Analysis of Questionnaire Investigation on SNS Utilizing Bayesian Network

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ABSTRACT

Social Networking Service (SNS) is prevailing rapidly in Japan in recent years. The most popular ones are Facebook, mixi, and Twitter, which are utilized in various fields of life together with the convenient tool such as smart-phone. In this work, a questionnaire investigation is carried out in order to clarify the current usage condition, issues and desired functions. More than 1,000 samples are gathered. Bayesian network is utilized for this analysis. After conducting the sensitivity analysis, useful results are obtained. Differences in usage objectives and SNS sitesare made clear by the attributes and preference of SNS users. They can be utilized effectively for marketing by clarifying the target customer through the sensitivity analysis.

Keywords: SNS, Questionnaire Investigation, Bayesian Network

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1. INTRODUCTION

Social Networking Service (SNS) is prevailing rapidly in recent years. Facebook, mixi, and Twitter are the most popular ones. It is well known that Facebook played an important role in communication under the condition that the telephones and/or cellular phones connected with Internet could not make links when the big disaster hit the eastern part of Japan. Google launched forth into SNS by the name Google+ in June 2011. Thus, it has become a hot business spot and it is exerting great influence upon society and economy. In this paper, a questionnaire investigation is conducted in order to clarify the current usage condition, issues and desired functions.

Differences in usage objectives and SNS sites would be made clear by the attributes and preference of SNS users.

For these purposes, we created a questionnaire investigation of jewelry/accessory purchasing (SNS). In recent years, the Bayesian network is highlighted because it has the following good characteristics (Neapolitan, 2004).

- Structural Equation Modeling requires normal distribution to the data in the analysis. Therefore, it has a limitation in making analysis, but the Bayesian network does not require a specific distribution type to the data. It can handle any distribution type.
- It can handle the data which include partial data.
- Expert's know-how can be reflected in building a Bayesian Network model.
- Sensitivity analysis can be easily performed by settling evidence. We can estimate and predict the prospective purchaser by that analysis.

● It is a probability model having a network structure. Related items are connected with directional link. Therefore, understanding becomes easy by its visual chart.

This research utilizes the Bayesian network to analyze SNS users' current usage conditions, issues and desired functions because no variable is required to have normal distribution. Reviewing past researches, there are some related researches as follows. Tsuji *et al.* (2008) have analyzed preference mining on future home energy consumption. There are some papers concerning purchase behavior in the shop (Tatsuoka *et al.*, 2008a, 2008b), but no research has been reported on the SNS users utilizing Bayesian network.

Bayesian network is utilized for this analysis. After executing the sensitivity analysis, useful results are obtained. Differences in usage objectives and SNS sites are made clear by the attributes and preference of SNS users. It can be utilized effectively for marketing by clarifying the target customer through the sensitivity analysis.

The rest of the paper is organized as follows. The outline of questionnaire research is stated in Section 2. In Section 3, an analysis by hypothesis testing is executed. In section 4, Bayesian network analysis is executed which is followed by the sensitivity analysis in Section 5. Section 6 is a summary.

2. OUTLINE OF QUESTIONNAIRE RESEARCH AND EXAMINEES

2.1 Outline of Questionnaire Research

We make a questionnaire investigation concerning the SNS. Outline of questionnaire research is as follows.
(1) Scope of investigation : student, government employee, and company employee, etc., Japan
(2) Period : April/26/2012–June/6/2012
(3) Method : mail, online and self-writing
(4) Collection : number of distribution 1,500; number of collection 1,197 (collection rate 79.8%); Valid answer 1,098

Analysis methods are as follows.
Questionnaire results are analyzed in three ways. First, analysis by hypothesis testing is executed inSection3 in order to confirm the hypotheses. Second, analysis by Bayesian Network is executed in Section4 in order to clarify and visualize the causal relationship among the items. Third, analysis by sensitivity analysis is executed in Section 5 in order to predict the prospective purchaser as is shown in Table1.

Table 1. Analysis procedure

Step	Aim of analysis	Used method
①	Confirm hypotheses	Hypothesis testing
②	Build Bayesian network in order to clarify and visualize the causal relationship among items	Bayesian network analysis
③	Predict the prospective purchaser	Sensitivity analysis

2.2 Outline of Examinees

Table 2. Major single variable summary results

Questionnaire	No. of answer (%)
Q1. Use the SNS	
Use	792 (72.1)
Do not use	306 (27.9)
Q13. Gender	
Male	650 (59.2)
Female	448 (40.8)
Q14.Age	
<20	196 (17.9)
21~30	328 (29.9)
31~40	299 (27.2)
41~50	194 (17.7)
51~60	73 (6.6)
> 60	8 (0.7)
Q15. Occupation	
Student	295 (26.9)
Government employee	15 (1.4)
Company employee	595 (54.2)
Schoolteacher/staff	43 (3.9)
Clerk of organization	19 (1.7)
Independents	45 (4.1)
Temporary employee	15 (1.4)
Part-timers	53 (4.8)
Miscellaneous	18 (1.6)
Q16. Residence	
Hokkaido	22 (2.0)
Tohoku region	49 (4.5)
Kanto region	157 (14.3)
Chubu region	176 (16.0)
Kansai region	400 (36.4)
Chugoku region	110 (10.0)
Shikoku region	105 (9.6)
Kyushu region	79 (7.2)

3. THE RESULTS OF STATISTICAL HYPOTHESIS TESTING

3.1 Outline of Questionnaire Research

χ^2 hypothesis testing is executed on users' SNS

consciousness. χ^2 hypothesis testing is to clarify the difference between the expected value and the observed data, which is shown in Eq. (1).

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i} \qquad (1)$$

where O_i is an observed data and E_i is an expected value.

Hypotheses are built based upon the following viewpoints (Table 3).

Table 3. Hypothesis building viewpoints (source: Kotler *et al.*, 2012; revised by the writer)

Consumers' characteristic	
Demographic	Sex, age, family, occupation
Geographic	Urban city, rural city, Tokyo/Osaka
Psychographic	Life-style, personality
Usage condition	Daily use, business use
Consumers' response	
Benefit response	Quality, endurance, after sales service, economical, convenience, swiftness
Usage ration response	Big user, etc.
Type of users	Non-user, former user, first user, regular user, etc.
Frequency	Light user, heavy user, etc.
Royalty	Absolute, non, etc.
Attitude towards products	Fanatic, negative, etc.

1. Difference of evaluation between user and non-user for SNS
2. Difference of evaluation by attribute
3. Difference of evaluation by residential area
4. Difference of usage by each SNS
5. Difference of Psychographic characteristics between user and non-user for SNS

As it takes so many pages, we omit "3" stated above. We set 6 themes as follows. These are extracted from the discussion of the authors.

Theme 1: In integrated genre SNS such as Facebook, users feel interests by sharing the information on the current condition with friends.
Theme 2: Young people use SNS more frequently and dispatch much more information than seniors.
Theme 3: Company employees mainly use integrated genre SNS such as Facebook while students often use game genre SNS such as GREE.
Theme 4: Singles want to build a new network by utilizing SNS.

Theme 5: Females use Facebook, the mixi, and YouTube more frequently than males.
Theme 6: Those who like outdoors activities spread the information much more than those of indoor activity type.

3.2 The Results of Statistical Hypothesis Testing

The results of statistical hypothesis testing are as follows.

Theme 1: In integrated genre SNS such as Facebook, users feel interests by sharing the information of current condition with friends.

Null hypothesis: It is not clear whether users feel interests by sharing the information of current condition with friends in Integrated genre SNS such as Facebook.

Table 4. Cross tabulation result 1

Q6①	Q4 (%)			
	Facebook	mixi	Twitter	Google+
Think so very much	0.537	0.195	0.170	0.011
Slightly think so	0.434	0.139	0.132	0.021
Ordinary level	0.167	0.064	0.115	0.064
Slightly not think so	0.294	0.000	0.088	0.088
Do not think so	0.087	0.087	0.174	0.043
Sum	0.439	0.150	0.147	0.024

	YouTube	Niconico β	Ustream	GREE
Think so very much	0.025	0.014	0.000	0.005
Slightly think so	0.128	0.011	0.000	0.011
Ordinary level	0.179	0.051	0.000	0.000
Slightly not think so	0.147	0.206	0.000	0.059
Do not think so	0.174	0.087	0.000	0.087
Sum	0.087	0.027	0.000	0.012

	Mobage	Hangame	Ameba	Taberogu
Think so very much	0.016	0.000	0.008	0.005
Slightly think so	0.021	0.011	0.028	0.021
Ordinary level	0.115	0.000	0.013	0.064
Slightly not think so	0.059	0.000	0.000	0.029
Do not think so	0.043	0.043	0.043	0.043
Sum	0.031	0.005	0.017	0.019

	KAKAKU.com	Ameba pico	myspace
Think so very much	0.003	0.000	0.000
Slightly think so	0.011	0.004	0.000
Ordinary level	0.077	0.013	0.000
Slightly not think so	0.029	0.000	0.000
Do not think so	0.043	0.000	0.000
Sum	0.015	0.003	0.000

	foursquare	Orkut	PowerLink
Think so very much	0.000	0.000	0.000
Slightly think so	0.000	0.000	0.000
Ordinary level	0.000	0.000	0.000
Slightly not think so	0.000	0.000	0.000
Do not think so	0.000	0.000	0.000
Sum	0.000	0.000	0.000

	Life Shot	Miscellaneous	Total
Think so very much	0.000	0.011	1.000
Slightly think so	0.000	0.028	1.000
Ordinary level	0.000	0.077	1.000
Slightly not think so	0.000	0.000	1.000
Do not think so	0.000	0.043	1.000
Sum	0.000	0.024	1.000

Real number	Integrated SNS[*]	Miscellaneous[†]	Sum
Important	537	109	646
Not important	25	32	57

Expectation	Integrated SNS[*]	Miscellaneous[†]	Sum
Important	516.4	129.6	646
Not important	45.6	11.4	57

[*] includes Facebook, mixi, Twitter and Google+,
[†] the other SNS.

Statistic(χ^2 value)	50.627
Rejection region(1% significance level)[*]	$Z > 6.635$

[*] Rejection region is over 6.635 for 1% significance level and 3.841 for 5% significance level by 1 degree of freedom.

The null hypothesis is rejected with 1% significance level. It can be said that in Integrated genre SNS such as Facebook, users feel interests by sharing the information of current condition with friends. It can generally be said that Integrated SNS is the most suitable tool for communication compared with other genre SNS.

Theme 2: Young people use SNS more frequently and dispatch much more information than seniors.

Null hypothesis: Young people use SNS as frequently as seniors and also dispatch information similarly.

Table 5. Cross tabulation result 2-1

Q2	Q14 (%)						
	< 20	21–30	31–40	41–50	51–60	> 60	Total
More than 5 times a day	0.383	0.338	0.197	0.076	0.007	0.000	1.000
Around 3~4 times a day	0.197	0.421	0.243	0.112	0.026	0.000	1.000
Around 1~2 times a day	0.112	0.341	0.324	0.176	0.047	0.000	1.000
Around 4~5 times a week	0.135	0.173	0.346	0.269	0.077	0.000	1.000
Around 2~3 times a week	0.157	0.196	0.373	0.275	0.000	0.000	1.000
Around 1 times a week	0.061	0.303	0.303	0.212	0.121	0.000	1.000
Around 2~3 times a month	0.000	0.444	0.333	0.111	0.111	0.000	1.000
Around 1 times a month	0.000	0.167	0.583	0.167	0.083	0.000	1.000
Less than that	0.059	0.294	0.412	0.118	0.118	0.000	1.000
Sum	0.226	0.331	0.271	0.139	0.033	0.000	1.000

Real number	< 40	> 40	Sum
More than once a day	529	83	612
Else	122	52	174

Expectation	< 40	> 40	Sum
More than once a day	506.9	105.1	612
Else	144.1	29.9	174

Statistic(χ^2 value)	25.335
Rejection region(1% significance level)	$Z > 6.635$

Table 6. Cross tabulation result 2-2

Q8	Q14 (%)						
	< 20	21~30	31~40	41~50	51~60	> 60	Total
Every time	0.304	0.304	0.278	0.101	0.013	0.000	1.000
Frequently	0.251	0.371	0.246	0.114	0.017	0.000	1.000
Sometimes	0.213	0.362	0.253	0.129	0.043	0.000	1.000
Scarcely	0.152	0.273	0.303	0.235	0.038	0.000	1.000
Never	0.231	0.212	0.385	0.115	0.058	0.000	1.000
Sum	0.221	0.333	0.271	0.140	0.034	0.000	1.000

Real number	< 40	> 40	Sum
Frequently	222	32	254
Else	139	45	184

Expectation	< 40	> 40	Sum
Frequently	209.3	44.7	254
Else	151.7	32.3	184

Statistic(χ^2 value)	10.436
Rejection region(1% significance level)	$Z > 6.635$

The null hypothesis is rejected with 1% significance level. It can be said that young people use SNS more frequently and dispatch much more information than seniors. The SNS market is growing owing to the prevailing smartphones for one reason. com Score in the United States reported that the smartphone users in Japan consist of the following division of generations: 18–24, 19.4%; 25~34, 25.6%; 35~44, 22.7%; 45~54, 12.5%; 55~64, 8.6%; in which 45% are 18~35 generation.

Theme 3: Company employees mainly use Integrated genre SNS such as Facebook while students often use game genre SNS such as GREE.

Null hypothesis: It cannot necessarily be said that company employees mainly use Integrated genre SNS such as Facebook while students often use game genre SNS such as GREE.

Table 7. Cross tabulation result 3

Q15	Q4 (%)			
	Facebook	GREE	mixi	Twitter
Student	0.188	0.020	0.270	0.223
Company employee	0.800	0.000	0.100	0.100
Government employee	0.530	0.010	0.080	0.134
School teacher/staff	0.667	0.000	0.111	0.000
Clerk of organization	0.500	0.000	0.286	0.071
Independents	0.725	0.000	0.075	0.025
Temporary employee	0.636	0.000	0.091	0.000
Part-timers	0.500	0.000	0.088	0.059
Miscellaneous	0.615	0.000	0.154	0.077
Sum	0.438	0.011	0.148	0.145

	Google+	YouTube	Niconico β
Student	0.031	0.105	0.063
Company employee	0.000	0.000	0.000
Government employee	0.023	0.088	0.013
School teacher/staff	0.000	0.074	0.000
Clerk of organization	0.000	0.071	0.000
Independents	0.000	0.125	0.000
Temporary employee	0.000	0.091	0.000
Part-timers	0.118	0.088	0.000
Miscellaneous	0.000	0.000	0.000
Sum	0.027	0.092	0.027

	Ustream	Mobage	Hangame	Ameba
Student	0.000	0.035	0.012	0.012
Company employee	0.000	0.000	0.000	0.000
Government employee	0.000	0.034	0.003	0.008
School teacher/staff	0.000	0.000	0.000	0.000
Clerk of organization	0.000	0.071	0.000	0.000
Independents	0.000	0.000	0.000	0.025
Temporary employee	0.000	0.091	0.000	0.000
Part-timers	0.000	0.000	0.000	0.118
Miscellaneous	0.000	0.000	0.000	0.154
Sum	0.000	0.030	0.005	0.016

	Taberogu	KAKAKU. com	Ameba pico
Student	0.004	0.000	0.008
Company employee	0.000	0.000	0.000
Government employee	0.028	0.021	0.000
School teacher/staff	0.074	0.074	0.000
Clerk of organization	0.000	0.000	0.000
Independents	0.000	0.025	0.000
Temporary employee	0.091	0.000	0.000
Part-timers	0.000	0.029	0.000
Miscellaneous	0.000	0.000	0.000
Sum	0.019	0.015	0.003

	My space	Four square	Orkut	Power Link
Student	0.000	0.000	0.000	0.000
Company employee	0.000	0.000	0.000	0.000
Government employee	0.000	0.000	0.000	0.000
School teacher/staff	0.000	0.000	0.000	0.000
Clerk of organization	0.000	0.000	0.000	0.000
Independents	0.000	0.000	0.000	0.000
Temporary employee	0.000	0.000	0.000	0.000
Part-timers	0.000	0.000	0.000	0.000
Miscellaneous	0.000	0.000	0.000	0.000
Sum	0.000	0.000	0.000	0.000

	Life shot	Miscellaneous	Total
Student	0.000	0.031	1.000
Company employee	0.000	0.000	1.000
Government employee	0.000	0.028	1.000
School teacher/Staff	0.000	0.000	1.000
Clerk of organization	0.000	0.000	1.000
Independents	0.000	0.000	1.000
Temporary employee	0.000	0.000	1.000
Part-timers	0.000	0.000	1.000
Miscellaneous	0.000	0.000	1.000
Sum	0.000	0.024	1.000

Real number	IntegratedSNS	Miscellaneous	Sum
Company employee	297	90	387
Miscellaneous	303	102	405

Expectation	Integrated SNS*	Miscellaneous†	Sum
Company Employee	293.2	93.8	387
Miscellaneous	306.8	98.2	405

*includes Facebook, mixi, Twitter and Google+, and †other SNS stated above.

Statistic(χ^2value)	0.397
Rejection region(5% significance level)	$Z > 3.841$

Real number	Game genre SNS[*]	Miscellaneous[†]	Sum
Student	17	239	256
Miscellaneous	20	516	536

Expectation	Game genre SNS[*]	Miscellaneous[†]	Sum
Student	12.0	244.0	256
Miscellaneous	25.0	511.0	536

* includes GREE, Mobage, and Hangame, [†]other SNS stated above.

Statistic(χ^2 value)	3.235
Rejection region(5% significance level)	$Z > 3.841$

The null hypothesis is not rejected. It cannot necessarily be said that company employees mainly use Integrated genre SNS such as Facebook while students of the use game genre SNS such as GREE. We can observe that Facebook, which is one of the Integrated genre SNS, is used by the people of various type occupations.

Theme 4: Singles want to build a new network by utilizing SNS.

Null hypothesis: Singles do not necessarily want to build a new network by utilizing SNS.

Table 8. Cross tabulation result 4

Q17	Q12②(%)					
	Think so very much	Slightly think so	Ordinary level	Slightly not think so	Do not think so	Total
Married	0.182	0.350	0.239	0.145	0.084	1.000
Single	0.201	0.343	0.271	0.122	0.063	1.000
Sum	0.193	0.346	0.258	0.131	0.071	1.000

Real number	Important	Not important	Sum
Married	202	311	513
Single	87	106	193

Expectation	Important	Not important	Sum
Married	210	303	513
Single	79	114	193

Statistic(χ^2 value)	1.888
Rejection region(5% significance level)	$Z > 3.841$

The null hypothesis is not rejected. It can be said that singles do not necessarily want to build a new network by utilizing SNS.

By another analysis, we could get the result that those who esteem getting acquainted with the friends of the opposite sex by SNS were rather few. It has few relationships with those who esteem building a new network by SNS whether they are single or married.

Theme 5: Females use Facebook more frequently than males, and the same is true with the mixi and YouTube.

Null hypothesis: Females do not use Facebook more frequently than males, nor do they use the mixi and You Tube more frequently than males.

Table 9. Cross tabulation result 5

Q13	Q4 (%)				
	Facebook	mixi	Twitter	Google+	YouTube
Male	0.462	0.124	0.117	0.025	0.108
Female	0.408	0.178	0.181	0.029	0.072
Sum	0.438	0.148	0.145	0.027	0.092

	Niconico β	Ustream	GREE	Mobage	Hangame
Male	0.034	0.000	0.016	0.045	0.009
Female	0.017	0.000	0.006	0.011	0.000
Sum	0.027	0.000	0.011	0.030	0.005

	Ameba	Taberogu	KAKAKU.com	Ameba pico
Male	0.007	0.011	0.023	0.000
Female	0.029	0.029	0.006	0.006
Sum	0.016	0.019	0.015	0.003

	myspace	foursquare	Orkut	PowerLink
Male	0.000	0.000	0.000	0.000
Female	0.000	0.000	0.000	0.000
Sum	0.000	0.000	0.000	0.000

	Life shot	Miscellaneous	Total
Male	0.000	0.020	1.000
Female	0.000	0.029	1.000
Sum	0.000	0.024	1.000

Real number	Integrated Genre's and Moving Picture Genre's SNS[*]	Miscellaneous[†]	Sum
Student	354	90	444
Miscellaneous	283	65	348

Expectation	Integrated Genre's and Moving Picture Genre's SNS[*]	Miscellaneous[†]	Sum
Student	357.1	86.9	444
Miscellaneous	279.9	68.1	348

* includes Facebook, mixi, Twitter, Google+, YouTube, Niconico β, and Ustream,†the other SNS.

Statistic(χ^2value)	0.313
Rejection region(5% significance level)	$Z > 3.841$

The null hypothesis is not rejected. Females do not use Facebook more frequently than males, nor do they use the mixi and YouTube more frequently than males.

Theme 6: Those who like outdoors activities spread the information much more than those of indoor activity type.

Null hypothesis: It cannot necessarily be said that those who like outdoors activities spread the information much more than those of indoor activity type.

Table 10. Cross tabulation result 6

Q21	Q8 (%)		
	Every time	Frequently	Sometimes
Outdoor	0.093	0.195	0.472
Indoor	0.101	0.237	0.430
Cannot choose either	0.106	0.235	0.426
Sum	0.101	0.223	0.441

	Scarcely	Never	Total
Outdoor	0.183	0.057	1.000
Indoor	0.158	0.075	1.000
Cannot choose either	0.165	0.068	1.000
Sum	0.168	0.066	1.000

Real number	Frequently	Else	Sum
Outdoor	71	77	148
Indoor	59	53	112

Expectation	Frequently	Else	Sum
Outdoor	74	74	148
Indoor	56	56	112

Statistic(χ^2 value)	0.565
Rejection region(5% significance level)	$Z > 3.841$

The null hypothesis is not rejected. It cannot necessarily be said that those who like outdoors activities spread the information much more than those of indoor activity type. Indoor activity type persons would use SNS on the PCs.

4. BAYESIAN NETWORK ANALYSIS

4.1 Confirmation of Hypothesis by Utilizing Bayesian Network

Now, we examine the probabilistic inference of Bayesian network by picking up Hypothesis 1 stated above. Set "Facebook" as a parent node and "Relationship" as a child node.
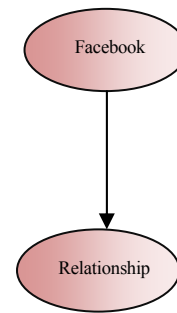

Figure 1. Node and parameter (Hypothesis 1).

As a result, we can see rather high value in Conditional Probability Table (CPT) (posterior probability in Table 11.) for Facebook "Use" and Relationship "Important". This means that users of Facebook are the majority in these questionnaire answerers and they think it important for having relationships.

Building the model with Demographic, Geographic and Psychographic items, we show that SNS can be utilized for further effective marketing in the next section.

Table 11. Built model

Node	Parameter	Prior probability	Posterior probability
			Facebook
Facebook	Use	0.6335	**1.0000**
	Not use	0.3665	0.0000
Relationship	Important	0.8242	**0.8942**
	Ordinary level	0.1019	0.0679
	Not important	0.0739	0.0379

4.2 Model Structure

In constructing Bayesian network, it is required to set an outline of the model reflecting the causal relationship among groups of items. Concept chart in this case is exhibited in Figure 2.

Haga and Motomura (2005) restricted the range of search to the following 5 stages while building the model.
①Selection of variables
②Grouping the variables
③Setting the search range for variable groups
④Setting the search range within the variable group
⑤Building the total structure

She found that it makes possible to interpret the model easily and to forecast the future activities of variables effectively.

We refer to this sample and build a model where cause and effect relationship is assumed by the order of (I) Purchaser ⇒ (II) Extroversion and Usage condition ⇒ (III) Purpose for Usage ⇒ (IV)SNS. This means that (III) Purpose for Usage for (IV)SNS is influenced by (II) Extroversion and Usage condition, and one's sense of value for these is influenced by the (I) Purchaser.
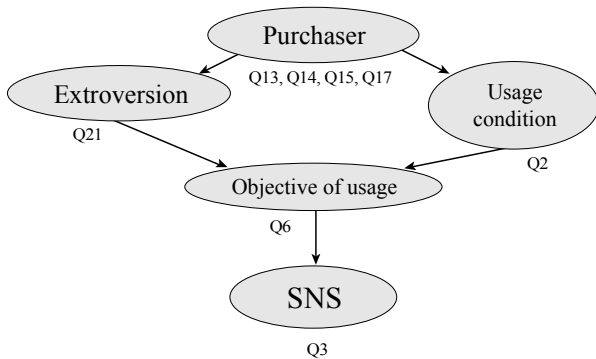
Figure 2. Node and parameter (source: Takahashi *et al*, 2008; revised by the writer).

We used BAYONET software (http://www.msi.co.jp/BAYONET/). When plural nodes exist in the same group, the causal relationship is hard to set a priori. In that case, the BAYONET system sets the sequence automatically utilizing AIC standard. Node and parameter of Figure 3 are exhibited in Table 12.

To decrease the number of nodes, "Think so very much" and "Slightly think so" are condensed into one. So are "Do not think so" and "Slightly not think so." We have chosen 4 sites from Integrated Genre's SNS and 1 site each from Blog Genre SNS, Moving Picture Genre SNS, genre SNS and game genre SNS.

5. SENSITIVITY ANALYSIS

Bayesian network calculates CPT after inputting the data. Sensitivity analysis of Bayesian network is executed mainly by the following two methods.

A. Change the value in CPT
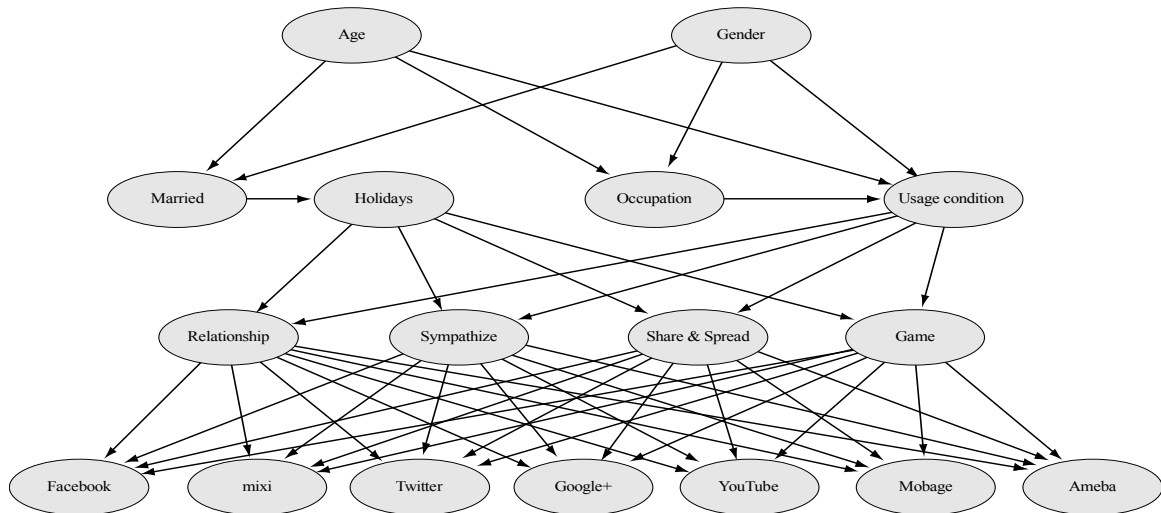Set the certain value in CPT and calculate again. Then

Figure 3. Builtmodel.

Table 12. Node and parameter

Group name	Node in group	Parameter					
		1	2	3	4	5	6
Purchaser	Gender	Male	Female	-	-	-	-
	Age	< 30	< 50	> 50	-	-	-
	Occupation	Student	Company employee	School teacher/staff	Independents	Part-timers	Others
	Married	Married	Single	-	-	-	-
Usage condition	Usage condition	More than 5 times a day	More than 1 times a day	More than 1 times a week	Less than that	-	-
Purpose for Usage	Relationship, sympathize, share and spread, game	Important	Ordinary level	Not important	-	-	-
Extroversion	Holidays	Outdoor	Indoor	Cannot choose either	-	-	-
SNS	Facebook, mixi, Twitter, Google+, YouTube, Mobage, Ameba	Use	Do not use	-	-	-	-

the back propagation is executed and posterior probability is calculated. From the difference of prior probability and posterior probability, its influence can be observed.

B. Add new input

If the data is repeatedly inputted, then it becomes a kind of reinforcement learning, in which repeated data are stressed. Posterior probability is calculated from the new coming data (repeated data). Then the influence can be observed by comparing prior probability with posterior probability.

We use A. method and set evidence 1.0 to "Use" for each node in group (Facebook, mixi, Twitter, Google+, YouTube, Mobage, Ameba), then calculate by the back propagation method. After that, we obtain posterior probability shown in Table 13. If it goes up higher than prior probability, then we can seethe positive influence by "Use" as we have set evidence to the utmost 1.0. If it goes down, then we can see that it has a negative influ-

ence in "Use", i.e., "do not use" would increase.

The result of Hypothesis testing for Hypothesis 1 is as follows. "It can be said that in Integrated Genre SNS such as Facebook, users feel interests by sharing the information of current condition with friends." In the Bayesian network analysis, Evidence 1.0 is set to "Use" in the item of "Facebook" and to "Important" in those of "Relationship." Prior probability and posterior probability is shown in Tables13 and 14.

Hatched parts are the items where posterior probability has increased. From the result, we can observe the following feature and/or characteristics.

"Outdoor typed Single male of Student/School teacher/Independents/Part-timers who are under 30 andlike Facebook use mixi/Twitter/Google+/Mobage/Ameba more than 1 time a week and esteem "Share and spread".

But hatched parts include subtle changes. Therefore, we calculate the odds ratio. It is often seen that the change of the probability becomes small when the hierarchical data cluster is distant. Posterior probability is calculated in the back propagation method. It is often

Table 13. Odds ratio for "Use"

Node	Parameter	Prior probability	Common logarithm	Posterior Probability (**Use**)	Common logarithm	Odds ratio
Gender	Male	0.5918	0.7642	0.5923	0.7723	1.0953
	Female	0.4082	0.6107	0.4077	0.6096	0.9908
Age	< 30	0.4768	0.6776	0.4797	0.6803	1.0251
	< 50	0.4487	0.6513	0.4467	0.6493	0.9826
	> 50	0.0745	0.8722	0.0735	0.8663	0.9014
Occupation	Student	0.2672	0.4265	0.2699	0.4298	1.0273
	Company employee	0.5417	0.7324	0.5175	0.7135	0.8280
	School teacher/staff	0.0399	0.601	0.0421	0.6232	1.2057
	Independents	0.0417	0.6201	0.0459	0.6618	1.4372
	Part-timers	0.0489	0.6893	0.0580	0.7634	2.1151
Married	Married	0.4236	0.6235	0.4172	0.6201	0.9715
	Single	0.5764	0.7513	0.5828	0.7649	1.1599
Usage condition	More than 5 times a day	0.3679	0.5647	0.3120	0.4942	0.5673
	More than 1 times a day	0.4083	0.6107	0.3882	0.5888	0.8332
	More than 1 times a week	0.1745	0.2405	0.1940	0.2878	1.6286
Relationship	Important	0.8242	0.9159	0.8361	0.9222	1.1846
Sympathize	Important	0.3852	0.5885	0.3309	0.5185	0.5670
Share and spread	Important	0.6140	0.7882	0.6217	0.7931	1.0610
Game	Important	0.2538	0.4031	0.1972	0.2945	0.3821
Holidays	Outdoor	0.3106	0.4914	0.3148	0.4969	1.0450
	Indoor	0.2687	0.4281	0.2594	0.4133	0.8856
Facebook	Use	0.6335	0.8014	1.0000	-	-
mixi	Use	0.4950	0.6946	0.5310	0.7251	1.3450
Twitter	Use	0.4219	0.6243	0.4556	0.658	1.3406
Google+	Use	0.1423	0.1523	0.2056	0.3118	6.3593
YouTube	Use	0.5617	0.749	0.5369	0.7292	0.8143
Mobage	Use	0.1159	0.0607	0.1730	0.238	23.3601
Ameba	Use	0.1486	0.1703	0.2220	0.3464	6.6672

Table 14. Odds ratio for "Important"

Node	Parameter	Prior Probability	Common logarithm	Posterior Probability (**Important**)	Common logarithm	Odds ratio
Gender	Male	0.5918	0.7642	0.5932	0.7731	1.1053
	Female	0.4082	0.6107	0.4068	0.6085	0.9817
Age	<30	0.4768	0.6776	0.4931	0.6928	1.1514
	<50	0.4487	0.6513	0.4364	0.6395	0.9020
	>50	0.0745	0.8722	0.0705	0.8482	0.6703
Occupation	Student	0.2672	0.4265	0.2771	0.4425	1.1391
	Company employee	0.5417	0.7324	0.516	0.7126	0.8207
	School teacher/staff	0.0399	0.601	0.0409	0.6117	1.0938
	Independents	0.0417	0.6201	0.0441	0.6444	1.2325
	Part-timers	0.0489	0.6893	0.0557	0.7459	1.7507
Married	Married	0.4236	0.6235	0.4095	0.6117	0.9049
	Single	0.5764	0.7513	0.5905	0.7709	1.2407
Usage condition	More than 5 times a day	0.3679	0.5647	0.3443	0.5366	0.7968
	More than 1 times a day	0.4083	0.6107	0.3979	0.5988	0.9052
	More than 1 times a week	0.1745	0.2405	0.1703	0.2304	0.8938
Relationship	Important	0.8242	0.9159	1.0000	-	-
Sympathize	Important	0.3852	0.5885	0.3729	0.5705	0.8626
Share and spread	Important	0.6140	0.7882	0.5921	0.7723	0.8307
Game	Important	0.2538	0.4031	0.2485	0.3945	0.9308
Holidays	Outdoor	0.3106	0.4914	0.3136	0.4955	1.0333
	Indoor	0.2687	0.4281	0.2651	0.4232	0.9607
Facebook	Use	0.6335	0.8014	0.6593	0.8189	1.2557
mixi	Use	0.4950	0.6946	0.5578	0.7459	1.6658
Twitter	Use	0.4219	0.6243	0.468	0.6702	1.4956
Google+	Use	0.1423	0.1523	0.1878	0.2718	4.3160
YouTube	Use	0.5617	0.749	0.5421	0.734	0.8551
Mobage	Use	0.1159	0.0607	0.1592	0.2014	15.2297
Ameba	Use	0.1486	0.1703	0.2092	0.3201	5.2613

spoken metaphorically that back propagation is a kind of wave after the collision to the wall. Therefore, it decreases greatly as it parts from the "wall." Therefore, we take common logarithm before calculating the odds ratio. The odds ratio is calculated in Tables 13 and 14.

When Evidence is set to 1.0 for "Use" in "Facebook", the Odds ratio parts for more than 2.0 are "Part-timers", "Google+", "Mobage", and "Ameba." These have strong correlation for the users of "Facebook."

When Evidence is set to 1.0 for "Important" in "Relationship", the odds ratio parts for more than 2.0 are "Google+", "Mobage", and "Ameba." These have strong correlation for those who esteem relationship. These have a similarity in having or constructing relationship with friends.

As is stated before, the change of the probability becomes small when the hierarchical data cluster is distant.

To this point, reinforcement learning, for example, may be one of the improving methods to cope with this.

As stated before, if the data is repeatedly inputted, then it becomes a kind of reinforcement learning, in which repeated data is stressed. The decrease is improved by this reinforcement learning and we can observe its influence more clearly. Another improving method is to make shallow the depth of the hierarchy of the model.

Thus, utilizing the sensitivity analysis, we can make clear the difference of usage objective and SNS site by the attributes and preference of SNS users. Sensitivity analysis can be utilized effectively for marketing by clarifying the target customer through the sensitivity analysis.

6. CONCLUSION

SNS has been prevailing rapidly in Japan in recent years. Facebook, mixi, and Twitter are the popular ones. These are utilized in various fields of life together with the convenient tools such as smart-phones.

In this paper, a questionnaire investigation was executed in order to clarify the current usage condition, issues and desired functions. Difference of usage objectives and SNS sites was made clear by the attributes and preference of SNS users. These differences can be utilized effectively for marketing by clarifying the target customer through the sensitivity analysis.

Various cases should be examined hereafter.

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APPENDIX

Questionnaire concerning the SNS

Please answer the following questions. Please write down ○ to the answering items. Plural selection is allowed for the Question 3, 5, 7, 9, 10. Select ①–⑤ of the right column for the Question 6, 11, 12.

1. Do you use the SNS?

Q1 ① YES ② NO * If you answer "② NO", then proceed to Q11, please.

2. How often do you use the SNS?

Q2 ① More than 5 times a day
② Around 3–4 times a day
③ Around 1–2 times a day
④ Around 4–5 times a week
⑤ Around 2–3 times a week
⑥ Around 1 times a week
⑦ Around 2–3 times a month
⑧ Around 1 times a month ⑨ Less than that

3. What kind of the SNS do you use?

Q3 ① Facebook ② mixi ③ Twitter ④ Google+
⑤ YouTube ⑥ Niconico β ⑦ Ustream ⑧ GREE
⑨ Mobage ⑩ Hangame ⑪ Ameba ⑫ Taberogu
⑬ KAKAKU.com ⑭ Ameba pico ⑮ myspace
⑯ foursquare ⑰ Orkut ⑱ PowerLink ⑲ Life Shot
⑳ Miscellaneous (   )

4. What kind of the SNS do you usethemost?

(   )

5. Why is it?

Q5 ① Able to communicate with friends and acquaintances
② Able to seek old friends and acquaintances
③ Able to seek new friends and acquaintances
④ Able to agree with/ appreciate the valuable information
⑤ Able to collect special and delightful information
⑥ Able to browse artists/celebrities' comments
⑦ Able to apply for the campaign
⑧ Able to collect/put out the company's services and service information
⑨ Able to collect/put out hobby and interesting information
⑩ Able to post diary, tweets, moving images and pho-

tos
⑪ Able to play the game (including the online game)
⑫ Miscellaneous ( )

6. What are the SNS's interesting and fascinating points?

Importance	Think so very much	Slightly think so	Ordinary level	Slightly not think so	Do not think so
Q6 ① Able to communicate with each other by diary and tweets					
② Obtained much opportunities to contact with friends and acquaintances who were under rare contact					
③ Able to find new friend who has the same hobby and interest via the Net					
④ Able to get a feeling of intimacy by browsing artists/ celebrities' comments					
⑤ Able to collect news and information efficiently					
⑥ Able to share sympathy by joining a group	①	②	③	④	⑤
⑦ Able to share hobby and interests with friends and acquaintances					
⑧ Able to let others know about myself well					
⑨ Able to control the information for public, which is different from blog					
⑩ Able to retain the thinking of our own opinion and to make the record					
⑪ Rich online game					
⑫ Good for killing time					
⑬ Miscellaneous ( )					

7. How did you come to use the SNS?

Q7 ① To create a new network
② Agree with/ appreciate the valuable information
③ To collect information
④ Utilize to my business
⑤ To apply for the campaign
⑥ To Put out and share the information
⑦ Sound like fun by posting everything
⑧ More easy to handle than those by phone and e-mail
⑨ Suggestion by the friends and acquaintances
⑩ Acquaintances and friends use them
⑪ Became current topics
⑫ Miscellaneous ( )

8. How often do you reply to the comments or share photos and news?

Q8 ① Every time ② Frequently ③ Sometimes
④ Scarcely ⑤ Never

9. What kind of the SNS are you going to continue to use?

Q9 ① Facebook ② mixi ③ Twitter ④ Google+
⑤ YouTube ⑥ Niconico β ⑦ Ustream ⑧ GREE
⑨ Mobage ⑩ Hangame ⑪ Ameba ⑫ Taberogu
⑬ KAKAKU.com ⑭ Ameba pico ⑮ myspace
⑯ foursquare ⑰ Orkut ⑱ PowerLink ⑲ Life Shot
⑳ Miscellaneous ( )

10. Why is it?

Q10 ① Want to enrich communication with friends and acquaintances
② Want to seek old friends and acquaintances
③ Want to seek new friends and acquaintances
④ Want to agree with/appreciate the valuable information
⑤ Want to collect beneficial and delightful information
⑥ Want to browse artists/celebrities' comments
⑦ Want to apply for the campaign
⑧ Want to collect/put out the company's services and service information
⑨ Want to collect/put out hobby and interesting information
⑩ Want to continue posting diary, tweets, moving images and photos
⑪ Want to play the new game (including the online game)
⑫ Miscellaneous ( )

11. Why don't you use the SNS?

Importance	Think so very much	Slightly think so	Ordinary level	Slightly not think so	Do not think so
Q11 ① Do not have interest ② Interesting but do not know how to use ③ Anxious about security concerning individual information ④ Anxious about fee ⑤ Surrounding people do not use them ⑥ Become poor in human communication ⑦ Will waste a lot of time ⑧ Feel uneasy how friends and acquaintances make response ⑨ Cannot continue because it is too bothering ⑩ Likely to increase the spam e-mail ⑪ Miscellaneous ( )	①	②	③	④	⑤

12. What do you expect the SNS in the future?

Importance	Think so very much	Slightly think so	Ordinary level	Slightly not think so	Do not think so
Q12 ① Make full communication with friends and acquaintances ② Want to seek old friends, acquaintances and new friends ③ Encounter the friend/lover of opposite sex ④ Provide the valuable information ⑤ Enrich the collection of information ⑥ Have a space/field for exchanging opinion about goods, service and politics ⑦ Gather interesting information ⑧ To disclose the information of himself ⑨ To make perfect the security of individual information ⑩ Easiness in using ⑪ Restrict the writing in board by others ⑫ Interconnection among SNS functions ⑬ Miscellaneous ( )	①	②	③	④	⑤

About yourself

Q13 <Gender> ① Male ② Female
Q14 <Age> ( ) years old
Q15 <Occupation> ① Student ② Government Employee ③ Company Employee ④ School Teacher/Staff ⑤ Clerk of Organization ⑥ Independents ⑦ Temporary Employee ⑧ Part-timers ⑨ Miscellaneous ( )
Q16 <Address> Prefecture : ( ) City : ( )
Q17 <Are you married?> ① Married ② Single
Q18 <How many children do you have?> ( )
Q19 <Are you positive to do anything?> ① Positive ② Somewhat positive ③ Ordinary level ④ Somewhat passive ⑤ Not positive
Q20 <Do you like to play with many others?> ① Think so very much ② Slightly think so ③ Ordinary level ④ Slightly not think so ⑤ Do not think so
Q21 <How do you spend holidays?> ① Outdoor ② Indoor ③ Cannot choose either
Q22 <What is the most important thing to you?> ① Affection ② Safety and security ③ Honor ④ Clothes/Eating/House ⑤ Self-realization ⑥ Contribution to society ⑦ Recognized from others ⑧ Miscellaneous ( )

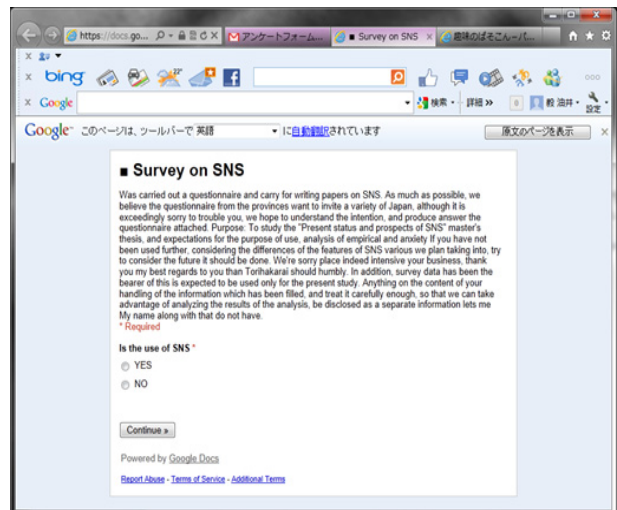The figure below is an on-line data gathering Form for Questionnaire Investigation.

Figure A. On-line data gathering Form for Questionnaire Investigation (https://docs.google.com).