

Modeling Consumers with TV and Internet

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Abstract. The importance of web in marketing has been emphasized and extensive studies have been carried out. On the contrary, there still exist important marketing studies which follow traditional framework. Although the importance of web marketing is undeniable, if we consider the wide spread of hard disk recorders and off-line viewing of TV shows, we have to consider the advertisement effect of off-line viewing using hard disk recorders. In this paper, we propose a framework of consumer modeling to analyze the effect of off-line viewing. It follows multi/cross-channel marketing framework. The important characteristic of the proposed framework is that the stimulation of TV advertisement is assumed to start consumer's behavior. We assume that the TV advertisements stimulate information flows in the social networks and affect purchase behavior of consumers. Although the Internet, especially social network on the Internet, is now playing important role to affect customers behavior during the process, the marketing theory still have to settle TV advertisement as the main factor. To show the adequacy of the proposed framework, this paper reports the effect of TV advertisement on the phenomenon around WWW.

Keywords: Web marketing, TV advertisement, consumer modeling.

1 Introduction

The importance of web in marketing has been emphasized and extensive studies have been carried out. For example, the prediction of box-office record using twitter data [1] and evaluation of advertisement efficiency using web data [2] are typical examples of success based on such studies. The diminishment in TV program rating (See Fig. 1) also emphasizes the importance of this rapidly leaping web marketing. Fig.1 shows the decreases of program ratings in each Japanese TV broadcast channels. The total program rating has been decreased from 37.4% to 31.4% during these 10 years in Japan [3].

On the contrary, there still exist important marketing studies which follow traditional framework. Studies on consumer such as "AIDMA"[4] try to model consumers' purchase behavior theoretically. Corporate marketers have used the theoretical results of these studies in the business. In the standard theory, consumers first acquire product information through stimulation from outside. Articles on magazines and TV program are the typical examples of such stimulation.

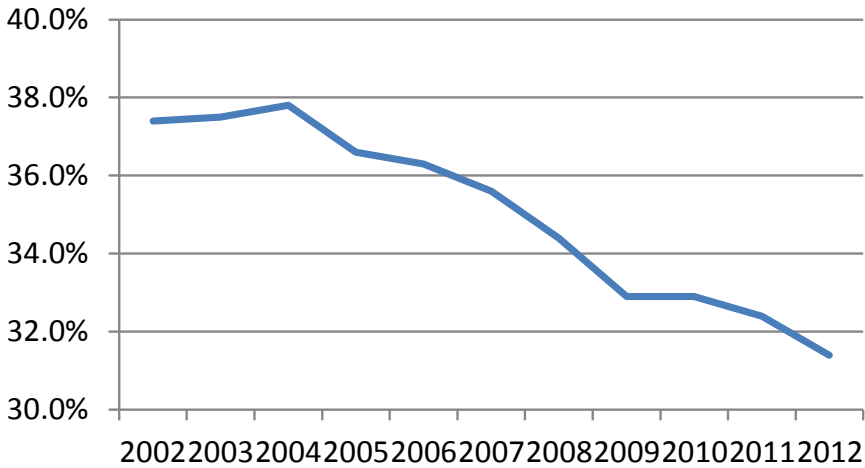


Fig. 1. Program Rating by Household in Japan [3]

Then, they will decide if they purchase the product based on the reputation of their familiar friends.

Since the wide spread of Internet has changed the customer behavior, simple theory cannot handle today's customer behavior. The information resources are spread into various types, and the customer behaviors become complex. This also emphasizes the importance of web marketing. Fig.1 is also used to accelerate this trend toward web marketing

Although the importance of web marketing is undeniable, if we consider the wide spread of hard disk recorders and off-line viewing of TV shows, the same Fig.1 might indicate the increase of total program rating. We have to consider the advertisement effect of off-line viewing using hard disk recorders. Note that the relative decrease of program rating during these 10 years is only 6%. If we consider the rapid spread of hard disk recorders and on-line viewing style of same 10 year period, the actual program rating might have increased.

In this paper, we propose a framework of consumer modeling. It follows multi/cross-channel marketing framework [5]. The important characteristic of the proposed framework is that the stimulation of TV advertisement is assumed to start consumer's behavior. We assume that the TV advertisements stimulate information flows in the social networks and affect purchase behavior of consumers. Motivation behind this framework is our intuition that the effect of TV advertisement is still the main factor in marketing. Although the Internet, especially social network on the Internet, is now playing important role to affect customers behavior during the process, the marketing theory still have to settle TV advertisement as the main factor.

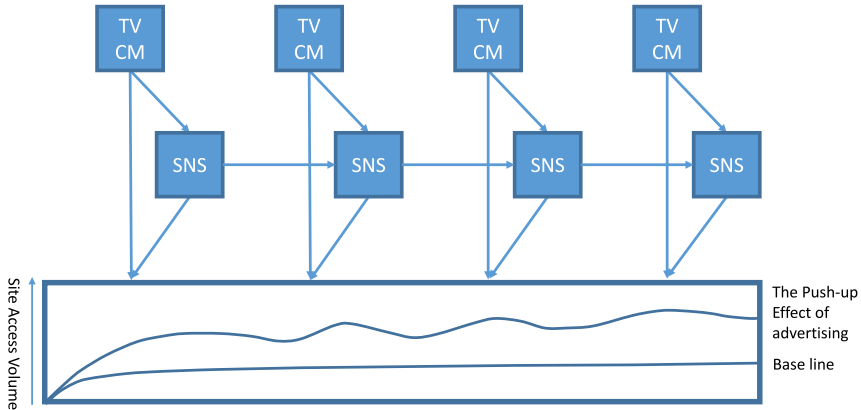


Fig. 2. Multi-Channel Model of Consumer Behavior

2 Multi-channel Model of Consumer Behavior

Fig.2 shows the conceptual image of our multi-channel model of consumer behavior. Important characteristic of it is that the TV advertisements are assumed to be the key factor of the model. We also assume that the information flow through social networks plays an important role in affecting consumers' purchase behavior. However, we believe that the key factor is TV advertisement. It first stimulates consumers. Then, social networks propagate its effect on sales.

Important data shown in Fig.2 are:

1. Data about advertising activities through TV broadcasting.
2. Information flow in social networks
3. Purchase log of Consumers

We plan to analyze the process which is stimulated by the TV advertisements. We will use 1) the broadcasting log of TV advertisements, 2) Twitter data which include the number of positive and negative reactions posted by consumers, and 3) the purchase log of panels. A consulting company makes us use their data on 2) and 3). The data is acquired using a toolbar installed in their web browsers. The current panel size is approximately 300,000. We also use user information such as gender, age, marital status, annual income, residence of panels.

Based on the above marketing data, we try to extract information flow in twitter. How the information is propagated through the panels? What are the common characteristics of the panels who are involved in the propagation? If they form clusters? If the brand of products gives the characteristics to the clusters? Analyzing these points is the target of our study. If we can clarify these points, we can design the best strategy to spent for TV advertising and WWW sites. Budget for the Japanese advertisement in 2012 was 58,913 billion yen, and TV advertisement is about 30% of them [6]. We can use the analyzing results to find best split of such large budget.

3 Preliminary Experiment

3.1 Comparison of Correlations

Our first experiment compares the correlation between purchase, WWW page view, amount of TV advertisement, and amount of keywords given to the search engines. Table 1 shows the results. Using the data acquired from panels (i.e., data gathered through the tool bar), keywords to the search engines and WWW viewing are analyzed. We concentrate on an online commerce site in this experiment. The site is a popular fashion commerce site in Japan. To make Table 1, we count how many times panels search the fashion site name through search engine (“search”). We also count the number of page views of the site (“visit”) and number of page view of purchase pages (“purchase”). We also use weekly based amount of TV advertisements (GRP, “tspot”). Then, we calculate the correlations between weekly based numbers.

Table 1. Correlation between Data

	purchase	visit	tspot	search
purchase	100.0%			
visit	72.2%	100.0%		
tspot	36.9%	35.7%	100.0%	
search	67.6%	90.2%	48.7%	100.0%

As clearly shown in Table 1, “purchase (number of purchase page view)” and “visit (number of page view of the commerce site)” have high correlation. In addition, “search (how many times the site name was searched through search engine)” has high correlation with “purchase” and “visit”. Using other data, we also confirm that “purchase” and “number of tweet” have high correlation (60.4%). However, “tspot (amount of TV advertisement)” has low correlation with them.

3.2 Analysis of Time Series Data

Simple comparison between correlations might miss lead inefficacy of TV advertisements, and exaggerate the importance of the Internet data such as data

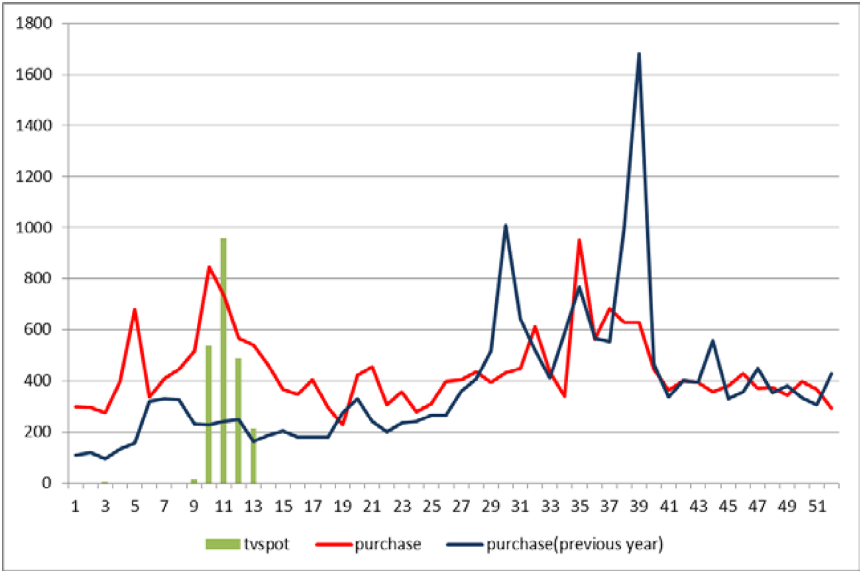


Fig. 3. TV spot and Purchase

from search engine. However, if we carefully analyze the time series of the same data, we can reach opposite conclusion. Figure 3 shows the phenomenon relates to such analysis.

Since “purchase” data is about fashion, seasonality is important characteristics of the data. To see this seasonality, Figure 3 shows the weakly based “purchase” data with “purchase” of previous year. It also shows the amount of TV advertisements “tspot”. Although “purchase” shows clear seasonality (i.e., “purchase” shows similar trends and drifts every year), “tspot” also shows clear relation with “purchase”. To confirm this, we made models which forecast “purchase” based on the past “purchase” and “tspot”. Figure 4, 5 and 6 shows the results.

We used time series environment of weka [7], and made 3 models:

Model 1: Only from previous “purchase”

Model 2: Also use “purchase” of previous year to handle seasonality

Model 3: Also with “tspot”

The root mean square errors (RMSEs) are 69.244, 26.530 and 1.294 respectively. These RMSEs clearly show the seasonality of the data. They also show the efficacy of TV advertisement on “purchase”. The important result here is that “TV advertisements still have large influence on purchase”.

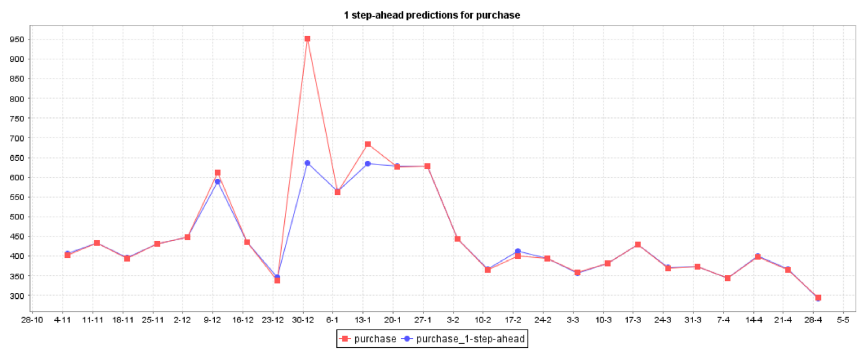


Fig. 4. Analysis based on only Purchase (RMSE=69.224)

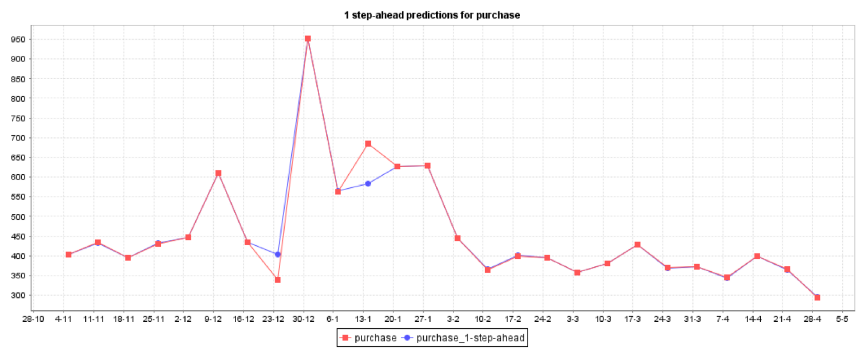


Fig. 5. Analysis with Previous Year Purchase (RMSE=26.53)

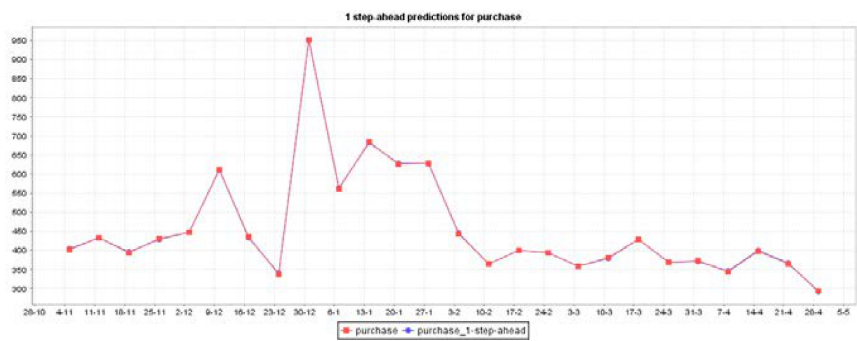


Fig. 6. Analysis with TV spot data (RMSE=1.294)

3.3 Analysis of Other Commerce Sites

The results shown in Fig. 4, 5, and 6 are based on the data about a single commerce site. To confirm the generality of the result, we also check the RMSEs of other commerce sites. Figure 7 shows the results.

Since site 3 is a small site, the number of purchase was not large enough to be analyzed. Thus we made models to estimate number of page views from TV advertisement. Model 1 tries to predict “number of page view” from past page view. Model 2 also uses “page view of previous year”. Model 3 uses “volume of TV advertisement”. The results also show the importance of TV advertisements.

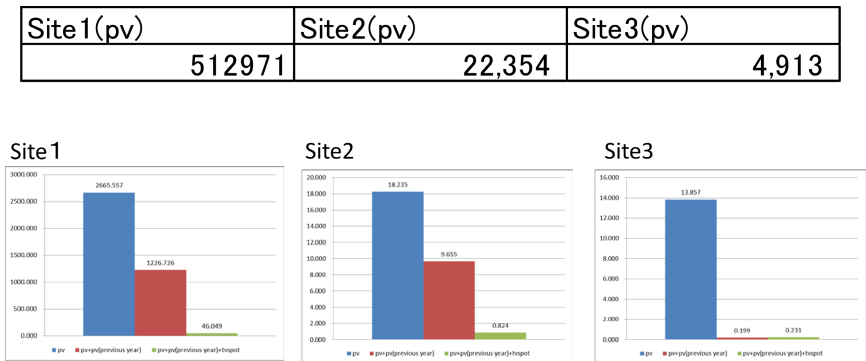


Fig. 7. Analysis of Other Commerce Sites

4 Conclusion

In this paper, we propose a framework of consumer modeling. It follows multi/cross-channel marketing framework and its important characteristic is that the stimulation of TV advertisement is assumed to start consumer’s behavior. We assume that the TV advertisements stimulate information flows in the social networks and affect purchase behavior of consumers. Although the Internet, especially social network on the Internet, is now playing important role to affect customers behavior during the process, the marketing theory still have to settle TV advertisement as the main factor.

To show the adequacy of the proposed framework, this paper analyzes the effect of TV advertisement on the phenomenon around WWW. The experimental results based on the data from 300,000 panels revealed that:

- The root mean square error of a model which predicts purchase of a fashion commerce site from past purchase was 69.244 on our data. The volume information of TV advertisement can decrease the error down to 1.294.
- Similar results (importance of TV advertisement) were also observed on the page view of other commerce site.

- Although our prediction models show the importance of web advertisement, we found simple correlation analysis tends to underestimate the importance of TV advertisements. It tends exaggerate the importance of the Internet data such as data from search engine.

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