International Journal of Data Analytics
Volume 3 • Issue 1

A Novel Approach for Tenuous Community Detection in Social Networks

Muhammad Asif, University of Lahore, Pakistan*
https://orcid.org/0000-0003-2189-5168

Hassan Raza, University of Lahore, Pakistan

Muhammad Imran Manzoor, University of Lahore, Pakistan

ABSTRACT

Tenuous community detection in social networks is becoming an interesting area of research, and its various important applications are emerging. Existing research has focused on the identification of a dense community. However, finding the tenuous community has posed a different kind of challenge, and existing solutions are not viable for this research problem. In this paper, a novel approach called the least linked community (LLC) is proposed to find a tenuous community from online social networks. The concept of k-links with the shortest path distance between two nodes is proposed and utilized to find a community with the least interaction and weak relationships. The experiment demonstrated significant results in terms of accuracy, effectiveness, and efficiency compared to other existing techniques. Although the proposed algorithm presents significant results, it may require further evaluation with different data sets.

KEYWORDS

Algorithm Design, Dense Graphs, Graph Mining, Least Link Community, Link Analysis, Social Media Mining, Social Networks, Tenuous Community

INTRODUCTION

Social networks of different kinds and purposes are emerging every day making the community more connected and informed. Social networks, like Twitter, TikTok, Facebook, WhatsApp, LinkedIn, ResearchGate, and others are making the community more connected. The research on finding connected dense groups in large social networks is increasing. Finding such dense groups in social networks have certain requirements and fulfills different useful purposes. Most of the research performed in this domain is to find dense groups from these online social networks based on certain common attributes, interaction levels, similarities, and behavioral aspects. Dense communities are those which have a strong relationship and all the entities are tightly connected in these communities. Dense graphs mining is playing a vital role in different domains such as fraud detection. However, finding tenuous groups (weak relationships) within a network is a growing trend nowadays and it has interesting real-world applications. Tenuous communities are the communities in which all the

DOI: 10.4018/IJDA.297518
*Corresponding Author

entities have weak relationships with the least interactions. According to (Li W., 2018) tenuous groups are sets of nodes with very few interactions or having weak relationships that have many practical applications and is of great significance. Figure-1 describes a tenuous community in a social network with six entities involved as an example.

A survey of classification of community detection algorithms and techniques is presented by (Souravlas, 2021) (Zhao, 2021). As described by (Barabâsi, 2002) S1 is not a tenuous community within the social network as all three nodes are directly connected having a strong relationship. While S2 is presenting more sparseness than S1 as all nodes are not directly connected but still it is not the best one. However, S3 may be the best tenuous community having the least interactions (Carolan, 2013). Minimum acquaintance sometimes presents more appealing location-based social groups (Zhu, 2017). Few unsupervised techniques are also used in community detection (Khatoon, 2021) (Das, 2021) (Moscato, 2021).

In contrast to finding dense communities, the identification of tenuous communities has interesting use cases as discussed in Scenario – 1: Tenuous communities have also a lot of applications in social biases and network development. In biases issues, social tenuous communities (STC) are useful in social group formation like Joint Investigation Team (JIT) formation. For development in existing networks like the construction of new roads and the installation of fresh equipment in telecommunication networks, tenuous communities can also play an effective role.

Tenuous Communities may play a significant role in the development of existing networks like road networks and telecommunication networks. For the new construction of roads, the least connected cities may be identified to construct the new road for better connectivity. Also, the least connected nodes may be identified in telecommunication networks and new infrastructure may be installed between these tenuous nodes to improve connectivity. Since the least link nodes are connected so there may greater possibility of good connectivity as well as communication.

Scenario-II Consider a scenario there are 12 nodes in a telecommunication network as shown in figure 2. If the new network is installed between these nodes, the overall connectivity will be improved. In the meanwhile, all the least connected nodes may be found using TCs and a new connection may be installed between these tenuous nodes to improve the connectivity of telecommunication networks. In the same way in the case of road networks, new roads may be constructed by keeping TCs in the mind for better connectivity of the road for good transportation.

There are many other applications where sparse connections assume a significant role. The research problem of TCs was first defined and addressed in 2017 (Shen et al., 2017) and a Minimum K-Triangle Group (MKTG) strategy is utilized to discover these networks. The idea of k-triangle is characterized as a triplet of hubs (Kassianos, 2015) where the briefest separation between any pair of hubs is not exactly a given worth k. While k-triangle-based calculation might prevail with regards to discovering questionable gathering, yet it may not function admirably in some uncommon cases. As a matter of fact, in numerous genuine applications, insofar as there is any hub pair inside a cozy relationship, it might have a negative effect. MKTG calculation needs to ascertain w (v) (i.e., the number of k-triangles containing hub v) for every hub v of the information chart. This advancement is

Figure 1. Tenuous community example