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Network Analysis of Informal Social Media Conversations about Autism

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Abstract

In today's society, the use of social media has become a necessary daily activity. Social media is typically used for social interaction and access to news and information, and decision making. It is a valuable communication tool with others locally and worldwide, as well as to share, create, and spread information. Social media has greatly influenced many aspects of our society, particularly healthcare. Informal public speaking on social media, especially in Iran, has an influential role in the health community, such as consulting patients and their families together and sharing experiences related to symptoms, home remedies, and finding an experienced therapist or good treatment center. The virtual community of autistic patients and their families is a young but growing community. Ninisite, as the most crucial Iranian family social network, has had nearly 21.5M total visits last three Months. In this study, we first crawled the social network of interactive conversations related to autism from this forum. After preprocessing and data cleaning, the communication network between people was extracted. Then this network was studied by graph analysis methods. It was shown that this network with more than 800 members has solid and active hubs, although a fledgling and sparse network. We further showed that an auxiliary node that connects these hubs could make it much more substantial and play an essential role in managing the flow of information between the families of autistic patients.

Keywords: Autism, Social network analysis, neurodevelopmental disorder, Ninisite.

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1. Introduction and preliminaries

Autism and social networks are like a double-edged sword. Researches have shown that social media has helped autistic children to communicate more easily with their peers [1]. On the other hand, Digital Nanning can be an important factor in emerging symptoms of autism in children [8]. Due to the popularity of the Internet and social networks and given that the conversation between autistic families, caregivers, and their therapists has become very widespread in social networks today to help further this group of patients, the study of these social networks and the level of participation of their users contains a lot of knowledge. A wide range of information about Autistic Spectrum Disorder (ASD) is available among their families. "Sharing experiences" in cyberspace and answering questions in various forums that other people have experienced, for example, one of the steps that can be taken to overcome the developmental disorders of children with autism is to follow a proper diet such as a gluten-free diet and casein-free on foods given to children with autism.

In Social Network Analysis (SNA), the aim is to find and exploit the most critical aspects of social networks to elucidate how nodes (usually representing people) are connected and how these connections inform the flow of information in the network. Based on a multi-domain ontology, Ben ´ıtez-Andrades et al. [3] developed a knowledge base that included classes that represented different concepts about people, questionnaires, and social network analysis about the alcohol consumption habits of adolescents. Since online public deliberations about diverse issues are increasingly taking place on social media sites, Bail[2] used natural language processing, network analysis, and a social media application to analyze how "cultural bridges" shaped public discourse about autism spectrum disorders on Facebook. Social media analysis was applied to identify, predict, and compare the development of children's social relationships with and without autism spectrum disorder by Anderson [1]. We applied social network analysis (SNA) in our research and our primary source was one of the well-founded Persian community question answering (CQA), which also were done other research on this forum [6][7][5]. The prevalent platform for information exchange is used as a data mining source. Beykikhoshk et al. [4] investigate if Twitter can be used to promote awareness of the disorder and increase engagement with the affected individuals and their families.

Regarding the importance of the effects of social media on our society, especially in certain groups like autistic patients and their families, in this study, a network of members in these communities was constructed based on the conversations and its features were explored based on the graph theory.

2. Method

There is a need to socialize, provide information, and share experiences about children with autism. Many people among Iranian users and Persian sites talk about autism, and we decided to do "Finding Expert" Authors in these forums. A complete analysis is done of Persian forums and a ranking analysis is performed using Alexa Internet. After reviewing these sites, we came across the Ninisite website where families gap informally. Ninisite, as the most crucial Iranian family social network, has nearly 21.5M 1 total visits last three Months. In Alexa, Ninisite is ranked approximately 20th in Iran, and therefore, Ninisite is used as the source for our study.

2.1. Data Acquisition

Initially, a dataset had to be created for research. For this purpose, we crawled significant data from the most well-known Persian community using a web scraper. A crawler is designed to crawl

https://www.alexa.com/siteinfo/ninisite.com
www.ninisite.com
https://www.similarweb.com/website/ninisite.com

some autism-related posts(questions) from 2020 to 2021. The crawled dataset consists of two data categories, which are summarized as below:

- Category 1: Thread records the basic information of each originally posted message, such as question ID (QID); questioner ID (QUSERID); question title (QSubject) and content of questions (QBody)
- Category 2: Each question is followed by a list of comments and each answer contains the following attributes: (i) comment identifier (CID); (ii) identifier of the user posting the comment (CUserID); Identify users who have responded to others' responses (ReplayCommentId).

2.2. Data Preprocessing

The total amount of data records is more than 50000, but most were advertisements and posters of autism conferences. Therefore, various preprocessing techniques were used on the structured crawled data to be scrutinized in the second step. Social network data has a relatively sophisticated structure and, if not adequately processed beforehand, may affect the final analysis of the network. Preprocessing requires several common steps that must first be done manually. Some questions were removed from the database using the following guideline:

- Posts with questions and answers posted by a user on the site.
- Many posts were duplicates.
- Posts that were posted on the site solely for information or invitation to a conference.

2.3. Network construction and graph analysis

In recent years, social networks have grown exponentially. Analyzing social networks based on graph theory is a modern way to help us better understand the web and make decisions. A graph was first created in this project based on the questions and answers in the database prepared in the previous section. In this graph, the vertices are the social network members who asked and answered questions about autism, and the edges show the members' interactions regarding autism in the network. The more interactions between members, the more weight the edges have. The features extracted from the network are summarized in Table 1.

Table 1: Network metrics and their definitions.

Network measure	**Definition**
Characteristic path length	The number of edges mediating between two nodes.
Degree	The number of edges incident to a node or sum of weights of incident edges (flow).
Efficiency	Quantifies a network's resistance to failure on a small scale.
Clustering coefficient	Quantifies how close a given node and its neighbors are to being a clique.
Betweenness centrality	The number of shortest paths running through a node i.

In graph theory, a clustering coefficient measures the degree to which nodes in a graph tend to cluster together. This measure showed that there are four members that tend to be in a cluster with more than 200 other members in the community. These members are considered the hubs of four

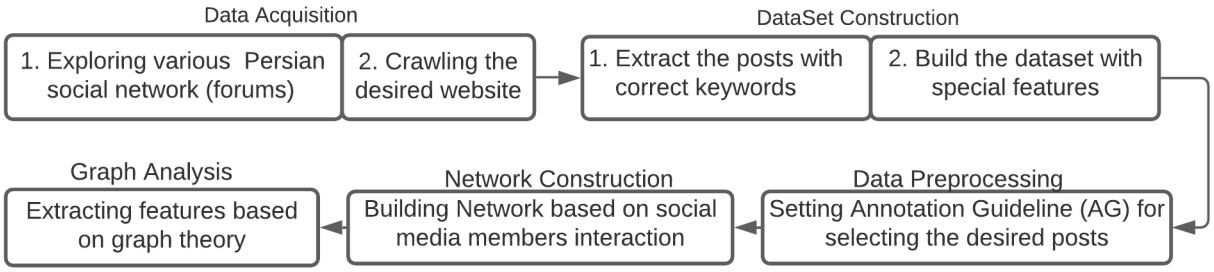

Figure 1: The research framework summary.

main components of the Networks. We further showed that creating an auxiliary node that can be a connection between these hubs can make the network much more potent and also play an important role in managing the flow of information between the families of autistic patients. All the steps of data collection and analysis in this article are summarized in Figure 1.

3. Results

Firstly, 1,337 questions and 6,981 answers (question-answer pairs) have been achieved during the dataset construction. Then, by using the annotation guideline (AG), the desired question for our study was extracted. Therefore, there are 96 questions and 2,139 corresponding answers in the dataset. The network construction process leads to a weighted directed graph with a total of 799

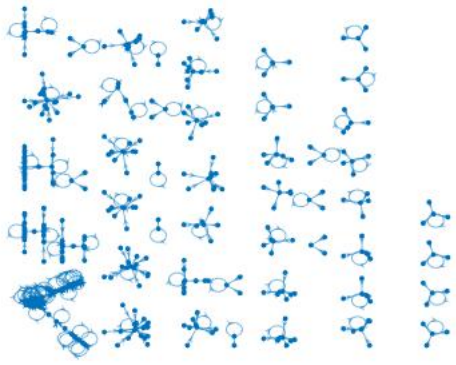

Figure 2: Graph representation of social network communities

vertices and 1316 weighted edges. Edge weight indicates the number of conversations between every two members. (see Figure 2). This figure shows that although this network is a fledgling and sparse network, it has active hubs. Figure 3 presented the degree distribution of vertices. According to this figure, there are four vertices with more than 25 neighbors. The network consists of 49 communities. The four largest collections together have 489 members, accounting for 61% of the network's total members. Figure 4 presented the degree distribution of these communities.

Table 2: Network global features before and after auxiliary node.

Network global features	Network	Network after modification
Global clustering coefficient	0.024	0.042
Characteristic path length	99.80	1.41
Global efficiency	0.01	0.72
Diameter	100	1.41
Global betweenness Centrality	61.90	1664

In the next step, we investigated how adding an auxiliary vertex to the network that connects the main four hubs can change the network to have the stronger network. It is remarkable that of these four main hubs, three were mothers of autistic children and one was a clinical child psychologist active in the field of autism. Table 2 summarised the comparison of the network's global features before and after this modification.

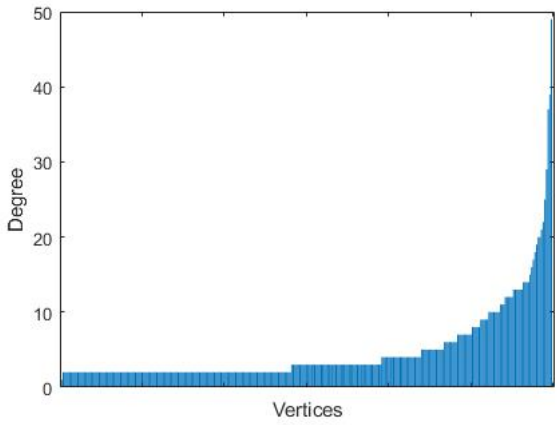

Figure 3: Degree distribution of vertices.

4. Discussion and Conclusion

Our study aimed to investigate social media networks about Autism in Iran. Firstly, to examine the network, make a dataset based on questions and answers about Autism in one of the important websites for families' informal gap. after cleaning the dataset, the network was constructed based on questions and answers exchanged between members. The exploration showed that although the network consists of distinct communities, but it has active hubs with high clustering coefficients based on graph theory. Finally, we suggest that to make this network stronger and have an excellent stand to manage information in this type of network, we should add an auxiliary node that connects these active hubs. Then we apply the suggestion to the network in this study and have shown that not only do the parameters of network strength change significantly in this process but also the auxiliary vertex plays a vital role in the network and has a high degree of centrality.

Our findings reveal that in the network of informal social media conversations about disorders between patient families, a few members have a substantial role in the network. Based on the results,

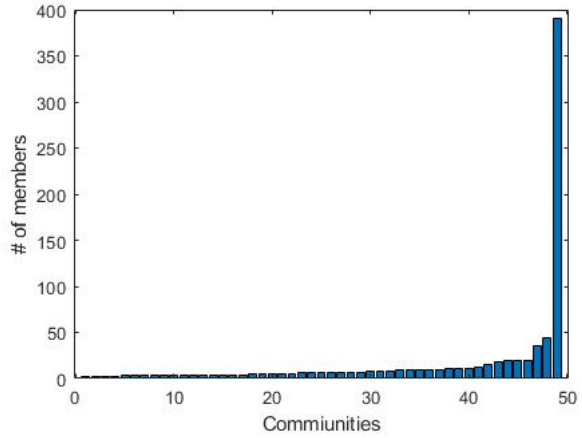

Figure 4: Communities sorted by size.

we think that helping an auxiliary node to connect between these members can be an excellent suggestion to make the network more robust and manage information follow to control the accuracy of the content and avoid rumors from spreading.

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