Analysis the Mobile Social Network of a Class in University

Yadigar Imamverdiyev, Hamid Zargari Asl, Namat Janani, Behzad Sami, Samira Faraji, Davar Pilevar, Maryam Bazel, Ezatali Feyz, Behrooz Ershadifar, Nasim Khorrandoost, Roza Azarvand

1Institute of Information Technology of ANAS, Baku, Azerbaijan.
2Islamic Azad University, Ardabil, Iran.
3Payam Noor University, Ardabil, Iran.
4Mobile Communication Iran, Ardebil, Iran.

Abstract: We collected the information about female students of one B.Sc. class and their lectures in university for preparation their social graph. Then we compared their social graphs by different layouts. The centralities of both groups were obtained by social network professional software. Finally the centralities of them were compared and discussed.

Key words:

INTRODUCTION

Social network analysis in recent decades has increasingly attracted researchers’ attention. The rising interest in this topic is attributed to the notation of “interdependent social actors” and “the ‘flow’ of resource along the relational linkages between actors”.

Amongst many methodologies in network analysis, graph theory is widely applied. It is a theory by considering nodes as actors and lines as ties.

Since 1950s when network analysis was initially introduced by Bavelas, (1950), network centrality and its role in different environments have been widely studied and we look to this field of knowledge from mobile social network graph view of point in order to show some hidden aspect of this subject.

A lot of works done for siding links between social network analysis and other branches of science, some approaches focused on social methods and education.

Katz-Bonacich centrality which is a known term in social network is stated that is related to educational performance (Antoni Calvó-Armengol, 2006). A web base study compares the educational performance and network centrality in a group of students (Heng-Li Yan, 2003). In an approach the relationship between network centrality and academic performance among a group of students from emails shows relation between network centrality and students’ academic performance (Ying Zhang).

In this study, we consider the relation between students and lecturer in a department of university to prepare the social graph and visualize the new ideas. The main goal is the answer of "What look like the graph of lecturers and students".

Because of using mobile communication technology in this article we should review some terminologies. In this study we work on CDR (Call Detail Records) files to retrieve the connection details of subscribers in a Mobile Switching Center (MSC). CDR files are made by every switching system to prepare the billing information of subscribers such as call duration, originating and terminating numbers (A-numbers and B-numbers), furthermore, original and destination physical coordination are recorded. Figure 1 shows the generation of the CDR files. CDR files are closed periodically and the next file is opened to continue the data warehousing.

In such studies the MSISDN (Mobile Station Integrated Service Digital Network Number) can be assumed as nodes or vertices.

Materials:

Centralities in a mobile social network constructed of 27 female university students and 22 lecturers in an Iranian university have been calculated. We collected 10,451 established calls from CDRs by snow ball method in a not working week for lecturers and 12,857 established calls from CDRs from the same group in a working week. In the same time period we collected 2,805 and 3,950 established calls for the group of students by the same method (totally 30,083 calls). For preserving the privacy rights, all the information is gathered from volunteers and the rest were coded.

We used Ucinet (Borgatti, S.P. 2002) and Netdraw (Borgatti, S.P., 2002) to demonstrate graphs and do the required analysis.

In order to refine raw data and get ready them for utilization, another soft ware is prepared.

Corresponding Author: Hamid Zargari Asl, Institute of Information Technology of ANAS, Baku, Azerbaijan.
E-mail: hamid_zargari@ardabiltelecom.ir
Lecturers' Social Graph:

Using a prepared program we retrieved required information from billing log files and collected them in tables. We prepared separated tables for lecturers and students and a combined table for both of them. For distinguishing two groups we used attributes for every group i.e. 1 for lecturers and 2 for students. They are used in Netdraw to show them separately.

Figure 1 shows the lecturers' social graph in a working week prepared by snowball method and was begun from the list of lecturer as primary actors (red nodes). The used lay out for showing the graph is spring embedded method. Because of compressing graphs by deleting the pendants in several steps, the number of main groups reduced.

Figure 2 illustrates the social graph of lecturer in a not working week prepared by snowball method with spring embedded method where the red nodes are denoted to lecturers.

As you see the relation by mobile is lower than normal days and it demonstrates that in this time lectures want to relate with some special people like family or friends who are similar in work or colleague, and this one is look like Fig1 due to lecture's role in the graph as showed, but as you see they save relation between themselves and it shows that they want to enforce their relationship instead of having new relations with others, also the academic environment has not effective role in their social life.

Figure 3 depicts the social graph of lecturer in working day with multidimensional scaling of geodesic distances (MDS) method. When we regard this graph we understand that relations between nodes are focused in somewhere, we saw high concentration and it demonstrates that their relationships are more close than others.

Figure 4 shows the social graph of lecturer in not working day with multidimensional scaling of geodesic distances (MDS) method.

In not working week absolutely amount of calls are lower than normal week.
Fig. 4: lecturers' MDS social graph in a not working week.

We see that there is a stable relation between lecturer not only in working days but also in vacations and social graph does not change radically. Their relation is not more depended to the university environment. Also it shows that they does not play an important role in their social network, compared with other nodes.

Students' Social Graph:

Figure 5 and 6 show the social graph that is prepared by students in working and not working days by snowball method. The base actors are shown by red nodes. By looking at Fig 5 and 6 we see that graph of female students are really different with the lectures. As you see their graphs are simple and relation between them is in low rate and most of them have relation with together not with others and make graph Fig 6 we saw that graph in Fig 5 is divided to smaller graphs It show us the smaller graph may be friendship groups and the big reason of organizing Fig 5 is university

Fig. 5: Students' graph in a working week by spring embedded lay out.

Fig. 6: Students' graph in a not working week by spring embedded lay out.

Fig. 7: Students' graph in normal week by MDS lay out.
Figures 7 and 8 show the same graphs for students by multidimensional scaling of geodesic distances (MDS) method.

Figure 7 shows the social graph that is prepared by students in working days by snowball method and prepared by multidimensional scaling of geodesic distances (MDS) method. The base actors are shown by red nodes.

Figure 8 shows the social graph that is prepared by students in not working days by snowball method and designed by multidimensional scaling of geodesic distances (MDS) method. The base actors are shown by red nodes.

Students are related to a smaller social network than the lecturers' social graph and it is very vulnerable to vacation because of radically changes in their social graph in vacation. So the university has great role in the social life of students.

**Comparing Centralities:**

Considering centrality as measure to find the importance of an actor in a social network, there are three main measurements on network centrality:

A. Degree-based network centrality that evaluates local centrality and uses comparison of the various nodal degree;

B. Closeness-oriented centrality that is the global centrality and considers geodesic path between different nodes;

C. Betweenness-oriented centrality that is local centrality and shows the extent to which a particular point lies “between” the various other points in the graph.

For example, Betweenness is a centrality measure of a vertex within a graph. Vertices that occur on many shortest paths between other vertices have higher betweenness than those that do not.

For a graph \( G = (V, E) \) with \( n \) vertices, the betweenness \( C_B(v) \) for vertex \( v \) is:

\[
C_B(v) = \sum_{s \neq v \neq t} \frac{\sigma_{st}(v)}{\sigma_{st}}
\]

(1)

Social network analysis software can show the centrality of each node by the size of nodes as in figures 9 and 10.
In calculating betweenness and closeness centralities of all vertices in a graph, it is assumed that graphs are undirected and connected with the allowance of loops and multiple edges. When specifically dealing with network graphs, oftentimes graphs are without loops or multiple edges to maintain simple relationships (where edges represent connections between two people or vertices).

We calculated separately the centralities of two mentioned groups. Fig 11 shows the centrality of both groups.

The result Ucinet databases were analyzed by Ucinet to prepare the centralities. Fig 11 shows the average centralities of both group i.e. the centrality of lecturers are divided to centralities of students.

It is obviously shown that totally all centralities of lecturer are at least 5 times more than students. The out and in ARD centralities are greater and betweenness centrality has the biggest value.

Owing to connection the lecturers to bigger network and their broker role between students and their big network, it is reasonable that their betweenness centrality appeared to be bigger.

Conclusion:

Lectures' graphs and their relation with others does not rely to university in working week and in not working week. Their graphs don't split to small groups in not working week. The relation is more stable in different time periods. They are also connected to bigger networks.

Lectures' network are greater than other due to female's graph and other graph are linked to them.

if we separate graph to small size and it show that their relations are low with others in the days that is normal and they work.

Female students' graph is altered by time i.e. they are more variable and more related to university. The graph in working week is bigger. It is broken to small graphs in not working weeks. They may be small friendship groups.

By looking on graphs they show us that difference between female students' graph in two style of drawing, their network is not a condensed network. The brokers and bridges are eliminated in not working weeks and the structural holes are increased.

We saw in these graphs our considered actors are not important in the network composition and others are more important. The elimination of our actors will not destroy the network.
After compressing the prepared graphs the rest number for lecturer were 9 (41%) and for students 15 (56%). It means that the role of students are more important than lecturer in their own network. The rest actors because of having less links (pendants) have been eliminated.

In both graphs about lecturers and students, the considered groups have not important role in centralities. High scores of centralities in both of them are dedicated to other actors.

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