



## **Chapter V**

# **Modeling Brand Choice Using Boosted and Stacked Neural Networks**

Rob Potharst, Erasmus University Rotterdam, The Netherlands

Michiel van Rijthoven, Oracle Nederland BV, The Netherlands

Michiel C. van Wezel, Erasmus University Rotterdam, The Netherlands

## **Abstract**

---

*Starting with a review of some classical quantitative methods for modeling customer behavior in the brand choice situation, some new methods are explained which are based on recently developed techniques from data mining and artificial intelligence: boosting and/or stacking neural network models. The main advantage of these new methods is the gain in predictive performance that is often achieved, which in a marketing setting directly translates into increased reliability of expected market share estimates. The new models are applied to a well-known data set containing scanner data on liquid detergent purchases. The performance of the new models on this data set is compared with results from the marketing literature. Finally, the developed models are applied to some practical marketing issues such as predicting the effect of different pricing schemes upon market share.*

## Introduction

---

A classical topic in marketing is modeling brand choice. This amounts to setting up a predictive model for the following situation: to purchase a specific product available in  $k$  brands, a consumer or household chooses one of these brands; the prediction of this choice is based on a number of household characteristics (such as income), product factors (such as price) and situational factors (such as whether or not the product is on display at purchase time). In the past, numerous different models have been proposed for brand choice problems. The best known models are the conditional and multinomial logit models (Franses & Paap, 2001; McFadden, 1973).

During the last decade, methods from computational intelligence, such as neural networks, have been proposed as an alternative to these classical models (Hruschka, 1993; West, Brockett, & Golden, 1997). A recent contribution to the neural networks for brand choice literature is a paper by Vroomen, Franses, and van Nierop (2004) in which neural networks are used to model a two-stage brand choice process: first a household chooses a so-called consideration set (i.e., a sub-set of the available brands which are most interesting for the consumer), and then the household selects a brand from this consideration set (Roberts & Lattin, 1997).

Another line of research which became very popular during the last decade, both in the statistics and in the computational intelligence community, is the use of ensemble methods such as boosting, bagging and stacking (Hastie, Tibshirani, & Friedman, 2001; Rijnthoven, 2004; Schwenk & Bengio, 2000; Tibshirani, Friedman, & Hastie, 2000). These methods work by building not one model for a particular problem, but a whole series (ensemble) of models. These models are subsequently combined to give the final model that is to be used. The main advantage of these ensemble techniques is the sometimes spectacular increase in predictive performance that can be achieved. The predictive performance of a marketing model is a crucial factor for its successful application, since an increase in prediction accuracy causes increased reliability of market share estimates, which may have a substantial effect on the expected turnover of competing firms. In marketing, ensemble methods are proposed in a forthcoming paper by two of the authors of this chapter (van Wezel & Potharst, 2005). Stacked neural networks for customer choice modeling were also applied in Hu and Tsoukalas (2003). The use of boosted neural networks in another application area (character recognition) is described in Schwenk and Bengio (2000).

In this chapter we will explain some of these ensemble methods (especially boosting and stacking) and use them by combining the results of a series of neural networks for a specific brand choice problem. All methods presented will be demonstrated on an existing set of scanner data which has been extensively analyzed in the marketing literature: the A.C. Nielsen household scanner panel data on purchases of liquid detergents in a Sioux Falls, South Dakota, market. This dataset contains 3,055 purchases concerning 400 households of six different brands of liquid detergent: Tide, Wisk, Eraplus, Surf, Solo and All. In addition, possible use of these methods by marketing managers is demonstrated in a special section on market share simulations.

Summarizing, this chapter contains:

18 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: [www.igi-global.com/chapter/modeling-brand-choice-using-boosted/6020](http://www.igi-global.com/chapter/modeling-brand-choice-using-boosted/6020)

## Related Content

---

### Building a Competitive Intelligence System: An Infrastructural Approach

Egbert Philips (2004). *Information and Communications Technology for Competitive Intelligence* (pp. 228-247).

[www.irma-international.org/chapter/building-competitive-intelligence-system/22568](http://www.irma-international.org/chapter/building-competitive-intelligence-system/22568)

### A Fuzzy Cyber-Risk Analysis Model for Assessing Attacks on the Availability and Integrity of the Military Command and Control Systems

Madjid Tavana, Dawn A. Trevisani and Dennis T. Kennedy (2014). *International Journal of Business Analytics* (pp. 21-36).

[www.irma-international.org/article/a-fuzzy-cyber-risk-analysis-model-for-assessing-attacks-on-the-availability-and-integrity-of-the-military-command-and-control-systems/117547](http://www.irma-international.org/article/a-fuzzy-cyber-risk-analysis-model-for-assessing-attacks-on-the-availability-and-integrity-of-the-military-command-and-control-systems/117547)

### Impact Analysis of Temperature Data on the Increase in the Count of Infected Cases of COVID 19

Parag Verma, Ankur Dumka, Anuj Bhardwaj, Alaknanda Ashok, Mukesh Chandra Kestwal and Praveen Kumar (2020). *International Journal of Business Analytics* (pp. 63-72).

[www.irma-international.org/article/impact-analysis-of-temperature-data-on-the-increase-in-the-count-of-infected-cases-of-covid-19/256927](http://www.irma-international.org/article/impact-analysis-of-temperature-data-on-the-increase-in-the-count-of-infected-cases-of-covid-19/256927)

### A Dynamic Modeling and Validation Framework for the Market Direction Prediction

Xugang Ye and Jingjing Li (2015). *International Journal of Business Analytics* (pp. 1-13).

[www.irma-international.org/article/a-dynamic-modeling-and-validation-framework-for-the-market-direction-prediction/126242](http://www.irma-international.org/article/a-dynamic-modeling-and-validation-framework-for-the-market-direction-prediction/126242)

### A Case Study of a Knowledge-Sharing Web-Based Platform for Energy Education

Mei-Chen Chang and Yao-Ming Chu (2016). *Business Intelligence: Concepts, Methodologies, Tools, and Applications* (pp. 869-879).

[www.irma-international.org/chapter/a-case-study-of-a-knowledge-sharing-web-based-platform-for-energy-education/142656](http://www.irma-international.org/chapter/a-case-study-of-a-knowledge-sharing-web-based-platform-for-energy-education/142656)