Spreading of Information through "*Silaturahmi*" Network

Reading Data from Social Structure of Alumni

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Abstract
The paper introduces the organization concept of *silaturahmi* that widely used as an important concept to maintain a lot of community structures in Indonesia. One of the organization is alumni forum where alumni gathers and establishes an institutional organization. The concept of *silaturahmi* is demonstrated to build a network among alumni that has been spread world-wide by observing the clustered gathered in social clusters. The paper reports the small world topology emerged and discusses some interesting conjectures regarding to social institutions that is made upon the concept of *silaturahmi*.

Keywords: *silaturahmi*, social networks, small world topology, social organization, voting system.

1. Introductory Background

Some strategies to win polls or voting might be related to the existence of the emerged social networks. One way is to spread the information of the campaigned messages through the networks. An interesting case is the one showed in the voting event to elect a new chairman of a *silaturahmi*[1] forum of ITB alumni[2]. In order to gather the voters aspiration as well as gaining vote for winning the election, the data sequence of friends to friends are listed. This is necessary since the alumni or potential voters are spread world-wide and friend-to-friend network can be used to disseminate the big idea of the candidacy, campaigned program, and so on. Reviving the friend-to-friend network of the alumni can now be implemented by using the available communication devices, e.g.: handphones, chat rooms, blogs, and of course, if geographically possible, a meeting might be held. A similar frame of work has also been reported in the academic affiliation fashion [5].

In practice, the listed *silaturahmi* network is used to spread the idea of the program and campaign messages brought for the election. Let the result of the elections and the eventual gained voters aside, the paper discusses the topology of the emerged friend-to-friend network and some conjectures that can be taken from it [*cf.* 6].

The next section of the paper discusses the topology of the network and this part is followed by the discussions about what we can learn from the emerging network. The paper concludes of the uniqueness of the network and broad social network properties can be outlined.

2. The Emerging *Silaturahmi* Network

The list of the friend-to-friend data, or in short can be stated as the "*silaturahmi* network", are interestingly emerged the global topology of the network. The first days participants of the network is shown in figure 1.

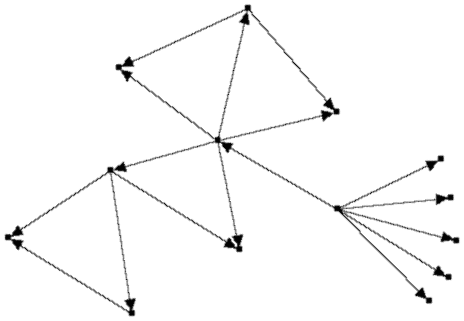

Figure 1
The ten most central agents in the network

[1] *Silaturahmi* is rooted from Islamic-Indonesian terminology referring to a friendly social communality or social club emphasizing the strength of fraternity and mutual solidarity. This communality does not have to be a kind of rigid institution or organization but in some cases a lot of Indonesian organizations are established based on this value called as the *silaturahmi* forum.

[2] ITB, Institut Teknologi Bandung, a well known campus in Indonesia based on art, science, and technology higher education. The alumni of the campus are gathered in an organization called *Ikatan Alumni ITB (IA ITB)*. The organization is intended to keep the alumni bounded for togetherness, as well as contribution to the campus life and society in general.

The global emerging network is come from the micro interaction among social actors and the process can be represented as Bayesian process as showed in figure 2. There would be a probability function as an actor $x_i \in X$ approaches her friend in the set of $Z = \{z_1, z_2, z_3, ...\}$, for example *A, B,* and *C*, the probability of *A* and *B* are interconnected is proportional to the probability of $p(z)$ and conditional probability of $p(z \mid x)$ - can be written as,

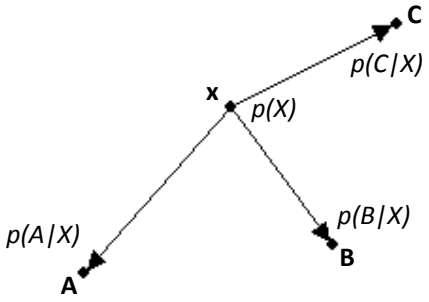

Figure 2
The Bayesian network showing the representation of the *silaturahmi* among alumni

$$p(X, Z) = p(Z)\, p(Z \mid X) \tag{1}$$

thus since

$$p(Z \mid X) = \prod_i p(z_i \mid x) \tag{2}$$

then

$$p(x, z) = p(z) \prod_i p(z_i \mid x) \tag{3}$$

In global, summing over the approached friends, we can write

$$p(z) = \int p(z \mid x)\, p(x) dx \tag{4}$$

However, from the Bayesian theorem, we understood that

$$p(x \mid z) = \frac{p(z \mid x)\, p(x)}{p(z)} \tag{5}$$

so that equation 3 turns out to be,

$$p(x, z) = \left[\int p(z \mid x)\, p(x) dx \right] \left[\prod_i \frac{p(z \mid x)\, p(x)}{p(z)} \right] \tag{6}$$

Here we can see that the probabilistic micro properties emerging the connection between X and Z. A practical work can be conjectured from this is the possibility to calculate the emerging new nodes per period of the ideas disseminated in the forum of *silaturahmi*. In some aspects, this Bayesing representation can also be seen as the Sznajd (micro) rule of persuasion as showed in [3,7]

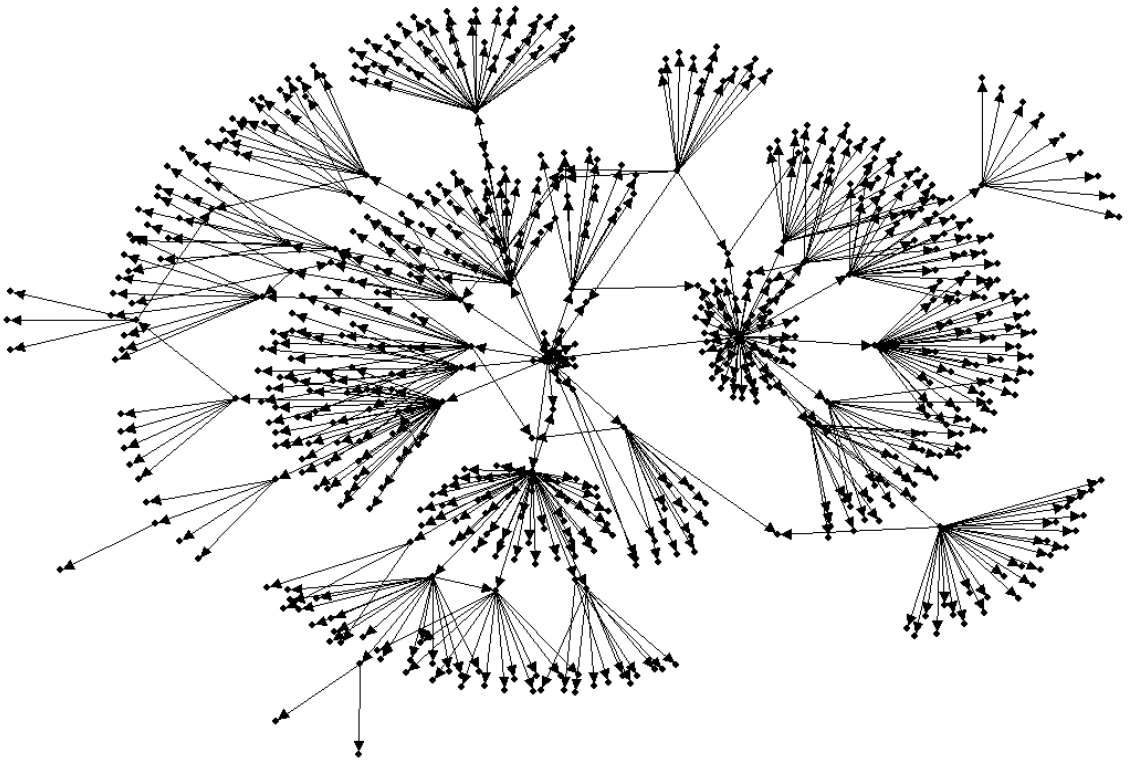

Figure 3
The topological structure of the emerging network of the sampled ITB alumni

3. The Topology of *SIlaturahmi* Network

The organization and communication activities among alumni was worked out for about six weeks by using the rule as described in the previous section. The yielded topology of the network is then becoming an interesting part of our discussion. It is interesting that the yielded graph topology can be categorized as a small world network. Small World Network can be recognized as a graph representation in which most vertices are not neighbors of one another, but most of them can be reached from every other by a small number of steps. As it showed in [1, 8, 10], the small world graph can be identified by observing the clustering coefficient (C) of the network and the average shortest path length between vertices ($\lfloor d \rfloor$) along with the the scaling properties in their degree distribution.

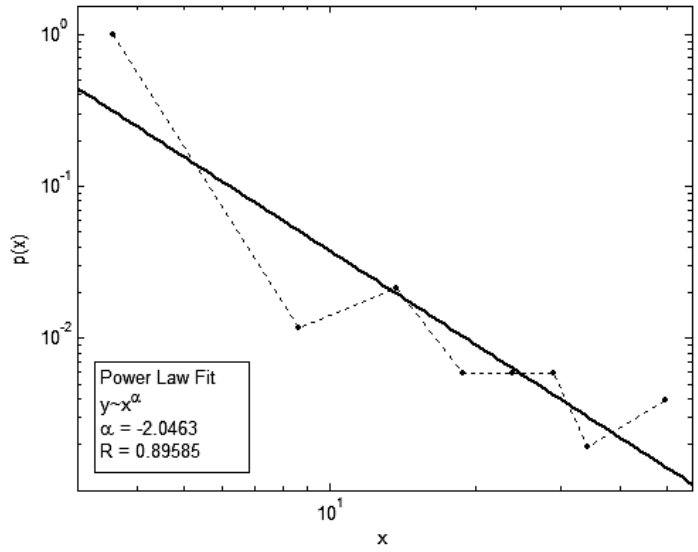

Figure 4
The power law degree distribution of the alumni silaturahmi network

Topologically speaking, if we denote the set of links $e_{ij}, (i, j = 1, 2, ..., N)$ where $e_{ij} = 1$ if an edge exists and $e_{ij} = 0$ otherwise and that the average number of links per vertice is $\overline{k}$ and we can indicate by $\Gamma_i = \{ j \mid e_{ij} = e_{ji} = 1 \}$ the set of immediate neighbors of a person $a_i \in A$, $i = \{1, 2, ..., N\}$. Thus, here we want to observe two main properties of the small world network, *i.e.:*

- ✓ *Clustering coefficient,* defined as the proportion of links between vertices within its neighborhood divided by the number of links that could possibly exist between them. In other words, it measures the average fraction of pairs of neighbors of a node that are also neighbors of each other. Mathematically speaking, the clustering coefficient of each player i, thus can be written as

$$C_i = \frac{1}{|\Gamma_i|}\left(\sum_{j=1}^{N} e_{ij} \left[\sum_{k \in \Gamma_i ; j<k} e_{jk} \right] \right) \tag{7}$$

where

$$|\Gamma_i| = C(k_i, 2) = \frac{k_i (k_i - 1)}{2} \tag{8}$$

since the topology represented here is an undirected graph of which identical e_{ij} and e_{ji}. Thus, the general clustering coefficient of the network can be written as the average over all players A_S,

$$C = \frac{1}{N} \sum_{i=1}^{N} C_i \tag{9}$$

- ✓ *Average shortest path length between vertices*. Let us denote $\delta(i, j) = \min(d_{ij})$ as the minimum path length that links two players $a_i, a_j \in A_S$, the average path length of a player to another can be written as

$$d_i = \frac{1}{N}\sum_{j=1}^{N}\delta_{\min}(i, j) \tag{10}$$

and thus the total average path length in the network,

$$d = \frac{1}{N}\sum_{i=1}^{N} d_i \tag{11}$$

- ✓ *Degree Distribution*. Some of the small world graphs exhibit the scaling properties in their degree distribution. In other words, the probability of a node with degree k scales over the power law

$$P(k) \approx k^{-\alpha} \tag{12}$$

The first two properties described above are the standard parameters to indicate the small world network. The small world structures are highly structured (indicated by $C >>$) but the interconnectedness of the vertices are relatively high (indicated by $d <<$) both relatively to the random graph with the similar structural properties [2]. However, in our observation to the big picture of the yielded graph, the three properties are interestingly exhibited. Table 1 summarizes the result of our observation for the first two of the properties and figure 4 shows the third one.

Table 1.
The Silaturahmi and Random Graph

graph	*Clustering Coefficient*	*Average Shortest Path*
Random Graph	0.0033	95.08
Silaturahmi Graph	0.0171	4.203

4. Discussions

Specific social cohesiveness among social actors regarding to *silaturahmi* relation depends upon the domain of social interaction, e.g.: the working place, hobbies, interests, of each. Some of the clustered was made by the alumni of same faculties while they were students, while the other are made by alumni in the same working place, social club, and other interest-based forum [*cf.* 4, 11]. Interestingly, since the data was retrieved from the way to disseminate campaigned messages, the listed alumni are also reflecting the institutional aspirations and programs campaigners or respective candidate should bring if they were elected to manage the *silaturahmi* institution. This is an interesting formal approach for a bottom-up participation-based program-making that could be conducted in other institutions based *silaturahmi* in Indonesia. Thus, beside a constituent gives vote, she also organize social actors related to them to win the election and have their aspiration transformed into a real program [9].

The topology of the whole networks becomes a way to portray how the system worked in a *silaturahmi* forum. It is worth noting that the interaction among the social actors as reported in this paper is not formally held but kept in the way the regular communication and interaction are went on. This fact, however, shows that in the case of *silaturahmi* forum, the small world network is also emerged, and empirically demonstrated in daily basis.

5. Concluding Remarks

We have introduced the interesting concept of *silaturahmi* as an important basis of a lot of community and social forum in Indonesia and presented the its Bayesian representation in a way of conveying campaigning messages in a specific election in the institution of alumni *silaturahmi* forum. The macro view of the yielded network shows the very clustered structure reflecting differences of daily life aspects of each social elements.

We show that this topology emerges the small world topology while in return presenting some conjectures that can be taken to manage an organization related to participatory program-making as well as gaining more voters and wider the constituents circle.

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