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Social Network Users and Social Graph Construction

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Abstract*: The work is devoted to the analysis of friendly relations of the VK social network users. The work aims to obtain connected components of the social graph of the social network users, where edges represent friendships between users and nodes represent users. The total population is approximately 54,000 users (intersection of audiences from two professional communities in the field of social media marketing). The following libraries are used in the work: NumPy and Pandas. The author uses a structural approach focusing on the geometric shape of the network. As a result, a group of 168 users with intra-group connections was allocated from the sample of 1,000 users, of which eight users had visited VK 15 or more days before and eight users had visited the VK from 5 to 15 days before.

***Keywords* : social networks, digital economy, information technologies, social media marketing.**

I. INTRODUCTION

Social networks are an integral part of Web 2.0 and their further development largely determines the prospects for the development of the Internet itself [1]. Obtaining information about the behavior of users in social networks opens the possibility for a rapid and convenient analysis of social structures. Thus, the analysis of social networks can be used to predict the behavior of participants in economic relations in the field of information technology and marketing [2-4].

The term “social network” appeared long before the advent of the Internet. In 1954, sociologist James Barnes introduced it. Barnes understood a social network as a certain circle of acquaintances with the center of the network – the person themselves. Acquaintances are branches of social networks; relations between them are arrows, connections [5]. The graph model is the basis of all modern social networks. In common sense, a social network is a community of people united by common interests, a common cause or having other reasons for direct communication with each other. In the philosophical approach, a social network is understood as a number of social objects and a certain set of relations between them. A social network is a social structure consisting of a group of nodes, which are social objects (people, groups of people, communities, organizations) and connections between them – social relationships [6]. S. Neti [7] in his article tells that social networks today are one of the best opportunities available to a manufacturer for communication with a potential consumer. The article touches upon the concepts of social networks, social media marketing and other aspects. W.G. Mangold and D.J. Faulds [8] note that the advent of social media has allowed one person to communicate with hundreds or even thousands of other people about the products and companies that provide them.

Thus, the impact of communications between consumers has increased significantly in the market. The authors define social media as a hybrid element of promotion because it allows companies to communicate with their customers in the traditional sense, while it allows customers to talk directly to each other in the non-traditional sense.

The content, time and frequency of social media conversations that occur between consumers are beyond the direct control of managers. This contrasts with the traditional paradigm of integrated marketing communications, according to which, a high degree of control is present [9,10]. Therefore, managers need to learn how to shape consumer discussions in a way that is consistent with the organization's goals and objectives.

The authors describe methods that include providing consumers with networking platforms, as well as using blogs, social media tools and advertising tools to attract customers. C. Chung and K. Austria [11]in their article note that social networks provide marketers with interactive communication environments with opportunities to strengthen existing relationships with consumers. Although social networks have been recognized as the most potentially powerful tool, there is no understanding of business practice in terms of why people use social networks and how they perceive messages on social networks. The authors explore 1) the satisfaction underlying social media use, 2) attitudes toward social media posts and 3) the effectiveness of posts regarding the value of online shopping. The research model was created based on the uses and gratifications theory. Social media pleasures, including entertainment, information and interaction, were considered as exogenous variables. Attitude towards advertising messages in social networks and the value of online shopping was considered as the endogenous variables. The authors' findings explain that attitudes toward social media marketing messages are closely related to social media interaction and information satisfaction, but not related to entertainment pleasures. Moreover, positive social media marketing messages enhance the hedonistic values of online shoppers.

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As a managerial factor, marketers should provide useful information and actively interact with the virtual arena, using social media to create positive marketing messages from consumers and increase the value of online shopping [2].

The main directions of social network analysis were considered by A. Churakov [12], who identified four main directions, as well as proposed data collection strategies for the analysis of social networks.

Approaches to the analysis of social networks were also described in the work by T.V. Batura [13], where the application for their analysis is given. The analysis of social networks with the help of the graph theory is considered by Robert Hanneman [14]. Charu C. Aggarwal [15] described data results, as well as algorithms, for traversing social network graphs and applying them to the cluster using various metrics. Umit Can and Bilal Alatas [16] in their work identified the problems of social network analysis. Stevan Milovanović together with co-authors [17] developed an approach to determining user preferences based on social network analysis. Ruxue Ren [18] explored minority opinions using a group decision-making method based on the analysis of social networks with fuzzy linguistic information.

II. PROPOSED METHODOLOGY

A. General description

Vkontakte (international name VK) – a Russian social network – was chosen as a research base. The site is available in more than 90 languages; it is especially popular among Russian-speaking users. VK allows users to send messages to each other, create their pages and communities, share images, tags, audio and video recordings, as well as play browser games.

B. Algorithm

The work aims to obtain the connected components of the social graph of social network users, where edges represent friendships between users and nodes represent users. Obtaining data about the links was conducted using API VK – an interface that allows receiving information from the database vk.com with http requests to a special server. The total population was approximately 54,000 users (intersection of audiences from two social media management communities: "Cerebro Trager" and "Target Hunter"). The social graph was constructed based on a random sample of 1,000 users. The following libraries were used in the work: NumPy and Pandas. NumPy is an open-source module for Python that provides general mathematical and numerical operations with large arrays and matrices. Pandas is a package for Python serving as a tool for data analysis. The package allows constructing pivot tables and performing grouping. Data were received from VK in September.

C. Flow chart

The methodology of the study is shown in Fig. 1.

We used a structural approach that focuses on the geometric shape of the network and the intensity of interaction. Structural theories and network exchange theories were used to interpret the results.

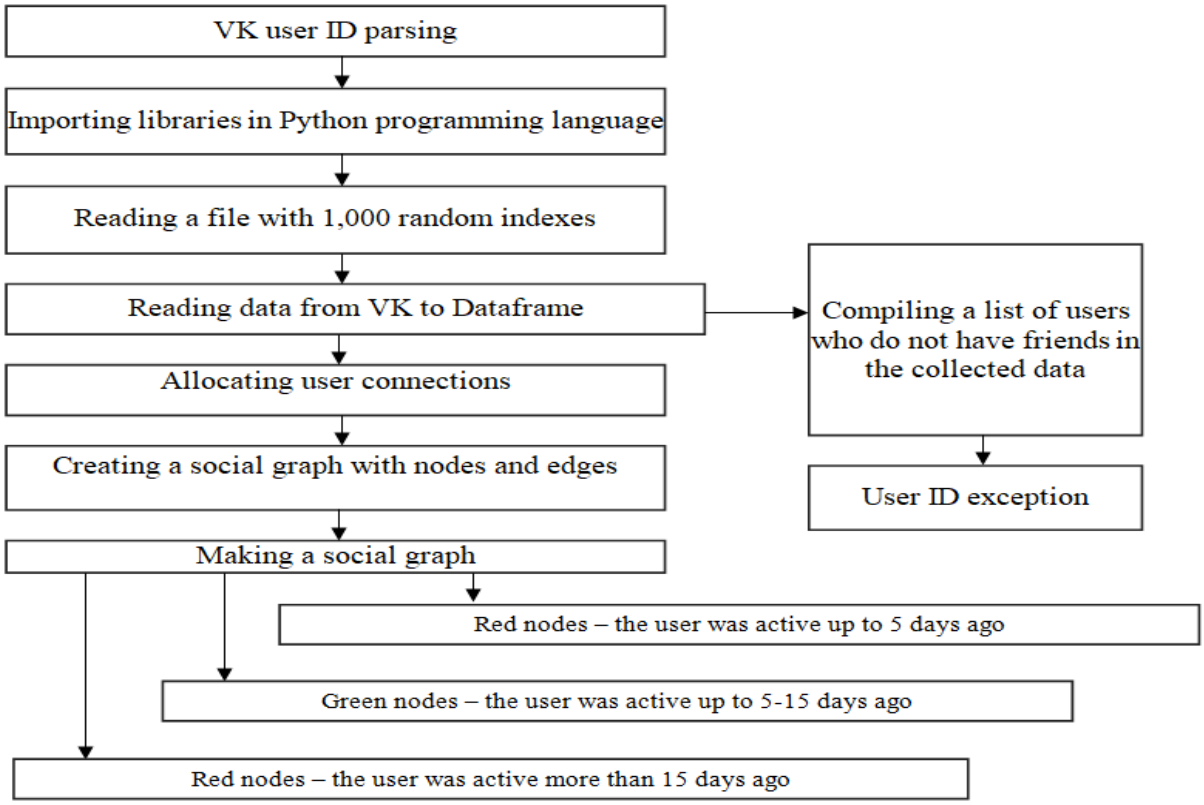

Fig. 1: Research methodology

III. RESULT ANALYSIS

As a result, a group of 168 users with intra-group connections was allocated from the sample of 1,000 users, of which eight users had visited VK 15 or more days before and eight users had visited VK from 5 to 15 days before. The average number of friends of each user was 1.95 people, median value = 1. This suggests that there are virtually no offers in this sample. This conclusion was made because of the high activity of users. The resulting social graph is shown in Fig. 2.

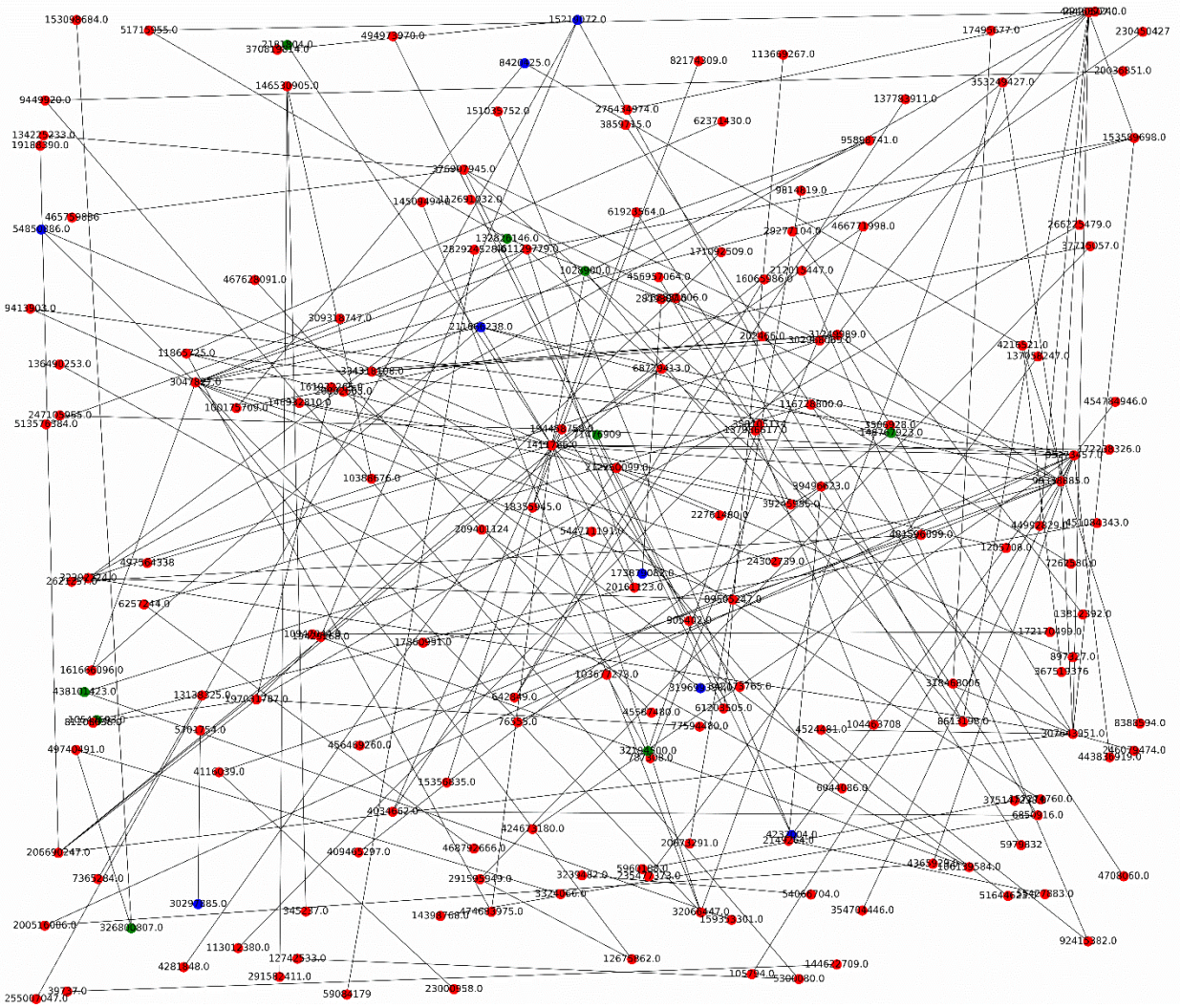

Fig. 2: The received social graph.

Information about social network communities at the global level is used in recommendation systems, spam filtering and many other applications. Automatically defined communities of the user's closest contacts in the social network can be used to optimize the flow of inbound and outbound information (send a message only to the "Colleagues" community, read news only from the "Close friends" community) [19-21].

Modern methods of promoting resources on the Internet are diverse; the most popular among them are "offers". This type of promotion has appeared recently and is more common in social networks. Unlike bots, offers are real people who join groups or communities for a certain reward and perform certain actions (leaving comments, likes, etc.). Such actions include the following: joining a group on a social network, reading publications, shares or comments. Due to offers in VK, it is possible to increase the attendance of the community and increase the number of subscribers. The main advantage of this method of promotion is its relative safety. That is, the administration of the social network will not be able to ban for driving up attendance. There are no such users in the resulting graph.

IV. CONCLUSION

A method of analyzing users of social network communities based on social connections between them was developed. A social graph of users of a social network was obtained, where edges represented friendly relations between users and nodes represented users. As the main conclusion, it can be said that the analyzed communities are authentic – without fake users (offers).

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