An Enhanced Method of Segmenting the Retail Market Based on Store Images Using Artificial Neural Networks

Dr.Chandrasekar.K., Meena.M. and Sezhiyan.D.M.

Abstract— This paper focuses on the segmentation of the shoppers based on their behavioral pattern towards the retail store images. The shoppers have been segmented by the use of 'Back Propagation' in 'Artificial Neural Networks' based on the various store attributes. The resulted segments are Pre-Decided, Variety-Seekers, Economy, and Familiar. Each of these segments place importance on the various store image attributes.

Keywords— Artificial Neural Networks, Market Segmentation, Shoppers Behavior, Store Images,

I. INTRODUCTION

This paper is on the same lines of the work [1]. and focuses on the segmentation of the shoppers based on their behavioral pattern towards the retail store images.

Indian market has high complexities in terms of a wide geographic spread and distinct consumer preferences varying by each region necessitating a need for localization even within the geographic zones. India has highest number of outlets per person (7 per thousand), Indian retail space per capita at 2 sq. ft. (0.19 m^2)/ person is lowest in the world, while Indian retail density of 6 percent is highest in the world.1.8 million Households in India have an annual income of over ₹45 lakh.

With the influence of visual media, urban consumer trends have spread across the rural areas also. The shopping spree of the young Indians for clothing, favourable income demographics, increasing population of young people joining the workforce with considerably higher disposable income, has unleashed new possibilities for retail growth even in the rural areas. Thus, 85% of the retail boom which was focused only in the metros has started to infiltrate towards smaller cities and towns. Tier-II cities are already receiving focused attention of retailers and the other smaller towns

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and even villages are likely to join in the coming years. This is a positive trend, and the contribution of these tier-II cities to total organized retailing sales is expected to grow to 20-25%.

Segmentation, an essential tool for effective marketing in the organized retail sector, involves identifying groups of target customers who are similar in buying habits, demographic characteristics or psychographics. In this paper we focus on segmenting the market through a technique called 'Back Propagation' in 'Artificial Neural Networks'. We use MATLAB to implement this algorithm. A questionnaire was circulated across various stores in Trichy and the response was obtained through a 7-point Likert type Scale. Using this data, we segment the respondents into 4 categories viz. Pre-decided, Variety Seekers, Economy and Familiar.

II. REVIEW OF LITERATURE

Store Images, Segmentation and Various Approaches: Store image may be defined as the overall attitude towards the store based upon the perceptions of relevant store attributes [2], [3], [4], [5] Image considerations are important aspects in the development of an integrated marketing strategy for individual stores, store chains and shopping centers. Different consumers might place different weightage on the various store image attributes. Store may pursue different image attributes as their marketing strategy, and ideally, the important attribute emphasized by the store should be in accordance with those of the target audience. Store segmentation image provides guidelines for a retail firm's marketing strategy and can increase profitability [6], [7], [8]. The importance of segmenting retail markets on the basis of store image attributes and the development of an image that conforms to the needs of the retailer's target group of consumers have been repeatedly stressed in the literature [3], [8], [9]. Several approaches have been used in store image segmentation research. One stream of research has examined the important differences in store image attribute for a priori defined segmentation variables [2], [9], [10], [11]. A further approach is to cluster individuals on consumer characteristics and subsequently to estimate the importance of the various image attributes in each segment [12]. Further, there are studies that have clustered the subject on the self-stated importance of store image attributes [13], [14], [15], [16]. [16]

has developed a segmentation method within the context of conjoint designs, and [17], [18] have proposed cluster wise regression approaches to market segmentation. Of late, a number of new judgmental methods to market segmentation have been proposed that may be fruitfully applied to the domain to store-image segmentation. Recently, [19]. Argued that fuzzy cluster wise regression analysis (FCR) holds high potential for store-image segmentation research. [20]. feel that shopper's behavior will be a better judge rather than using scales for measurements.

III. Novel Idea

While the work [1]. Focused on segmentation of shoppers based on store images using K-means Clustering, our work is essentially the same, except that we use Artificial Neural Networks to perform the process for predicting purposes. We take the output from the K-Means clustering process and train the neural network with this data. Now as a result, the trained neural network is ready for predicting the cluster for any new data (Post-Hoc Prediction).

IV. Research Design

Again the research design and input data used is the same to what was used in the work [1].

A. Measures (Instrument Development)

The instrument was designed and developed from the previous related researches using image attributes of retail outlets [2], [3], [9], [10], [21], [22]. Initially 46 items were decoded for the purpose of customizing the research for Indian retail conditions and later it was tested with a pilot sample of 38 items. These were tested with a sample, which included shoppers, management students, retailers, wholesalers, and it was later reduced to 25 items.

B. Pilot Test

Further, to test the content of the questionnaire twenty-five in-depth interviews were conducted with the shoppers of various retail stores and extensive discussions made with such retailer and merchandise managers. Respondents were evaluated as to how they understand, interact and respond to the structure, wordings and ease of answering as well as the time taken to complete the questionnaire in all respect. Suggestions through feedbacks regarding the format and structure of the questionnaire were considered, and changes were made to the questionnaire to reflect respondents' recommendations. Such other suggestions in respect of clarifying the survey instructions, using less technical words, giving examples for each store type, were elicited and were duly incorporated. All items were measured on a 7-point Likert-type scale, where the ratings ranged from 1 to 7 (1 = strongly disagree, 7 = strongly agree).

C. Validity

To establish the "face validity", merchandise managers of various retail store chains were asked to examine whether the scale items adequately cover the entire domain of store image dimensions with the research objectives.

D. The Design Process, Target Population, Sample Frame and Size Determination

Target Population for the research was determined based on three parameters namely, 1. Element: male or female in the household who all visited the branded retail stores. 2. Extent: The branded retail stores in Tricky, India. 3. Time: January and February, of 2009. The population size had expected to be more than 20,000 in typical store (**Judgmental**). To estimate the sample size, a pilot study was conducted to measure or estimate the store image attributes with 25 questions that was measured on a 7-point Likert-type scale. The ratings range from 1 to 7 (1 = strongly disagree, 7 = strongly agree). Keeping a margin error of 3.67% and a response distribution of 85% along with the confidence level at 95%, the estimated sample size is 358. To achieve the total sample size 358 and to cover the entire spectrum of retail stores, an equal quota based proportionate stratified random sampling had performed. That is to say, six different types of retail store had chosen for study to cover the various verticals in the retail segment. (358 estimated sample size divided by six types of retail store is 60 (approx.), which is the sample from each type of retail store). The sample frame has been effectively generated from using random digit table and a simple random sample of respondents drawn up from each retail store excluding children. The stores covered in the research included various branded showrooms in Trichy and Chennai. The stores covered included the following:

Watch stores (59 respondents at Titan and Swatch),
Shoe and apparels store (60 respondents at Reebok, Nike and Adidas),
Shopping malls (60 respondents at Femina Shopping Mall and Big Bazaar),
Clothes store (59 respondents at Raymonds,),
Food stores (60 respondents at Spencers and Food Bazaar), and Gifts and accessories stores (60 respondents at Odyssey, Crosswords and Landmark),

E. Data Collection

Data were collected during the month of January and February of 2009. Data were collected through mall intercept personal interviews. The respondents were intercepted while or after they shopped in the mall. The interviewer then administered the questionnaire. The usable questionnaires were received from the respondents with an average response rate of 67.57%.

V. Theory and Analysis

An artificial neuron is a computational model inspired in the natural neurons. Natural neurons receive signals through synapses located on the dendrites or membrane of the neuron. When the signals received are strong enough (surpass a certain threshold), the neuron is activated and emits a signal though the axon. This signal might be sent to another synapse, and might activate other neurons. In this research, 'Back Propagation' in 'Artificial Neural Networks' is used to segment the customers based on store image attributes. The

complexity of real neurons is highly abstracted when modeling artificial neurons. These basically consist of inputs (like synapses), which are multiplied by weights (strength of the respective signals), and then computed by a mathematical function which determines the activation of the neuron. Another function (which may be the identity) computes the output of the artificial neuron (sometimes in dependence of a certain threshold). ANNs combine artificial neurons in order to process information.
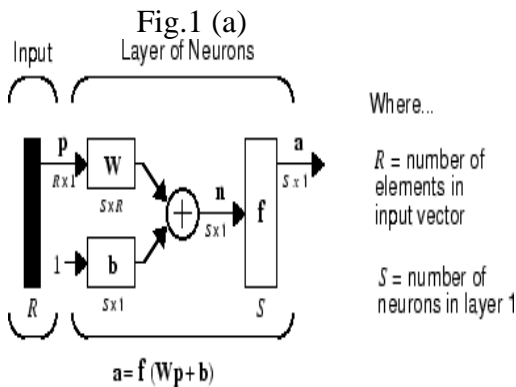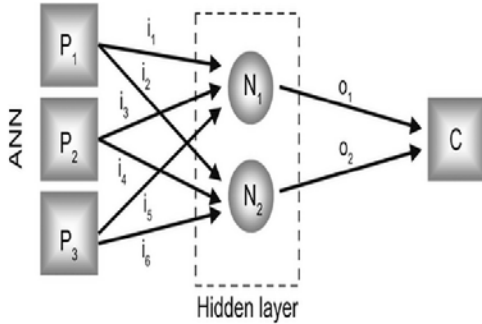

Fig.1 (a)

Fig.1 (b)

The higher a weight of an artificial neuron is, the stronger the input which is multiplied by it will be. Weights can also be negative, so we can say that the signal is inhibited by the negative weight. Depending on the weights, the computation of the neuron will be different. By adjusting the weights of an artificial neuron we can obtain the output we want for specific inputs. But when we have an ANN of hundreds or thousands of neurons, it would be quite complicated to find by hand all the necessary weights. But we can find algorithms which can adjust the weights of the ANN in order to obtain the desired output from the network. This process of adjusting the weights is called learning or training.

The back propagation algorithm [23]. is used in layered feed-forward ANNs. This means that the artificial neurons are organized in layers, and send their signals "forward", and then the errors are propagated backwards. The network receives inputs by neurons in the input layer, and the output of the network is given by the neurons on an output layer. There may be one or more intermediate hidden layers. The back propagation algorithm uses supervised learning, which means that we provide the algorithm with examples of the inputs and outputs we want the network to compute; and then the error (difference between actual and expected results) is calculated.

The idea of the back propagation algorithm is to reduce this error, until the ANN learns the training data. The training begins with random weights, and the goal is to adjust them so that the error will be minimal.

The work flow for the general neural network design process has seven primary steps:

1 Collect data
2 Create the network
3 Configure the network
4 Initialize the weights and biases
5 Train the network
6 Validate the network (post-training analysis)
7 Use the network

The output of the K-means cluster is the input to the neural network. The neural network is trained using this data and thus is ready for predicting the cluster to which a new person would belong based on his responses,

In our case, we are using the MATLAB Neural Networks Toolbox to do the above operations. We also found that out of 358 people, 356 people were rightly segmented which gives a performance of 99.4413%. Note that this figure can be improved by adding more number of neurons to the process as well as by increasing the number of iterations. For our sample space we had the optimum number of iterations and neurons to minimize the usage of space and time.
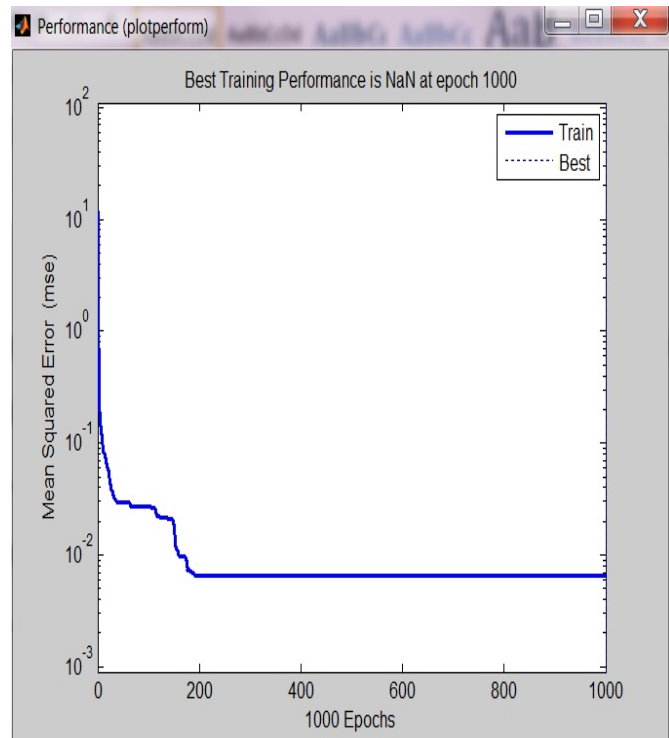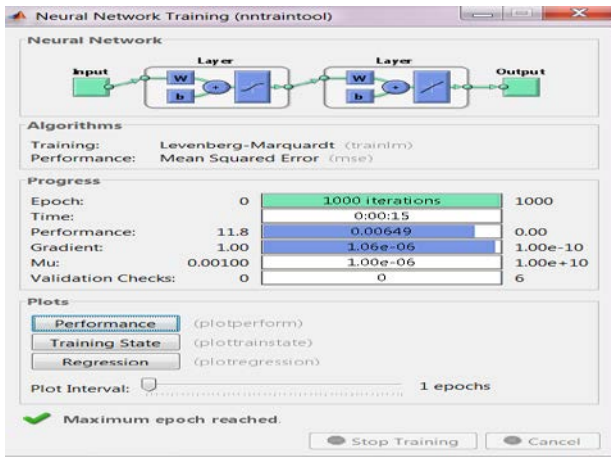

Fig.3 Performance

Fig.4 Neural Network Training

VI. RESULTS

Based on the results of the segmentation process, the following clusters were identified. The results were found to be in correlation with those obtained through K-Means clustering [1].

A. Pre-Decided

These people knew before-hand about what they were going to purchase. The variables related to Availability, Prior-information and the Specifics of a product were major factors in the behavior pattern of this group of people. They were neither concerned about the ambience of the store nor the variety in the store. Also their interactions with sales personnel were limited. They were present in all types of stores and were also the largest segment of shoppers. However, their number was highest in food and garment stores. Men in the age group of 25-45 dominated this segment.

B. Variety-Seekers

This cluster consisted of customers whose behavioral pattern was related to factors such as Display of Product, Depth of merchandise, Promotions, Intensive Brand Search etc. They did not place much importance on a particular brand or product. They observe all the choices in the racks before choosing a product. 'Value for Money' was the selecting criteria. While they were present in all shops, a majority were present in shopping malls. In order to attract this class of customers, stores would need to have a wide range of products. While salespersons don't have any major role to play, a good display and a proper communication system is essential. The shoppers were mostly married men and women.

C. Economic

These shoppers were willing to change products/brands if it exceeded their budget. The behavioral pattern of these customers involved factors like Involvement of Sales Personnel, Price Tag Display, Discount Tags and Promotions. They repeatedly demanded for bargains and asked salespeople to give them discounts. These shoppers were concentrated in the shops with durable products. The shoppers were generally females in the age group of 35-60.

D. Familiar

These customers were regular visitors to the stores. The major factors that influence the behavior of these customers were Priority over other Customers, Ambience, Friendly Attitude of salesperson and Brand consciousness. They walk straight to that part of the shop, where their products are present. They knew the salesperson, and even shook hands with the shop owner before leaving. Such shoppers have a priority over others and have to be attended immediately. While they were presenting a majority of the stores, they tend to be more prevalent in gifts and accessories shops. A majority of these shoppers were men of the age group 30-50.

For each cluster, we determine the average score obtained for each of the questions asked. This gives the Final cluster centers after the segmentation process.

TABLE-I
FINAL CLUSTER CENTERS

	Cluster			
	1	2	3	4
The ambience of the store is not a major factor in my purchase decision	4	3	3	6
I am informed about a product even before I visit the store	3	3	3	6
Availability of merchandize I want to purchase is important when I visit a store	4	4	3	6
I look for a specific type of product in a store	3	3	3	6
The variety is not an important criterion for me to visit a store	3	3	3	6
My interaction with sales personnel is less	3	3	3	6
I check the Price of a product before purchase	3	6	3	4
I switch between brands if prices are increased	3	6	3	3
I seek merchandize with price clearly displayed	3	6	4	3
I seek discounts	3	6	3	3
I prefer to go to the Discount Section as I enter the shop	3	6	3	3
I look for indoor displays and outdoor promotions related to discounts	3	6	3	3
I seek help from the sales personnel	3	6	3	3
I conduct an intensive search of alternate brands before making a purchase decision	6	3	3	3
I lay stress on a product category as opposed to brands	6	4	3	3
I seek value for money	6	4	3	3
I seek a wide depth in merchandize	6	3	3	3
The salesman has a limited role in my purchase decision	6	3	3	3
I keep myself informed about promotions	6	3	3	3
I examine the product thoroughly before purchasing it	6	4	3	3
The image of the store will influence my visiting it again	3	3	6	3
I seek priority over other customers	3	3	6	3
I seek a friendly attitude from the sales personnel	3	3	6	3
I recommend people to visit the store that I like	3	3	6	3
I am conscious about brands	3	3	6	3

Source: Primary Data Analysis

The following table gives us the details of the Cluster Size along with the percentage of the total sample size each cluster forms. Note that there is a slight change to what was obtained through K-means process [1].

TABLE II DESCRIPTIVE DETAILS OF ESTIMATE SAMPLE

Clusters	Frequency	Percent
Pre-Decided	151	42.18
Economy	60	16.76
Variety Seeking	67	18.72
Familiar	80	22.35
Total	**358**	**100.0**

Source: Primary Data Analysis

VII. SUMMARY AND DIRECTIONS FOR FURTHER RESEARCH

The research has segmented the customer base in retail stores into four clusters based on their behavior to store images. The customers in the Pre-Decided cluster seek availability of me goods when they come. So, the managers are required to have a good amount of stock piled for such buyers. The people in Economy cluster have price and 'value for money' as the most important criteria. So, it is important to have separate discount sections for such customers, as well as a salesman who could attend to such customers. New schemes and discount offers should be displayed prominently for such customers. For the Variety-Seekers, the product range is important along with the depth of product line. Similar products of various qualities and brands have to be placed in the racks. The 'Familiar 'customers know the shop and owners well. They must be immediately attended to when they visit the shop. A salesperson should be present at all times in order to attend these customers.

We have made use of second generation neural networks. Now-a-days there is more and more research papers coming out on third generation neural networks. They are a subject of further research. They could be incorporated into segmentation applications. They would be very accurate and fast in processing speeds. Other areas to be improved upon include data collection, pilot tests. Also efforts can be made to improve the unorganized sectors as well, given that the Indian market is predominantly un-organized. This should be a potential area for future research.

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Bankruptcy: A Natural Phenomena Being Attacked On Malaysians'

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*Abstract--*Young generations around 30's who hold numbers of credit card and personal loans are an example of today's Malaysia. Many people claims that the socio economy status of someone is reflected by the number of credit cards they own. Without realizing the consequences of the usage of credit card beyond their limit, more and more young peoples aged around 30's were declared bankrupt due to credit card debts. This research intended to explore the factors that contributed to the bankruptcy of younger generation due to credit card debts. The findings of the research provide useful outcomes to younger generation as well as public in order to increase their awareness regarding the bankruptcy issue that could be seen as a "new disease". An update on the insolvency trends, performance and recent initiatives undertaken by Malaysia Department of Insolvency (MdI) were also reviewed in this study. Insolvency Trends and the administrations consisting of individual bankruptcies and bankrupts' cooperation were also studied thoroughly.

Keywords—Bankruptcy, Malaysian, debts, credit cards.

I. BACKGROUND OF STUDY

CREDIT cards were first issued in the USA in the early twentieth century. In Malaysia, the first card was introduced in the mid-1970s (Zafar U. Ahmed & et al., 2010) [1]. At the early on period, credit cards were only issued to professionals or successful business persons by card issuing companies. However, with the passage of time, eligibility criteria for obtaining credit cards have been changed because credit cards are now easily obtained by individuals regardless of their income or other measures of financial wellbeing. As a result, the number of cardholders reached to about three million by the turn of the last century (Zafar U. Ahmed & et al., 2010[1]. The increase of credit card has brought many side effects to the users especially for the people aged below 30.

This is because credit card influence them in making the excessive spending because it easier and convenient for user to pay with credit card rather than bring cash with them. As a result, in March 2009, outstanding debts from credit card holders amounted to RM15.719 billion were reported. Then, by the year 2009 outstanding credit card debts accounted for 1.35 percent of the total loans outstanding or 11.41 percent of the total consumer credit (Bank Negara Malaysia, 2009; as cited in Zafar U. Ahmed & et al., 2010)[1].

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Thus, its shows that increase in the number of credit card holders seeking bankruptcy records over the years were also reported. The people below 30 are the leading aged group that has been declared bankrupt because of credit card debts (Credit Card Debt and You: Under-30s Under Siege, Malay Mail Insight, 2009)[2].

In the bankruptcy survey of the Panel Study of Income Dynamics, the most common reason that households gave for filing for bankruptcy was "high debt/ misuse of credit cards"—33 percent gave this as their primary reason for filing. A 2006 survey of debtors who sought credit counseling prior to filing for bankruptcy found that debt was even more important: two-thirds were in financial difficulty because of "poor money management/excessive spending" according to (National Foundation for Credit Counseling). In addition, all of the empirical models of the bankruptcy filing decision have found that consumers are more likely to file if they have higher debt. [3] Domowitz and Sartain (1999) found that households are more likely to file as their credit card and medical debt levels increase. [4] Gross and Souleles (2002a) similarly found that credit card holders are more likely to file as their credit card debt increases. In Fay, [5] Hurst, and White (2002)found that households are more likely to file as their financial gain from filing increases— where the financial gain from filing mainly depends on how much debt would be discharged in bankruptcy.

II. LITERATURE REVIEW

Given the apparent connection between the expansion in credit card debt and the rise in bankruptcy filings, it's useful to review how markets for credit cards have evolved in recent decades. My discussion here draws on [6] Ausubel (1997), Evans and Schmalensee (1999), [7] Moss and Johnson (1999), [8] Peterson (2004), and [9] Mann (2006). Until the 1960s, consumer credit generally took the form of mortgages or installment loans from banks or credit unions. Obtaining a loan required going through a face-to-face application procedure with a bank or credit union employee, explaining the purpose of the loan, and demonstrating ability to repay.

Because of the costly application procedure and the potential embarrassment of being turned down, these loans were generally small and went only to the most creditworthy customers.4 This pattern began to change with the introduction of credit cards in 1966, since credit cards provided unsecured lines of credit that consumers could use