

# RULE-BASE DATA MINING SYSTEMS FOR CUSTOMER QUERIES

A.Kaleeswaran<sup>1</sup>, V.Ramasamy<sup>2</sup>  
Assistant Professor<sup>1&2</sup>

Park College of Engineering and Technology, Coimbatore, Tamil Nadu, India.<sup>1&2</sup>

**Abstract:** The main objective of this paper is to have a best association between customer and organization. This project is proposed in order to discover knowledge from huge amount of data and to use the data efficiently because of great demand. Banking is the most commonly used application for financial section. In which, Enterprise Resource Planning (ERP) model is most widely used in order to cost control, accounting and e-business & analyses. The order of the customers are routing automatically to the next department when one department finishes their work of the customer's order and each department have access to the single database that holds the customers new order. Customer Relationship Management (CRM) model is responsible for receiving the request and responses to the customers quickly and directly. The request includes queries, complaints, suggestions, and orders. These requests are forwarded to inner view ERP through query generator. In this paper, we proposed a model that integrates the customer queries, transactions, databases and all other specifications used in ERP Systems, then use data mining techniques to integrate decision making and forecasting. Using ERP characteristics, data gathered from central database are in cluster format which is based on action taken against the queries generated by customers. Later the clustered data's are used by Apriori algorithm to extract new rules and patterns for the enhancement of an organization.

**Keyword:** CRM Model, ERP model, Data Mining, Data Clustering, Rule-Base.

## 1. Introduction

Most of the companies use an ERP (Enterprise Resource Planning) system in order to improve the core competency. Functionalities of all the business in an organization are integrated into a single system to do the particular needs of various departments and to share the information effectively [1].customer management will be described by CRM model. CRM is process oriented, technological, capability –oriented, strategic perspective [2]. ERP system is most widely used in financial section which adds many functions from Financial, Relation management,

Production, Distribution, E-Business & analyses [6]. CRM model is responsible for receiving request and sending responses to the customer.

## 2. Literature Review

Customer Relationship Management (CRM), is examined especially in customer behavior and customer profiling. Then we describe the general overview of most common data mining techniques. Data mining techniques can extract respectable knowledge from the large customer's database and customer behavior evaluation is done to improve business performance [1]. Using the ERP database, data mining application is applied to evaluate the best result for the growth and establishment of a company. It integrates the database, customer queries, transactions, and all other specifications used in ERP systems, use data mining techniques to integrate decision making and forecast flows. By using ERP's characteristics, data from central database in cluster format are gathered based on the action taken against the queries generated by the customers. Furthermore, Apriori Algorithm is used to extract new rules and patterns for the enhancement of an organization [2, 3].

Apriori algorithm minimizes the number of candidate sets while generating association rules by evaluating quantitative information associated with each item that occurs in a transaction, which was usually, discarded as traditional association rules focus just on qualitative correlations [6]. The proposed approach reduces not only the number of item sets generated but also the overall execution time of the algorithm. Apriori algorithm gives solution with higher optimized efficiency while comparing to other algorithms [4]. Some key problems related to these applications of Data Mining are discussed in the CRM [5].

## 3. ERP-CRM Model

The ERP-CRM model clearly describes how to solve the business problems. In the proposed model, automatic response is generated for the customer query. Customer request is directly forward to the concern department for the assessment and positive response. After statistical analysis and evaluation of the request, the response is directed to the corresponding customer and its feedback will be saved in the database for the future enrichment.

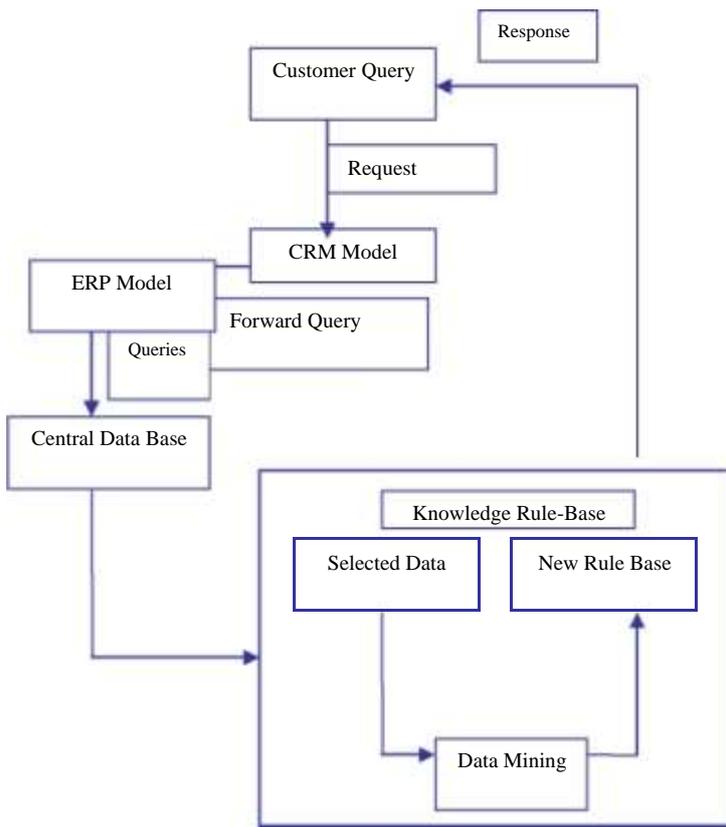


Fig 1 ERP-CRM Model

**3.1 CRM Model**

CRM Model is responsible for receiving and sending requests and responses to the customer directly. These requests include queries, complaints, suggestions and orders are forwarded to the Enterprise Resource Planning (ERP) through the query generator. After taking corrective action automatic response generated will be forwarded through the CRM Model. These transactions will be saved in the database for knowledge rule-base conception.

**3.2. ERP Model**

In this ERP model, request from the customers are sent to corresponding department for further evaluation. Each department has equal access to a single database that holds the customer’s data or complaints.

For example a customer want to purchase any product will apply for a product through the customer support department (CRM Model) and the request will be forward to the sales department (ERP Model) and sales department will check the payment status in the database and will forward the same request to

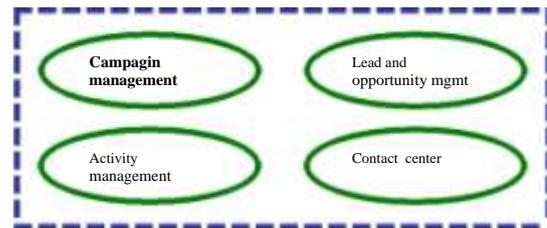


Fig. CRM Model

**3.3 Knowledge Rule-Base Conception**

All kinds of queries from customers to corresponding department in ERP are saved in a central database. Knowledge rule base consists of historical data collected from various bank, data’s selected from the customer query and generation of rules. Among several data mining techniques, Apriori algorithm gives more accurate prediction. The customer queries are clustered and confidence level is set and does pattern matching with the historical data using rule-base in order to generate most accurate solution.

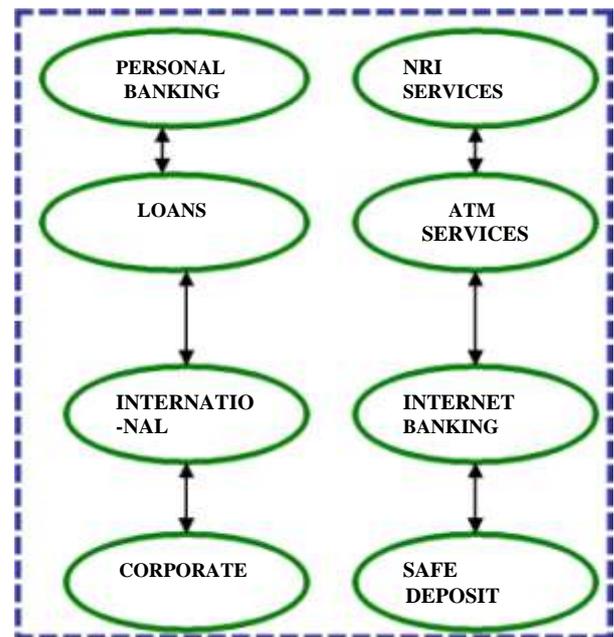


Fig. ERP Model

**4. Data Mining using Apriori Algorithm**

Data mining (DM) is a technology by which useful hidden information is found out and extracted from large database, in order to assist decision-maker to search the possible connections among data and discover t he possible factors. The DM belongs to the field with high value of application in the database research and integrates database, artificial intelligence, machine learning, science of statistics and other theories & technologies in several fields.

The DM is applied to the commercial banks' CRM mainly in the following ways in DM:

- i. Means of Classification
- ii. Data Clustering
- iii. Apriori Algorithm

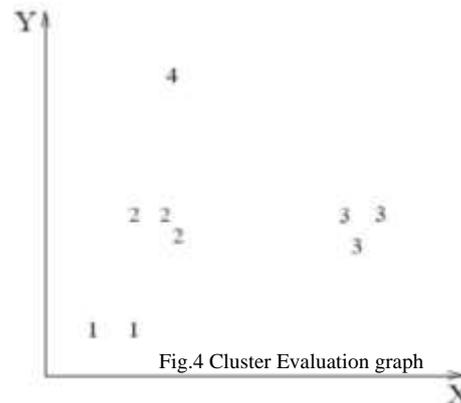
#### 4.1 Data Clustering

Data clustering is to categories the department of set of customer queries. Some set of numbers are described for each department. This is to identify the customer query belongs to which department. Some queries belong to more than two one department. These queries are sent to both the department. Fig. 3 shows that cluster analysis of gathered customer queries.

CUSTOMER'S QUERY	Value	CATEGORIES
way to deposit cheques	1	cheque deposit
who can apply for personal loan	2	personal loan
options for repayment tenures	4	repayment of loans
services or facility available at atm	3	ATM queries
maximum loan amount eligibility	2	personal loan
cheque return charges	1	cheque deposit
maximum cash withdrawal limit	3	ATM queries
any bank atm card facility	3	atm queries
procedure for additional loan amount	2	personal loan

Fig. 3- Data Enhancement

Cluster Evaluation graph for the above Fig.3 is shown in Fig. 4.



#### 4.2 Apriori Algorithm

The Apriori Algorithm is a prominent algorithm for mining frequent item sets for association rules. Apriori is designed to operate on databases containing transactions (for example, collections of queries from customers, or details of a website frequentation). Classification using association rules combines association rule mining and classification. It is concerned with finding rules that accurately predict a single solution. In association rule mining, various new rules found can be updated in Rule base. Apriori Algorithm is suitable to compute the rules and patterns and predict for any organization to improve the customer satisfaction. An association rule is "strong" if its confidence value is greater than a user-defined threshold. The association rules are created by combining each large item set with each of its subsets. The Apriori algorithm is an efficient algorithm for finding all frequent item sets. It implements level-wise search using frequent item property and can be additionally optimized.

The Apriori algorithm used is given below.

- $L_k$ : Set of frequent item sets of size  $k$  (with min support)
  - $C_k$ : Set of candidate item set of size  $k$  (potentially frequent item sets)
- ```

 $L_1 = \{\text{frequent items}\};$ 
for ( $k = 1; L_k \neq \emptyset; k++$ ) do
 $C_{k+1} = \text{candidates generated from } L_k;$ 
for each transaction  $t$  in database do
increment the count of all candidates in  $C_{k+1}$  that are contained in  $t$ 
 $L_{k+1} = \text{candidates in } C_{k+1} \text{ with min\_support}$ 
return  $\bigcup_k L_k;$ 
    
```

| CUSTOMER'S QUERY                                   | CATEGORIES         | SOLUTIONS                                                                                                                                                |
|----------------------------------------------------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| way to deposit cheques                             | cheque deposit     | You may deposit a cheque at any of the SBI Branches or at any SBI ATM Centre. Kindly use the cheque deposit slips available at the Branch / ATM Centres. |
| who can apply for personal loan                    | personal loan      | salaried individuals, self employed professionals, existing customers.                                                                                   |
| options for repayment tenures                      | repayment of loans | over a period of 12 to 60 months                                                                                                                         |
| services or facility available at atm              | atm queries        | account info, cash deposit, bill payment, mobile vouchers, mini statement, account enquiry                                                               |
| maximum loan amount eligibility                    | personal loan      | upto 15 lakhs                                                                                                                                            |
| cheque return charges                              | cheque deposit     | local-inward 275 outward 100, outstation 250                                                                                                             |
| document required for change in signatory          | documents required | Customer Instruction signed as per existing sign rule                                                                                                    |
| maximum cash withdrawal limit                      | atm queries        | RS.10,000/TRANSACTION                                                                                                                                    |
| interest rate for personal loan                    | personal loan      | 14% to 18%                                                                                                                                               |
| beginning of first payment of loan                 | repayment of loans | month after the loan distribution                                                                                                                        |
| turn around for outstation clearing of cheque      | cheque deposit     | 3 to 4 weeks                                                                                                                                             |
| any bank atm card facility                         | atm queries        | available                                                                                                                                                |
| procedure for additional loan amount               | personal loan      | customer should have completed since last loan availed                                                                                                   |
| modes of repayment of EMI                          | repayment of loans | post dated cheque(pdc), electronic clearing service, standing instructions.                                                                              |
| maximum loan to value(LTV)                         | personal loan      | UPTO 80% OF PROPERTY VALUE                                                                                                                               |
| commission charges for foreign currency cheque     | cheque deposit     | yes, visit SBI online banking                                                                                                                            |
| document name change in account(error in spelling) | documents required | attested copy of introduction document                                                                                                                   |
| lost atm card                                      | atm queries        | contact issuing bank immediately/contact customer care                                                                                                   |
| collateral required                                | personal loan      | no collateral is required                                                                                                                                |

Fig. Historical Data for Banking

## 5. Rule-Based Conception

Customer Queries stored in database are tokenized. Most frequently used words in Banking are stored in a file and object number is created for each word. Tokenized objects matches with the predefined object number and form a group of numbers. When any combination of object occurs,

then it do pattern matching with the predefined queries that are present in the database. If any matches occur then its corresponding solution will be automatically generated to the Customer using CRM Model.

Sample Rules:

If cheque, deposit, way has object number 1, 2, 3 respectively, then to match query1 in Fig. Rules for query one is as follows.

**Rule 1: Object List = { 3,2,1 }; No. of objects = 3;**

It can match in any order. If it matches then its corresponding solution will be generated.

For Query 2, If loan, personal, apply has object number 5,6,7 respectively, then rule for query2 is as follows

**Rule 2: Object List = {5,6,7}; No. of objects = 3;**

It can match in any order. If it matches then its corresponding solution will be generated.

## 6. Conclusion

The CRM in commercial banks has become a priority tool for banks to carry out various personalized services as a novel operating mechanism aiming at improving the relationship between banks and customers.

## References

- [1] Abdullah S. Al-Mudimigh, December 2009, 'A Framework of an Automated Data Mining Systems Using ERP Model', International Journal of Computer and Electrical Engineering, Vol. 1, No. 5.
- [2] Zahid Ullah, 2009, 'Data Mining For Customer Queries In ERP Model –A Case Study', Fifth International Joint Conference on INC, IMS and IDC.
- [3] Farrukh Saleem, 2009, 'Efficient Implementation of Data Mining: Improve Customer's Behaviour', IEEE journal 2009.
- [4] Veeramalai, August 2010, 'Efficient Web Log Mining Using Enhanced Apriori Algorithm with Hash Tree and Fuzzy', International journal of computer science & information Technology (IJCSIT) Vol.2, No.4.
- [5] Bin Fang, 2009, 'Data Mining Technology and its Application In CRM of Commercial Banks', First International Workshop on Database Technology and Applications.
- [6] Parvathi, 2010 an Enhanced Scaling

Apriori for Association Rule Mining Efficiency',  
European Journal of Scientific Research, Vol.39  
No.2.

- [7] P. Becuzzi, M. Coppola, and M. Vanneschi,  
Mining of Association Rules in Very Large  
Databases: Structured Parallel Approach," Proc.
- [8] Wu, Wen-Hsiung , Ho,(2006) 'SMES Implementing  
An Industry Specific ERP Model Using A Case  
Study Approach', Journal of the Chinese Institute of  
Industrial Engineers, 23: 5, 423 — 434.
- [9] Parvathi, 2010 'an Enhanced Scaling  
Apriori for Association Rule Mining Efficiency',  
European Journal of Scientific  
Research, Vol.39 No.2.



**Kaleeswaran.A** received his B.Sc (Physics) and MCA from Bharathiar University, Coimbatore and M.E (SE) in Anna University Coimbatore. He has four years of teaching experience. He is now working as a Assistant Professor in Department of Computer Science and Engineering in Park College of Engineering and Technology, Coimbatore. He has many publications to his credit in various international conferences and journals. He has attended a number of conferences, seminars and workshops His research interest is mainly focused on Data mining and Image Processing.



**Ramasamy.V** received his B.E from Anna University, Chennai and M.E in Anna University Trichy. He has four years of teaching experience. He is now working as a Assistant Professor in Department of Computer Science and Engineering in Park College of Engineering and Technology, Coimbatore. He has guided many undergraduate and post graduate students. He has attended a number of conferences, seminars and workshops His research interest is mainly focused on Data mining and Network.