Personal social analytics for healthy societies and businesses

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Abstract – **The paper describes approach and prototype application for personal analytics of social interactions in electronic media for individuals and business staff. Paper provides brief review on importance of such interactions in modern world and analytical possibilities that means of electronic media are supplying. Based on that, practical approach on improving personal social performance and comfort of social environment is described. Finally, software solution implementing the approach is presented.**

Keywords – **Block-chain, cognitive model, online media, personal analytics, social capital, social network, theory of functional systems**

I. INTRODUCTION

In modern world, number of relationships between people and intensity of communications over these relationships is improving drastically. This is powered with more efficient means of electronic communications introduced by industry and amount of people using these means growing daily. The latter effects in multiple social and economical phenomena of multi-agent systems with high density of interconnections as shown in works of A. Makarov [1].

Multiple phenomena of social psychology and mass behavior has been studied by R. Cialdini at phenomenological level earlier [2]. It has been discovered that social interactions and structure of these relationships in a community play key role in performance of individuals within community, including even matters of life and death [3].

Modern social networks and other instruments of online media and electronic communications provide ability to capture behavioral and communication patterns of individuals in huge volumes. Besides capturing, they make it possible to impact on human behavior in bulk, like it is being confirmed by more and more experiments using different online communication platforms [4], [5]. The latter make it possible to implement destructive impact on individuals and societies artificially.

Recent studies on phenomenological connections between social comfort and healthy social environment with physical health confirm presence of such connections [6]. The other work justifies these connections from perspective of *Theory of Functional Systems (TFS)* developed by P. K. Anokhin and suggests approach to improve physical health and general well-being state of an individual by means of improving her or his social environment [7].

The other work based on TFS suggests computable mathematical model of society as super-system involving individuals as sub-systems, with each individual further represented as super-system of internal reflections of social environment in the individual's self [8].

In the following discussion, we will be integrating practical approaches developed by D. Shamenkov and I. Kaledin [7] on one hand with mathematical model and computational solutions suggested by E. Vityaev, A. Kolonin, and Y. Orlov [8] on the other hand.

II. METHODOLOGY

The primary goal of this work is to deliver practical solution for individual or members of society consisting of individuals. The solution would turn into *Aigents* software application and web service – capable to monitor social interactions in individuals's environment or within entire community. Study of these interactions in terms of *social evidence-based cognitive model* [9] for individual or community [8] would make it possible to implement self-reflection approach for a person or whole society – from TFS perspective [7].

In order to develop the practical solution, several social networks were taken as electronic media enabling cross-individual interactions. Primarily, we took official application programming interfaces (API-s) of well-known *privately owned* networks, namely Facebook,

Google+ and VKontakte [10]. Later, ongoing research has shown limited usability of these networks for the purpose – because breadth of volume of interactions that can be obtained using official APIs is quite limited, due to of privacy and licensing restrictions imposed by these networks. Further, use of two less popular networks has been involved, so we used *community-owned* Steemit (https://steemit.com) and Golos (https://golos.io), because these networks are based on public block-chain technology and entire scope of interactions logged in these networks is public by definition [11].

Three kinds of study were implemented as part of the solution, as follows.

First, thematic aspect of communications has been covered by means of feature extraction and classification of textual content of posts and comments in social networks [12]. Based on that, it has turned possible to build clusters of *natural classification* categories indicating interests of individuals and communities by means of cluster analysis in time window, framing temporal focus of interest for given person or social group [13].

Second, social aspect of communication has been evaluated calculating multiple kinds of relationships between individuals in environment of the person in the study or entire community as discussed in earlier work [10]. To name a few, there were *best friends*, *similar people*, *leaders/authorities* and *fans/followers*. Also, various properties of individuals were implemented too, with *karma* as primary one – indicating amount of attention attracted by person in study denominated by amount of attention the person allocates to others.

Third, dynamic aspect of communication has been studied having the features discussed above evaluated along temporal axis on basis of specified time interval (number of years, months, weeks or days) using certain time increment and window (year, month, week or day) [11]. The most interesting temporal features turned to be dynamical change of focus of interests drifting over time and karma changes based on content the person of study is publishing and its quality – in terms of attention it attracts.

The emotional aspect has been intended to be covered with evaluation of sentiment and intentional moods of posts and comments made in social networks based on earlier works [14]. This would let determine more fine-grained relationships between individuals, e.g. *love, compassion, hate,* or *trolling*. Also, this would enable evaluation of properties of the individual's self, such as *positive karma* (amount of positive sentiment attracted) and *negative karma* (negative sentiment attracted) separated from *absolute karma* (overall attention). When measured in the long-term perspective, the positive karma can be also treated as *social capital*. However, the results of this work were not ready timely and not included in this paper.

For evaluation purposes, solution has been implemented as part of Aigents service available at https://aigents.com web site. It works as follows.

User can register with Aigents service on https://aigents.com web site with either email or their existing social network account in Facebook, Google+ or VKontakte. Upon registration, user can also add more social networks on their Aigents account. Also, for social networks Steemit and Golos, which do not have support for authorization binding with other services, user can register independently and enter their id on these networks into the properties of their profile on Aigents site.

The results were obtainable by users in several forms. First, there were textual (HTML) reports displaying different social or personal aspects of user profile, having these aspects ranked with simple bar charts indicating value of the property or relationship, as discussed in earlier work [11]. Second, same data as included in reports can be obtained in numeric form via Aigents API in JSON format for integration with other software applications and services. Third, there were network graphs presenting aggregation if multiple relationships and properties in different ways, as presented below.

For selected users using the service, feedback was collected to evaluate value of suggested solution – the summary of the feedback is discussed further.

III. RESULTS

The overall impression of the service is that quality of the analysis for *privately owned* social networks, such as Facebook, Google+ and VKontakte is strongly bound to area where user maintains her or his communications. Specifically, official APIs of these networks limit access to content to substantial extent. For instance, in Facebook, the analysis like discussed above can be applied only to personal *home page* of the user – posts of the user and comments made on user's posts and replies to these comments. That means, reliability of the analysis could be achieved only in case if most of communications of the user in given social network are carried out on the home page.
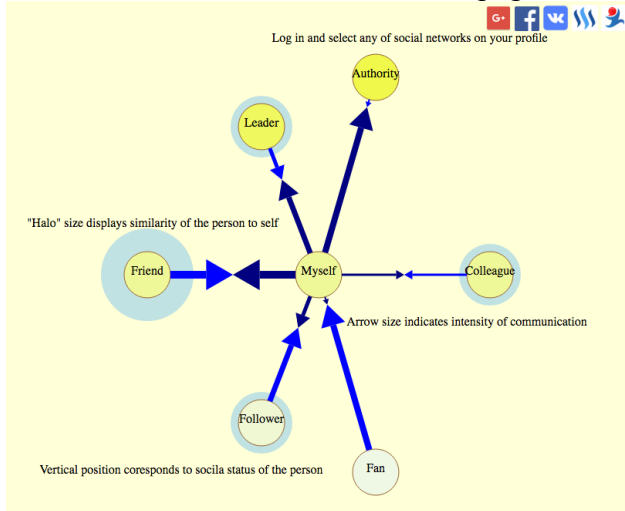

Fig. 1. Screenshot of sample graph of personal social environment. Circles are representing individuals. Person of study is in the middle. Leaders and authorities are placed at the top of the diagram. Followers and fans are placed at the bottom of the diagram. Friends and colleagues are placed at the same level with self. Relative lengths of opposing arrows indicate amount of attention coming from one person to another. Thickness of arrows indicate intensity of interaction between connected persons. Size of *halo* circle around a person corresponds to similarity of the other person to person of the study. Saturation of fill color rendering circles corresponds to social capital of respective persons. Icons of social networks in the top-right corner allow to switch between different networks.

On the contrary, using community-owned social networks such as Steemit and Golos make it possible to capture overall communication structure and content, reconstructing communication graph of society with all possible flavors, which turned much more reliable and practical.

The most useful cases found and confirmed by feedback were a) finding people sharing the same area of interest in community, b) discovering unknown fans/followers to establish communications with them, c) finding out people serving as opinion leaders for a person intentionally or unintentionally and tracking change of their status, d) figuring out *bots* or *avatars* corresponding to fake identities or managed accounts, e) track changes of personal karma and development of social capital.
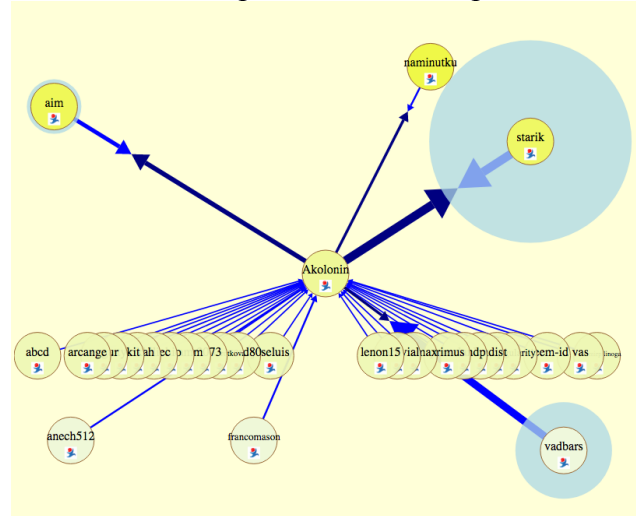

Fig. 2. Example of author's personal environment in Golos social network (in Russian language). In the top right, there is person very similar to author by area of interest (not known to author before). Author pays more attention to three persons at the top than perceives from them in return. In the middle half, there are a lot of unclassified followers plus three followers paying a lot of attention to author. With one of them – in the bottom right corner – author maintains intense conversation.

On Fig. 1, typical graph of social relationships is displayed with explanations. On Fig. 2 and Fig 3., there are real graphs based on data extracted from Golos and Steemit social networks, respectively. Since both of these social networks are public by definition, sharing such information does not violate anyone's privacy.
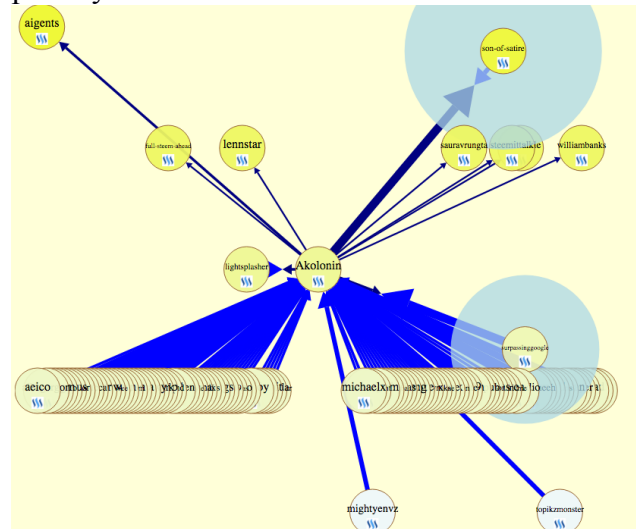

Fig. 3. Example of author's personal environment in Steemit social network (in English language). In the upper half, there are 8 opinion leaders for the author. One of them – in the top-right corner – share area of interest with author to great extent and receives a lot of attention from the author with little response. There is also author's follower similar to substantial extent and many other followers paying a lot of attention.

IV. DISCUSSION AND CONCLUSION

We anticipate that presented solution could be useful for individual and corporate users to improve social capital and social environment of individuals and improve stability, safety and performance of communities and businesses.

We expect that, being implemented as either service connected to user's social networks or mobile application plugged to user's personal device, it could help user in the following ways.

For individual, it could discover incoming threats from social engineering attempts and sources of fake news. Also, it could strengthen social binds detecting and preventing rudeness and incorrect behavior outgoing from individual to her or his close friends and colleagues.

For community or corporation, it could also use internal corporate communication channels to get more data improving precision and reliability of analytics. In this case, it can determine real organization structure of community or corporation, unveil true leaders and dense communities, help building better synergetic teams, discover and monitor positive and negative behavioral patterns in social environment, powering the former and preventing the latter.

In the end, making positive karma and social capital for people grown in mutual co-operation powered by such instrumental self-reflection at the level of entire society, it is possible to improve health and state of well-being for every member of community.

Our further work will be directed toward making this service available on mobile applications and including sentiment and intent analysis along with psychological profiling and matching.

ACKNOWLEDGMENT

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