REVIEW OF LITERATURE ON DATA MINING

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ABSTRACT
Data mining is used for mining data from databases and finding out meaningful patterns from the database. Many organizations are now using these data mining techniques. In this paper authors has reviewed the literature of data mining techniques such as Association Rules, Rule Induction Technique, Apriori Algorithm, Decision tree and Neural network. This review of literature focuses on how data mining techniques are used for different application areas for finding out meaningful pattern from the database.

KEYWORDS: *Association Rules, Rule Induction Technique, Apriori Algorithm, Neural Network, Decision Tree.*

REVIEW OF LITERATURE

Data mining techniques provide a popular & powerful tool set to generate various data driven classification systems. Leonid Churilov, Adyl Bagirov, Daniel Schwartz, Kate Smith and Michael Dally had already studied about combined use of self organizing maps & nonsmooth, nonconvex optimization techniques in order to produce a working case of a data driven risk classification system. The optimization approach strengthens the validity of self organizing map results. This study is applied to cancer patients. Cancer patients are partitioned into homogenous groups to support future clinical treatment decisions.

Most of the different approaches to the problem of clustering analysis are mainly based on statistical, neural network, machine learning techniques. Bagirov et al. [4] propose the global optimization approach to clustering and demonstrate how the supervised data classification problem can be solved via clustering. The objective function in this problem is both nonsmooth and nonconvex and has a large number of local minimizers. Due to a large number of variables and the complexity of the objective function, general purpose global optimization techniques, as a rule fail to solve such problem. It is very important therefore, to develop optimization algorithm that allow the decision maker to find "deep" local minimizers of the objective function. Such deep mininizers provide a good enough description of the data set under consideration as far as clustering is concerned. Some automated rule generation methods such as classification and regression trees are available to find rules describing different subsets of the data. When the data sample size is limited, such approaches tend to find very accurate rules that apply to only a small number of patients. In Schwarz et al. [16] it was demonstrated that data mining techniques can play an important role in rule refinement even if the sample size is limited. For that at first stage methodology is used for exploring and identifying inconsistencies in the existing rules, rather than generating a completely new set of rules. K-mean algorithm lies in the improved visualization capabilities resulting from the two dimensional map of the cluster. Kohonen developed self organizing maps as a way of automatically detecting strong features in large data sets. Self organizing map finds a mapping from the high dimensional input space to low dimensional feature space, so the clusters that form become visible in this reduced dimensionability. The software used to generate the self organizing maps is Viscovery SOMine (www.eudaptics.com), which provides a colorful cluster visualization tool, & the ability to inspect the distribution of different variables across the map.

The subject of cluster analysis is the unsupervised classification of data & discovery of relationship within the data set without any guidance. The basic principle of identifying this hidden relationship is that if input patterns are similar, they should be grouped together. Two inputs are regarded as similar if the distance between these two inputs is small.

This study demonstrates that data mining techniques can play an important role in rule refinement, even if the sample size is limited. Leonid Churilov, Adyl Bagirov, Daniel Schwartz, Kate Smith and Michael Dally demonstrated that both self organizing maps & optimization based clustering algorithms can be used to explore existing classification rules, developed by experts and identify inconsistencies with a patient database. As the proposed optimization algorithm calculate clusters step by step and the form of the objective function allow the user to significantly reduce the number of instances in a data set. A rule based classification system is important for the clinicians to feel comfortable with the decision. Decision tree can be used to generate data driven rules but for small sample size these rules tend to describe outliers that do not necessarily generalize to larger data sets.

Anthony D Anna & Oscar H. Gandy develop a more comprehensive understanding of data mining by examining the application of this technology in the marketplace. As more firms shift more of their business activities to the web, increasingly more information about consumers and potential customers is being captured in web server logs. Anthony D Anna & Oscar H. Gandy examine issues related to social policy that arise as the result of convergent developments in e_business technology and corporate marketing strategies. About consumers and potential customers is being captured in web server logs. Sophisticated analytic and data mining software tools enable firms to use the data contained in these logs, to develop & implement a complex relationship management strategy. Individuals whose profile suggest that they are likely to provide a high lifetime value to the firm will be provided opportunities that will differ from those that are offered to consumers with less attractive profiles. Analytic software allows marketers to combine through data collected from multiple customers touch points to find patterns that can be used to segment their customer base. Web generated data includes information collected from forms, transactions as well as from clickstream records.

Artificial neural networks are designed to model human brain functioning through the use of mathematics. Like neural network data mining through the use of decision tree algorithms discerns patterns in the data without being directed. According to Linoff "decision trees work like a game of 20 questions", by automatically segmenting data into groups based on the model generated when the algorithms were run on a sample of the data (1998, p. 44). Decision tree models are commonly used to segment customers into "statistically significant" groups that are used as a point of reference to make predictions (Vaneko and Russo, 1999). Both neural networks & decision trees require that one knows where to look in the data for patterns, as a sample of data is used as a training device. The use of market basket analysis & clustering techniques does not require any knowledge about relationships in the data, knowledge is discovered when these techniques are applied to the data. Market basket analysis tools sift through data to let retailers know what products are being purchased together. Clusters prove to be most useful when they are integrated into a marketing strategy.

The software companies that market personalization products that use data mining techniques for knowledge discovery, speaks to their potential clients in a language that make the benefits of these systems unmistakable. However customer relationship management appears to be the philosophy that will drive marketing strategies in the 21th century. Customer relationship management focuses not on share market, but on share of customer. Marketing strategists have been able to demonstrate that a firm's profitability can increase substantially by focusing marketing resources on increasing a firm's share of its customers business rather than increasing its number of customers (Peppers & Rogers, 1993).

One of the basic tenets behind customer relationship management is the Pareto Principle, the notion that 80% of any firms profit is derived from 20% of its customers. Engaging in a dialogue with that 20% in order to ascertain what their needs are & offering goods & services to meet those needs are said to be what customer relationship management is all about. Data mining technologies have allowed firms to discover and predict whom their most profitable customers will be by analyzing customer information aggregated from previously disparate database. The web has created a forum for firms to engage in a one to one dialogue with particular segments of their customer base in order to ascertain what the needs of those segments are.

Huda Akil, Maryann E. Martone, David C Van Essen made a study about understanding the brain requires a broad range of approaches and methods from the domains of biology, psychology, chemistry, physics & mathematics. The fundamental challenge is to decipher the "neural choreography" associated with complex behaviors and functions including thoughts, memory, actions and emotions. National Institute Of Health recently launched the Human Connectome Project and awarded grants to two consortia. The consortium led by Washington University of Minnesota aims to characterize whole brain circuitry & its variability across individuals in 1200 healthy adults. Neuroimaging & behavioral data from the HCP will be made freely available to the neuroscience community via a database & a platform for visualization & user friendly data mining. The informatics effort involves major challenge owing to the large amounts of data, the diversity of data types & the many possible types of data mining. Some investigators will drill deeply by analyzing high resolution connectivity maps between all gray matter locations. It is inefficient for individual researcher to sequentially visit and explore thousands of databases. To promote the discovery and use of online databases, the NIF created a portal through which users can search not only the NIF registry but also the content of multiple databases simultaneously. The current NIF federation includes more than 65 databases accessing 30 million records in major domain of relevance to neuroscience. Beside every large genomic collection, there are nearly 1 million antibody records, 23000 brain connectivity records and more than 50,000 brain activation coordinates. Many of these areas are converted by multiple databases, which the NIF knits together into a coherent view. The NIF users should be able not only to locate answers that are known but to mine available data in ways that spur new hypothesis regarding what is not known. Perhaps the single biggest roadblock to this higher order data mining is the lack of standardized frameworks for organizing neuroscience data. Individual investigators often use terminology or spatial coordinate systems customized for their own particular analysis approach. This

customization is a substantial barrier to data integration, requiring considerable human effort to access each resource, understand the context and content of the data and determine the conditions under which they can be compared to other data sets of interest.
Neurolex terms are accessible through a wiki that allows users to view, augment and modify these concepts. The goal is to provide clear definitions of each concept that can be used not only by human but by automated agents, such as NIF, to navigate the complexities of human neuroscience knowledge. A key feature is the assignment of unique resource identifier to make it easier for search algorithms to distinguish among concepts that share the same label.
So in future good planning and future investment are needed to broaden & harden the overall framework for housing, analyzing, and integrating future neuroscience knowledge. The international neuroinformatics coordinating facility plays an important role in coordinating and promoting this framework at a global level.

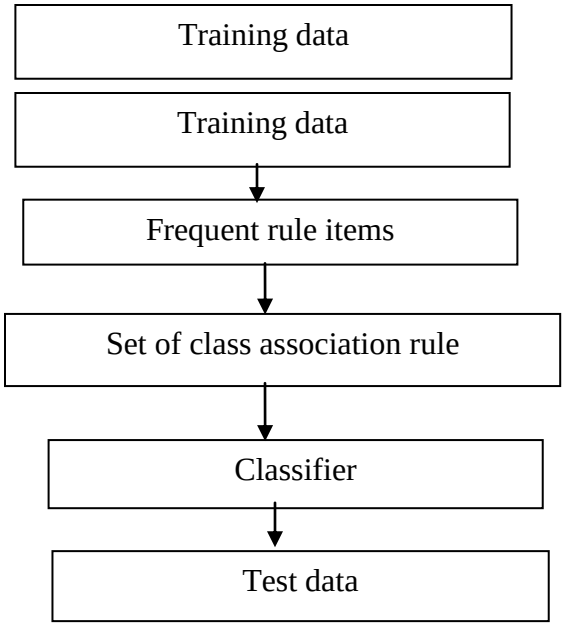
Following suggestions are given by Huda Akil, Maryann E. Martone, David C Van Essen:

Neuroscientists should as much as feasible, share their data in a form that is machine accessible, such as through a web based database or some other structured form that benefits from increasingly powerful search tools. Database spanning a growing portion of the neuroscience realm need to be created, populated and sustained. This effort needs adequate support from federal & other funding mechanism. Because databases become more useful as they are more densely populated, adding to existing database may be preferable to creating customized new one. Some type of published data should be reported in standardized table formats that facilitate data mining. Cultural changes are needed to promote wide spread participation in this endeavor.
Chandrika Kamath in her study said that the size & the complexity of the data from scientific simulations, observations and experiments becoming a major impediment to their analysis. To enable scientists to address this problem of data overload and benefit from their improved data collecting abilities, the Sapphire project team has been involved in the research, development & application of scientific data mining techniques for nearly a decade. According to her team the raw data available for analysis was in the form of images, structured or unstructured mesh data with physical variables at each mesh point or time series data collected by different sensors. They designed and built a software toolkit with separate modules for different tasks such as denoising, background subtraction to identify moving objects in video, dimension reduction to identify key characteristics of objects, pattern recognition for clustering and classification. Recognizing that for each task different methods were likely to be appropriate based on the data; we used object oriented techniques to provide a uniform interface to the algorithms. Data from first survey are available in two forms of image maps & catalog. Goal of this scientific application is not to build a predictive model but to discover a set of features that may provide insights into the phenomena of interest.
Study made by Fadi Thabtah about associative classification mining said associative classification integrates two known data mining tasks, association rule discovery and classification to build a model for the purpose of prediction. Classification and association rule discovery are similar tasks in data mining, with the exception that the main aim of classification is the prediction of class labels, while association rule discovery describes correlations between items in a transactional database. Rule induction approach such as IREP (Furnkranz & Widmer, 1994) and RIPPER (Cohen, 1995) derive local sets of rules in a greedy manner. The derived rules are local because when a rule is discovered, all training data objects associated with it are discarded & the process continues until the rule found has an acceptable error rate. This means rules are discovered from participations of the training data set & not from the whole training data set once. The search process for the rules is greedy as most rule induction algorithms normally look for the rule that maximizes a statistical measure.

Example:-

The IREP rule induction algorithm constructs the rules based on first order inductive learner, gain measure (Quinlan & Cameron Jones, 1993). This means that the attribute value in the training data set with the best FOIL gain is chosen first as a member of the current rule left hand side (antecedent) and the process is repeated until a stopping condition is met.

Associative classification steps:



In the Apriori association rule discovery algorithm (Agrawal and Shrikant, 1994) the discovery of frequent itemsets is accomplished in levels, where in each level Apriori uses itemsets found to be frequent in the previous level to produce new candidate itemsets. Apriori utilizes the downward closure property with aim of speeding up the search process by reducing the number of candidate itemsets at any level. The downward closure property ensures that all subsets of a frequent itemset must be frequent as well. If an itemset is infrequent at any level, it will be removed because any addition of items to it will not make it frequent. Apriori uses this property to prune candidate itemsets that have infrequent subsets before counting their support at any level. This should reduce the time to produce and compute the support for all items combinations in the transactional database.

In Perkowitz & Etzioni (1998), the problem is defined in terms of automatic constructions of index pages based on logfile data, with the goal of constructing index pages that provide users access to information that they are likely to view. The algorithm proposed has four steps :

1. Processing the logfiles into user visits.
2. Computing co-occurrence frequencies between pages and creating a similarity matrix.
3. Creating a graph from this matrix & then finding cliques in this graph.
4. Creating index pages corresponding to each clique in the graph.

The algorithm is evaluated based on how often users simultaneously visit the pages in the index page. Shrikant & Yang (2001) propose another interesting approach to the problem of automatically synthesizing web pages. They address the issue of comparing the "expected location" of various pages with the actual location where the page is, and they propose an algorithm that automatically finds such pairs of web pages. The main idea is examine user session in the logfiles and identify backtracking points where a user backtracks to a previous page & continues the session. An objective of website design can be to maximize navigational simplicity by minimizing the average number of clicks required to get to any page. Further there may be several constraints on the design. Yet another constraint may require the sports & finance pages to be explicitly linked to each other based on input from the marketing department. However it is difficult to provide user specific constraint a priori. Data Mining can help to address this problem. First the website is structured as per the solution to the optimization problem. As the user navigates this site, data on user's access pattern is gathered. Data Mining can thus identify additional constraint using patterns identified by this data. Data Mining can find most user access the finance & sports pages together. This information can then be used as a constraint. The optimization problem is then solved incorporating the additional constraint. This process can be iteratively done until some user defined stopping criteria. This example demonstrates the opportunity for new research to identify similar problems that can be formulated in the context of

website design. In this mode, problem in website design will be mainly formulated as optimization problems. However Data Mining will play a key role in the specification of the optimization step and will also play a part in the specification of the constraints.

Another interesting customer interaction issue is the provision of personalized services to customers, including recommendations. Most of the approaches developed for solving this type of recommendation problem use statistical & data mining approaches and usually tries to determine "good" products to recommend to the customer. Various existing recommendation method were classified by Balabanovic & Shoham (1997) into content based, collaborative & hybrid approaches and have been reviewed in survey (Pazzani 1999, Schafer et al. 2001, Adomavicius and Tuzhilin 2003)

Example :-

Amazon.com may want to determine which best 10 books to put on the customers welcome page. The challenge for this problem is that the rating function is usually partially specified. Once the optimization problem is defined, data mining can contribute to its solution by learning additional constraints with data mining methods, thereby significantly reducing the search space. For example, in the case of online wine store, we can learn that a customer usually prefers to buy red inexpensive wines, however on certain occasions, such as his wife's birthday, he usually buys midrange white Chablis. By storing this information in the customers profile and invoking it on these special occasions, much tighter constraints on recommendations can be specified. In this section, we reviewed some of the existing approaches to solving three main analytical e_CRM problems. First is specifying effective performance metrics and finding optimal solutions based on them. Second is developing effective customer analysis & third is a customer interaction method.

Another study is made by Tae Kyung Sung, Namsik Chang and Gunhee Lee about how data mining approach develop bankruptcy prediction model suitable for normal & crisis economic condition. It observes the dynamics of model change from normal to crisis condition and provides interpretation of bankruptcy classification. The bankruptcy prediction model revealed that the major variables in predicting bankruptcy were "cash flow to total assets" and "productivity of capital" under normal conditions and "cash flow to liabilities", "Fixed assets to stockholders equity and long term liabilities" under crisis conditions. The accuracy rate of final prediction models in normal conditions & in crisis conditions were found to be 83.3 % and 81.0 % respectively. When the normal model was applied in crisis situations, prediction accuracy dropped significantly in the case of bankruptcy classification (from 66.7 percent to 36.7).

As we are in the 21th century, corporate bankruptcy in the world, especially in East Asia, has reached an unpredictable level. Corporate bankruptcy brings with it economic losses to management, stockholders, employees, customers and others together with great social and economical cost to the nation. Thus accurate prediction of bankruptcy has become an important issue in finance. Since the seminal study of Altman on bankruptcy prediction, numerous follow up studies have tried to further develop appropriate models, by applying data mining techniques including multivariate discriminate analysis, logistical regression analysis, profit analysis, genetic algorithms, neural networks, decision trees and other statistical & computational methods. It is worth noting however that all of these bankruptcy models assume "normal" economic conditions.

The detection of corporate failures is a subject that has been particularly amenable to financial ratio analysis. According to Altman, the first study was done in 1935 by smith & winakor during the great depression era, then in 1942, Merwin showed that failing firms exhibit significantly different ratio than do successful firms. Beaver then applied univariate analysis of financial ratios to predict corporate bankruptcy, while others strongly recommended multivariate analysis.

The breakthrough bankruptcy prediction model, the Z – score model developed by Altman came in the late 1960s. The five variables Z – score model using multiple descrimenant analysis showed by very strong predictive power. Most of the studies including that of Altman used relatively small firms in their samples; generalization of research results was hard to accept. Altman, Haldeman and Narayanan therefore developed the ZETA model to be applied to larger firms, not limited to specific industries.

The study made by HE Zengyou, XU Xiafei and DENG Shengchun said that clustering is an important KDD technique with numerous applications, such as marketing & customer segmentation. Clustering typically groups data into sets in a way that intra – cluster similarity is maximized, while the inter cluster similarity is minimized. Many efficient clustering algorithms such as ROCK, C2P, DBSCAN, BIRTH, CURE,CHAMELEON, wavecluster & CLIQUE have been proposed by the database research community.

Most previous clustering algorithm focus on numerical data whose inherent geometric properties can be exploited naturally to define distance function between data points. However many of the data in databases are categorical, where attribute values cannot be naturally ordered as numerical values. An example of categorical attribute is shape whose values including circle, rectangle, ellipse etc. Due to the special properties of categorical attributes, the

clustering of categorical data seems more complicated than that of numerical data. They present Squeezer, a new clustering algorithm for categorical data. The basic idea of Squeezer is simple. Squeezer repeatedly read tuples from a dataset one by one. When the first tuple arrive, it forms a cluster alone. The consequent tuples are either put into existing clusters or rejected by all existing clusters to form a new cluster by given a similarity function defined between a tuple and a cluster. The Squeezer algorithm only makes one scan over the dataset, thus is highly efficient for disk resident datasets where the I/O cost becomes the bottleneck of efficiency. The main objective of Squeezer is the combination of efficiency and scalability. Experimental result shows that Squeezer achieves both high quality clustering results & scalability. Main contribution of the study are the algorithm is suitable for clustering data streams, where given a sequence of points, the objective is to maintain consistently good clustering of the sequence so far, using a small amount memory & time, outliers can be handled efficiently and directly, the algorithm does not require the number of desired clusters as an input parameter. This is very important for the user who usually does not know this number in advance. The only parameter to be pre –specified is the value of similarity between the tuple and the cluster, which incorporates the users expectation that how close the tuples in a cluster should be.

Swift (2002) describes analytical eCRM as a four step iterative process consisting of collecting & integrating online customer data, analyzing this data, building interactions with customers based on this analysis such that certain performance metrics such as LTV are optimized. A typical performance metric used in many CRM applications is the LTV of a customer. One of the key questions in CRM is how to develop proactive customer interaction strategies that maximize LTV. This key problem is viewed by some as the "holy grail" of CRM.

Traditionally the problem of estimating LTV is divided into two components. One is estimating how long a customer will stay& second is estimating the flow of revenue from the customer during this period.

Estimating the flow of revenue during customer's lifetime was done with parametric models in the marketing literature. With respect to estimating customer tenure, Schmittlein et al. (1987) provide analytical models that determined whether a customer at any point in time is "active", by identifying a set of qualitative criteria that capture when a customer is more likely to be active. The concept of customer retention is a natural extension of this approach, because it deals with trying to prevent a customer from becoming inactive and hence it is a proactive method of increasing LTV. Blattberg and Deighton (1991) present a more general framework for inactive marketing for LTV, suggesting the key notion that customers are "addressable" and can be engaged in interaction. This notion of customer interaction is further explored in Dreze and Bonfrer (2002) in which the problem of optimal communication to maximize LTV is addressed. They show that both too little and too much communication can result in a firm's failure to capture adequate value from its customers. This analysis provides useful insights into the LTV optimization problem. However this work considers only optimal communication frequency with customers & the model does not take into account the existence of data on customer behavior.

In contrast the Data Mining community studied the LTV problem in the presence of large volumes of customer data (Mani et al.1999, Roset et al. 2002). In particular Mani et al. (1999) predict customer tenure using classical survival analysis methods by building a neural network & training it on past customer data. However Mani et al. (1999) do not address the problem of computing optimal parameters for LTV models. Roset et al. (2002) compute LTV based on large volumes of customer data by focusing on using Data Mining to estimate customer churn & future revenues. They use statistical and data mining methods to estimate future revenues. They point out that it is difficult to solve an LTV optimization problem in the presence of large volumes of data and Rosset et al. (2002) stopped short of doing this. Similar Dreze and Bonfrer (2002) studied only an optimization problem & did not deal with large volumes of data. Therefore developing new algorithms computing optimal LTVs and utilizing optimization & data mining methods in the presence of large volumes of data constitutes an important & challenging problem for operations research or management science researchers.

One way to deal with the complexity of the general LTV optimization problem is to reduce it to simpler types of problems. One such reduction may consider various heuristics producing higher LTV values, rather than attempting to find an optimal solution.

For example, we can study customer attention problems & determine policies that will result in lower attrition rates and therefore higher customer LTVs. Another way to deal with this complexity is to seek to optimize simpler performance measurers that can serve as proxies for LTV. We can use customer satisfaction rates with various offerings as one such measure.

Customer analysis includes two main steps in the eCRM context. First is preprocessing data that tracks various online activities of the customers – this involves staring with individual user clicks on a site and constructing logical users "session" and summary variables. Second is building customer profiles from this and other data. At a general level, a profile is a set of patterns that describe a user. Data Mining is used to learn these patterns from data. Customer profiles are then built from these results.

Current literature considers heuristic methods for analyzing click stream data generated by websites. One of the most important problem is the session identifies problems, which determines how to group consecutive clicks into

session. This is an important business problem because most of the users tracking system developed by such companies such as Epiphany and Blue Martini provided only ad hoc solutions to the session identification problem.
Some popular session identification methods include session level characterization (Srivastava et al. 2000, Theusinger and Huber 2000) that aggregates user clicks into session, a fixed length sliding window method (Cooley and Mobasher 1999) that breaks a session into several slinding windows, and different types of clipping methods that break a session into windows of different sizes using various splitting methods. (Brodley and Kohavi 2000, Vandermeer et al. 2000, Padmanabhan et al. 2001). Zheng et al. (2003) demonstrate that various session identification methods can produce radically different conclusions derived from the same data.
The main reason for preprocessing click stream data is to build a model, such as one that would predict the likelihood that a current user's session would result in a purchase. Accurate model are crucial for such problems, requiring optimal preprocessing of the click stream data. To partition the click stream data into session, one needs to specify optimization criteria. This can be done by first identifying "similar" groups of consecutive pages in the click stream, which can then be partitioned into sessions to maximize intrasession similarities and intersession differences. One way to specify these similarities & difference is to identify the variance of some browsing measure, such as the time spent viewing a page.
Building rich & accurate profiles of customer based on their transactional histories is also crucial in many CRM applications, including recommendation applications, one to one marketing & personalized web content delivery. These user profiles can contain factual information about the users such as demographic & psychological data, a set of rules capturing behavior of the user.
Because many of the discovered rules can be superiors, irrelevant or trivial, one of the main problem is how to select an optimal set of rules for each customer from the set of rules previously discovered with Data Mining methods. In such applications personalized content needs to be delivered in real time, while the customer is waiting online. Therefore content delivery discussion should be driven by only a few rules to guarantee real time delivery and relevant content for the customer (Davis 1998). Consequently optimization can help customer profiling and other applications to select a small number of the most important patterns from the set of previously discovered patterns.
The aim of the study made by T. W. Rennie and W. Roberts was to demonstrate the epidemiological use of multiple correspondence analyses as applied to tuberculosis (TB) data from North East Landon primary care trusts between the years 2002 & 2007 was used. TB notification data were entered for Multiple Corresponding Analysis allowing display of graphical data output.
There has been rise in tuberculosis notifications in the UK since 1987. However excluding TB in Landon, rates of TB in the UK are relatively low & stable. In the context of North East Landon, high rates of TB are observed in some primary care trust areas whilst in others rates are relatively low. This demonstrates the complexity of TB epidemiology in the UK and Landon & is suggestive of a range of factors that give rise to high rates of TB in specific geographical areas. The enhanced tuberculosis surveillance (ETS) system was introduced in 1999 to aid notification. These collected data show the different demographic and clinical profiles of patients observed in NE London & may account for variations in TB rates. This requires appropriate statistical support & effective communication to decision makers. However analysis of large volume of data with a large proportion of categorical or nominal data that can display multiple associations may prove to be difficult to interpret if bivariate comparison is made. Factor analysis & Principle Component Analysis are inappropriate methods of analysis for these data which include a mix of continuous & categorical data. Multiple correspondence analyses are an analytical method that allows analysis of multiple categorical variables. We demonstrate the use of MCA as a tool for performing epidemiological mapping of TB patient variables. This may prove to be useful in identifying commissioning priorities in NE London.
Multiple Correspondences Analysis is a multivariate extension of Correspondence Analysis that allows explanation of relationships between two or more variables. By including two or more variables in this type of analysis the complexity is increased, relationships between variables are described in terms of the variance of data.
The study made by Shakil Ahmed, Frans Coenen and Paul Leng consider strategies for partitioning the data to deal effectively. Partitioning approach organizes the data into tree structure that can be processed independently. The performance of these methods, depend on the size of original database.
The study made by Balaji Padmanabhan & Alexander Tuzhilin said previous work on the solution to analytical electronic customer relationship management problem has used either data mining or optimization methods, but has not combined the two approaches. By leveraging the strength of both approaches, the eCRM problems of customer analysis, customer interaction & the optimization of performance metrics can be better analyzed. In particular many eCRM problems have been traditionally addressed using DM methods. There are opportunities for optimization to improve these methods .Balaji Padmanabhan & Alexander Tuzhilin describes these opportunities. Prior research has used optimization methods for solving data mining problems (Mangasarian et al. 1990, Vapnik 1995, Fu et al. 2003) and used DM methods for solving optimization problems (Brijis et al.1999, Campbell et al. 2001). In this survey we

systematically explore how optimization and DM can help one another for certain customer relationship management (CRM) applications in e_commerce, termed analytical eCRM (Swift 2002). Analytical eCRM includes customer analysis, customer interactions and optimization of various performance metrics such as customer lifetime value in web based e_commerce.

To illustrate how optimization and DM interact in eCRM settings, consider the following two important eCRM problems. The first deal with finding the optimal lifetime value of a customer by determining proactive customer interaction strategies resulting in maximal lifetime profits from that customer. These eCRM applications include Max. of customer LTV, Customer analysis, including preprocessing click stream data & building profiles, Customer interaction methods including website design & personalization.

By considering previous studies authors find out the scope to go for research in market basket analysis using three different algorithms namely Association Rule Mining, Rule Induction Technique and Apriori Algorithm. Authors will make a comparative study of three techniques and adopt the best conclusion.

In Association Rule Mining, we will generate association rules and calculate support and confidence. Assume minimum support and minimum confidence. The rules satisfying both the criteria of minimum support & minimum confidence is true otherwise false. Rule induction technique retrieves all interesting patterns from the database. In rule induction systems the rule itself is of the simple form of "if this and this and this then this". In some cases accuracy is called the confidence and coverage is called the support. Accuracy refers to the probability that if the antecedent is true that the precedent will be true. High accuracy means that this is a rule that is highly dependable. Coverage refers to the number of records in the database that the rule applies to. High coverage means that the rule can be used very often and also that it is less likely to be a spurious artifact of the sampling technique or idiosyncrasies of the database. Assume minimum accuracy and minimum coverage. The rules satisfying both the criteria of minimum accuracy & minimum coverage is true otherwise false.

The theory of Apriori algorithm is that "All nonempty subsets of a frequent itemset must also be frequent." This property prune the candidate which is not in any of the category & thus to reduce number of candidates.

Authors will collect the data from shopping mall and will apply the data mining algorithms to find out the association between the products.

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