



Variables importance in questionnaire data on advertising

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ABSTRACT

In this article, we deal with the problem of measuring the importance of features, that determine the purchase of the product after being exposed to an advertisement. We use an algorithm called Monte Carlo feature selection, which is based on multiple usage of decision trees, to achieve a ranking of variables from the questionnaire data. Our data generation process relies on low-involvement during the advertisement watching phase and the comparison of advertised products is based on purchase in a virtual shop.

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1. Introduction

In marketing, the effective advertisement is one of the keys to success. Marketers responsible for the decision, which advertisement should be applied, are interested, prior to the emission, what is the expected result of the emission on customers. For example, whether customers will like it, find it interesting and convenient. Marketers are interested in what associations are created with their brand and product as an effect of watching an advertisement by their customers. Sometimes, a few versions of the same advertisement are produced and the question is, which version should be chosen and shown in mass media. Usually, before the advertisement is broadcasted on TV or printed in newspaper, it is tested whether it will perform its functions well. Answering to these questions may be done using various types of market research techniques. A focus study may be the illustrative example. A small group of potential clients is shown a commercial and then they discuss, among each other, their opinion about it. This discussion is recorded by researchers and then the conclusions are drawn. Sometimes, a wider group of potential customers is shown a commercial and then they fill a questionnaire about the just watched commercial.

However, results obtained from the above mentioned procedures are severely biased, due to the fact, that respondents concentrate during watching advertisements, which is usually not true in real life (people usually switch channels during commercial breaks). One of the key concerns in market research of this type is therefore providing an experimental design, as similar to the real life situation as possible. Also, the effect of advertisement on willingness to purchase in real life may differ from the one declared in questionnaire. In order to diminish this difference, often the research based on low-involvement of respondents is conducted.

After the research is made, the statistical and logical analysis of its results is performed. One of the questions, which should be answered at this stage, is as follows: which features of the product (or advertisement) are most important when making a decision of purchase? Having this knowledge, the marketers may verify, whether their ideas and aims during the design of the advertisement were confirmed by clients. In other words, whether the message from the advertisement was correctly interpreted by the customers. In particular, the marketers may want, according to the long term policy of the company, customers to associate its product with such features as “modern, innovative” and associate the product of competitors as “traditional”. In other words it is possible to find out whether the associations created with the brand (product, user) are in line with the long term policy of the company. Advertisement should coincide with this policy and the market research is a way to verify this coincidence. It is also possible to unveil consumers’ associations with the competing products. Such research enables comparison of the examined brand and product versus its competitors, therefore providing essential information for future campaigns.

The aim of this article is to present the methodology, that is capable to answer the just stated questions. The result is a ranking of variables with respect to their influence on the purchase and on the perception of the particular brand by the customer. This ranking has a clear interpretation and may be easily utilized by the marketers, who do not have statistical or machine learning background. The technique, we apply, is called the Monte Carlo feature selection and was introduced by [Dramiski et al. \(2008\)](#). This article is organized as follows: in the next section, we describe other works that are related to our problem. Then, we discuss in details our data generating process and methodological problems that are related to it. Then, we describe the statistical methodology applied to achieve the importance ranking. In the fifth section, we illustrate this approach to generate the ranking of features, that determine the purchase of an FMCG (Fast Moving Consumer Goods) product.

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Our dataset is gathered from one of the Polish market research agency.

2. Related work

The idea of applying data mining techniques to analyze questionnaire data is well documented in the literature.

In Ramalingam, Palaniappan, Panchanatham, and Palanivel (2006), a group of respondents was asked 50 questions about three advertisements of toothpastes. Then, they were asked about the effectiveness of each advertisement. Then, the neural networks were applied to predict the advertisement effectiveness.

The authors of Terano and Ishino (1996) used C4.5 decision trees and genetic algorithms to achieve clear, simple and interpretable models learned on questionnaires about toothpastes. Conclusions from these models were then the basis for strategy of promotion for domain experts.

In Chen and Yan (2008), the architecture of customer utility prediction system is introduced. It uses conjoint analysis of questionnaire data to measure the product utility value and radial basis function neural networks based on the features of the product as a prediction module. A case study on cellular phone design is presented.

The idea, how to apply association rules to questionnaire data, is described in Chen and Weng (2009). Authors emphasize, that various data types may occur in such datasets and propose a unified approach, based on fuzzy sets, to handle them correctly. They illustrate the performance of their methodology on the survey on the teaching evaluation.

3. Data generating process

Comparing to the previous studies, our dataset has far less observations. There are only tens of questionnaires compared to hundreds or even thousands in articles mentioned before. However, our questionnaires are gathered in an experiment, that is very close to the real life decision process. Now we describe it in details.

We use data gathered during a research conducted by one of the Polish market research agencies. A group of 180 respondents selected with respect to the gender and age was invited to take part in the research. This group was then randomly split into three groups of 60 persons. The first two groups, denoted by E1 and E2 respectively, watched two versions of the same advertisement. The group E1 watched the first version and the E2 group watched the second version. The third group, denoted by K, did not watch any of the two versions. The group K is a control group. In all advertisement blocks for both experimental groups (E1 and E2), the advertisement of the competitor was played. In order to keep this experiment close to the real life, the respondents were informed, that they are invited to the research about the TV programs. Nothing about the commercials was mentioned before the study.

Respondents watched TV programs with commercial breaks. During the commercial breaks, they were allowed to do things, they usually do in this situation. Some of them made a coffee, read newspapers, talked to each other etc. What is important, in these commercial breaks, the advertisements, that were the target of the study, were shown. In this way the low-involvement principle was applied.

After this part, questions about the association with brands and products of the FMCG company, that ordered the research, and with brands and products of its closest competitor, were asked. Also questions about the purchase intentions were asked. Questionnaires were computer aided, i.e. questions were presented on laptops and so were the answers collected. Respondents had to answer questions concerning 37 attributes of the product, brand

or user. Each attribute was used in two questions: (1) in relation to the product (brand, user) of this particular company and (2) in relation to the product (brand, user) of the competitor. This made $2 * 37 = 74$ questions. Each question was repeated three times in random order. So there were overall 222 questions, the customers had to answer. Each question was answered on the 5 grade Likert scale from -2 to $+2$, where -2 means "I totally disagree" and $+2$ means "I totally agree". Each question had the following form: "Does the description *attribute* suits *brand/product/user*?". For example "Does the description 'is expert in cooking' suits 'brand M1'?" Some questions were synonymous and were included in the research in order to filter inconsistent answers, for example "my brand" and "brand for me". Also, three repetitions of the same question were applied for this filtering.

After this part, the questions with inconsistent answers (among three repetitions and among the group of synonymous questions), for each respondent, were deleted. The successive answers to repetitions and synonymous questions were then averaged. This gave 62 explanatory variables. After the questionnaire part, each respondent was given a certain amount of money and he or she was allowed to spend it in a specially arranged shop. The money might have been spent on the product of this particular brand or on the product of the competitor. The prices were reduced in comparison to the real market prices. The respondents could also keep the money for themselves. This last part is called the shelf test.

This last part allows to calculate the categorical binary explained variable: the brand the customer chose, i.e. the brand of the company, that produced the advertisement and ordered the research, or the brand of the competitor. Almost all the customers chose a product and no one kept the money for himself, so this variable has two levels. The individuals, that kept the money, were excluded from the research.

So we have 62 continuous explanatory variables and a two level categorical explained variable. This forms the supervised learning task. The goal is to answer the following question: what are the determinants of purchase? In other words, what are the most important features, the customers take into account when buying a product? What is their perception of this particular brand and the competitor's brand? What features do they associate with these brands?

The goal is to describe the relations between the features of the product implied by the advertisement and the future purchase behavior. In particular, the hierarchy of the variables, with respect to their influence on the purchase, is the key concern. Having two target groups and the control group allows to compare, which elements of the marketing communication, that is which attributes, were activated by each advertisement.

Answering to these questions has very serious business implications. If the advertisement activates an attribute, which is commonly associated with the brand of the competitor, then the advertisement may be unsuccessful. The single advertisement may not be able to break this association, because of the strong association of this particular attribute to the competitor's product. Of course, using a long term advertising policy, it is possible to do so, but it may be too expensive.

Strategies concerning the creation of the image of brands and products are planned in a few year advance. For example, it may be concluded, that a particular advertisement activates an attribute that is seemingly advantageous, but this attribute stays with the contradiction to the policy of the firm. For example, if the advertisement activates "traditional" attribute, but the policy assumes the target group of young people, then this target group may be discouraged to buy this product. In case of the emission of this advertisement, older people are activated, but they may form less profitable segment of the market. What is more, the positive association itself may not be correlated with increase of the purchase.

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