Original Article

Data mining of university philanthropic giving: Cluster-discriminant analysis and Pareto effects

Received (in revised form): 11th December 2008

Louis A. Le Blanc

serves as Professor of Business Administration at the Berry College Campbell School of Business.

Conway T. Rucks

holds an appointment as Professor of Marketing at the University of Arkansas at Little Rock College of Business Administration.

ABSTRACT A large sample of 33 000 university alumni records were cluster-analyzed to generate six groups relatively unique in their respective attribute values. The attributes used to cluster the former students included average gift to the university's foundation and to the alumni association for the same institution. Cluster detection is useful in this application because there are very likely natural groupings that may represent segments of alumni that have much in common, and for which customized marketing approaches are justified. The clustering generated six groups of sizes ranging from eight to more than 25 000 records. Once the groups were established, discriminant analysis evaluated the difference(s) between the *a priori* determined and mutually exclusive giving groups. The first four groups provided the foundation with a disproportionate share (88 percent) of its major gifts, while the last two groups afforded the alumni association with the largest part (88.3 percent) of its annual funds. The discriminant model predicted with 100 percent accuracy the membership of the extreme groups (Group 1 and Group 6), with an overall predictive accuracy of 98 percent. The same model calculated membership in Group 2 and Group 5 with accuracy of 94.9 percent and 91.3 percent, respectively. Other numbers of groups were attempted, including five groups and seven groups, but no other number of clusters gave the clear distinction between groups, as did six clusters. The analysis further investigated two particular groups for their giving to the annual fund of the alumni association. These two groups comprised 98 percent of the sample, and could be characterized as one

Correspondence: Louis A. Le Blanc
Campbell School of Business, Berry College,
P. O. Box 5024, Mount Berry GA, 30149-5024, USA
E-mail: lleblanc@berry.edu

group that contributed substantially and another that did not. The findings provide a basis for marketing communication efforts aimed at specific niches within the groups based on giving patterns and demographics. As per the Pareto Principle, one cluster accounts for 63.7 percent (almost two-thirds) of contributions to the alumni's annual fund from only 20.1 percent of the sample alumni, giving an average of US\$111 annually and making more than eight gifts since graduation. The gift amounts from members of this cluster to the annual fund are in relatively small parcels, with 95 percent of the contributions averaging less than \$250. The largest cluster with 78.3 percent of the entire sample can be characterized as non-contributors to both the annual fund and the foundation.

International Journal of Educational Advancement (2009) 9, 64–82.
doi:10.1057/ijea.2009.28

Keywords: data mining; cluster and discriminant analysis; alumni giving

INTRODUCTION

Data mining, extracting meaningful patterns from large quantities of information, is useful in any field in which there are large quantities of data and something worth knowing (that is, 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 Linoff, 2000), university fund raisers can potentially turn the myriad of alumni records into some sort of coherent picture.

Data mining may be compared to looking for a needle in a haystack. There are no pre-defined dependent or independent variables, for example, or hypothesis formulation *a priori*. When using cluster analysis as a data mining technique, groups or clusters are employed as the basis of analysis, that is, is there some pre-specified number of groups whose membership can be predicted accurately and that have distinguishing attributes?

RESEARCH SETTING

A large sample (33 000 cases) from a very large public, land-grant university's alumni giving records were cluster-analyzed to generate six groups relatively unique in their respective attribute values. The attributes used to cluster the alumni include average gift to the university's foundation and to the alumni association of the same institution. Each state has such a land-grant institution, typically with extensive academic and research programs in agriculture and engineering.

The university's foundation and the alumni association serve as two of the institution's non-profit, fund-raising organizations. The foundation 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 foundation is on major gifts and endowments, as well as managing the donated assets for the university. Through an annual fund, the alumni association helps meet the university's ongoing need for flexible, unrestricted

income to support academic and extra-curricular endeavors such as student scholarships and financial aid, student organizations and their activities, faculty development, and alumni career services.

The university foundation and the alumni association share a common database with a single set of identification numbers. Therefore, it was quite easy to use giving statistics to both entities and a common set of attributes to describe the donors to both foundation and alumni association. Analysis of both giving patterns would be conducted simultaneously.

CLUSTERING, DISCRIMINANT PROCEDURE AND PARETO ANALYSIS

From a cluster analysis, solutions ranging from two to seven clusters were tested by a discriminant analysis. Discriminant models were built using the same variables that were used to cluster the groups. The discriminant criterion used to determine the optimum cluster solution was the percentage of cases correctly classified into clustered groups. This criterion indicated that the six-group cluster solution was optimal, with 97.9 percent of the 32 898 cases being correctly classified. Other numbers of groups were attempted, including five groups and seven groups, but no other number of clusters gave the clear distinction between groups, as did six clusters.

The most interesting result, with likely implication for other large universities, is the pattern of giving to the alumni association – a disproportionately large percentage of the annual gifts in total dollar value is provided by a relatively small percentage of alumni and in small

amounts. The implication is that fundraising efforts might be focused on those alumni that have already given in some amount, but the encouragement should be to give marginally more rather than to encourage them to become a major benefactor.

It is much more difficult to identify givers to a typical college or university foundation, especially detecting the potential large givers of significant sums to major capital campaigns. Compare this predictive problem to the relatively large number of givers to the alumni association's annual fund or yearly membership drive. For the university setting of this study, about 60 000 individuals (about 20 percent of the more than 300 000 living alumni) contribute more than six million dollars annually.

The Pareto analysis in this study was an afterthought and not suggested by any prior research in this area. When the groups were developed and giving differed substantially by cluster, it was sensible to calculate if one particular small group contributed a disproportionate amount of the total gift value.

RELEVANT RESEARCH

Charitable and philanthropic organizations, including university fundraising departments, face increasing pressure to more effectively employ a variety of marketing techniques (Brown, 2004). Segmentation, or grouping alumni, may provide an effective tool to help achieve marketing goals (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), segmentation can assist college and university development

officials in identifying 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 US\$100 000. Clotfelter (2001) utilized basic descriptive statistics (for example, 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 non-profit sector. Ewing *et al* (2002) use market segmentation to identify voluntary labor pools for non-profit agencies. Connolly and Blanchette (1986) applied survey research and a multivariate statistical technique (that is, discriminant analysis) to categorize individual university alumni who could be solicited for annual or major gifts.

The research application reported herein recognizes that neither money nor time is available to solicit directly from every member an alumni base of

nearly a quarter million people. Some method needs to be devised to segment those who are very likely to give again from those alumni with significantly smaller probabilities of charitable giving. The strategies for communication and solicitation would obviously be different for each segment.

METHODOLOGY: CLUSTER AND DISCRIMINANT TWO-STEP

The cluster-discriminant analysis combination (Hair *et al*, 1992) blends complete empiricism in the exploratory phase of the research with *a priori*ism in the identification and analysis phase. Cluster analysis develops an optimal grouping characterized by maximum homogeneity within groups and maximum heterogeneity among groups. As the grouping is developed without initial hypothesis regarding cause and effect, cluster analysis is a completely empirical process of pattern recognition. However, optimal clustering may not necessarily be 'powerful' clustering, characterized by substantial within-groups homogeneity and among-groups heterogeneity. Moreover, the patterns within and among the groups may not be clearly recognizable. Discriminant analysis, using the empirically derived clusters as *a priori* groups, allows for a test of the power of the clustering, an identification of the patterns within and among the clusters, and an analysis of the variables contributing most to overall group differentiation. Thus, the cluster-discriminant analysis combination is a powerful tool of pattern recognition, in which true but complex patterns likely exist in a data set.

CLUSTER ANALYSIS AND EXPLORATION

Cluster analysis was selected for this undirected data mining application, as there is no target variable to be predicted. Cluster detection is useful because there are very likely natural groupings that may represent groups of alumni possibly having much in common. Customized marketing or communication approaches would be reasonable for these respective groups. Furthermore, in this situation there may be many competing patterns in the data, thereby making it difficult to spot any single pattern (Berry and Linoff, 2000).

Cluster analysis is also different from other multivariate statistical techniques, in that it does not treat some variables as independent and some as dependent. It provides only description and has no inferential properties (Hair *et al.*, 1992).

The number of groups must be pre-designated by the analyst. An algorithm based on nearest centroid sorting (Anderberg, 1973) was employed to efficiently cluster this large number of cases. A case is assigned to the cluster for which the distance between the case and the center of the cluster (that is, the centroid) is smallest. The optimal number of groups is determined by the subsequent discriminant analysis. The best number of groups is the set with the highest correct classification rate.

DISCRIMINANT ANALYSIS

Once the best set or number of alumni groups is established, discriminant analysis evaluates the difference(s) between the *a priori* determined and mutually exclusive giving groups. The analytical data are the attribute values

for cases whose group membership has already been established. The discriminant procedure identifies variables that are important for distinguishing among the groups, and can predict group membership for new cases whose group membership is undetermined.

ALUMNI DATABASE

The database for this empirical analysis of giving behavior consisted of nearly 33 000 records and 20 variables. The variables were all continuous in nature, although sometimes displayed as interval data. This sample of 32 898 records represents approximately 10 percent of all such cases (one entry for each alumnus or alumna) that had graduated from this university. Some of the attributes did not have a cell value in a given record, and therefore those cases were not incorporated in the statistical calculation. This was especially true for the index variables that indicated potentially significant donors.

The average gift to the university's foundation (variable) was constructed by dividing the total value of all gifts to the foundation by the number of gifts, yielding the average value of a gift by an alumnus or alumnae. The average gift to the alumni association's annual fund is created by dividing the total value of all gifts to the alumni association by the number of gifts, yielding the average value of a gift. The variables that had extreme numbers of missing cases were later used to build profiles of the six groups or clusters.

CLASSIFICATION RESULTS

One way to assess the goodness-of-fit of the discriminant function is to

Table 1: Classification results

Cluster	Count	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
<i>Predicted group membership</i>							
Group 1	8	8	—	—	—	—	—
Group 2	39	—	37	2	—	—	—
Group 3	104	—	—	72	32	—	—
Group 4	371	—	—	—	301	47	23
Group 5	6605	—	—	—	2	6032	571
Group 6	25771	—	—	—	—	—	25771
<i>Classification rates (%)</i>							
Group 1	8	100.0	—	—	—	—	—
Group 2	39	—	94.9	5.1	—	—	—
Group 3	104	—	—	69.2	30.8	—	—
Group 4	371	—	—	—	81.1	12.7	6.2
Group 5	6605	—	—	—	—	91.3	8.6
Group 6	25771	—	—	—	—	—	100.0

Percent of original grouped cases correctly classified: 97.9%.

assess the *hit rate*, the proportion of observations classified correctly. Table 1, sometimes termed the *confusion matrix*, shows the numbers of correct and incorrect classifications for each group. Correctly classified cases appear on the diagonal of the table.

As shown in Table 1, the clustering generated six groups of sizes from eight to 25 771. The discriminant model was able to predict with 100 percent accuracy the membership of these extreme (in size) groups, with an overall predictive accuracy of almost 98 percent. The same model predicted membership in Group 2 and Group 5 with accuracy of 94.9 percent and 91.3 percent, respectively. The model gave relatively poor results for Group 3, by correctly predicting only 69.2 percent in that cell and misclassifying 30.8 percent in Group 4. The discriminant analysis correctly classified 81.1 percent of the records in Group 4, but misclassified 12.7 percent and 8.6 percent in Group 5

and Group 6, respectively, meaning that these cases actually belonged to Group 4, but were incorrectly assigned to the latter groups.

EXPECTED MISCLASSIFICATION RATE

The percentage of cases classified correctly is often taken as an index of the effectiveness of the discriminant function. It is important to compare the observed misclassification rate to that expected by chance alone. As the number of groups with equal prior probabilities increases, the percentage of cases that can be classified correctly, by chance alone, decreases. As there are six groups, only 16.7 percent of the cases would be expected to be classified correctly by chance. The poorest predictive performance was for Group 3 at 69.2 percent correct classification, and more than four times greater than that expected by chance alone (that is, 16.7 percent correct classification).

Table 2: Group means for six clusters

	<i>Group 1</i>	<i>Group 2</i>	<i>Group 3</i>	<i>Group 4</i>	<i>Group 5</i>	<i>Group 6</i>
Average gift foundation	\$133 347	\$35 831	\$8888	\$1396	\$43	\$10
Average gift alumni	\$10	\$2049	\$103	\$111	\$111	\$11

Table 3: Tests of equality of group means

	<i>Wilk's Lambda</i>	<i>F</i>	<i>df1</i>	<i>df2</i>	<i>Significance</i>
Average gift foundation	0.093	64019.429	5	32892	0.000
Average gift alumni	0.087	15679.074	10	65782	0.000

DIFFERENTIATION

Table 2 contains the mean values (across the six groups) for giving to the foundation and giving to the alumni association. Table 3 shows significance tests for the equality of group means for each variable. This table includes the respective *F* values (64019.429 and 15679.074) and their significance. The significance level for both giving variables is 0.000. If the observed significance level is small (that is, less than 0.05), the hypothesis that all groups' means are equal is rejected, and the alternative hypothesis that they are not equal is accepted. The latter situation exists here; however, the mean gift to the alumni for Group 3 (\$103), Group 4 (\$111) and Group 5 (\$111) would be considered equal, as would the corresponding means for Group 2 (\$10) and Group 6 (\$11).

PROFILING OF THE CLUSTERS OR SEGMENTS

Table 4 describes the giving behavior in each of the six groups. The profile descriptions will begin with Group 1 and describe the average giving to both

the foundation and the alumni association of the university.

Group 1 through Group 6 exhibit declining average giving to the foundation, whereas giving to the alumni association was nearly the same average value for Group 3 (\$103), Group 4 (\$111) and Group 5 (\$111), and Group 1 (\$10 average gift to the alumni) and Group 6 (\$11) average annual donation to the alumni association were almost identical in this regard but at a significantly lower level. Especially noteworthy is Group 2, which contains alumni that gave an average of more than \$2000 per year to the alumni association and an average gift of almost \$3000 to the foundation. The number of records was 32 898 for this part of the analysis and only excludes a few records with gifts greater than \$705 000 to the alumni association. The groups also become substantially larger in size while reading across Table 4.

GROUP 1 – HIGH ROLLERS AND LOW ROLLERS

Group 1 includes alumni who are very generous to the foundation yet give

Table 4: Giving statistics, group size and correct classification rates

	<i>Group 1</i>	<i>Group 2</i>	<i>Group 3</i>	<i>Group 4</i>	<i>Group 5</i>	<i>Group 6</i>	<i>Total</i>
Average gift foundation	\$133 347	\$35 831	\$8888	\$1396	\$43	\$10	\$135
Average gift alumni	\$10	\$2049	\$103	\$111	\$111	\$11	\$35
Cases	8	39	104	371	6605	25771	32898
Classification (%)	100.0	94.9	69.2	81.1	91.3	100.0	97.9

very little on average to the alumni association (see Table 4). The eight alumni comprising this group (predicted with 100 percent accuracy by the discriminant model) gave an overall average of \$133 347 per gift to the foundation, yet only gave an average of \$10 to the alumni association. The range of individual average gifts to the foundation is from \$100 500 on the low end to \$200 000 at the high end. The range of individual average gift to the alumni association is from a maximum of \$80 to a minimum of zero. Being able to predict this cluster with 100 percent accuracy demonstrates the high homogeneity of this group or cluster.

GROUP 2 – VERY GENEROUS ALUMNI

Group 2 is characterized by individuals who give unselfishly to both the foundation and the alumni association (see Table 4). Their average gift to the alumni was in excess of \$2000 (the highest rate of giving of any of the six groups to the alumni association), while the overall average beneficence to the foundation was nearly \$36 000, ranging from a minimum gift of \$21 191 to a maximum of \$75 218. Only those alumni in Group 2 gave an average amount greater than \$111 to the alumni association while simultaneously contributing heavily to the foundation. The 39 members of

Group 2 gave the second highest average amount (\$35 831) to the foundation. The next largest average giving history to the foundation was only a fourth as much (that is, Group 3, average foundation gift of \$8888). Membership in this cluster (Group 2) was correctly predicted at a rate of 94.9 percent, suggesting that the 39 members of this group are very similar, typically white males who had class years between 1930 and 1959 and majored in engineering.

GROUP 3 – GENEROUS TO THE FOUNDATION

Group 3 members gave an average amount of \$8888 (with a minimum of \$4500 and maximum of \$20 063) to the foundation, while providing an average gift of \$103 to the alumni association. Group 3 (at \$103) gave about the same to the alumni as Group 4 (\$111) and Group 5 (\$111). The distinguishing gift behavior for Group 3 (relative to these latter clusters) is their high average bequest to the foundation. This group is comprised of alumni who are usually between the ages of 70 and 89 years and more likely to be engineering graduates.

Membership in this cluster was correctly predicted at a rate of 69.2 percent (or 72 cases of 104) – the lowest predictive performance for any of the six clusters. Not surprisingly,

the other 30.8 percent (or 32 cases) were misclassified to Group 4, possibly as a result of the close similarity of the alumni giving behavior of both clusters to their association.

GROUP 4 – LESS TO FOUNDATION AND SAME TO ALUMNI ASSOCIATION

The 371 members of Group 4 gave an average amount of \$1396 to the foundation, with average gifts ranging from \$530 to \$4310. Each successive group (reading across the table) gave less money to the foundation on average. At the same time, Group 3 through Group 5 gave the same amount (about \$100 on average) to the alumni association, and Group 1 and Group 6 gave almost equal amounts on average (\$10 and \$11, respectively) to that association. Similar to Group 3, the average donation of Group 4 members to the alumni association was \$111, identical to the average corresponding gift by Group 5.

Group 4 is characterized by the fourth highest average gift to foundation (\$1396), while maintaining the same giving pattern as Group 3 to the alumni association, characterized by slightly younger alumni than preceding groups with fewer engineering students, still predominantly Caucasian males, but with some Hispanic representation.

Membership in Group 4 was correctly predicted at a rate of 81.1 percent (or four of five cases). Another 12.7 percent of this group were incorrectly assigned to Group 5 by discriminant model, possibly because of the identical average gift (\$111) of both groups to the association.

GROUP 5 – LITTLE TO FOUNDATION BUT SAME TO ALUMNI ASSOCIATION

Group 5, the second largest cluster with 6605 members in that sample, gave only an average amount of \$43 to the foundation with a minimum gift of zero and a maximum bequest of \$525. This was the next to the lowest average giving behavior to the foundation. However, Group 5 maintained the same giving rate to the alumni association as Group 3 (\$103) and Group 4 (\$111). Membership in Group 5 was correctly predicted at a rate of 91.3 percent. (The discriminant model correctly classified membership in four of the six groups at a rate better than 90 percent, with two groups at 100 percent, including the largest cluster, Group 6 with 25771 cases.)

Group 5 was the second largest cluster and the first segment with more than 400 members. They gave only \$43 (second lowest) on average to the foundation yet provided the alumni association with an average contribution of \$111 (second highest). Half of this cluster graduated between 1980 and 1999, and engineering graduates were less than one third, substantial non-white composition.

GROUP 6 – LARGE IN NUMBER BUT NOT CONTRIBUTING

Group 6, the largest of all the groups, with 25771 members (77.7 percent of the total sample) exhibited very similar giving behavior to both the university foundation and the alumni association, an average amount of \$10 and \$11, respectively. The maximum gift to the foundation was \$367 and the minimum was zero. To the alumni association, Group 6 provided a maximum gift of

\$60 and a corresponding minimum of zero. Group 6 is characterized by very similar demographics as the entire sample of 32 898, much younger and diverse group on multiple dimensions such as gender, ethnicity and marital status.

The discriminant model correctly predicted 100 percent of the records for Group 6. This cluster exhibited absolute homogeneity. A few cases from Group 5 were misclassified in Group 6, most likely because of similarity with characteristics of Group 6.

ANALYSIS OF TRENDS ACROSS THE GROUPS

From Group 1 through Group 6, a number of distinct trends occur. Clearly, the average gift to the foundation drops precipitously, while the membership of the groups increases. (However, the average amounts given to the foundation by Group 1 through Group 4 are all substantial.) This suggests that a few alumni donate a disproportionately large share of the receipts, similar to the 80-20 Rule, also known as Pareto's Law. Only Group 5 and Group 6 give minimal amounts to the foundation. Average gift to the foundation was the most powerful discriminator between all of the groups. Average gift to the alumni association was significantly less powerful yet non-trivial, as documented by a number of statistical measures.

Unfortunately, the database of the alumni suffers from a number of missing values for the attributes. Although the entire sample was 32 898 records, the giving indices had fewer than 7000 cell values, as the other 22 000 records had no entry for this field. Class year was available for only

27 742 records, age for 25 009 records, preferred college for 27 666 records, ethnicity for 14 790 records, marital status for 27 107 and number of children for 9633 records. These values were more likely to be missing for older alumni, most likely in Group 1 through Group 3. Therefore, the profiles or descriptions of the six groups were constructed with less than complete information.

Moving from Group 1 to Group 6, the alumni in the early groups are older (by class year and age), exclusively white males and very likely to be engineers. These somewhat extreme demographic percentages decline as giving to the foundation subsides and group size increases. Group 5 and especially Group 6 closely mirror the total sample of 32 898 cases. Group 6 has the fewest Caucasians, most females, and broadest distribution of colleges and so on. In essence, these latter groups are much more diverse than the other clusters.

Any observed differences in giving behavior could be the result of one (or more) of four effects (Clotfelter, 2001). These effects are composition, cohort, life cycle or income.

COMPOSITION EFFECT

The variation in group means in this study could be because of changes in the composition of the student body, that is, in terms of gender, geography, race, economic status or legacies (a student whose parent or parents graduated from the same institution). For the case of Princeton University, Willemain *et al* (1994) argue that 'democratization' of admissions (a reduction in the share of students from wealthy families) leads to reduced

donations from younger cohorts. In Clotfelter's study (2001) of former students from 14 private colleges and universities, he found that the average size gift from male donors was over twice as large as that for women, although men and women were equally as likely to make any gift. In this university study, the total sample (with values for gender) indicated 34 percent female cases, while Group 6 had 37.2 percent female records.

COHORT EFFECT

Differences in giving between classes separated by as much as two or more decades might possibly be because of a 'cohort effect' or an effect that is generation-wide. Graduates from 1955 versus the class of 1980 are literally members of quite different generations – one experienced World War II and the other the end of the Vietnam War, as teenagers. Such contrasts in historical period imply many different life experiences that may not be captured by any set of objectively measured variables. There is quite a difference in the historical experience across the six groups, possibly explaining some differences in propensity for philanthropic giving.

LIFE CYCLE EFFECT

Another reason for differences in giving is life cycle effects that arise from age alone. As documented by many econometric studies of charitable giving, contributions tend to rise with age, independent of income. Auten and Joulfaian (1996), for example, present regression estimates, suggesting that giving in the 55–64 age bracket exceeded those in the less than 45 age bracket by a ratio of 2.4:1.

INCOME EFFECT

The fourth reason to expect older alumni to give more is that their income is likely to be higher. Most studies of charitable giving (for example, Clotfelter, 1985) confirm the existence of a strong positive income effect on charitable giving. Grant and Lindauer (1986) estimated that a 62-year-old alumnae of Wellesley College gave approximately three times as much as 37-year-olds. This may be because of a combination of cohort, life cycle and income effects over the 60 graduating classes examined, but this research leaves little doubt that older alumna give more; and, this appears to also be the case for this university.

A PARETO ANALYSIS OF GIVING TO FOUNDATION AND ALUMNI ASSOCIATION

Pareto Analysis is a method of classifying items, events or activities according to their relative importance. The principle¹ was suggested by management advisor and quality pioneer Joseph M. Juran (Juran and Godfrey, 2003). The so-called Pareto Principle (also known as the 80-20 Rule) suggests that for many phenomena 80 percent of consequences stem from 20 percent of the causes. Organizations can concentrate more detailed attention on the highest value and most important items. Determining whether there is a small number of contributors that accounts for a disproportionate amount of fund giving might prove useful at this point.

PARETO ANALYSIS OF FOUNDATION GIVING

As shown by Table 5, Groups 1 through 4 (combined) corresponded to

Table 5: Pareto analysis (a) Giving to the foundation; (b) Giving to the alumni association

	<i>Group 1</i>	<i>Group 2</i>	<i>Group 3</i>	<i>Group 4</i>	<i>Group 5</i>	<i>Group 6</i>
<i>(a) Giving to the foundation</i>						
Total	\$1066776	\$1397409	\$924352	\$517916	\$284015	\$257710
Percent	24	31.5	20.8	11.7	6.4	5.8
	—	88	—	—	12.2	
Number	8	39	104	371	6605	25771
Percent	0.02	0.1	0.3	1.1	20.1	78.3
	—	2.6	—	—	98.4	
<i>(b) Giving to the alumni association</i>						
Total	\$80	\$79911	\$10712	\$41181	\$733155	\$283481
Percent	0.01	6.9	0.9	3.6	63.7	24.6
	—	11.4	—	—	88.3	
Number	8	39	104	371	6605	25771
Percent	0.02	0.1	0.3	1.1	20.1	78.3
	—	2.6	—	—	98.4	

2.6 percent of the alumni in the sample, and contributed 88 percent of the gifts. This is consistent with the finding of Clotfelter (2001), where just a few alumni (as few as 1 percent) make most of the major gifts. At the same time, Group 5 and Group 6 (combined) represent 98.4 percent of the sample's members but supply only 12.2 percent of the funds. This certainly provides an extreme example of the Pareto phenomenon.

Pareto analysis of giving to the alumni association

With respect to alumni association contributions, a similar phenomenon persists, but with some interesting differences. Groups 1 through 4 (combined) correspond to 2.6 percent of the alumni association members in the sample, and represent 11.4 percent of annual giving. Simultaneously, Group 5 and Group 6 (together) represent 98.4 percent of the sample

members and account for 88.3 percent of giving.

But Group 5 alone represents one-fifth or 20.1 percent (6605 members) of the sample and provides almost two-thirds (that is, 63.7 percent) of the monies. This giving behavior can also be labeled as a Pareto phenomenon for Group 5 and at a ratio of 20.1 to 63.7. The members of Group 5 have given an average eight times since their individual graduations, with an average amount of \$111.

Group 6, with its 25771 members, and representing almost four-fifths of the entire sample, only provides about one-fourth (24.6 percent) of the funds. The members of Group 6 have only given 1.5 times on average since their respective graduations and with an average gift of \$11.

It might be informative to further investigate the giving patterns of Group 5, as they gave a disproportionately large amount

Table 6: Frequency distribution of average giving by group 5

<i>Category</i>	<i>Contribution</i>	<i>Frequency</i>	<i>Percent</i>	<i>Cumulative percent</i>
Active	LT \$100	3201	48.5	49.4
Bronze	\$100–\$249	2979	45.1	95.3
Silver	\$250–\$499	235	3.6	98.9
Gold	\$500–\$999	63	1.0	99.9
Diamond	\$1000–\$1999	6	0.1	100.0
Double diamond	\$2000–\$4999	1	0.0	100.0
Sub-total	—	6485	—	—
Missing	—	120	—	—
Total	—	6605	—	—

(63.7 percent) to the fund but only represent a relative small percentage (20.1) of the total alumni sample. Group 5 is but one-fourth the size of Group 6, the largest of the groups and representing almost 80 percent of the entire sample.

THE GIVING PATTERN OF GROUP 5

Table 6 portrays the frequency distribution for giving by Group 5, the group that gives a disproportionate share of the monies to the alumni association's annual fund. On average, half of the annual gifts (49.4 percent) are in amounts less than \$100. An additional 45 percent of the annual gifts range between \$100 and \$250. These two categories account for more than 95 percent of the annual gifts for Group 5. The interpretation suggests that the group of alumni that gives a disproportionately large volume of monies to the annual fund does so in relatively modest amounts.²

THE COMPARATIVE DEMOGRAPHICS OF GROUPS 5 AND GROUP 6

The members of Group 5 and Group 6 (combined) account for more than

98 percent of the entire sample, while contributing more than 88 percent of the annual giving. Group 3 and Group 4 also contribute an average amount at just over \$100 like Group 5, but together these groups only account for 1.4 percent of the sample. Group 2 gives an average of \$2000 per year, but only represents 0.1 percent of the sample. Group 5 and Group 6 total more than 32 000 sample members, and there are adequate attribute values in these records with which to comparatively describe their respective attribute values (for example, age, gender, ethnicity, marital status and Greek affiliation). Comparing Group 5 to Group 6 may be considered a contrast of those who give and those who do not contribute to the annual fund.

GIVING INDICES

Blackbaud Planned Giving, Annuity, Bequest and Charitable Remainder Trust scores (Table 7a) identify donors with propensity to make a major gift, annuity, bequest and so on. Top Blackbaud donors have scores of 800 plus. Group 5 exhibited higher Blackbaud scores than Group 6 by margins of 72.5, 100, 175 and 142.

Table 7: Comparative demographics for Group 5 versus Group 6*(a) Blackbaud indices of charitable giving*

	<i>Blackbaud scores</i>			
	<i>Planned giving</i>	<i>Annuity</i>	<i>Bequest</i>	<i>Charitable trust</i>
Group 5	532.5	585	638	661
Group 6	460.0	485	463	519

(b) Decade of preferred class year

	<i>Decade of class year</i>						
	<i>1940–1949 (%)</i>	<i>1950–1959 (%)</i>	<i>1960–1969 (%)</i>	<i>1970–1979 (%)</i>	<i>1980–1989 (%)</i>	<i>1990–1999 (%)</i>	<i>2000+ (%)</i>
Group 5	6.3	8.6	10.0	17.4	26.0	25.1	5.1
Group 6	2.1	2.5	4.4	12.8	23.3	32.4	21.5

(c) Age categories

	<i>Decade intervals</i>							
	<i>20–29 (%)</i>	<i>30–39 (%)</i>	<i>40–49 (%)</i>	<i>50–59 (%)</i>	<i>60–69 (%)</i>	<i>70–79 (%)</i>	<i>80–89 (%)</i>	<i>90–99 (%)</i>
Group 5	6.0	26.7	30.0	16.8	7.1	7.2	4.9	1.3
Group 6	21.3	33.0	26.6	13.1	3.1	1.4	1.1	0.3

(d) College affiliation

	<i>College Affiliation</i>							
	<i>Ag (%)</i>	<i>Arch (%)</i>	<i>Bus (%)</i>	<i>Ed (%)</i>	<i>Engr (%)</i>	<i>Lib Art (%)</i>	<i>Science (%)</i>	<i>Vet (%)</i>
Group 5	18.9	3.7	15.5	5.1	30.5	10.8	3.8	3.7
Group 6	17.9	4.4	14.5	9.6	23.3	15.0	5.0	4.6

(e) Ethnicity

	<i>Ethnicity</i>				
	<i>Black (%)</i>	<i>Hispanic (%)</i>	<i>Native Am (%)</i>	<i>Asian (%)</i>	<i>White (%)</i>
Group 5	1.5	7.4	0.3	2.7	87.9
Group 6	3.1	10.1	0.3	9.6	76.0

Table 7 Continued

(f) Gender

	<i>Gender</i>	
	<i>Male (%)</i>	<i>Female (%)</i>
Group 5	75.6	23.9
Group 6	62.1	37.2

(g) Corps of cadets

	<i>Cadet corps</i>	
	<i>Yes (%)</i>	<i>No (%)</i>
Group 5	29.6	70.4
Group 6	9.4	90.6

(h) Greek affiliation

	<i>Greek social organization</i>	
	<i>Yes (%)</i>	<i>No (%)</i>
Group 5	5.6	94.4
Group 6	4.6	95.4

(i) Marital status

	<i>Connubial type</i>			
	<i>Formerly married (%)</i>	<i>Married (%)</i>	<i>Single (%)</i>	<i>Widowed (%)</i>
Group 5	2.4	73.9	21.1	2.6
Group 6	1.6	60.6	36.8	1.0

(j) Number of children

	<i>Offspring</i>						
	<i>One (%)</i>	<i>Two (%)</i>	<i>Three (%)</i>	<i>Four (%)</i>	<i>Five (%)</i>	<i>Six (%)</i>	<i>>6 (%)</i>
Group 5	22.9	42.4	22.8	7.9	2.6	0.9	0.5
Group 6	33.1	40.6	17.8	5.7	1.7	0.7	0.4

(k) Non university degrees

	<i>Degrees from other schools</i>				
	<i>Zero (%)</i>	<i>One (%)</i>	<i>Two (%)</i>	<i>Three (%)</i>	<i>Four (%)</i>
Group 5	92.7	5.7	1.6	0.0	0.0
Group 6	97.5	2.2	0.1	0.0	0.0

This indicates that the members of Group 5 had a greater likelihood to financially support the alumni association compared to Group 6.

CLASS YEAR AND AGE

Tables 7b and 7c indicate the preferred class year³ decades, and age intervals for Group 5 and Group 6. Group 5 clearly has more members in the older class year categories from 1940 through 1989, while Group 6 has more members in the younger classes from 1990–1999 and especially in the classes since 2000 (the latter by a four to one ratio). With respect to age, similar results occur. Group 5 consistently shows a greater percentage of members in the older age intervals, from ages 40 through 99 years. Group 6 has significantly more members between the ages of 20 and 29 years, as well as more in the age range between 30 and 39 years but to a lesser extent. For many institutions, their elder graduates contribute more generously because of income as well as life cycle effects.

COLLEGE AFFILIATION

The percentages of college affiliation for the two groups (giving and non-giving) are illustrated by Table 7d. Group 5 has noticeably less members in two colleges that have lower earning expectations for their graduates, specifically education and liberal arts. There are 4.5 and 4.2 fewer percentage points in Group 5 of these respective majors relative to Group 6. Furthermore, Group 5 has 7.2 percent more engineering affiliations than Group 6. Engineers enjoy high earnings expectations and likely have more capacity to give, while the opposite may be the case for education and liberal arts graduates.

ETHNICITY

Group 5, from Table 7e, clearly has fewer African American, Hispanic, Asian members, while having almost 18 percent more Caucasians. The diversity of the university has changed dramatically in the last two decades. These ethnic contrasts probably result from the greater proportion of minority students among recent graduates found in Group 6.

GENDER

According to Table 7f, Group 5 has 13.5 percent more men and 13.3 percent fewer women than Group 6. This gender difference might result from the university historically being a male-dominated institution. Since 1990, the number of women has increased dramatically, and first-year undergraduate classes are now half female. If women earn less than their male counterparts and women are less numerous in Group 5, the combination of both phenomena explains some of the difference between these donor groups.

CORPS OF CADETS

From Table 7g, Group 5 shows three times as many former corps of cadet members than Group 6. Nearly one-third (29.6 percent) of Group 5 is a former cadet. Cadets claim to have greater loyalty to their alma mater, and therefore they may be more actively contributing to the annual fund than non-cadets.

GREEK AFFILIATION

The two groups had essentially the same rates of Greek affiliation among its respective members, averaging about 5 percent. See Table 7h.

MARITAL STATUS

There are 13.3 percent more members of Group 5 who are married than in Group 6, according to Table 7i. Simultaneously, Group 6 has 15.7 percent more single members, not too surprising because of their younger age and later class years. Married, but older alumni, like those members of Group 5 may contribute more to their alma mater. But this may result more from income and life cycle effects, rather than being married with children.

NUMBER OF CHILDREN

As shown by Table 7j, Group 6 has just over 8 percent more members (33.1 percent) with one child compared to the members of Group 5 (22.9 percent). However, Group 5 has more members with two through six and more offspring. Do alumni with more children contribute more to their university? There appears to be some evidence of a positive correlation between giving and the number of children, but the real effect on giving is more probably from a higher income level and advanced stage of the life cycle.

NON-UNIVERSITY DEGREES

Group 6 has 5 percent more members without degrees from schools other than this university according to Table 7k. Group 5 has slightly more members with one degree (3.5 percent) or two degrees (1.5 percent) than Group 6. But with greater than 90 percent membership of both groups having no degrees from other universities, any differences on this measure may have inconsequential impact on giving.

SUMMARY

These six groups or clusters of alumni are very homogenous within themselves and are very distinct from one another, as evinced by the powerful predictive performance of the discriminant model, correctly classifying 97.9 percent of the 32 898 cases. For the foundation, Group 1 through Group 4 provides 88 percent of total major gift value, ranging from 11.7 percent to 31.5 percent by cluster. These same groups comprise less than 3 percent of the sample members. For the alumni association, Group 5 and Group 6 represent the key clusters. As per the Pareto Principle, Group 5 accounts for 63.7 percent (almost two-thirds) of contributions to the alumni's annual fund from only 20.1 percent of the sample alumni, giving an average of \$111 annually, and making more than eight gifts since graduation. The gift amounts from members of Group 5 to the annual fund are in relatively small parcels, with 95 percent of the contributions averaging less than \$250. Group 6, the largest cluster with 78.3 percent of the entire sample, can be characterized as non-contributors to both the annual fund and the foundation.

CONCLUSIONS

The Pareto Principle can enhance the effectiveness of any organization. For fundraising, the value of that logic remains for the organization to concentrate its effort on the relatively small percentage of donors that really matter. For the foundation, the 2.6 percent that contribute 88 percent of major gifts is the segment worthy of special attention. However, to identify potential donors that have not given previously poses a task of heroic

proportions and is well beyond the scope of this manuscript. For the alumni association, the 20.1 percent that give 63.7 percent of funds to the yearly campaign clearly produce a disproportionate percentage of results. As clearly suggested by the Pareto Principle, it is important to identify and focus on these alumni to ensure their continued support.

Through marketing and communication efforts (especially via on-campus intervention with undergraduates and targeted approaches to new graduates), the alumni association might influence members of Group 6 (assuming new graduate immediately go into this cluster) to move to higher levels of participation and giving. In each of the last few years, the university has graduated approximately 9000 students. This number of graduates provides a tremendous opportunity to add new and contributing members to the alumni association's fold.

However, the alumni association should also remember that all members of Group 6 are not from recent class years and not necessarily young in age. Twenty percent of Group 6 indicated class years before 1980, representing ages approaching 50 years and older. This segment presents another formidable challenge to the association. It is important to know which groups to target and to tailor marketing strategies to achieve the best results, that is, the highest level of donations.

STRATEGIES

Based on the Pareto Principle, the strategy or policy implication is that the alumni association might be best served by promoting smaller annual gifts that range between \$50 and

\$250, rather than angling for larger gifts at \$500, \$1000, \$2000, \$5000, \$10 000 and greater than \$25 000. (These intervals represent the current loyalty program levels.) A slightly different frequency analysis than reported in Table 6 illustrated that 66.3 percent of Group 5 gave between \$51 and \$100 on average, and 26.5 percent gave between \$101 and \$250 annually. Only 3.7 percent gave more than \$250 on average. The extremely high levels of the aforementioned required donations appear to be directed at less than 5 percent of donors in Group 5.

Further, the loyalty gifts associated with all these aforementioned levels are not significantly differentiated. All levels provide an annual subscription to the alumni magazine, a decal, a plaque for first time program members (a small brass tag to attach to the plaque for subsequent gifts) and mention in the alumni magazine (very large gifts usually are honored with a picture and brief biography).

As an example, public broadcasting systems (both television and radio) in the US promote annual giving at levels such as \$65, \$90, \$120, \$180 and \$250. Although they certainly accept larger gifts, they focus on these amounts and offer increasingly valuable and attractive loyalty gifts at each successively higher level of giving, there appears to be a 'small elasticity' or responsiveness at each donor level and the corresponding loyalty gift.

This represents a finely tuned marketing approach based on donor behavior that appears comparable to giving patterns of Group 5. There are plenty of potential loyalty gifts (for example, coffee mugs, t-shirts, sweatshirts, posters, CDs of fight

songs, DVDs of football highlights and so on.) available for the alumni association to employ in a similar marketing program.

NOTES

- 1 It was named after the Italian economist Vilfredo Pareto, who observed in 1906 that 80 percent of property in Italy was owned by 20 percent of the Italian population.
- 2 For Group 6, the frequency distribution was quite simple, as 28.1 percent of this group gave an average of less than \$100 and the remaining 71.9 percent gave an average of zero.
- 3 Alumni sometimes select a class year based on when they matriculated at the university, rather than when they actually graduated.

REFERENCES

- Anderberg, M.R. (1973) *Cluster Analysis for Applications*. New York: Academic Press.
- Auten, G. and Joulfaian, D. (1996) Charitable contributions and intergenerational transfers. *Journal of Public Economics* 59: 55–68.
- Berry, M.J.A. and Linoff, G. (2000) *Mastering Data Mining: The Art and Science of Customer Relationship Management*. New York: John Wiley & Sons.
- Brown, D.W. (2004) What research tells us about planned giving. *International Journal of Nonprofit and Voluntary Sector Marketing* 9(1): 86–95.
- Clotfelter, C.T. (1985) *Federal Tax Policy and Charitable Giving*. Chicago, IL: University of Chicago Press.
- Clotfelter, C.T. (2001) Who are the alumni donors? Giving by two generations of alumni from selective colleges. *Nonprofit Management & Leadership* 2(2): 119–138.
- Connolly, M.S. and Blanchette, R. (1986) Understanding and predicting alumni giving behavior. In: J.A. Dunn (eds.) *Enhancing the Management of Fund Raising*, Vol. 51, San Francisco, CA: Jossey-Bass, pp. 69–89.
- Drye, T., Wetherill, G. and Pinnock, A. (2001) Donor survival analysis: An alternative perspective on lifecycle modelling. *International Journal of Nonprofit and Voluntary Sector Marketing* 6(4): 325–334.
- Ewing, R.L., Goveckar, M.A., Govekar, P.L. and Rishi, M. (2002) Economics, market segmentation and recruiting: Targeting your promotion to volunteers' needs. *Journal of Nonprofit & Public Sector Marketing* 10(1): 61–76.
- Grant, J.H. and Lindauer, D.L. (1986) The economics of charity: Life-cycle patterns of alumnae contributions. *Eastern Economic Journal* 2: 129–141.
- Hair, J.F., Anderson, R.D., Tatham, R.L. and Black, W.C. (1992) *Multivariate Data Analysis with Readings*. New York: Macmillan Publishing Company.
- Johnson, M.S. and Garbarino, E. (2001) Customers of performing arts organizations: Are subscribers different from nonsubscribers? *International Journal of Nonprofit and Voluntary Sector Marketing* 6(1): 61–77.
- Juran, J.M. and Godfrey, A.B. (2003) *Juran's Quality Handbook*, 5th edn., Southbury, CT: Juran Institute.
- Key, J. (2001) Enhancing fundraising success with custom data modeling. *International Journal of Nonprofit and Voluntary Sector Marketing* 6(4): 335–346.
- Lindahl, W.E. and Winship, C. (1992) Predictive models for raising and major gift fundraising. *Nonprofit Management & Leadership* 3(1): 43–64.
- Shelley, L. and Polonsky, M.J. (2002) Do charitable causes need to segment their current donor base on demographic factors? An Australian examination. *International Journal of Nonprofit and Voluntary Sector Marketing* 7(1): 19–29.
- Todd, S. and Lawson, R. (2001) Lifestyle segmentation and museum/gallery visiting behaviour. *International Journal of Nonprofit and Voluntary Sector Marketing* 6(4): 269–277.
- Willemain, T.R., Goyal, A., van Deven, M. and Thukral, I.S. (1994) Alumni giving: The influences of reunion, class and year. *Research in Higher Education* 35: 609–629.
- Wymer Jr, W.W. (2003) Differentiating literacy volunteers: A segmentation analysis for target marketing. *International Journal of Nonprofit and Voluntary Sector Marketing* 8(3): 267–285.