Chapter 16
A Soft Computing Approach to Customer Segmentation

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ABSTRACT

There are a number of traditional models designed to segment customers, however none of them have the ability to establish non-strict customer segments. One crucial area that can meet this requirement is known as soft computing. Although there have been studies related to the usage of soft computing techniques for segmentation, they are not based on the effective two-stage methodology. The aim of this study is to propose a two-stage segmentation model based on soft computing using the purchasing behaviours of customers in a data mining framework and to make a comparison of the proposed model with a traditional two-stage segmentation model. Segmentation was performed via neuro-fuzzy two stage-clustering approach for a secondary data set, which included more than 300,000 unique customer records, from a UK retail company. The findings indicated that the model provided stronger insights and has greater managerial implications in comparison with the traditional two-stage method with respect to six segmentation effectiveness indicators.

1. INTRODUCTION

Segmentation strategy is an important method to achieve more targeted communication with customers by classifying them according to previously defined characteristics. In order to build a close relationship with customers and arrange the right resources to serve a target customer segment, it is crucial to establish appropriate customer segmentation models. The selection of segmentation techniques is one of the most important issues in segmentation, because the improper selection of classification or clustering tools may have an effect on segmentation results and may cause a negative financial impact (Tsai & Chiu, 2004). In order to avoid this problem, marketing managers should decide which segmentation tools are suitable to adopt.

The vast availability of data and the inefficient performance of traditional statistical techniques (or statistics-oriented segmentation tools) on such voluminous data have stimulated researchers to find effective segmentation tools in order to discover useful insights about their markets and customers. Cluster-based segmentation methods, particularly hierarchical and non-hierarchical methods, have been widely used in the field. But, the hierarchical methods are criticised for non-recovery, while the non-hierarchical methods for their inability to determine the number of clusters initially (Lien, 2005). Hence, the integration of hierarchical and partitioning methods is suggested to make the clustering results powerful for large databases (Kuo et al., 2002a). None of those approaches, however, have the ability to establish non-strict customer segments that could play a significant role in today's competitive consumer markets. Soft computing can be seen as an emerging topic that could tackle this problem (Mitra et al., 2002). Pertaining to segmentation problem, although several individual applications of soft computing techniques can be found in the related literature, they are not based on the effective two-stage methodology. The usage of soft computing techniques in business-related problems, particularly in segmentation, makes segmentation problems more attractive, since these techniques are very effective and applicable (Kuo et al., 2006). This aim of this study is to propose a segmentation model in which the two-stage clustering methodology is used through utilising select soft computing techniques, Artificial Neural Networks (ANN) and Fuzzy Logic (FL). In addition, the model was compared with the select traditional two-stage clustering approaches based on selected indicators regarding segmentation effectiveness.

The rest of the paper is organised as follows. Section 2 discusses key issues in customer segmentation and the applications of soft computing in segmentation, while the research methodology including the associated research questions and hypotheses are described in Section 3. Empirical results of a real-world data are presented in Section 4. Section 5 includes key conclusions and discussions that can be drawn from this study and Section 6 concludes the paper with limitations and future work.

2. LITERATURE REVIEW

The conceptual usage of the term "segmentation" has been attributed to Wendell R. Smith (1956), and in his pioneering article, he considered the differences between the strategies of differentiation and segmentation. Following his work, some other authors, such as Wind (1978), Myers and Tauber (1977), Wilkie and Cohen (1977), Beane and Ennis (1987), Yankelovich and Meer (2006), Dolnicar (2004), Sun (2009) and Tynan and Drayton (1987) also provided broad reviews of segmentation research. The main idea of segmentation or clustering is to group similar customers. A segment can be described as a set of customers who have similar characteristics of demography, behaviours, values, and so on (Nairn and Berthon, 2003, Bailey et al., 2009).

For customer segmentation, a wide variety of data analysis techniques, such as cluster analysis (Hruschka et al., 2004, Li et al., 2009, Liu and Shih, 2005, Wang, 2009, Xia et al., 2010), clusterwise regression (Desarbo et al., 2008), AID (Automatic Interaction Detection)/CHAID (Chi-squared Automatic Interaction Detection) (Gil-Saura & Ruiz-Molina, 2008, Jonker et al., 2004), multiple regression (Suh et al., 1999), discriminant analysis (Tsiotsou, 2006), latent class structure (Wu and Chou, 2011) and sophisticated soft computing techniques such as ANN and FL have been used in the related literature. Even though it is very difficult to provide a clear classification for segmentation techniques, Figure 1 is proposed as a baseline scheme for the classification of those techniques. In this figure, while some

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