

APPLYING DATA MINING IN CUSTOMER RELATIONSHIP MANAGEMENT

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ABSTRACT

In this article we are going to define the overall customer relationship management (CRM) and Data mining, Factors between the techniques and software to "data mining" in "CRM" and the interaction between two concepts. For this purpose and after that in past studies and reports on issues of "data mining" and "CRM" took place between them. The effect of "data mining" and extract latent information from large databases of valuable customer has made their determination, and maintenance in order to attract customers through its taken a step forward and ultimately achieve profitability and efficiency are good.

KEYWORDS

CRM, Data mining, Applying data mining in customer relationship management

1. INTRODUCTION

With the development of growing s technology, the infamous Internet services competitive process by increasing access to customers According to different approaches to management companies in connection with the customers' show different companies for survival in market competition wished more profit in business need to analyze that in the market will be done[8]. In fact that the future oriented companies were identified and needs of their own customers' infection more belief and showed their own customers' infection is considered a value for them. Always in competitive markets more successful action. The companies via information in connection with their own customers' infection models that high-ranking bought from other rivals. Infamous their products and services with regard to this information.

In general cycle stages attract customers included 4 due under phase [7]:

- 1) Customer Identification
- 2) Customer Attraction
- 3) Customer Retention
- 4) Customer Development

With time professional internet professional services the scope of the customers And the use of various kinds of infamous don't differ marketing approach s this method, the collections of a multitude of data founded. And the use of various kinds of infamous doesn't differ marketing approach s this method, the collections of a multitude of data founded. To a high volume of data to analyze and vital devotes to obtain one of the best methods in this field has used the prospect.[11]

Given the prospect with the use of the computer algorithm to analyze data in order to provide useful information, useful to paid company goals. All the other hand, can be part of this information to control profile and understand their customers in different aspects [6]

In continuing to follow it through to the concepts of management and communication with customers prospect given the role and use prospect given management in connection with customers.

2. CRM

Intensive rivalry with the commercial and marketing organizations for the business of the deal, the most precious thing for organizations that the "customers". In line with the same organizations instead of marketing and management relationship unique relations with customers, value-added products to add his eyes that the value of more marketing relationship to the organization. This requires a long term relationship with customers that require new topics to bring to the customer relationship management.[5]

The concept of "CRM" may be considered two-stage skills at the first stage carefully to customer specifications and divided among them the famous "80 percent interest One of the organization only by 20 percent of the number of customers to you. "

In fact transition than the product of the customers' pivotal and concentration to the needs of customers than the characteristics of customers In the second round to follow the principles of the first in the discouraging this stage is not merely organization should not be satisfied with the existing usage But customers' need to develop through the pivotal s method and tools "relation with customer management" with the customers to pay. [1] Perhaps you think about divisions with customer management "is merely a technological solution but this is what is wrong [3] In fact "relation with customer management" need to move market with swing voters are elected. This process under the title "life of the customers'" be mentioned that includes attract new customers, the increase in customers will benefit the customers [2]

Swift and Parvatiyar in 2001 with four major CRM knew that customer identify, customer attraction customers, Customer Retention, Customer development these four dimensions can be regarded as closed-loop customer relationship management. [7]

Customer Identification

CRM begins with the identification of customers. This phase includes the crowd that is likely that our customers are a lot or a profit for the organization. Phase elements identified customers, including analyze customers after months on the customers. analyze clients include the search of the most profitable customers through the characteristics of the constitution customers. While in the category includes customers division of labor groups to customers after months of the smaller customers, including relatively similar customers in each group. [7]

Customer Attraction

In the third phase which is the main discussion with customer relationship management. Customers' satisfaction to the expectations that customer satisfaction with perception is essential to protect customers Jupiter preserve elements include marketing person to person pointing to the marketing person who analyze with support. The diagnosis of nose contains provisions change in Jupiter. Loyalty programs include support activities with the long-term relationships with customers especially analyze customers shunned, ranking credit, the quality of services or satisfaction from the loyalty programs [7]

Customer Retention

In the third phase, this is the main argument CRM. Satisfaction of customer expectations with customer perceptions of satisfaction is the basic condition for maintaining the customer Elements of customer retention and marketing person to person marketing analysis is supported. Detect and predict changes in customer. Loyalty programs, including activities aimed at supporting long-term relationships with customers turn away customers, especially analysis, credit rating, service quality or satisfaction from the loyalty program [7]

Customer Development

This phase includes a plurality of transactions, transaction value and customer profitability is discovered. the elements of customer development, can be cited Cross Selling, Up Selling, including analysis of the value of customer life [2] The customer relationship management technology from the four categories of strategic, operational, analytical, interactive.

Strategic CRM

Strategic CRM, a part of a management system communication with customers. In that it will try to achieve macro strategy and work in the form of statement that the attitude and mission and has found. With a look at Jupiter pivot and look at the necessities of the review to [7, 4]

Operational CRM

This type of customer relationship management in all areas that contain a direct relationship with the customer is established in these dimensions. Sometimes a customer points of contact with both of these places that can be and truth in connection with the organization of the customers in parts of this happens. [7]

Collaborative CRM

Interactive systems based on the customer participation, are seeking to use the infrastructure and proper tools, communication channels more and more suitable to the organization and customers. In fact, this kind of system s are seeking to increase with Jupiter communication channels with the organization and increase the quality of the canals during the period of time period of customer relationship with the organization[4]

Analytical CRM

Analytical CRM "to analyze data and information on the organization dealsSo according to the results of this analysis, management strategies can be identified [4]. A general tool for analyzing the function of the customer "data mining" [1] Through several organizations store customer data

and analysis results have been able to achieve profitability and stability in the market competition.

It can be inferred from what we have said that "CRM" is the process and technology. The organization uses a comprehensive view of CRM, by focusing on maintaining and developing relationships with the customers and finally within reach understanding of customers' needs.

3. DATA MINING

With time and increasing data volume and expansion of modern data storage size, nature and management of statistical methods, Data necessary to evaluate the extraction of knowledge from the show. The best solution to meet this data mining can be cited. We show in Table under evolutionary data mining techniques to collect data.[14]

Table 1: The evolution of data collection methods

| technology | Evolution |
|----------------------------------------|--------------------------|
| Disks of computers | data collection(1960) |
| Relational database(ODBC, SQL) | access data(1980) |
| OLAP (Online analytical processing) | data warehouse DSS(1990) |
| Multi-processing computer professional | data mining(2000) |

Data mining process to extract information and advanced data analysis, and extracting knowledge from massive amounts of data in a database format, a data warehouse or any information storage is saved. In fact very similar to the data mining is the extraction of metals from the mountain .The data warehouse and data mining information that lies in the extract. [13]

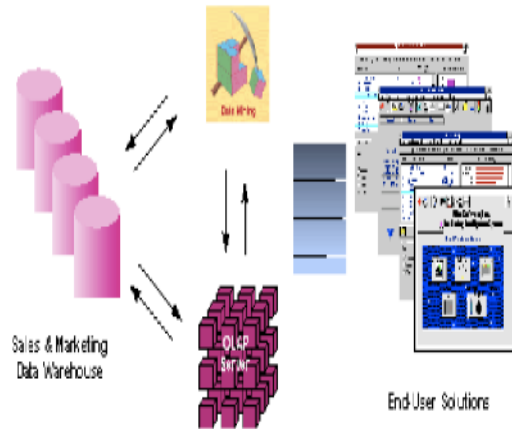


Figure 1: The above diagram shows the architecture of data mining

Basis of a data mining process involves five stages [9] as follows:

- a set of training samples should be chosen, are collected and trimming.
- Type of knowledge: knowledge of the expected data mining techniques used will be specified.
- Knowledge base: the transfer of existing knowledge about the process
- data mining, often a hierarchy of concepts
- Evaluation criteria: criteria value of knowledge gained from data mining, extraction time and knowledge in what has been the representation of key importance and will help data mining process

- Presentation: usually extracted is determined depending on the type of knowledge. In many cases there is also suitable for representation.

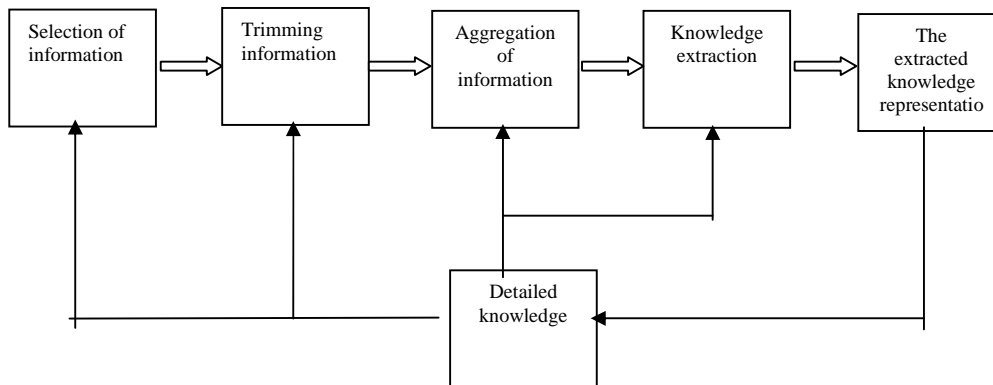


Figure 2: Data Mining Process

Away from previous definitions of what data mining have included topics such large-scale knowledge extraction, data mining, data analysis and finding patterns and relationships between data is safe. [1]

The ultimate goal of data mining, decision support systems and organizational development. Data mining and knowledge to extract useful information from large volumes of data are discussed. Data mining, pattern search will contain information in existing data. These models and algorithms can be descriptive to describe the data or aspects are predictable, i.e., of unknown variables, other variables used to predict values. Descriptive data mining, followed by activities or actions of ifs in the past. Data mining and predictive look at history, to predict future behaviour [1]

Data mining activities toward knowledge discovery [9] includes the following steps:

- 1) Identify the purpose and scope of its application is clear understanding that what, in what will be done within a field.
- 2) Select the data analysis and discovery for purposes of determining the
- 3) preparation of data, including data cleansing
- 4) adopt the best methods for achieving the goals of data mining
- 5) The application of data mining algorithms
- 6) Evaluation and validation results
- 7) The use of stabilization and consolidation of results and knowledge discovered
- 8) making decisions based on the knowledge discovered

At this stage of exploration data that might typically preparation. Include a focus on data, data conversion, recorded and performed works selected subset of the initial selection process begin. Then, depending on the analysis, this stage of the process of data extraction may each selection includes simple and straightforward for a regression model to elaborate heuristic analysis with using a wide range of graphical and statistical methods to identify relevant variables and determine the nature and complexity of the models. [9]

Nevertheless, the data mining course, usually with lots of research and inquiry report and they are confused. But in fact none of them does not include data mining. Data mining done by special equipment, the search operation based on repeated analysis of the data. The following characteristics of data mining [10] explain:

- The hypothesis does not require special
- different types of data, data mining tools, not only to numerical
- Data mining algorithms to automatically create relations are
- data mining needs to be correct and true
- The results of data mining is relatively complex and requires a team of professionals to express their

If this is indeed the performance of data mining techniques that created a data mining system interpreter and procedures including data collection, data integration and devotion to perform data mining deals. Data mining all unusual patterns which have deviated from the normal state and may lead to fraud could be found. Data mining results should be interpreted in different modes that can later study, show. Finally, models can be obtained by customers who have the possibility of fraud, to predict. [1]

Data mining and analysis methods with observer, through algorithms such as neural networks , classification and decision tree (C & RT), genetic analysis, Shopping, SOM applicable. In addition, common algorithms, as well as new algorithms for scientific research or commercial purposes through academic research projects, are produced. The unique characteristics of data mining can be outlined as follows [3]:

- Not only the analysis phase, but the study design and data collection also affect
Able to identify and respond to questions clearly. The main advantage and the difference is that instead of providing them with other techniques in the same time grand strategy, accurate responses are given to researchers.
- Ability to assess the effect of different variables on the dependent variables are provided.
Ability to search for the exact questions and answers with high complexity in the data collected provide.
- To help managers to evaluate the impact of future scenarios

modelling of multiple options and help with decision making under uncertainty must move to the selected route. Four basic approaches to data mining [3] has the following:

- 1) Classification
- 2) Regression
- 3) Clustering
- 4) Association

Classification: The prospects of this approach to predict customer behaviour Database records by Classification Based on defined criteria Through partner values mapping function composition characteristics to difference category allow phonetic typing mentioned in the decision tree approach Bayesian learning to be used for evaluation[1]

Regression: This model enables to obtain specific models the rhythm of the comet in data mining. And provide management reports that the usual tool of statistical theory in the discovery sequence is set [1].

Clustering: in these approach a division of large heterogeneous sample is used on Applications that can be mentioned the following [1]:

- Information Retrieval
- Compression associated with the destruction

Association: The purpose of these communication different items in the collection of information inputs and finally support and confidence through various measures are related [1].

4. Data Mining in CRM

The important role in the process of data mining "CRM" plays. Because on one hand, with data centers or data warehouse is the interaction and the interaction with the software analysis is competitive management. Relationship between the manual management competitive analysis software with data mining software requires the transcription of data models to the data transmission. The same definition in the software sector, customer data mining and analysis software for corporate management to ensure that competitive. The model need not have your entire database. [12] Data mining in customer relationship management process is shown in figure 3:

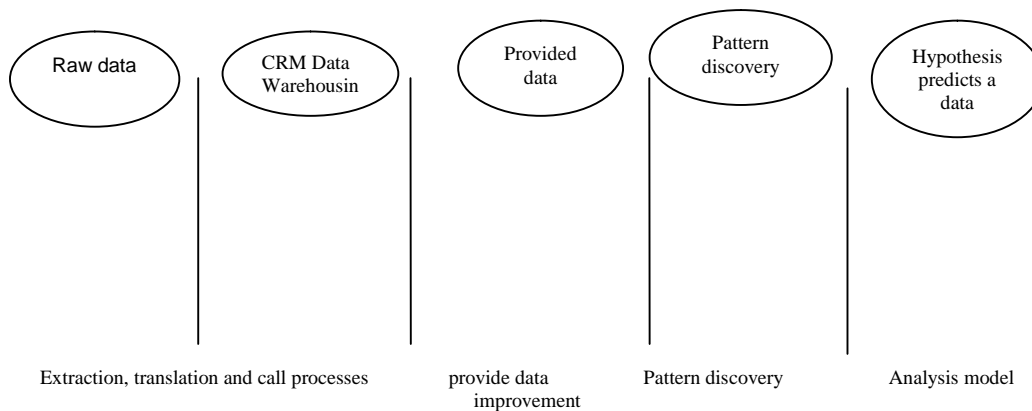


Figure 3: data mining process in CRM

Raw data are collected from various sources and the extraction, translation and management processes of this type are called data warehouse. In data preparation, data out of the warehouse and data mining are an appropriate format. [1, 12]

The overall advantages of using "data mining" in "CRM" [15]:

- 1) data filtering to eliminate duplicate data
- 2) extraction, data management, analysis and access to utility customers, retain customers models
- 3) rapid and accurate access to integrated data
- 4) The use of precision instruments and advanced data analysis and reporting
- 5) increase customer satisfaction
- 6) to attract potential customers, retain existing customers and increase market share

In total, over a period of data mining can be used to predict the exact changes. Organizations in order to fetch data to identify patterns in data mining helps customers .For example, a company can predict from the data mining toward a specific event in the "customer life cycle" to use. [1]

In fact, data mining techniques can help to extract or detect the presence of lifetime customers in the United. And create value for the analysis of performance data and behaviour customer. Our aim in this study, a review article by Ngai[3] analysis is given in Figure 4.

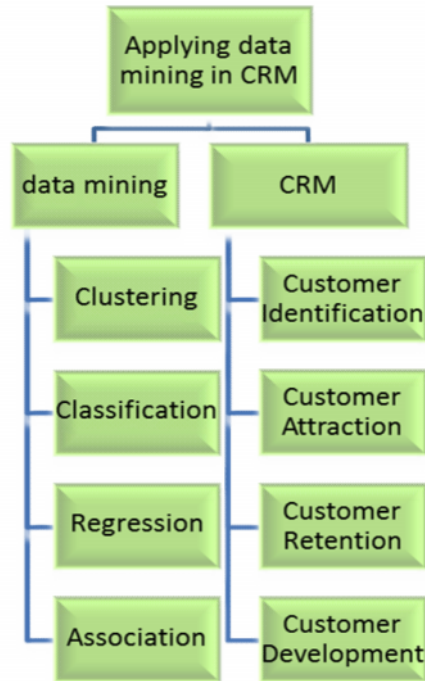


Figure 4: the classification of data mining techniques in CRM

As you have seen in the Figure 4 data mining methods include:

Clustering: Clustering of data mining methods is descriptive, Classification of heterogeneous data into several clusters based on similar characteristics, that purpose of clustering, classification data is partial to a few groups Data from the different groups may also have different maximum and existing data in a group are very similar to the clustering with different classification. And this difference and not being labelled categories is related to the clustering of pre-defined categories [1]

Classification: Mapping data in predetermined categories, sorting is done in two stages. Beginning on the last batch of data is identified and it is predicted that a new data belongs to which category [1]

Association: In the early 90s with the advent of data mining algorithms to extract association rules from the database into the field formed. Among the activities that will do this, find the dependencies and relationships between data, finding patterns that exist between the data, And also making a series of structured items and objects in the database [1]

Regression: Continuous values predicted by the statistical technique called regression. The regression analysis model that can determine the output variable with multiple input variables to determine. Regression analysis, a process that determines how the variable associated with one or more variable Y_1, Y_2, \dots, Y_n . Response or dependent variable Y is called the output and input X_1, X_2, \dots, X_n , returned products, called the independent variable. Indeed, regression techniques, a very common technique for the study of customer satisfaction level is predicted [1]

As you have seen in the Figure 4 CRM dimensions include:

Customer identification: In this article, because the customer segmentation, customer analysis purposes is discussed. The customers have been used segmentation than clustering techniques. However, for purposes of customer analysis techniques used are classified.

Customer attraction: Discussed in the following general categories based on mainly through direct marketing and the techniques used are classified

Customer retention: In the following categories such as complaint management, relationship marketing is the loyalty program. Clustering method and sequence of discovery in the topic of complaint management and customer loyalty programs within the topic of the classification method. However, most research in the field of relationship marketing has been paid to the Forums.

Customer development: These methods mainly because of the exchange lifetime customer and market basket analysis, it is raised. Articles is mainly used in the clustering of customers through the methods and rules based forums.

As noted, articles on current research in 2009 has been reviewed by Negai

Table 2: the classification of data mining techniques in CRM

| CRM dimensions | Data mining model | Amount |
|-------------------------|-------------------|--------|
| Customer identification | Classification | 5 |
| | Clustering | 6 |
| | Regression | 1 |
| Customer attraction | Regression | 1 |
| | Classification | 5 |
| | Clustering | 1 |
| Customer retention | Clustering | 7 |
| | Classification | 27 |
| | Regression | 2 |
| | Association | 13 |
| Customer development | Classification | 1 |
| | Clustering | 2 |
| | Regression | 1 |
| | Association | 5 |

As can be seen in Table 2. Volume of activities carried out in the preservation of other aspects of customer relationship management, especially after the customer has been attracting customers. And methods used have been classified and most forums. See Figure 5 in most research studies related to the classification and clustering methods

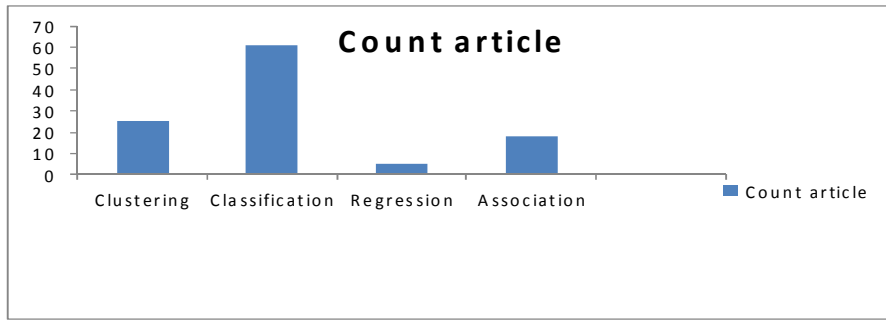


Figure 5: the extent of data mining techniques used in the customer management between 2000 and 2006

In table 3, Data Mining methods have been investigated and their strengths and weaknesses in customer relationship management

Table3: Strengths and weaknesses of various data mining techniques in CRM

| Weaknesses | Strengths | Data mining techniques |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| <ul style="list-style-type: none"> method's performance alone is not sufficient to predict customer behavior [1] | <ul style="list-style-type: none"> The most widely used method Initial assessment of customer data [1] | Clustering |
| <ul style="list-style-type: none"> due to lack of stability, stability in some of the methods are simple[18], yet complex and obscure methods are stable and properly functioning[16] | <ul style="list-style-type: none"> Diversity of the simplest techniques used to the most complex methods[1] provide tangible rules[17] | Classification |
| <ul style="list-style-type: none"> Inability to express behavior patterns hidden in data the inability of the behavioral patterns of behavioral phenomena [16] | <ul style="list-style-type: none"> Ease of application performing model very rich literature on the use of model[19] | Regression |
| <ul style="list-style-type: none"> Total amount of items that do not frequent [20] | <ul style="list-style-type: none"> Ability to discover hidden relationships among data behavioral the ability to sequence the events, phenomena customer behavior [20] | Association Rules |

5. Conclusion

Organization of the maxim that the customer behaviour over time will change. Organizations know more about each other if their relationship will evolve and grow better. Generally, the use of "CRM" software and technologies used in its proper context for the relationship between the organizations provides customers. Key to the success of the "CRM" having a good strategy in the management of the "customer life cycle" .Using a variety of technologies and data mining applications and methods appropriate for the area between the stored data. Years due to interaction with customers in different time periods and knowledge needed to achieve marketing success and profitability for the organization .Procedures to be adopted and causes your target market to potential customers so we can become the ultimate customers. Generally, the use of data mining in "CRM" is due to good response. In order to customer needs, improving returns on capital, labor productivity, Quality improvement in end products that can respond quickly to environmental change

REFERENCES

- [1] Berry ,Gordon S.linoff., “EBook Data Mining Technique for marketing Sales and CRM: Wiley Publishing”, Inc., Indianapolis, Indiana ,2004
- [2] Gneiser,“Value-Based CRM, The Interaction of the Triad of Marketing Financial Management and IT”,2012
- [3] Ngai , Xiu , Chau,“Application of data mining techniques in customer”, Expert Systems with ApplicationsVol. 36,pp.2592–2602,2009
- [4] Olafsson, S., Li, X., & Wu, S, “Operations research and data mining”, European Journal of Operational Research , Vol.187, pp.1429-1448,2008
- [5] Ryding(2010), “The impact of new technologies on customer satisfaction and business to business customer relationships: Evidence from the soft drinks industry” , Journal of Retailing and Consumer Services, Vol.17 pp.224–228
- [6] Rygielski , Wang, Yen .“ Data mining techniques for customer relationship management “, Technology in Society, Vol.24 , pp.483–502,2002
- [7] Parvatiyar, Sheth,“Customer relationship management: Emerging practice, process, and discipline. Journal of Economic& Social Research,Vol.1,pp.1-3,2001
- [8] Payne,“Customer Relationship Management: A Strategic Perspective, Gabler Verlag ,Vol.3,2009
- [9] LuanJing ,”data minig as driven by Knowledge management in higher education”, Public conference UCSF, 2001.
- [10] Morgan Kaufmarm,“Data mining:concepts and Techniques” .Academic Press Publihers,2001
- [11] Reza Allahyari Soeini and Keyvan Vahidy Rodpysh,“Evaluations of Data Mining Methods in Order to Provide the Optimum Method for Customer Churn Prediction: Case Study Insurance Industry”,2012 International Conference on Information and Computer Applications (ICICA 2012)IPCSIT vol. 24 (2012) © (2012) IACSIT Press, Singapore
- [12] Reza Allahyari Soeini and Keyvan Vahidy Rodpysh ,”Applying Data Mining to Insurance Customer Chu rn Management”,2012 IACSIT Hong Kong Conferences IPCSIT vol. 30 (2012) © (2012) IACSIT Press, Singapore
- [13] Dr. Jamal Shahrabi, "Seminar on Data Mining Society of Iran", January 2010
- [14] Dr. Jamal Shahrabi,“Ebook: Data Mining”, 2005
- [15] Samira Malek Mohamadi,“ graduate seminar, Application of data mining in customer relationship management”, University of Science and Technology,2009
- [16] Au , Chan."A Novel Evolutionary Data Mining Algorithm with Applications to Churn Prediction.",IEEE Transactions on Evolutionary Computation, Vol. 7, No. 6, Dec 2003,pp. 532-545
- [17] Guo-en, Wei ,“ Model of Customer Churn Prediction on Support Vector Machine”, Systems Engineering Theory & Practice,Vol. 28,2008,pp. 71-77
- [18] Hadden , Tiwari , R.Roy ,D. Ruta.(2005). ,” Computer assisted customer churn management: State-of-the-art and future trends”, Computers &Operations Research, Vol. 34,2005,pp.2902-2917
- [19] Hwang, Jung , Suh (2004) ,”An LTV model and customer segmentation based on customer value: a case study on the wireless telecommunication industry”,Expert Systems with Applications, Vol.26,2004, pp.181–188
- [20] Chiang , Wang , Lee , Lin, “Goal-oriented sequential pattern for network banking churn analysis”. Expert Systems with Applications, Vol 25,2003, pp.293–302