Data Mining Technology and its Applications for Sales Productivity Analysis

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ABSTRACT

This project focuses on the study of Data Mining technology and implementation of product sales predictive analysis for Amway (M). Certain parts have been adopted to enumerate the grounds of study, where at this stage mainly books, journals and articles on the Internet about Data Mining, as well as interviews and observations have been performed to gather the data of Amway (M). After the collection of data, model was developed to interpret the significance of results performed on the basis of such data by integrating automation, visual representation and predictive analysis into business processes, companies can enhance the efficiency and accuracy of decision making by appropriate methodology. Lastly, regarding this project the author has learned a lot upon the completion of it. It has been, thus, a very satisfactory and fruitful journey of completing this project. Generally, this whole project needs to be polished to have a better effect.

INTRODUCTION

While coming in from a historical background of technology, it is understood that current information technology has been upgraded far better than in past and as well it's the sector which is achieving most advancements in all over the world (De Silva et al., 2018a; De Silva et al., 2018b; Nikhashemi et al., 2013). Where the technology has made much easier things to do, it further has played vital role in the management of computer sciences where the data collection and arrangement procedure is much easier than in past (Bose, 2009). However, to explore these patterns and thus to use more of the information resides in the available data turns out to difficulty. To revamp the data into useful knowledge the tools are less quantity as compared to plentitude of data. People are inquisitive towards information and knowledge seeking. As a result a new area of research named Data Mining is emerged and which use the challenge to evolve techniques that help humans to discover convenient patterns in their data (Rygielski, Wang, & Yen, 2002).

Amway (M) establish a small office and warehouse facility in jalan ipoh in 1976 with only five employees with just five employees and At that time Amway (M) was one of the founder of direct selling industry. Amway (M) distribute a wide dimension of superb trait consumer commodity, ranging from daily goods, health care, home care, home technology, auto care, personal care products, to fashion(Tsai, 2012). The distribution is made through an extensive network, consisting of the members and sales centers throughout Malaysia. Today, Amway (M) has become the well-known direct selling company with 161,000 core distributor force and sales turnover of RM456 million, forging Amway a household name all over the Malaysia. Therefore, mining their data is one of the crucial steps in order to meet their challenges toward the future (Cabena et al., 1999; Dewi et al., 2019; Pambreni et al., 2019; Tarofder et al., 2017).

Questions concerning the knowledge representation had long been of the interests to many of the cognitive psychologists. They had been conducting lots of experiments on this issue. Many theoretical distinctions of different kinds of knowledge had come up. Procedural versus Declarative knowledge is the distinction that is particular relevance to data mining. Procedural knowledge is particular involving the "knowing how" to do things, while in the meantime, Declarative knowledge deals with "knowing that", of the factual information of the real world. Procedural knowledge might be referred to as a cookbook, or recipe for cooking a meal. It describes the process, or how to get certain activity done, or in other words, it shows the process of getting a thing done in step by step form. Declarative knowledge is usually used as a representation of the factual information, such as the name of all the products distributed by Amway (M) or lists of all of the active customers and etc. (Linoff & Berry, 2011; Doa et al., 2019; Maghfuriyah et al., 2019; Nguyen et al., 2019).

Distinguish Between Meta Knowledge and Actual Knowledge

It is important to have a clearer view of the types of information that are to be extracted from the data sets. Looking or describing either the known quantities or just looking up for interesting relationships existing in the classes of the knowledge that have already been known, are what matters here.
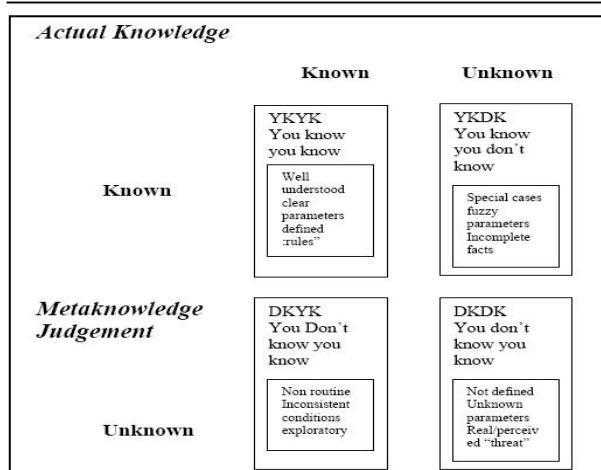
Figure1: Dimensions of Met knowledge and Actual Knowledge within the problem

In this figure, it can be seen that the Meta knowledge and This is the last of the four cells. There are some important gaps in the data sources of this case. Not having the Meta knowledge of them might lead the users being unaware of the gaps. This is the most vulnerable situation to the system. It in fact, affects all governments as well as corporations throughout the world (Nemati & Barko, 2003).

Well, most of the time, the clients are not really sure what they really want or they often do not have specific minds or ideas about what the beginning of the project is all about. They are just seen as an exploratory exercise, and are just hoping to get some interesting results. If it is in this kind of situation, there is still work to do on the initial investigation. In People's Caring Products, the category can further be narrowed into Personal Care, and Health Care products. Under the Non-Personal Caring product category, there are Home Care, Auto Care as well as Home Technology Products. This completes the conception of the category of Care Products (Massaro, Maritati, & Galiano, 2018).

LITERATURE REVIEW

In early 1960s data mining was carried through statistical analysis. SAS, SPSS, and IBM were the colonizer of statistical analysis. Today in data mining filed all these companies are progressive and they have convincing presentation of element based upon their years of experience. Basically, correlation, regression, chi-square, and cross tabulation are basic statistical method which subsisted by statistical analysis. These classical approaches are still offered by SAS and SPSS in particular, but they carried these statistical measures to more insightful surroundings to justify or predict the data (Koh & Tan, 2011). The term of Data Mining may be used to describe wide range activities. In short, Data Mining is the process of exploring the structure of data. Aforementioned technology is mainly concerned with screening large quantities of data and evaluating the hidden information. The most beneficial aspects of this process is of course the fact that new knowledge can turn into litigable results. With this information, appropriate actions can be taken, such as increasing the customer's likelihood to buy, or reducing the number of deceptive claims. Data Mining is certainly one of the fastest growing fields in the computer industry. As mentioned above, Data Mining has been termed a various definitions. Apart from the short definition above, the author is digging more details and accurate definitions of Data Mining, and what it is often used as and in what kind of situation (Ashamed & Hariharan, 2011). The most important key here is, it is important to adopt a flexible approach, as it may give more rooms to unexpected discoveries beyond bounds of the expected problem domain (Khajvand, Zolfaghar, Ashoori, & Alizadeh, 2011).

Data mining is a great problem solving technique as well as a natural activity that is best to be performed on a data warehouse (Dhond, Gupta, & Vadhavkar, 2000).

Predefined class can be assigned by examining the aspects of newly presented object through categorization. The main purpose of classification is to distinguish the unclassified and predefined variables through model building (Anderson & Kotsiopulos, 2002). Database provides records which are helpful to classify objects. Thus, Class code is filled by updating records via classification. Estimation is practically dealing with the continuously valued outcome (as discrete outcome is what matters in classification) as compared to classification. Estimation is commonly used in a situation using some input data about unknown continues variable such as height, weight and income etc.

There are still numbers of estimation tasks that might be practical, estimating the sales of a certain product, estimating the value or price of a product, estimating the numbers of members to be remaining as active members. As a conclusion here, classification and estimation are often used together. Prediction is, to some extent, related to both classification and estimation (Sumathi & Sivanandam, 2006). The difference is one of the stresses here. By the use of examples the predicted value of variable can be compared by historical data (Hui & Jha, 2000).

Affinity grouping is done to evaluate the correlation between the objects. In this case, affinity grouping can be helpful to organize the items to be displayed together on shelves in their various outlet, as well as organizing the items which are often been purchased together be seen together. In the process of clustering diversified groups are segmented into smaller groups or subgroups of similar trait. It seems that both clustering and classification are quite the same, but they are not still. Predefined variables are not categorized in clustering as in classification (Chen, Han, & Yu, 1996). Only similarity counts in clustering. Self-similarity is the main pillar of clustering on which data is arranged. Data mining is all about prediction and classification of complicated database to achieve accurate knowledge. Behavior of the variable is described and explain in efficient manner (Gong & Xia, 2009).

The number of the underlying objects had been the main attribute here (Deshpande & Thakare, 2010). The original specific values would still be available for reference in the data source, but the analysis would still be performed on the abstracted values. For the groupings, the range and size of the values depends on the actual values represented in the abstraction (Han, Pei, & Kamber, 2011). The numbers of segments are not supposed to be either too large or too small. This might also be applicable to qualitative data, where there are natural levels of abstractions. A good example would be the separation of geographical regions (Shmueli, Patel, & Bruce, 2011). This is very much applicable in direct sales organization, where the stockiest would be distributed all around in

Malaysia. They can be abstracted in the way that stores are located in districts, the districts are in cities, cities are in states, states are in regions, and etc. Predictive analysis is a study to find out or to forecast what will happen in the future. People have to face the reality that the analysis, no matter what is the nature of the analysis, it takes time. Careful thoughts and insights are needed to be done in order to interpret those indications that one have already taken time to collect. In order to have a clear and accurate prediction of the future elements, careful and accurate analysis should be taken in action (Olson & Delen, 2008).

A prediction of sales forecast is based on the performance of previous sale and analysis of expected market conditions. Peoples are forced to take a look on future objective by true value of making in forecast (Nemati & Barko, 2001). There is need to establish the trends between the actual performance and past forecast to feedback the forecaster for perfect future forecasting (Seifert, 2004). A forecast is similar to a weather forecast is an educated guess about what the future will bring. People can predict all kinds of elements for example the future stock price, the sales and cost, the weather and so on (Köksal, Batmaz, & Testik, 2011). Wishful thinking compel people to make their guesses and forecast. Dollar sales value from the past several years predict about the forecast which is based on company's previous sales. Thorough sales forecast can be completed by the evaluation of all internal and external elements (Eze, Onwuegbuchulam, Ugwuishiwu, & Diala, 2017). Mathematically, it is possible to forecast sales with some precision. Realistically, however, this accuracy can be worn out due to external market and economic factors, discrepancies. External and internal factors need some sufficient information for sales forecast requirements (Ngai, Xiu, & Chau, 2009). After answering these following questions sales forecast are called qualified. More precise its outcome will be, if the more focused the sales forecast.

Hypothesis:
H1: There is significance of Controlling Sales via Data Mining application.
H2: Data Mining significantly enables account management.

METHODS
Hierarchical Framework
It is essential for a data mining practice to map the problems onto an explicit conceptual framework. Flexibility of thought should be given great emphasis in order to have this mapping done effectively, since it is likely to go out of bounds that anyone would be familiar.
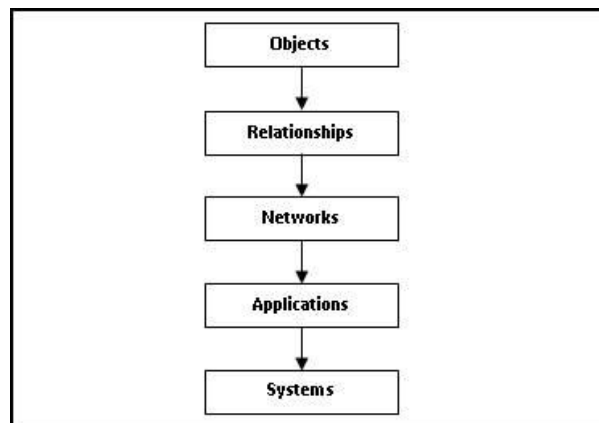

Figure 2: Hierarchical Framework for Knowledge Representation in Data Mining Applications

Some of the sample variables that can be observed in this project are listed below:
Sales volume for different categories of products can be viewed and compared.
Customers' accounts can be updated weekly.
Database
There is abundance of database application software everywhere now, due to the expansion of the database application systems that mushroomed today. Among those famous and well recognized are Microsoft Access, SQL Server, and Oracle.
Deriving Meta Data from dates, values, names, and addresses
Metadata here in data mining application is slightly different to those used in Artificial Intelligent. The metadata in this context is basically referring to the data within data. The purpose and goals of using this metadata is actually to be able to exploit it in a way that will make sense for the application and yield interpretable results. There are, however, some of them that occur commonly which are use of dates, values, names, and addresses.
Descriptive and Transactional Model
Declarative information belongs to descriptive model, while episodic information is part of transactional model. Meanwhile, transactional data model is contained of the episodic information about the time and place of the events, or transactions. This is to decide on the necessary models, based on the study of the data obtained.

Reactive and Proactive Analysis
Beginning the analysis in either a proactive or reactive mode can be decided on after the earlier activities. After the thinking of what the application would do, and the characterization of the problems into the conceptual frameworks, decision of the mode to be applied can be carried out. These two techniques are good at each area. We would like to review some of the major differences between both, and do a combination of both.

ANALYSIS
Predictive analysis based on the sets of data obtained, the correctness of the samples taken and this will thus develop a confidence level in statistics. Annual growth and evaluation of sales level can flourish via forecast conduction and helpful for people to compare the company with industry. Sales Forecasting is practically done in part as the analysis in this project. This is done mainly for calculating and estimating the performance

and the profitability of the organization. This is to have a better data mining on the system.

Simple Moving Average
The following example will demonstrate the idea of simple moving average forecasting.
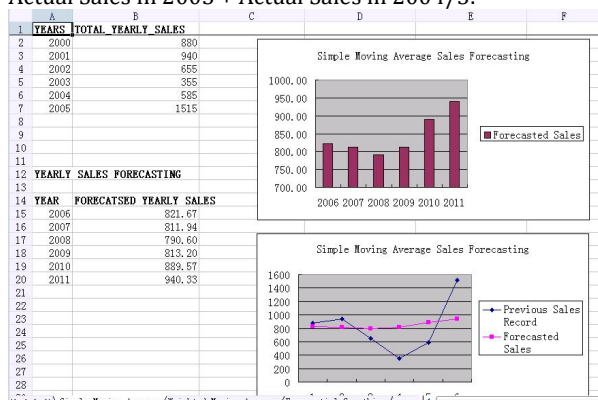Forecast for year 2005 (for n = 3) = Actual Sales in 2002 + Actual Sales in 2003 + Actual Sales in 2004/3.

Figure 3: Sales Forecasting of the Project – Simple Moving Average

Simple Moving Average
The following example will demonstrate the idea of simple moving average forecasting.
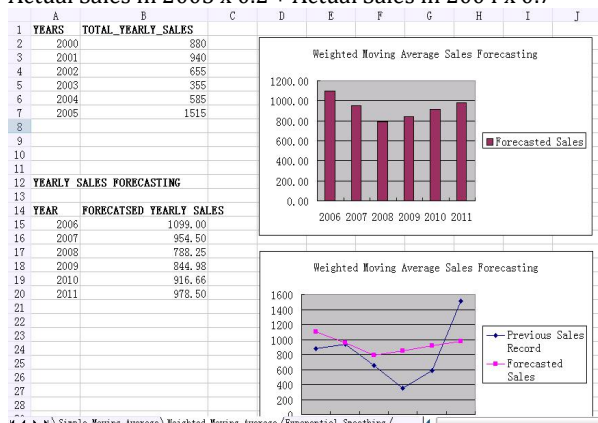Forecast for year 2005 = Actual Sales in 2002 x 0.1+ Actual Sales in 2003 x 0.2 + Actual Sales in 2004 x 0.7

Figure 4 (a): Exponential Smoothing

Alpha is open to choice, but a value of 0.2 to 0.3 is common.

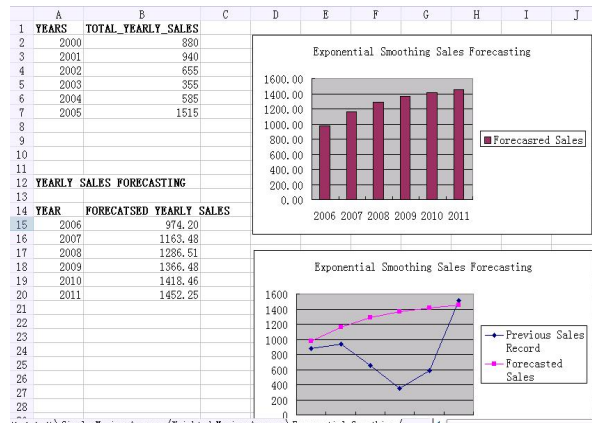Forecast for year 2005 = Alpha x Actual Sales in 2004 + (1- Alpha) x Forecasted Sales in 2004

Figure 4 (b): Exponential Smoothing

Ratio Analysis
They are mainly the liquidity ratio, profitability ratio, and use of assets, capital structures and the return of investment. As a matter of fact, only the first three ratios will be discussed here. This is mainly due to the irrelevance of the other ratios.

Liquidity Ratio
In this case, two of the commonly used ratios which addressed the situations about liquidity ratios, highlight such a situation.
Current ratio is one of them. It is obtained from the equation below.
Current Ratio= Current Assets / Current Liabilities
This current ratio actually measures the relationship between an organization's current assets and together with its current liabilities. As for an example, let's say Amway (M) has the current assets of RM90, 000 and the current liabilities of RM30, 000, then the current ratio would be 3:1 which 90,000/30,000 is. With this, it is clear that for every RM1 of current liabilities, there would be RM3 of current assets.
Acid Test, on the other hand, is the second type of the liquidity ratio. The formula goes on this way:
Acid Test = (Current assets - Stocks) / Current liabilities.
In this example, the author would like to have the continuation from the first example. Let's say the stocks in Amway (M) then the acid test ratio would be:
(90,000-45,000)/ 30,000 = 1.5:1
Significantly high current and acid test ratios indicate that the cash flow is not having a problem. As such, it confirms the importance of liquidity ratio.

Profitability Ratio
There are two different percentages of profits under this category. They are actually the Gross profit percentage, or gross margin, and the net profit percentage. Gross Profit Percentage, or Gross Margin, is the first of the two. It is represented as the equation below:
Gross Profit Percentage or Gross Margin = (Gross Profit/ Sales) x 100%
In this case, the gross margin expresses the gross profit as a percentage of total sales. As an example, if Amway (M) makes a gross profit of RM150,000 on the total sales of RM250,000, then the gross margin would be (150,000/250,000) x 100% = 60%. In other words, a gross margin of 60% would be obtained with the examples above. To simplify it, for every RM100 of sales, Amway is making a gross profit of RM60.
The second percentage of profit is the Net Profit Percentage, which can be expressed in this equation of:

Net Profit Percentage = (Net Profit / Sales) x 100%.

Well, the net profit percentage expresses the organization's net profit as a percentage of total sales. If, let's say Amway (M) is having RM25,000 of net profit for the sales of RM250,000, then the net profit percentage would be (25,000/250,000) x 100% = 10%.

As in the case of this project, the author had done some analysis and a simple calculation on the profitability ratio for Amway (M).

The Use of Assets

Sales to fixed assets ratio is one of the ratios that can be used. The equal goes:

Sales to Fixed Assets Ratio = Sales/Fixed Assets

The sales to the fixed assets ratio usually indicates how much each of the Ringgit Malaysia (RM) invested generates in sales. For example, if the recorded total annual sales of Amway (M) is RM250, 000, and the fixed assets is RM100, 000, then the ratio of its sales to fixed assets would be 2.5:1. In other words, for every RM1 invested in the fixed assets, then there would be RM2.50 of sales is generated. In general, the relationship between the two (fixed assets and sales) is directly proportional. The higher the ratio of sales to fixed assets, the more efficiently fixed assets is being utilized.

Stock turnover ratio is another ratio using assets. The equation goes this way:

Stock Turnover Ratio = (Average stock held / Annual Cost of Sales) x 365

As for the case of this project, direct sales organizations like Amway (M), the stocks would not be lasting that long, as with the case of transport industry. The stock turnover ratio is therefore rather low. This is normally due to the fact that the common products that are distributed by the direct sales organizations are of high demand products. And the fact that it is direct sales organization, there will not be a product that are too many in quantity, however, there will not be too low level of stocks as well, Amway (M) would normally ensure that they are holding optimum levels of stocks.

Ratio Analysis of the Project

There are some of the relevant and important ratios that had been adopted for the purpose of this project. The ratios like the Efficiency and Profitability Ratios had been performed on the available data. The results of the analyses are stored in the program and can be retrieved as reference.

CONCLUSIONS

The proposed system is basically divided into three modules which are management, analysis and reporting. In the management module, the proposed system provided four kinds of management function which are customer, product, sales and financial management. With these functions, the organization can easily manage its customer relationship, maintain inventories, sales and financial records as for all of the data will be stored in database for future analysis. While in the analysis module, the proposed system provided two kinds of analytic functions which are financial analysis and sales forecasting. For the financial analysis, the proposed system will performed cash flow analysis, investment analysis and ratio analysis base on the selected income statement and balance sheet information that are previously stored in database. On the other hand, result of sales forecasting will be generated also based on the selected previously stored sales records in database. In the last module of the proposed system – reporting it provided insightful reports and also transformed numbers into easy-to-understand visual representation. With this, the decision makers are allowed to draw a better decision if compared with the traditional way of interpreting the sales records. In conclusion, by integrating automation, visual representation and predictive analytics into business processes, companies can dramatically improve the efficiency and accuracy of decision making. Lastly, regarding this project the author has learned a lot upon the completion of it. It has been, thus, a very satisfactory and fruitful journey of completing this project. This project cannot really be smooth sailing without the help of the people that the author had mentioned in the acknowledgement of this report. Nevertheless, there is a strong urge for the author to thank them once again here. The author would like to take this opportunity to express his sincere gratitude to all those people who had made this project a smooth sailing one. Finally, the author is very glad to have this project done in time. Since this project is a prototype developed within a time constraint, the functionalities are limited. It would have been better if more powerful programming languages such as Java or C++ have been selected in this case. As for the database, it is recommended to adopt MS SQL than Oracle as it is as powerful as Oracle with less complexity in the configuration. The database size in this project can be expanded as for a better forecasting. The larger the size of the database, the more accurate the forecasting become. Generally, this whole project needs to be polished to have a better effect.

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