N_016

Model and Consideration on Advertisement Distribution

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1. INTRODUCTION

Almost all methods of traditional advertisement distribution have concerned only primary information distribution via certain kinds of media. However, the rapid growth of the Internet and interactive devices make the secondary information distribution or distribution by consumers to consumers can be performed effectively in various ways such as email. As a result, this kind of distribution has been playing an important role in our society. In order to analyze the next generation of advertisement distribution, not only measurement and analysis of primary information distribution but also the secondary information distribution should be considered.

2. THE FORMULA FOR PROPOSED ADVERTISEMENT DISTRIBUTION MODEL

We already proposed the advertisement distribution model and analysis method [1][2]. In our model, we define "Ready for Primary Distribution", "Primary Pushed", "Consumed", "Secondary Distribution", "Secondary Pushed" and "Discarded" as S_1, S_2, S_3, S_4, S_5 and S_6 respectively, and these states can be described as S_k $(1 \leq k \leq 6)$. Furthermore, we also describe transition probability from S_i $(1 \leq i \leq 6)$ to S_j $(1 \leq j \leq 6)$ as a_{ij}. After considering all kinds of advertisement distribution including consideration that contents may be freely copied by anyone in a certain circumstance, we can generalize the formulation for analyzing the effectiveness of its distribution based on Markov Chain theory shown as below Formula 1.

$$P_{t+1} = P_t A + P_c \qquad (1)$$
$$where\ P_c = [c_1 \quad 0 \quad 0 \quad c_4 \quad c_5 \quad 0]$$

P_t is defined as vector of probabilities of each state at time t, and the state transition probability matrix is defined as A. c_1, c_4 and c_5 represent the copy of primary pull distribution conducted at S_1, the copy of secondary pull distribution conducted at S_4, and the copy of secondary push distribution conducted at S_5, respectively.

An example of using c_1 is web advertisement. We need a value to compensate S_1 in this case; i.e. the quantity of S_1 shall be always kept as 1 because a kind of copy-and-delivery of advertisements happened while accessing the Web site and it does not take any resources away from it. For the c_4, it is similar to c_1 but the copy occurs at S_4. Then, c_4 is needed to compensate S_4.

c_5 is to be added to this formula when number of advertisements being redistributed in the secondary push distribution is increased. For example, one consumer forward multiple advertisement emails.

3. THE EXPERIMENT AND ITS ANALYSIS

To verify whether the proposed model can be used in real-life advertisement distribution, we conducted a practical experiment of advertisement distribution at GITS, Waseda-Honjo Campus.

In our experiment, we set out handbills and Web as the primary advertisement distribution media and period of the experiment is 21 days. We also provide an email service as a tool for distributing the information in the Web site. In other words, consumers can use this service to send emails to their friends easily. In the Web site, we also create functions for counting and recording number of access to our Web site by consumers; and number of transmitting emails from our email service. First, we distributed 50 handbills to students attending the entrance ceremony at GITS, Waseda Univeristy Honjo-Campus. Then three weeks after distributing handbills, we distributed 50 questionnaires to any one in the campus randomly.

3.1 The Analytical Result of Handbill and Word-of-Mouth Distribution

The analytical result from the questionnaires shows the distribution of handbills and word-of-mouth because some consumers use word-of-mouth to distribute the advertisement as secondary distribution. The detail of a_{ij} acquired from the questionnaires gathered after 21 days is clarified in Table 1, and the initial state quantity (P_0) and transition probability matrix (A) are shown in Figure 1.

Transition Probability	Definition	Value
a_{12}	Number of Transmitted Handbills / Number of Printed Handbills	1(50/50)
a_{23}	Number of Consumed Handbills / Number of Successfully Transmitted Handbills	1(50/50)
a_{33}	Number of Stored Handbills / Numbers of Consumed Handbills	0.5714(4/7)
a_{34}	Number of Consumers who Redistributed Advertisement / Numbers of Consumed Handbills	0.2857(2/7)
a_{36}	Number of Discarded Handbills / Numbers of Consumed Handbills	0.1429(1/7)
a_{45}	Number of Redistributed Advertisement / Number of Secondary Distribution Advertisement	1(9/9)
a_{53}	Number of Consumed Redistributed Advertisement / Number of Redistributed Advertisement	1(9/9)
a_{66}	This transition probability is always be 1	1

Table 1: Transition Probability Detail Acquired using Questionnaires

$$P_0 = [1 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0] \quad A = \begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0.5714 & 0.2857 & 0 & 0.1429 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

Figure 1: The Initial State Quantity and Transition Probability Matrix of Handbills and Word-of-Mouth Distribution of 21 Days

Having applied Markov Chain and Formula 1, the result shows that the numbers of advertisement being consumed have increased approximately 3 times of initial absolute value (50) after 21 days. In this analysis we cannot find out the real numbers of handbill and word-of-mouth advertisement being consumed because the distribution may be spread to outside our campus.

3.2 The Analytical Result of Web and Emails Distribution

The analytical result from our count function represents the distribution of Web and email advertisement. The detail of a_{ij} acquired from the count function is presented in Table 2, and the initial state quantity (P_0) and transition probability matrix (A) is shown in Figure 2.

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Having applied Markov Chain and Formula 1, the result shows that the result of Web and email advertisement being consumed after 21 days is 158.9082, and it represents that it is not far from the real result which is 143 obtained from the count function. It shows that the proposed model can present and also predict the advertisement distribution rate of pull and push methods

Transition Probability	Definition	Value
a_{11}	From $\sum_{j=1}^{6} a$ with $a_{12}, a_{16} = 0$	0.6892
a_{13}	By Formula 5	0.3108
a_{33}	From $\sum_{j=1}^{6} a$ with $a_{36} = 0$	0.387
a_{34}	$\frac{\text{Number of Accessing to the Email Service Web Page}}{\text{Number of Access to the Advertisment Website}}$	0.6129(76/124)
a_{45}	$\frac{\text{Number of Transmitted Email}}{\text{Number of Accessing to Email Service Web Page}}$	0.25(19/76)
a_{46}	From $\sum_{j=1}^{6} a$ with $a_{44} = 0$	0.75
a_{53}	$\frac{\text{Number of Consumed Transmitted Email}}{\text{Number of Successfully Transmitted Emails}}$	1(19/19)
a_{66}	This transition probability is always be 1	1

Table 2: Transition Probability Detail of Three Weeks Acquired using Count Function

$$P_0 = [1 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0] \quad A = \begin{bmatrix} 0.6892 & 0 & 0.3108 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0.387 & 0.6129 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0.25 & 0.75 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

Figure 2: The Initial State Quantity and Transition Probability Matrix of Web and Email Distribution of 21 Days

4. CONSIDERATION ON PARAMETERS IMPACT

Each parameter of Formula 1 has a different impact for the effectiveness of advertisement distribution. In order to clarify the impact, we focus on c_5 and a_{34} because both parameters have impacts against the secondary distribution effectiveness and one of our goals is to analyze the factors to increase the effectiveness of the secondary distribution.

Under the same condition in section 3.1, the total quantities of advertisements being consumed after 21 days (Y_{21}) are calculated using the different values of c_5 and a_{34} , which is shown in Figure 3. In Figure 3, the y-axis represents the total quantity Y_{21} , and x-axis represents the different values of c_5 and a_{34} incremented by 0.1 against their original values.By increasing a_{34} , we have to adjust other a_{3x} parameters so that the $\sum_{x=1}^{6} a_{3x}$ shall be always maintained as 1. In this consideration, we assume a_{33} is to be decreased against the a_{34} increasing. It should be noted that value of c_5 and a_{34} are not in the same scale, but we can estimate how large the increments give impacts against Y_{21} in a qualitative way. Consequently, Figure 3 shows Y_{21} rapidly and constantly increases when c_5 increases; whereas in case of a_{34} , Y_{21} gradually increases. Moreover, the result from our simulation also shows that 0.2857, 0.3857, 0.4857, 0.5857 and 0.6857 of a_{34} requires 2, 2.7, 3.4, 4.1 and 4.8 out of 7 consumers to make secondary distribution because this simulation is based on the data in analytical result from the questionnaires, i.e. 0.2857 of a_{34} is obtained by the questionnaires that 2 out of 7 consumers who received the handbill advertisement redistributed the advertisement information.

In general, to increase a_{34} is more difficult and more expensive than to increase c_5 . That is, increasing a_{34} means to increase the number of consumers who are willing to redistribute advertisements, and that requires higher cost; e.g. by conducting marketing campaigns. On the other hand, to increase c_5 is to be done easier, for example, by providing tools which can be easily used for copying and distributing advertisement such as sending multiple emails at the same time.

Figure 4 shows Number of Copied and Re-Distributed Advertisement (in short *NCRDA*) done by 1 consumer with corresponding c_5 under the same condition in section 3.1. The result in Figure 4 shows that if we need 0.0612, 0.1612, 0.2612, 0.3612 and 0.4612 of the c_5 , 1 consumer must copy and redistribute 4.4982, 11.8482, 19.1982, 26.5482 and 33.8982 advertisements, respectively.

Therefore, using our proposed model, it is clearly shown that providing redistribution tools such as email which enable copying of advertisement information in the secondary distribution leads the more effective proliferation of advertisement.

In the actual situation there is almost no possibility that consumers will send more than 10 emails for 1 advertisement. In other words, it is quite difficult to make c_5 more than 0.1612. However, regarding to Figure 3, even 0.1612 of c_5 it gives higher Y_{21} than 0.6857 of a_{34} . This result also represents that increasing number of consumer who will redistribute advertisement gives less distribution effect than increasing number of copied and redistributed advertisement in consumers even only a few numbers of consumer.

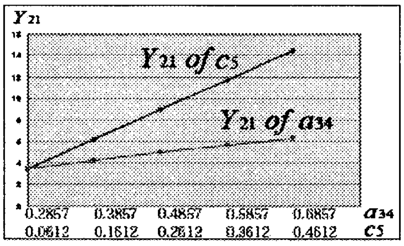

Figure 3: The Impact of c_5 and a_{34} in Formula 1

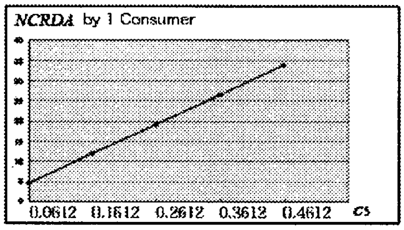

Figure 4: Number of Copied and Redistributed Advertisement by one consumer when c_5 is increased

5. CONCLUSION

Having conducted the experiment to verify the validity and usefulness of our model, we believe that our proposed advertisement distribution model can be used to analyze and measure the entire circulation of its distribution which includes primary and secondary information distributions. Our experiment shows that the model can present a part of the real world advertisement distribution, and analyze its effectiveness. However, there are some remaining issues in the proposed model because this experiment is just simple cases of advertisement distribution. The complicated case of advertisement distribution will be investigated in our future works.

REFERENCE

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