TELKOMNIKA, Vol.13, No.2, June 2015, pp. 654 ~ 660
ISSN: 1693-6930, accredited A by DIKTI, Decree No: 58/DIKTI/Kep/2013
DOI: 10.12928/TELKOMNIKA.v13i2.649

Determining Trust Scope Attributes Using Goodness of Fit Test: A Survey

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Abstract

Indonesian, as one of the countries with high number of internet users has the potential to serve as the place with great information resources. However, these resources must be accompanied by the availability of dependable information. Information trustworthiness can be obtained by assessing the confidence level (trust) of the source of information. This can be determined by using trust scope attributes. Hence, in this study, we intended to establish the trust scope attributes by means of utilizing the ones contained in the User Profile provided by social media; in this case Facebook, Google+, Twitter, and Linkedin. We carried out the research by conducting four stages namely data collection, attributes grouping, attribute selection, and surveys. The data collected originated from the User Profile contents of the 4 social media researched: Facebook, Twitter, Google+, and LinkedIn. A survey was then distributed to 257 randomly selected respondents (divided into two clusters: civilians and military officers) to seek for their opinions in terms of what attributes were considered to be crucial in defining the believability of an information source. Chi-square Goodness of fit Test was conducted to compare observed data with data we would expect to obtain. The results of the research suggested that there was similar judgment in terms of dictating source of information trustworthiness chosen by the research participants with the attributes provided by trust scope category. In this research, both civilians and military officer clusters concurrently perceived that educational background was the most dependable attribute. They subsequently indicated that the place where a person studies, occupation, and place of work were essential attributes to ensure a source of information trustworthiness.

Keywords: *Referral Trust, Functional Trust, Trust Scope, Trust Scope Attributes, Goodness of Fit Test Chi-Square*

1. Introduction

Nowadays, people in Jakarta are among the largest internet users–especially on Twitter- in Asia and are number 4 in the world. This fact proves that Indonesia has abundant of information and potential information sources used in decision making. Trust information is obtained based on level of trust and reputation of the information sources. There are some trust models developed to determine trust level, such as trust model that can help users to assess the trustworthiness of an application [1]; to determine trust level of internet users [2]; and to dictate trust level of the peer to reserve services [3]; to determine trust level and reputation of teammate without knowing the person to be selected [4].

Trust information is used to decide trust level of the media distributing information or social networking, such as *Facebook*, *Twitter*, *Google+*, *Linked In* and so on. Users of the social networking site may create a personal profile, exchange messages, including automatic notifications when their profile is updated with new content from other users [5], therefore, the profile is one way to knowledge sharing from one system to another [6].

User profile is used in several researchs for the purpose of identifying and matching a person. Alisa and Gordon (2005) used user profile to integrate contextual information about mobile users and devices in their environtment [7]. They used user location as the main drives for the context-aware information, because location-aware information services are services that provide the user with the information set that is related to their current position. Results of this research, they have identified the contextual element needed to describe the user profile and specified their definition in the proposed Resourch Description Framework (RDF).

Elie Raad et.al (2010) used user profile to solve the problem of matching user profile in its globality by providing a suitable matching framework able to consider all the profile's

Received October 1, 2014; Revised January 22, 2015; Accepted February 14, 2015

attributes. The framework is able to discover the biggest possible number of profiles that refer to the same physical user that existing approches are unable to detect [8].

Olga Peled et.al (2013) used a supervised learning method to match user profiles accross multiple Online Social Networks, this method is based on machine learning thechniques that use a variety of features extracted from a user's profile as well as their friend's profile. Result of the research is high matching performance when the method was evaluated using real-life data collected from two OSNs, Facebook and Xing. The high result is evidence that user identification based on web profiles is conceptually and practically possible [9].

However, the validity and trustworthiness of the information are often time questionable, because, the mechanism to determine information trust level is not provided yet. Therefore, a new model is needed to accommodate the needs to ensure the believability of the information distributed in social media.

We intended to establish an information trust model using trust level of information source [10], utilizing feedback [11], trust level [12], interaction-based [13], context information [14] and reputation of information source [15] parameters.

However in this specific paper we will only discuss source of information trust level which is determine based on trust scope and feedback given by others users. Trust scope is retrieved from the result of information main attribute matching process with the source of information context that exists in *User Profile*. This paper will discuss how to figure trust scope of information sources using referral trust and functional trust approach [16], and survey.

2. Research Method

In this research, the method used to determine attribute trust scope was broken into several processes. They are: data collecting attributes grouping, selecting attributes, and conducting survey. Social media utilized in this research are *Facebook*, *Twitter*, and *Google+*.

Data collection process was conducted by collecting all attributes in *User Profile* provided by the social media chosen in this research. The next step was administering attributes grouping. This grouping method was completed by means of looking at function similarities of each attributes. Selection attributes process was done by observing compatibility between attributes with two categories: *referral trust* (trust which is built based on knowledge of the users) and *functional trust* (trust that is established based on one's ability to solve certain task). Furthermore, survey distribution process was conducted by creating self-administered survey questions, and distributed directly to respondents. We also used survey agency service *(Lembaga Survey Muda Indonesia/LSMI)*.

To ensure whether *Trust Scope* attributes can be used to dictate trustworthiness of the source of information, we randomly surveyed 257 participants: 100 college students, 50 employees from finance domain, 23 medical doctors, 15 university professors, and 69 military officers. The underlying reasons why we selected the participants were as follows. It was assumed that these individuals in as much as their age (above 17 years old), educational background, job responsibilities or job demands, and their work ethics can judge the trustworthiness of a certain information better compared to other segments of population.

We then divided the participants into 2 clusters: civilians (110 participants) and military (69 participants). We assumed that civilians and military officers differ significantly in terms of trusting an information. They are trained to verify the information systematically and very carefully to ensure safety.

In this survey we administered chi-square Goodness of fit Test. We generated two hypotheses for this testing; there are null hypothesis (H_0) and alternative hypothesis (H_a):

H_0: $p_1 = p_2 = ... = p_n = 1/n$
H_a : *there is a probability greater than 1 / n*

Null hypothesis means each attributes have same probability, and alternative hypothesis means at least one attribute has probability greater that others attributes or mean value. Chi-square test (X^2 test) used to hypothesis test, that is a test to compare observation frequency with expectancy frequency. We used following formula to obtain X^2 *value*;

$$X^2 = \sum_{i,j=1}^{r,k} \frac{(o_{ij} - e_{ij})^2}{e_{ij}} \quad (1)$$

We counted uses chi-Square table to get X^2 *table* according to degree of freedom *(df)=(r-1)(k-1)* and significance level *α*. Null hypothesis rejected if chi-square value greater than chi-square table (X^2 value > X^2 table).

3. Results and Discussion

3.1. Analysis

Based on the results gotten from the data collection process We did on Google+, in User Profile section, We found that there were attributes groups named *People*, *Story*, *Work*, *Education*, *Places*, *Basic Information*, *Links*, and *Contact Information*. Each group contains attributes that match its group characteristic (illustrated in Table 1.). The table describes the attributes exists in User Profile on Google+.

Table 1. Attributes in User Profile on Google+

Groups	Attributes
People	In my Circles
	I in they Circles
Story	Tagline
	Introduction
	Bragging Right
Work	Occupation
	Skills
	Employment
Education	School Name
	Major or Field of Study
	Start year
	End Year
	Current
	Description of Courses
Places	City Name
	Current
Basic Information	Gender
	Looking for
	Birthday
	Relationship
	Other Names
Links	Other Profile
	Contributor to
	Links
Contact Information	Home
	Work

User Profile Attributes on *Facebook (Indonesian Version)*, consists of several groups, they are: *work and education*, *Places You've Lived*, *Contact Information, Basic Information, Family* and *Relationships*, *About You* and some additional information such as: *Friend*, *Application*, *Group*, *Photos* as seen in Table 2.

Table 2. Attributes in User Profile on Facebook

Groups	Attributes
Work & Education	Workplace
	Professional Skill
	College
	High School
Places You've Lived	Hometown
	Other Places Lived
Contact Information	Email
	Mobile phones
	Address
	Other Accounts
	Website
Basic Information	Birth Date
	Birth Year
	Gender
	Religious Views
	Language
	Your Political Views
Family & Relationships	Relationships
	Family Member
About You	About You
	Favorite Quotes
Friends	Friend's Name
Group	Group's Name
Photos	
Applications	Application's Name

Twitter User Profile has the following attributes: *Name*, *Username*, *Bio*, *Website*, *Tweeting Since* and *Location*. An account holder can write any kinds of information about him/herself on *Bio* attribute. However, the contents were filled in various kinds of formats. Such as the following: *Bio: inter family, unjani family, TAB family, and muslim family. @addicted to chemistry* (Source: *Twitter*, account holder @agiit_tiiga), or *Bio* which is simply created as follows: *Walikota Bandung 2013-2018* (Source: *Twitter*, account holder @ridwankamil).

The data obtained from the data collection process was then analyzed to see attribute similarities in the three social media chosen. For example, the ones we see on *Situs Web* attribute on *Facebook*, *Website* attribute on *Twitter* and *Links* attribute on *Google+*.

Based on the profile grouping process result of the three social media chosen, it was found that there were 6 profile groups that give information about *social circles*, *the profile*, *job*, *location*, *basic information*, and *educational background* of an account holder. Table 3. shows the profile groups that have been created based on the similarity attributes.

Table 3. Profile groups

Social Media	Groups
Google+	About
Facebook	Friend
	Group
Twitter	Bio
Google+	Story
Facebook	About You
Twitter	Bio
Google+	Work
	Education
Facebook	Work & Education
Google+	Basic Information
Facebook	Basic Information
Twitter	Bio
Google+	Places
Facebook	Places
Twitter	Location
Google+	Links
	Contact Information
Facebook	Contact Information
Twitter	Name
	Username
	Website

After grouping the data, the next process conducted was choosing suitable attribute that match *referral trust* category, as seen in Table 4.

Table 4. Referral trust attributes

Groups	Attributes
Work	*Occupation*
	Skills
Education	*Field of Study*
	Description of courses
Work & Education	*Workplace*
	College
	Professional Skill
About You	*Bio*

The attribute selection process results using *functional trust* category can be seen in the following Table 5.

Table 5. Functional trust attributes

Groups	Attributes
Work & Education	Workplace
	College
	Professional Skill
	Bio
Work	Occupation
	Skill
	Employment
Education	Major or field of study
	Description of Courses

All the attributes obtained, were combined into one big group called *Trust Scope* Trust that will be used to determine source of information trust level. Table 6. shows the newly formed group of attributes (Trust Scope attributes):

Tabel 6. Trust scope Attributes

Groups	Attributes
Trust Scope	Education
	School Name
	Major or Field of Study
	Workplace
	Employment
	Occupation
	Professional Skill
	Skills
	Interested in
	Community

3.2. Survey

Table 7. below describes the observation frequency of 110 participants (civilians). In this table we used 10 attibutes, which is Atr1 for Education attribute, Atr2 for School Name attribute, Atr3 for Major or Field of Studi attribute, Atr4 for Workplace atttibute, Atr5 for Employment attribute, Atr6 for Occupation attribute, Atr7 for Professional Skill, Atr8 for Skills attribute, Atr9 for Interested in attribute, and Atr10 for Community attribute.

Table 7. Observation Frequency

	Atr1	Atr2	Atr3	Atr4	Atr5	Atr6	Atr7	Atr8	Atr9	Atr10	∑
1	1	1	0	0	1	0	3	2	0	5	13
2	2	0	2	0	0	5	4	0	0	3	16
3	1	2	0	2	1	0	5	0	1	1	13
4	1	0	2	2	2	2	0	0	2	0	11
5	2	2	1	3	4	5	8	9	7	17	58
6	1	2	1	4	2	3	12	5	23	31	84
7	4	2	3	2	3	14	14	11	25	16	94
8	2	3	5	11	2	13	14	20	23	4	97
9	4	8	4	13	4	16	20	19	5	2	95
10	9	12	14	14	20	24	8	10	4	8	123
11	7	10	7	21	22	10	5	8	5	2	97
12	15	6	19	21	19	7	4	6	3	5	105
13	7	13	32	9	10	5	2	6	6	6	96
14	13	37	9	4	10	3	4	10	3	2	95
15	41	12	11	4	10	3	7	4	3	8	103
∑	110	110	110	110	110	110	110	110	110	110	1100

Based on observation frequency data seen in Table 7, expectation frequency in each cell was calculated by means of counting the mean. The mean value was obtained by multiplying the sum of observation frequency in each row and the sum of observation frequency in each column divided by the sum of observation frequency in each column. Expectation frequency values can be seen in Table 8.

Table 8. Expectancy frequency

Rank	Atr1	Atr2	Atr3	Atr4	Atr5	Atr6	Atr7	Atr8	Atr9	Atr10
1	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3
2	1,6	1,6	1,6	1,6	1,6	1,6	1,6	1,6	1,6	1,6
3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3
4	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1
5	5,8	5,8	5,8	5,8	5,8	5,8	5,8	5,8	5,8	5,8
6	8,4	8,4	8,4	8,4	8,4	8,4	8,4	8,4	8,4	8,4

Rank	Atr1	Atr2	Atr3	Atr4	Atr5	Atr6	Atr7	Atr8	Atr9	Atr10
7	9,4	9,4	9,4	9,4	9,4	9,4	9,4	9,4	9,4	9,4
8	9,7	9,7	9,7	9,7	9,7	9,7	9,7	9,7	9,7	9,7
9	9,5	9,5	9,5	9,5	9,5	9,5	9,5	9,5	9,5	9,5
10	12,3	12,3	12,3	12,3	12,3	12,3	12,3	12,3	12,3	12,3
11	9,7	9,7	9,7	9,7	9,7	9,7	9,7	9,7	9,7	9,7
12	10,5	10,5	10,5	10,5	10,5	10,5	10,5	10,5	10,5	10,5
13	9,6	9,6	9,6	9,6	9,6	9,6	9,6	9,6	9,6	9,6
14	9,5	9,5	9,5	9,5	9,5	9,5	9,5	9,5	9,5	9,5
15	10,3	10,3	10,3	10,3	10,3	10,3	10,3	10,3	10,3	10,3
Total	110	110	110	110	110	110	110	110	110	110

3.3. Discussion

The data collection process gave us information that *Facebook*, *Twitter* and *Google+* provide attributes that inform people about the profile of an account user. For example, *Google+* supplies *Work*, and *Education* attributes: meanwhile, Twitter uses *Bio* attribute that contains various kinds of information about an account user: and Facebook utilizes *work and education* attribute as the means to give personal information about the account user.

Furthermore, survey results suggested that there was similar judgment in terms of dictating source of information trustworthiness chosen by the research participants with the attributes provided by trust scope category. The Goodness of Fit Test using chi-square gave us the result that chi-square (X^2) value was 765,9588, and chi-square (X^2) table was 153,1979 (X^2 value ≥ X^2 table), therefore H_0 was rejected. This gave us information that the responses were not homogeneous. In other words, our participants gave different judgment in evaluating the each attribute.

For instance, based on the chi-square test, it was discovered that educational background ranked the highest in the civilians cluster's judgment. From the scale of 1 – 15, the

participants gave the highest score (15) to educational background attribute. Followed by, the context of where the education takes place (14); place where the person works/type of job (13); and the community the person belongs to (6). This gives us confidence that trust scope attributes can be used to determine the level of trust toward certain source of information.

Moreover, by means of using the same testing methods, we found that the military officers' cluster concurred that educational background was the most significant attribute to ensure the believability of certain source of information (15). They assigned 10 for context of where the education takes place; place where the person works (10); and occupation (10).

4. Conclusion

Based on the research we have conducted two major conclusions have been drawn:

1. Chi-square test administered informed that the hypothesis was rejected. Which means that each participants surveyed had different opinion in judging trust scope attributes. In this research both civilians and military officer clusters chose that educational background was the most trustworthy attribute.
2. Trust scope has been found to be one of effectif alternatives to determine source of information trustworthiness.

Our recommendation for future research in this domain is to analyze the correlation between attributes selection with account user's background, such as education background, reasons to use social media, and the intensity in using social media.

References

[1] J Matysiewicz. Consumer trust – challenge for e-healthcare. *Management*. 2003: 337–342.
[2] J Tian, J Li. *A Trust Domain-Based Resource Selection Model for Multi-Agen*t. 2009: 280–286.
[3] J Gong, J Chen, H Deng, J Wang. *A Trust Model Combining Reputation and Credential*. WASE Int. Conf. Inf. Eng. 2009; 2008: 635–638.
[4] QX Bo Z, Yang X. *Trust and Reputation based Model Selection Mechanism for Decision-making*. Second Int. Conf. Networks Secur. Wirel. Commun. Trust. Comput. 2010: 14–17.
[5] K Curran, S Morrison, SM Cauley. Google + vs Facebook : The Comparison. *Telkomnika*. 2012; 10(2): 379–388.
[6] N Karna, I Supriana, U Maulidevi. Intelligent Interface for a Knowledge-based System. *Telkomnika*. 2014; 12(4).
[7] A Devli GJ. *Location-Aware Information Services using User Profile Matching*. 8th International Conference on Telecomunications-ConTel. 2005: 327–334.
[8] E Raad, R Chbeir, A Dipanda. *User Profile Matching in Social Networks*. 13th International Conference on Network-Based Information System. 201; 978-0-7695-4167-9: 297–304.
[9] O Peled, M Fire, L Rokach, Y Elovici. Entity Matching in Online Social Networks. *SocialCom*. 2013; 53: 339–344.
[10] Y Gil, V Ratnakar. *Trusting Information Sources One Citizen at a Time*. Proceeding First Int. Semant. Web Conf. 2002.
[11] JM Jiujun C, Yulian W, Ming L, Antti YJ, Kuifei Y. *A New Trust Mechanism Based On Gravitation Model of Reputation Value In Social Network*. Proc. IC-BNMT. 2010: 1035–1039.
[12] V Tundjungsari, JE Istiyanto, E Winarko, R Wardoyo. *A Reputation based Trust Model to Seek Judgment in Participatory Group Decision Making*. Int. Conf. Distrib. Framew. Multimed. Appl. 2010.
[13] K Jung, Y Lee. *Autonomic Trust Extraction for Trustworthy Service Discovery in Urban Computing*. Eighth IEEE Int. Conf. Dependable, Auton. Secur. Comput. 2009*;* 978–0–7695: 502–507.
[14] R Neisse, M Wegdam, M Van S. Trustworthiness and Quality of Context Information. *IEEE*. 2008; 978–0–7695: 1925–1931.
[15] S Javanmardi, CV Lopes. Modeling Trust in Collaborative Information Systems. *Evolution (N. Y)*. 2007.
[16] K Thirunarayan, P Anantharam, CA Henson, AP Sheth. Some Trust Issues in Social Networks and Sensor Networks. *IEEE*. 2010; 978–1–4244: 573–580.