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Invited Review

Quantitative models for direct marketing: A review from systems perspective

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A B S T R A C T

In this paper, quantitative models for direct marketing models are reviewed from a systems perspective. A systems view consists of input, processing, and output and the six key activities of direct marketing that take place within these constituent parts. A discussion about inputs for direct marketing models is provided by describing the various types of data used, by determining the significance of the data, and by addressing the issue of selection of appropriate data. Two types of models, statistical and machine learning based, are popularly used for conducting direct marketing activities. The advantages and disadvantages of these two approaches are discussed along with enhancements to these models. The evaluation of output for direct marketing models is done on the basis of accuracy and profitability. Some challenges in conducting research in the area of quantitative direct marketing models are listed and some significant research questions are proposed.

1. Introduction

For product advertising and promotions, there are mainly two approaches that are used in practice: mass marketing and direct marketing. Mass marketing employs mass media to broadcast product related information to current as well as potential customers. The mass media used by marketers include television, radio, magazines, and newspapers. Mass marketing targets large groups of customers. It does not discriminate between customers within a group and the information delivered to customers is uniform. Direct marketing is different from mass marketing in that it targets individuals or households. Different customers are subjected to different marketing information. The Direct Marketing Association (DMA) defines direct marketing as "... communications where data are used systematically to achieve quantifiable marketing objectives and where direct contact is made, or invited, between a company and its customers and prospective customers". Roddy (2002) defined direct marketing as "the delivery of a marketing message or proposition to a target customer or potential customer, in a customer favourable format, put to the customer from the seller or the seller's agents (including call centers) without an intermediary person or indirect media involved". From the two definitions, it is immediately obvious that direct marketing classifies customers so that personalized advertising and promotional activities can be targeted to specific classes of customers. Direct marketing is increasing in importance at present. Barwise and Farley (2005) reported that in some European countries, expenditures on direct marketing have increased from 2001 to 2004. For example, the rate of increase is 14.6% in Germany, 73.6% in the UK, and 5.5% in France, respectively. The direct marketing expenditure in the US is quite significant as well. According to a report issued by Direct Marketing Association (Johnson and Frankel, 2005), the total direct marketing advertising expenditure in 2005 was about $161.3 billion. This is expected to result in $1.85 trillion in increased sales in 2005 accounting for 7% of the $26 trillion in total sales in the US. Direct marketing activities made up 10.3% of the US GDP in 2005. Direct marketing is marked by high efficiency. It is estimated that in 2005 the average profit margin of an investment of $1 in direct marketing advertising was about $11.49 across all industries. When compared to the profit margin of $10.99 in 2003 and $10 in 1999, it can be said that the profitability of direct marketing advertising is growing at a fast pace. Direct marketing is especially profitable for consumer direct marketing. For 2005, it is expected that, on an average, $1 spent on consumer direct marketing would yield $12.66 compared to $10.10 for B2B direct marketing. The use of the Internet has lowered the operational cost for direct marketers and so even a low response rate from customers is often sufficient to guarantee the success of a marketing campaign. Gopal et al. (2001) reported that unsolicited commercial email became cost-effective at a low response rate of 0.5%.

Due to the growing popularity of direct marketing in industry, academic interest and research in direct marketing is flourishing. Sophisticated direct marketing models can help marketers conduct direct marketing campaigns effectively. Elsner et al. (2003) reported the case of Rhenania, a direct marketing company, which continuously moved up in the market after adopting their Dynamic Multilevel Modeling approach. According to Nash

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(1984), the success of a direct mail campaign depended on the offer, the communication elements, the timing, and the selection of customers. These four issues proposed by Nash are the main motivating factors for research in the area of quantitative models for direct marketing. While Nash (1984) only talked about one end of direct marketing, the marketers, Rao and Steckel (1995) proposed a conceptual framework for direct marketing which also included the other end of direct marketing, the customers. In their framework, the main activities customers take part in are receiving solicitations and deciding whether to buy or not. Those activities of customers update the information of marketers and influence the decisions of marketers. Synthetically, quantitative models for direct marketing make use of customers' characteristics and customers' response to help marketers make decisions related to direct marketing activities.

This paper reviews research in the area of quantitative models for direct marketing. In the context of the paper, we defined quantitative models as models that use statistical approaches or machine learning based data mining approaches for direct marketing. We first identified a series of activities conducted in direct marketing. Then we grouped those activities into input, processing, and output; the three basic constructs of a system (Wasson, 2006). It is a simple description but has great generalizability. To supplement the abstract nature of the input–processing–output model, the review is conducted by systematically answering several research questions that will be faced by direct marketers when carrying out practical direct marketing campaigns as shown in Fig. 1.

2. Activities in direct marketing

Direct marketing develops interactions between a company and its customers. A typical interaction between direct marketers and customers begins when direct marketers send solicitations to customers for the purpose of selling products or services. After receiving the solicitations the customers need to decide whether to buy the suggested product or not. By observing the responses from the customers (i.e., buy or not buy), direct marketers adjust their strategy and carry out new rounds of direct marketing activities. In direct marketing the following activities take place sequentially. The first activity is the collection of customer data. Since the revenue of direct marketing depends on how many customers respond to the solicitations, the selection of target customers is the next important activity of direct marketing. Before target selection, usually sophisticated customer profiling is conducted to make the selection more efficient. Selection needs to be optimized in order to satisfy various business requirements and maximize the generated revenue. The final activity is the performance evaluation of the direct marketing activities.

Input

Activity	Questions
Collection of data	What types of data are used?
	What is the significance of different types of data?
	How can marketers choose appropriate data?

Processing

Activities	Questions
Selection of target customers	Who should be selected and how?
Customer profiling	How to understand customers better?
Cross-selling and up-selling	What products or services should be offered to customers?
Direct marketing strategy planning	How can direct marketing activities satisfy business requirements?
	Is single mailing enough?

Output

Activity	Questions
Performance evaluation	Is the model accurate?
	Is the model profitable?

Fig. 1. A systems perspective of direct marketing models.

2.1. Collection of data

Direct marketers are concerned about what type of data to collect about customers that may reveal meaningful information on customer's preferences. Since data is easily available they are not worried about the methods of data collection but at the same time they want to ensure that the collected data is clean, meaningful, and sufficient. The key research questions that are related to this activity are What types of data are used? What are the significances of the different types of data? How can the marketer choose the most appropriate data?

2.2. Selection of target customers

Selection of target customers is the core activity of direct marketing. A target can be an individual. It can also be a household (Bult, 1993; Bult and Wansbeek, 1995). Two important research questions that need to be answered by quantitative models in direct marketing: Who should be selected as target for direct marketing? What techniques should be used for selection of targets? Usually, a score is generated for an individual customer by the selection techniques. The score could take a binary value like one or zero indicating whether a customer would respond or not. It could also take an integer value representing the number or type of products the customer would buy. The score could also take a continuous value between zero and one thereby representing the probability that the customer will complete a purchase or a value representing the revenue that the customer might produce. There are three types of revenues generated by customers that direct marketing models try to estimate. The first is the amount of money a customer might spend as a response to a solicitation. The second is the expected monetary value of a customer's spending that is measured by multiplying the response probability with revenue. The third measure of revenue is the life time value (LTV) of a customer that is mostly used in multi-mailing problems. LTV is calculated as the sum of possible monetary amounts a customer would spend in response to all current and future solicitations. However, in addition to the revenue generated by the customer it is also important to consider the cost of the solicitation. A solicitation cost that is too high can offset the revenue generated by the customer, resulting in a negative contribution for the customer.

2.3. Customer profiling

The key research question that is related to this topic: How should marketers profile customers for effective target selection? Customer profiling includes customer clustering and customer pattern recognition. Customer clustering groups similar customers together and separates dissimilar ones. Customer clustering allows