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Method in Determining Regular Pattern in Edge Labelled Dynamic Graph and the concept of Partial Regular

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Patterns in Dynamic graphs (structured data) are used to represent relationships between various entities that evolve over time. Significant patterns in such structured data capture strong interactions and their evolution over time. The data from different sources are captured and represented in the form of a graph. The graphs can be labelled on the edge or left unlabelled. It is observed that most of the research on dynamic graph mining focuses generally on unlabelled dynamic graphs. However, in many practical applications we do come across labelled dynamic graphs where the edge weights frequently change over time. Accounting for this variation a novel method is proposed to discover Topological Regular Patterns (TRP) as well as Weighted Regular Patterns (WRP) in such graphs. Here, we will consider only those regular patterns which evolve with the same occurrence rule for structure as well as for weight. In the proposed method, different snapshots of edge labelled dynamic graph are transformed into a description graph, which is nothing but a matrix with edge description. Every label of edge consists of two parts namely binary part and weight part. Binary part has two possible values: 1 and 0 representing respectively the presence and the absence of edge. Weight part is represented by a label value of the edge. Using the same occurrence rule, the binary part gives occurrence of regular edge while the weight part gives its weight. In this manner, we are able to evolve both TRP and WRP. These patterns are used to describe exhaustively the neighborhood properties of dynamic graphs. To ensure its practical feasibility the method is applied to real world dataset (DBLP Co-author networks) with embedded labels being strings of various lengths. This paper also gives the notion of partial regular and explains its significance for different given data set.

1. INTRODUCTION

Graphs are data models used to represent the relationship among various entities [1]. In a wide range of disciplines, data can be intuitively cast into this arrangement. For example, computer networks consist of routers/computers (nodes) and the links (edges) between them. Social networks consist of individuals and their interconnections (which could be business relationships or trust, *etc.*). Protein interaction networks link proteins which must work together to perform some particular biological function. Ecological food webs link species with predator-prey relationships. Given such widespread use of graphs, there is a need for techniques that mine and analyze graphs. Mining graph patterns can help to understand the inherent data and domain characteristics. For example, in drug discovery, graph mining can reveal the conserved substructures in an active set of chemical compounds. In response to such need, different algorithm for pattern finding in the graph have been proposed [2-6]. However, it may be noted that these graphs are static in nature. But most of the graphs are dynamic in nature *i.e.*, their structure changes over time. It is also observed that the nature of graph has more meaning when it is dynamic type. Meaningful patterns in such structured data must capture strong interactions and their evolution over time. In social networks, such patterns can be seen as dynamic community structures, *i.e.*, sets of individuals who strongly and repeatedly interact.

A number of pattern discovering methods [1][7-9] are present on dynamic graph. Examples of periodic pattern by Lahiri *et al.*, in [7], se-

6. CONCLUSIONS

In this paper, we have presented a method for evolving regular patterns on edge labelled dynamic graphs. In particular we consider only those regular patterns which evolve with the same occurrence rule on structure as well as on weight. These types of patterns help in deep understanding of dynamic networks. By transforming a series of graphs to a Descriptive Graph and changing the graph problem to string pattern discovery, we ensure that the method is both time as well as space-efficient. It enables us to deal with large scale edge labelled dynamic networks. Furthermore, we have defined and explained significance of partial regular pattern. We intend to explore these patterns in our future proposed research.

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