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Early SME Market Prediction using USDNN

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***Abstract*—We present the application of an unsupervised snap drift neural network (USDNN) in the context of market prediction for small and medium enterprises (SMEs). The method is applied to small firm data collected from twenty seven participating SMEs across greater London. The motivation of this research is aimed at the significance of artificial neural networks in addressing the perceived failure associated to smaller firms irrespective of area of operation and business type. Hence, the work presented here provides crucial information for creating requirements for a small firm specific model that can be used to support growth or survival in predefined markets**.

***Index Terms*— Data Analysis, Market Prediction, SME, Unsupervised Learning, USDNN**

I. INTRODUCTION

The small firm sector often the major contributor towards the gross domestic product of large economies nonetheless suffers from an inability to predict its future businesses. As a result there is a divide between struggling small and medium enterprises (SMEs) and those considered to be growing enterprises. Therefore, for the truly small firms there must be an element of continuity that can initiate success. Consider the barter system of trading, it has allowed goods and services to be traded long before the existence of money. This means that for survival to be initiated then early man had to decipher what was to be considered most important and as such determine the bargaining tool to meet his needs.

For smaller firms to establish this need they must be given an opportunity to deduce factors that are beneficial for sustaining growth. Therefore, efficiency in marketing is a core requirement for SME survival. For small firm marketing to be considered efficient, such firms must be able to determine the needs of the customer in advance. As such, practice based marketing (distribution of goods based on market needs) will be instrumental. It is with this approach that small firms will be more suited in ensuring that the products and services created will be accepted by its customers. Essentially, the small firm must be able to acquire new customers (determining their specific needs) and retain existing customers (satisfy) if they are to remain a force in their respective market of operation.

II. RELATED WORK

The emphasis that has been duly placed on business survival has led to a continuous adaptation of neural network technology in the general business domain. This adaptation can be attributed to ANNs ability to model non- linear systems [1]. According to [2], such systems have benefited the business sector because of the ease in which they can be used to analyse data a company has at its disposal. Interestingly, a large proportion of prior works in business has focused on operations management, insurance, banking, finance, and marketing and of course the general retail sectors [3].

Key literature suggests that neural networks are considered the likeliest data analysis tool because of its feature discovery capabilities. Hence a large proportion of the work published in this business domain (under prediction) has largely focused on the areas of bank failure prediction [4],[5]; exchange rate prediction[6]; Firm failure Prediction[7],[8]; stock price prediction [9],[10]. All of which suggests that conflicts in markets have led to large firms considering implementing neural networks to sustain growth and initiate competitive advantage.

Marketing research to date has predominantly focused on forecasting (price and sales); segmentation analysis and consumer behaviour. The neural network marketing literature has provided works that have focused on telephone analysis using quantitative data [11],[12]; qualitative response models for decision making[13]; predicting market responses for fast moving goods[14];determination of market response functions [15]; purchase product frequency prediction[16], airline passenger forecasting [17]; industrial market segmentation classification [18]; future order processing [19]; target marketing [20]; using neural networks to determine early warning of loan risk assessment [21] and small business loan default [22];

predicting corporate bankruptcy using neural networks [23]; Analysis of customer satisfaction data [24]; Marketing decision support systems [25], and staff selection [26] and the evaluation of quality in small firms [27].

III. THE SNAP-DRIFT ALGORITHM

The snap drift algorithm is based on both adaptive resonance theory and learning vector quantization. Snap indicates that learning in such a network will take place when network performance is poor while on the other hand drift indicates detailed learning when the performance of the network is good. As snap-drift is based on ART and LVQ then it has to be appreciated that it can be used as a strategic tool for monitoring performance within a self-organising active network. In order to achieve the networks primary objectives both systems must compare inputted patterns in order to determine a level of change in the systems performance feedback propagation unit [28].

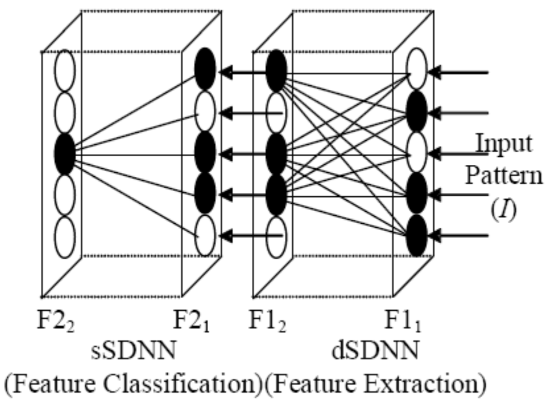

Fig. 1. shows the SDNN architecture[28]

The figure above represents the Snap-drift neural network. Input patterns (I) are presented to the drift half of this network then each pattern will be grouped based on the general features exhibited in the data (or input patterns). Successive epochs will ensure that this type of neural network toggles between snap and drift learning. For each even epoch (inputs such as 2, 4, 6) the algorithm executes the snap half of the algorithm and for each odd number epoch (such as 1, 3, 5) the algorithm executes the drift half of the algorithm. This type of an algorithm is useful for exploratory data analysis as it uses continuous self-organisation in order to discover features as they arise in the data. Hence, for each new execution of the algorithm a new set of classes are created. Each class contains a collection of inputs that are to be considered similar to those of its members.

IV. METHODOLOGY

A six part questionnaire was used as the main research instrument in this study in order to determine the feasibility of neural networks when applied to small and medium enterprises. Themes covered areas such as the company foundations; firm's management structure; employee profile; firm threats; firm competitiveness; innovative and technological capabilities. Collected questionnaires (27 collected) were then tabulated using the subheadings of each section of the questionnaire.

A. Data Pre-processing and Variable Selection

The responses made to each question were transposed using data scaling, data normalisation and coarse coding respectively. Closed question responses were mostly scaled or normalised. Open ended responses were ideally pre-processed using coarse coding as this was considered satisfactory for these kinds of responses in order to preserve key similarities and variations between patterns.

Our analysis consisted of sixty two variable types created directly from all questions on the questionnaire. At this stage in our research, data analysis was conducted using all sixty responses.

V. RESULTS

Our responses were collected from twenty seven participating companies across five distinctive operational areas.

Company Types	Number of Companies
Public Carriage Office Transportation	6
Restaurants	18
Education Recruitment	1
Financial Services	1
Cosmetics/ Hair Design	1

Table 1 shows breakdown of areas of operation of research participant companies.

From the responses collected (see Table 1) it is evident that firms operating in the restaurant sector were the dominant participants in our research so far.

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Classes	Inputs
One	3,13,15,20
Three	5,8,10,18,19,21,22,24,26,27
Four	6,9,12,17
Five	1,2,5,7,11,14,16,23,25

Table 2 shows the classification of each input using snap-drift neural network.

Table 2 shows the classification of each input by the snap-drift neural network. Each input consists of sixty variables representing a particular company. The assigned weights were used to interpret these distinctive classifications.

VI. CONCLUSIONS

The snap-drift neural network has been applied to small firm data. Thus demonstrating that irrespective of type of company there is some correlation in regards to how these firms conduct themselves in business. Our research work presented here is limited in regards to what has already been achieved. However, the associated weights within the snap-drift algorithm have demonstrated that correlations exist between 33% of our input variables (i.e. a third of the sixty variables under examination). This suggests that our ideal network may perform better if we were to use fewer input variables for classification.

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