

Chapter 14

Association Analysis of Alumni Giving: A Formal Concept Analysis

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ABSTRACT

A large sample (initially 33,000 cases representing a ten percent trial) of university alumni giving records for a large public university in the southwestern United States is analyzed by Formal Concept Analysis. This likely represents the initial attempt to perform analysis of such data by means of a machine learning technique. The variables employed include the gift amount to the university foundation as well as traditional demographic variables such as year of graduation, gender, ethnicity, marital status, etc. The foundation serves as one of the institution's non-profit, fund-raising organizations. It pursues substantial gifts that are designated for the educational or leadership programs of the giver's choice. Although they process gifts of all sizes, the foundation's focus is on major gifts and endowments. Association Analysis of the given dataset is a two-step process. In the first step, FCA is applied to identify concepts and their relationships and in the second step, the association rules are defined for each concept. The hypothesis examined in this paper is that the generosity of alumni toward his/her alma mater can be predicted using association rules obtained by applying the Formal Concept Analysis approach.

DOI: 10.4018/978-1-60960-595-7.ch014

INTRODUCTION

Data mining, extracting meaningful patterns from large quantities of information, is useful in any field where there are large quantities of data and something worth knowing (i.e., the resulting knowledge is worth more than the cost to discover). Data mining can be employed to identify the most valuable prospects, like those alumni most likely to give to their alma mater. Through the application of data mining techniques (Berry and Linhoff, 2000; Han and Kanbar, 2005), university fund raisers can potentially turn the myriad of alumni records into some sort of coherent picture.

Research Setting

A large sample (about 33,000 cases) from a very large public, land-grant university's alumni giving records was analyzed. Each state has such a land-grant institution, typically with extensive academic and research programs in agriculture and engineering. The university foundation (UF) serves as one of the institution's non-profit, fund-raising organizations. The UF pursues substantial gifts that are designated for the educational or leadership programs of the benefactor's choice. Although they process gifts of all sizes, the focus of the UF is on major gifts and endowments as well as managing the donated assets for the university.

Relevant Research on Philanthropic Giving

Charitable and philanthropic organizations, including university fund raising departments, face increasing pressure to more effectively employ a variety of analytical techniques (Brown, 2004). Potential donor identification may provide one such tool (Shelley and Polonsky, 2002). As applied in other public sector or not-for-profit agencies (Johnson and Garbarino, 2001; Todd and Lawson, 2001; Wymer, 2003), data mining can assist college and university development officials in identify-

ing potential donors and help define what best to communicate to potential donors.

Research studies report various methodologies and techniques to identify giving behavior for collegiate financial development. Willemain et al. (1994) employed a general linear model to predict university alumni giving. Lindahl and Winship (1992) used logit analysis to predict rare events such as gifts over \$100,000. Clotfelter (2001) utilized basic descriptive statistics (e.g., means, percentages) to portray survey results from two generations of alumni giving.

With somewhat more novel quantitative approaches, Drye et al. (2001) suggested survival analysis (based upon logarithmic charts) to better identify the most regular supporters and those most likely to repeat their support. Key (2001) recommended probit regression for building a response model to identify individuals most likely to make a major, capital or planned gift.

Two other related papers have suggested market segmentation analysis for identifying groups of potential donors in the nonprofit sector. Ewing et al. (2002) using market segmentation for identifying voluntary labor pools for nonprofit agencies. Connolly and Blanchette (1986) applied survey research and a multivariate statistical technique (i.e., discriminant analysis) to categorize individual university alumni who could be solicited for annual or major gifts.

Relevant Research on Analytical Techniques

After its introduction by Wille (1982), numerous recent applications of Formal Concept Analysis have appeared in the computing literature. FCA has been successfully applied to many different fields such as medicine and psychology, musicology, linguistic databases, library and information science, software re-engineering, civil engineering and ecology. Specific papers include Godin *et al.* (1994) and Snelting (1996) who applied this technique to software engineering and re-

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