the different communities over the social network. Different color defines different communities and number specify node id.

There are many available approaches for Community Detection<sup>[5]</sup>:

- 1) Group-based approach
  - 2) Network-based approach
  - 3) Propagation-based approach
  - 4) Hierarchy-based approach
- Seed-centric approach

### III. GRAPH MINING

Graph Mining is a quite new area of research which however has a strong base in traditional graph theory and sociological ideas such how people interrelate and observe each other. Graph mining focuses mainly on discovering the community structure among the social network using various graph mining algorithm. With the growing demand of the evaluation of huge amounts of data, graph mining has emerge as a crucial topic in datamining. Among the various types of graph patterns, frequent substructures are the very fundamental types that can be observed in a group of graphs. Recent research have built up numerous graph mining strategies .

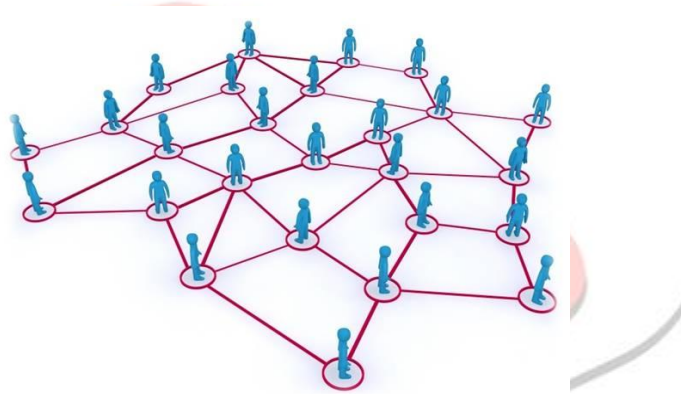


Figure 2.2A Sample Graph<sup>[6]</sup>

### III. RELATED WORK

#### Clique

In an undirected graph  $G$ , a *clique* is a complete sub graph of  $G$ , i.e., a sub graph in which any two vertices are adjacent. The set of vertices of a maximal clique of the complementary graph of  $G$  is a maximal independent set of  $G$ . Generating maximal cliques or maximal independent sets of a given graph is one of the fundamental problems in the theory of graphs .

A Clique is an undirected graph  $G = (V, E)$  is a subset of the vertex set such that for every two vertices in  $C$ , there exists an edge connecting two. This is equivalent to saying that the sub graph included by  $C$  is complete.

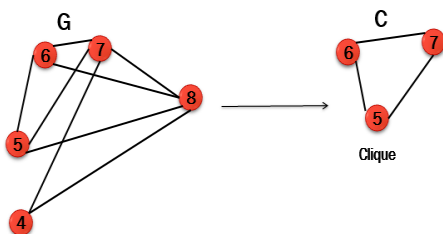


Figure 2. Graph with Clique<sup>[6]</sup>

### K Clique-

The approach is to use clique of fixed size,  $k$ . The clique graphs have vertices which represent the clique in the original graph while the edges of the clique graph record the overlap of the clique in the original graph.

A node may be in several cliques, it can be a member of several communities. For instance the clique percolation method, defines communities as percolation.

### Maximal Clique-

A Maximal clique is a clique of the largest possible size in a given graph. The clique number of a graph  $G$  is the number of vertices in the largest clique in  $G$ .

If a clique is not contained in any other cliques, this clique is called a maximal clique. A maximal clique is a clique that can not be extended by including one more adjacent vertex.

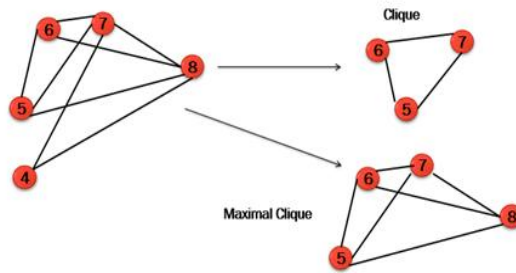


Figure 3. Graph with Clique and Maximal clique<sup>[6]</sup>

## IV. PROPOSED WORK

### Problem Statement

In this paper we have propose new methodology to discover community over social network with novel approach of Maximal Clique Algorithm. Main issue in community detection faced are of time complexity, speed or scalability due to which the discovered community are having lack of community issue. Thus to improve various community detection algorithm we have proposed an improved technique.

### Proposed Algorithm

We proposed a community detection algorithm which uses the concept of maximal clique for community detection. As an input social network is to be given which at the end of operation generate a group/community which are part of same group. Following steps elaborate general flow of proposed framework.

**Step 1** Given a original graph  $G=(V,E)$

**Step 2** Assign Community Initially  $V^c = \emptyset$

**Step 3** Initialize  $K_{max}$  as Highest of  $G(V_i)$ .

**Step 4** For every vertex belong to  $K_{max}$  perform

→ Sort the nodes on descending order

**Step-5** Formulate Community around that maximal clique node.

## V. Results

The Proposed Community detection Algorithm is implemented on MATLAB 2014 on personal computer and windows operating system. In this algorithm we use real networks as our datasets.

### A) KARATE CLUB NETWORK

Social network of friendships between 34 members of a karate club at a US university in the 1970. It contains 34 nodes, Undirected, Static, Unweighted.

### B) Dolphin social network:

An undirected social network of frequent associations between 62 dolphins in a community living off.

C) American College football:

The network of American football games between Division IA colleges during regular season Fall 2000. It contains 115 nodes.

Dataset	Modularity of K clique	Modularity of Proposed Algo
Karate Club Network	0.4555	0.5772
American Football Network	0.5235	0.6746
Dolphin Network	0.6046	0.7257

Table 1. Comparison table

Based on this value here is a graphical representation.

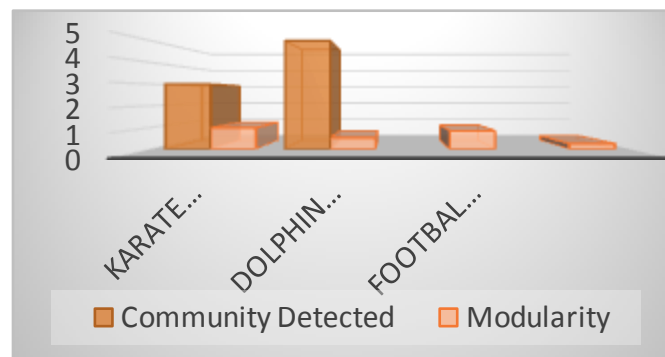


Figure. 5 Graphical representation

## VI. CONCLUSION

In this paper the proposed algorithm target to detect community with use of maximal clique algorithm which is advance over clique algorithm for social community detection. this research present high modularity results for community structure. Using parallel approach time complexity also improved.

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