

Chapter 14

An Exposition of CaRBS Based Data Mining: Investigating Intra Organization Strategic Consensus

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ABSTRACT

The non-trivial extraction of implicit, previously unknown, interesting, and potentially useful information is at the heart of efforts to solve real-world problems; perhaps nowhere more so than in the field of organization studies. This chapter aims to describe the ability of a nascent data mining technique, Classification and Ranking Belief Simplex (CaRBS), to undertake analysis in the area of organization research in the public sector. The rudiments of CaRBS, and the RCaRBS development also employed, are based on the general methodology of Dempster-Shafer theory (DST), as such, the data mining analysis undertaken with CaRBS is associated with uncertain modelling. Throughout this chapter, a real application is considered, namely, using survey data drawn from a large multipurpose public organization, to examine the argument that consensus on strategic priorities is, at least partly, determined by an organization's structure, process and environment.

INTRODUCTION

Deriving predictions from hidden patterns amongst large amounts of data is the cornerstone of data mining (Chen, 2001). The non-trivial extraction of implicit, previously unknown, interesting, and potentially useful information is at the heart of efforts to solve real-world problems (see Berry and

Linoff, 1997; Westphal and Blaxton, 1998); perhaps nowhere more so than in the field of organization studies. This chapter aims to describe the ability of a nascent data mining technique, based on uncertain modelling, to undertake analysis in the area of organization research in the public sector. Further, the chapter also demonstrates how such a technique itself can be developed to perform more pertinent analysis in this area.

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The Classification and Ranking Belief Simplex (CaRBS) non-parametric technique, introduced in Beynon (2005a, 2005b), was presented as a novel approach to undertake data mining. The rudiments of CaRBS are based on the general methodology of Dempster-Shafer theory (DST), introduced in Dempster (1967) and Shafer (1976). As such, the data mining analysis undertaken with CaRBS is associated with uncertain modelling. Indeed, DST is considered one of the three key mathematical approaches to uncertainty modeling (Roesmer, 2000), along with the probabilistic and fuzzy logic approaches (see Mantores, 1990; Zadeh, 1975; Yang *et al.*, 2006). Further, it is often described as a generalisation of the well-known Bayesian theory (Shafer and Srivastava, 1990).

One consequence of the association of the non-parametric technique CaRBS with DST, is the ability to undertake analysis in the presence of a form of mathematical based ignorance (Safranek *et al.*, 1990; Beynon, 2005b). The original CaRBS technique is employed in the classification-type analysis of strategic consensus in a public organization (see later), plus a development, termed RCaRBS, which affords the ability to undertake regression-type analysis on the same problem. The RCaRBS analysis presented here illustrates, at the technical level, how a data mining technique based on uncertain modelling, such as CaRBS, can be developed to undertake more general types of analysis pertinent to the types of continuous data generally used by organizational researchers (using RCaRBS). Indeed, uncertain modelling is uniquely able to accommodate the ambiguity that surrounds the subjective measures of organizational characteristics that are often used in studies of strategic management (see Dutton *et al.*, 1983).

Throughout this chapter, a real application is considered, namely, using survey data drawn from a large multipurpose public organization, to examine the argument that consensus on strategic priorities is, at least partly, determined by an organization's structure, process and environment (Dess and Origer, 1987). This is a pertinent ap-

plication, since management theory suggests that strategic consensus has important implications for organizational performance (Bourgeois, 1980). Despite widespread speculation on the veracity of these propositions on consensus (see Bowman and Ambrosini, 1997), few studies have systematically examined the antecedents of strategic consensus in public, private or non-profit organizations (see Kellermanns *et al.*, 2005). Moreover, there has been a relative dearth of studies employing non-parametric techniques, such as the well known neural networks (and the CaRBS here in particular), in research on this and related issues in organizational research (see for example DeTienne *et al.*, 2003).

Amongst the technical expositions given in this chapter, the binary classification based data mining presented, using the original CaRBS technique, is operationalised in terms of a constrained optimisation problem. This problem is solved here using the evolutionary computation technique Trigonometric Differential Evolution (TDE - Fan and Lampinen, 2003), which employs an objective function which confers the minimisation of ambiguity, in the classification of vertical consensus based on managers' perceptions of strategic priorities, but not concomitant ignorance (Beynon, 2005b). The second analysis expositied, using the RCaRBS development on CaRBS, demonstrates regression-type analysis in the presence of ignorance (again using TDE and an objective function based on the minimisation of the level of predictive fit 'sum of squares error' of the degree to which vertical consensus exist on perceived strategic priorities). This latter analysis is pertinent since the majority of quantitative organizational research is regression oriented (DeTienne *et al.*, 2003).

Throughout the analysis presented in this chapter, there is emphasis on the graphical representation of results, primarily using the simplex plot method of data representation, an intrinsic part of the CaRBS technique (and RCaRBS), explicitly referred to in its introduction (see Beynon, 2005a).

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