N-030

On Advertisement Distribution Model and Its Analysis Method

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1. INTRODUCTION

Traditionally, almost secondary information distributions of advertisements, distribution by consumers to consumers, have been done by "power of mouth". However, according to the rapid growth of the Internet and interactive media devices, the secondary information distribution can be performed effectively by various methods such as e-mail and etc. Consequently, we can not disregard the power of this distribution anymore. 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 are something must be considered. Hence, we proposed the advertisement model[1] and advertisement distribution model[2] which can be used to analyze and measure the entire circulation including primary and secondary information distribution. In this paper we describe the detail processes in the proposed model for making analysis and representing advertisement distribution. Moreover some of our experiments and its analytical results are discussed as well.

2. THE PROPOSED MODEL

Our proposed advertisement distribution model is composed of 6 states and 11 operations as shown in Figure1.

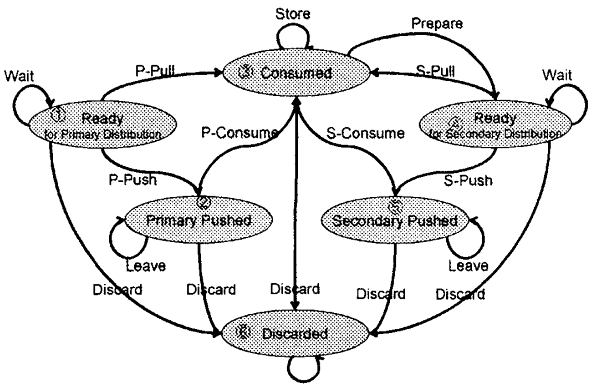

Figure 1: The Proposed Advertisement Distribution Model

As illustrated in Figure 1, 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 $(1 \leqq k \leqq 6)$. Furthermore, we also describe transition probability from S_i $(1 \leqq i \leqq 6)$ to S_j $(1 \leqq j \leqq 6)$ as a_{ij}. Thus, the state transition probability matrix can be considered as Markov Chain Model. Consequently, the matrix model shown in Figure 2 can be analyzed by the Markov Chain theory.

In this model, the summation of total numbers of advertisement being consumed at each instance time of

To (S1 … S6), From (S1 … S6)

$$\begin{bmatrix} a11 & a12 & a13 & 0 & 0 & a16 \\ 0 & a22 & a23 & 0 & 0 & a26 \\ 0 & 0 & a33 & a34 & 0 & a36 \\ 0 & 0 & a43 & a44 & a45 & a46 \\ 0 & 0 & a53 & 0 & a55 & a56 \\ 0 & 0 & 0 & 0 & 0 & a66 \end{bmatrix}$$

Figure 2 :The State Transition Probability Matrix

"t" is mainly observed regarding to below formula.

$$\sum_{t=0}^{n} X_t \ , \ X_t = X_1 + X_2 + X_4 + X_5 - X_6$$

where $X_1 = Input\ from\ S_1, X_2 = Input\ from\ S_2, \dots X_n = Input\ from\ S_n$

X_t and $\sum_{t=0}^{n} X_t$ is numbers of advertisement and the summation of total numbers of advertisement being consumed at each instance time of "t", respectively.

In order to verify the use of this model, 3 simple cases of advertisement distribution including handbills and email advertisements are given corresponding to 3 kinds of information distribution such as "only primary information distribution", "primary and secondary information distribution", and "primary and secondary information distribution with copy". In each example, the transition probability and initial state probability are defined. After used Markov Chain to calculate the model, the condition and graph results are shown as in Figure 4,5,6 respectively.

According to Figure3, if the secondary information distribution is not performed, the numbers of total advertisement consumption will be decreasing to "0". However, if the secondary information distribution is occurred, the number of total advertisement consumption will be increased, and it will be rapidly increased with the occurrence of copy as shown in Figure 4 and 5 respectively.

0.3376*2=0.6752

T(Time)	S1	S2	S3	S4	S5	S6
4	0	0	0.8439	0.1004	0.28	0.3689
5	0	0	0.5754	0.3376	0.1004	0.5799
6	0	0	0.3018	0.2302	0.6752	0.7238

0.2302*2=0.4696

Figure 3 :An Example of Ads distribution with copy

In the third case, we define that the copy is performed in S_4 at every instance time "t". Therefore, the copy parameter should be added to this state and this kind of copy we define it as "Push-Copy" parameter, copy parameter for the push-distribution model such as handbills and emails distribution. An example of this case is shown in Figure 3. This example shows quantity of advertisement in each state at instance time t=4, 5 and 6. These of quantities in each state are acquired by multiplying the quantities of previous time by transition probability. According to this example, when two-time copy is performed at t=5, the 0.3376 which is quantity of

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advertisement in S_4 at t=5 must be multiplied by 2. Therefore, the result is 0.6752. If the two-time copy also occurred at t=6, 0.2302 must be multiplied by 2 which is the same method while t=5. To be noted that, the state probabilities at instance time of t are acquired by using Markov Chain theory.

According to the results from given examples, the proposed model can represent generic advertisement distribution.

To verify whether the proposed model can be used in real-life advertisement distribution and the Markov Chain can be practically used to analyze our model, we conducted practical experiments of advertisement distribution at Waseda-Honjo Campus.

3. THE EXPERIMENT AND ITS ANALYSIS

In our experiment, we use handbills and web as advertisement media. We also provide email service in the website calling EZHONJO for supporting occurrence of secondary information distribution. In this website, we have count and record functions for gathering web access and submitting email information. Furthermore, some gifts are provided as motivation for distributing advertisement information, and the period of experiment is 21 days.

Transition Probability

$$A=\begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0.75 & 0 & 0 & 0.25 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

Summation of total numbers of advertisement being consumed

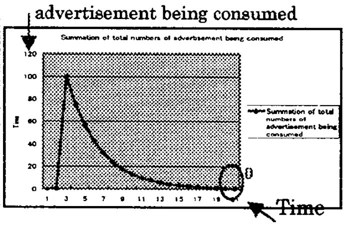

Figure 4: Primary Information Distribution of Handbills

Transition Probability

$$A=\begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0.35 & 0.4 & 0 & 0.25 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

Summation of total numbers of advertisement being consumed

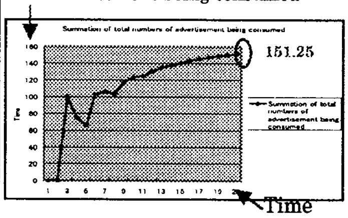

Figure 5: Primary and Secondary Information Distribution of Handbills

Transition Probability

$$A=\begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0.35 & 0.4 & 0 & 0.25 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

Summation of total numbers of advertisement being consumed

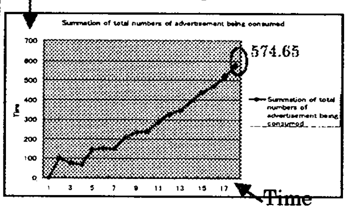

Figure 6: Primary and Secondary Information Distribution of Emails with Copy

First, 50 advertisement handbills are distributed to some GITS students and then we gather the distribution result and making analysis by using questionnaires and count function provided in the website every 7 days. The result from questionnaires and the count function are used to find transition probability, and then Markov Chain is used to calculate the model respectively. Some of our results are shown in Figure 7, 8.

The analytical result from questionnaires represents the distribution of handbills advertisement and it shows that after 21 days the total consumption of the handbills advertisement is approximately 156 as shown in Figure7 and 2.225 handbills are copied in everyday.

The analytical result from the count function in the experimental website represents the distribution of Web and email advertisement. In our analysis, we conclude that making analysis for the pull distribution model such as web and sign board advertisement is different from push distribution model because pull-model advertisement can be copied unlimitedly at anytime. We should include another copy parameter called "Pull-Copy" in S_1 or S_4 at every instance time of "t". Consequently the calculated result is 121.64 as shown in Figure 8 and this result is almost the same to the real result which is 124.

Transition Probability

$$A=\begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0.25 & 0.5 & 0 & 0.25 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

Summation of total numbers of advertisement being consumed

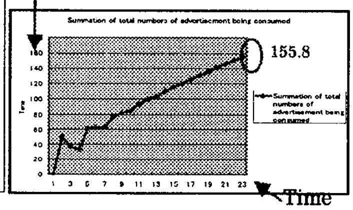

Figure 7: The Analytical Results from Questionnaires

Transition Probability

$$A=\begin{bmatrix} 0.722 & 0 & 0.278 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0.525 & 0 & 0.475 \\ 0 & 0 & 0 & 0 & 0.143 & 0.857 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

Summation of total numbers of advertisement being consumed

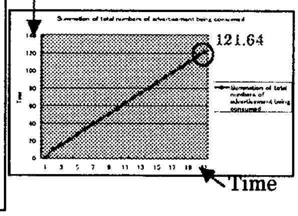

Figure 8: The Analytical Results from Count Functions

4. CONCLUSION AND FUTURE WORKS

We proposed the advertisement distribution model which can be used to analyze and measure the entire circulation of its distribution including primary and secondary information distribution. We also conducted the experiment to verify the validity and usefulness of the model. Our experiment shows that the model can be used to represent the real world advertisement distribution and it can also be used to predict the distribution behavior in the future of time.

In our future works, the dynamic change of transition probability will be investigated and be applied to the proposed model.

REFERENCE

[1] S.Pao, Akiko Seki, Wataru Kameyama, Nobuyuki Kinoshita, Tatsuo Inoue, Yasuhiro Nakanishi, "Some Considerations on Proposed Advertisement Model and Advertisement Distribution", IPSJ SIG-note, No.EIP-26 ,Vol.12.pp2, October 2004

[2] S.Pao, Akiko Seki, Wataru Kameyama, Nobuyuki Kinoshita, Tatsuo Inoue, Yasuhiro Nakanishi, "A Proposal on Advertisement Distribution Model and Discussion on Its Experiment", IPSJ SIG-note, No.EIP-27 ,Vol.32.pp33-39, March 2005