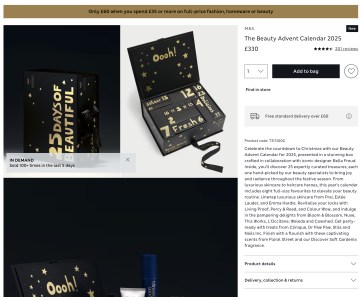
Improving Marketing Efficiency Using Predictive Analytics for M&S (II): Customer Targeting Using Supervised Learning*

MSIN0094 Case Study

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Last week, M&S used unsupervised learning to segment customers based on their spending and income. While segmentation allows M&S to identify customer groups and tailor general marketing strategies, it doesn't directly tell us which customers M&S should target. In this part of the case study, we take a step further by targeting individual customers using supervised learning models, which help identify who is most likely to respond positively to marketing offers.

Recently, M&S has launched its highly anticipated Beauty Advent Calendar for 2025, a curated selection of beauty and skincare products worth £330. This limited-edition calendar is available to customers for only £60 when a customer purchases it alongside other products. With the holiday season approaching, M&S wants to maximize the reach and response of its marketing campaign by promoting the advent calendar offer to the right customers.

M&S decides to use a conventional direct mail marketing strategy, where customers receive colour-printed leaflets via Royal Mail to their doorsteps. Each mailer costs £1.5 to produce and another £0.5 to mail to the customers. M&S also plans to include a small sample of the beauty product, which costs M&S £2 to produce. If a customer responds to the offer, M&S expects them to spend £35 on full-price clothing, homeware, or beauty, and purchase the advent calendar at £60. The COGS for clothing, homeware, and beauty products is 85%. The COGS for the advent calendar is 90%.

*This case was prepared by Wei Miao, UCL School of Management, University College London for the MSIN0094 Marketing Analytics module. This case was developed to provide material for class discussion rather than to illustrate either effective or ineffective handling of a business situation. Names and data may have been disguised or fabricated. Please do not circulate without permission. All copyrights reserved.

Question 1
Based on the information provided, calculate the following values:

1. `cost_per_offer`: the cost of sending a marketing offer
2. `profit_per_customer`: the profit from a customer if a customer responds to the marketing offer

1 Blanket Marketing

M&S's starting point is blanket marketing, a simple strategy where marketing offers are sent to all customers in the dataset. Although easy to implement, blanket marketing can lead to wasted marketing costs, as not all customers are interested or responsive. To analyse the effectiveness of blanket marketing, we'll calculate the Return on Investment (ROI) for this strategy and compare it to more targeted approaches.

M&S has used blanket marketing and sent marketing offers to all 2000 customers in the database. Please calculate the total marketing costs below.

Question 2
Please calculate the total marketing costs for sending marketing offers to all 2000 customers in the dataset. The dataset is the same dataset used in the previous case study.

Next, we'll calculate the total profit from blanket marketing by summing up the profits from all responsive customers in the dataset. M&S has sent out the mail to all 2000 customers in the dataset, and recorded their responses. There is a variable `Response` in the dataset, which indicates whether a customer responded to the marketing offer. We can use this variable to identify responsive customers and calculate the total profit from the marketing campaign.

First, let's calculate how many customers responded to the marketing offer in the dataset.

Question 3
Based on the `Response` variable in the dataset, calculate the total number of customers who responded to the marketing offer. Then calculate the total profit from the marketing campaign.

- Tip: you can use `data_full$Response` to extract the `Response` variable from the dataset as an R vector. Based on this vector, you can calculate the total number of responding customers and the total profit from the marketing campaign.

Return on Investment

ROI = (Profits - Initial Investments) / Initial Investments, which means the return rate of an investment activity.

- ROI needs to be a positive number in order for the company to make profits from the investment.

Therefore, the **Return on Investment (ROI)** on the marketing offer would be

> **Question 4**
> Calculate the Return on Investment (ROI) from blanket marketing.

A negative ROI from blanket marketing means the company makes a loss from sending offers to all customers. The reason is that not all customers are responsive to our marketing offers. It does M&S no good to send offers to those customers who would not respond anyway.

2 Customer Targeting Using Supervised Learning

We have seen that blanket marketing is not an efficient strategy for M&S. In this section, we will use supervised learning models to target customers who are more likely to respond to the marketing offer. By doing so, we hope that M&S can improve its marketing efficiency and increase the ROI of the marketing campaign.

2.1 Break-Even Analysis: Break-Even Response Rate

In order to break even, we can calculate the break-even response rate, which is the **minimum response rate** we need from a customer in order to avoid losing money from sending the marketing offer.

Only if a customer's expected response probability is at least the minimum response rate can we recover the costs of sending a marketing offer. The higher the response probability, the more expected profit we can make from the marketing campaign.

If we send offers to customers whose expected response rate is lower than the break-even response rate, we will lose money on average.

> **Question 5**
> Calculate the break-even response rate from customers. The break-even response rate is the minimum response rate we need from a customer in order not to lose money from sending the marketing offer.

Next, we will use supervised learning models to predict the response rate of individual customers. We will then target customers whose predicted response rate is higher than the break-even response rate.

2.2 Data Analytics Using Supervised Machine Learning

Select Meaningful Features/Predictors from `data_full`, Named `data_full_small`

We need to select meaningful features/predictors from the dataset to train the supervised learning models. We can use the following features as predictors:

- Since ID is solely a customer identifier, it should be removed from the final data

- Since `Dt_Customer` is a character string, which cannot be directly used in the model, we should also remove it

Construct a Training Set and a Test Set

Tasks: randomly divide `data_full` into a training set and a test set

Train a Decision Tree

Tasks: load the `rpart` and `rpart.plot` packages. Follow the code examples in the lecture notes and try to train a decision tree on `data_training`

Predict Response Rate from Decision Tree Model

First, we have already trained the decision tree model, named `decision_tree`, from the training set. We can predict the probability of test set customers responding to our marketing offer, using `predict()`.

Tasks: We should only send marketing offers to customers whose expected or predicted response rate is higher than the break-even response rate. This is called targeted marketing.

Finally, we have decided to send marketing offers to selected responsive customers. We can then compute the ROI for targeted marketing as in the blanket marketing case.

Train a Random Forest (Next Week)

Tasks: load the `ranger` packages. Follow the code examples in the lecture notes and try to train a random forest on `data_training`

If M&S uses random forest, an arguably better supervised learning model, to conduct targeted marketing, we can follow a similar logic as above, and compute the ROI from using random forest.

> **Caution**
>
> Note that the random forest model package in R uses C++ as the backend to speed up the computation. Therefore, if you use a Macbook, you should see the same ROI as above; however, if you use a Windows machine, you may see a slightly different ROI due to the different random number generation algorithms used in C++ on Windows and macOS.

Predictive analytics models can help the company boost the marketing ROI by allowing M&S to target customers who are more likely to respond to the marketing offers than the break-even response rate. By doing so, M&S saves unnecessary marketing costs on those unresponsive customers and therefore improves its marketing efficiency.