

A Method of Selecting Optimum Customer in Company Customer Relationship Management

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ABSTRACT

CRM systems have been developed and designed to support the areas of marketing, service process and sales. A company will give declination to the customer based on the historical data which is not effectively. In this paper, we suggest a data mining and artificial technique to maintain the customer relationship. We use data mining ARM technique to mine the customer information, and we provide an offer to the selected customers using PSO technique. Experiment results show the performance of apriori algorithm for diverse combination of profit lengths of each customer.

KEYWORDS

Customer Relationship Management, data mining, data objects.

INTRODUCTION

Data mining refers to extracting or mining of knowledge from huge quantity of data (Mary and Iyengar, 2010; Raza, 2010). Classification, regression, clustering and dependence modeling are some examples for data mining tasks (Aghaebrahimi et al., 2009). In recent times, numerous data mining applications (Syurahbil et al., 2009) and models have been created for diverse fields. Parameters that create defects in manufacturing processes can be identified using data mining methods utilized in other complicated fields like Customer Relationship Management (CRM) (Batmaz et al., 2006). Companies have ascertained that investing in customers who are valuable or potentially valuable by reducing their investments in non-valuable customers is more effective than evenly treating all customers.

Customer relationship management is considered to be one of the aforementioned tools, which is a business strategy, has the propensity to select and manage the most precious relationships with the customers.

Often, information related to customers, products and markets are analyzed by means of simulations, predictions and classification of customers, using analytical tools such as OLAP and Data Mining after consistently storing such data in data warehouses. Nowadays, the business profit of enterprises is improved supported by CRM.

MATERIALS AND METHODS

The proposed customer relationship management methodology

The main aim of our proposed technique is to maintain a good relationship between customers and companies through monetary offers that are based on the revenues provided by those customers. So, this relationship is maintained by using the historical database which contains the information about the customers stored during their visit to our company for buying products or some service purposes. The information stored in the database is processed by using the data mining and PSO (Nacy et al., 2009).

The structure of the proposed CRM system

The Customer information in the historical database has four fields: Date, Number of transactions, Customer ID and Profit. The framework of the system show in Fig.1.

We suppose that the database C contains a huge set of records, each transaction $C = \{\{d_i\}, \{T_{ij}\}, \{id_k\}, \{P_{ijk}\}\}$, where d_i represents the date on which the customer visited to the company, i varies from $1 < i < N * 365$ and N is the number of years, T_{ij} be the number of transactions done in a particular date, j varies from $0 < j < N - 1$, id is a customer ID and fourth field P_{ijk} represents the company profit given by the customer. A example of the database show in Table1.

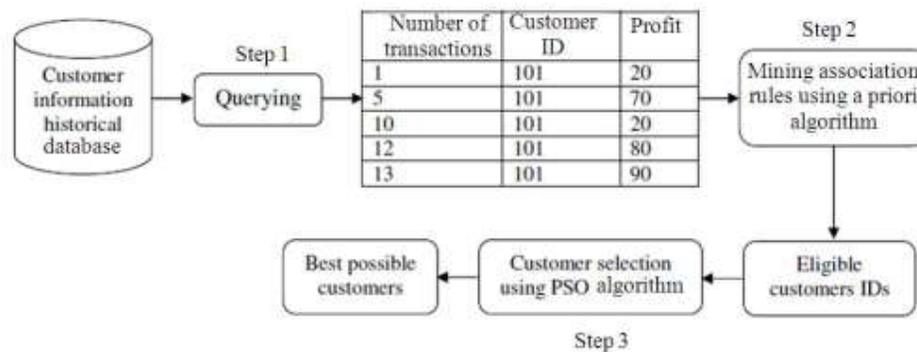


Figure 1. Framework of system.

TABLE 1. A SINGLE CUSTOMER DATABASE AFTER QUERY PROCESS.

Number of transactions	Customer id	Profit
1	101	20
5	101	70
10	101	20
12	101	80
13	101	90

TABLE 2. HISTORICAL DATABASE.

Date	Number of transactions	Customer id	Profit
2/2/2010	1	101	20
3/2/2010	2	102	70
4/2/2010	3	104	80
5/2/2010	4	106	20
6/2/2010	5	101	70
7/2/2010	6	106	80
8/2/2010	7	105	90
9/2/2010	8	102	80
10/2/2010	9	104	20
11/2/2010	10	101	70

Querying

In this first stage, the customer information is extracted from the database by performing a query process. The extracted customer information is a set of tables which contain set of fields are number of transactions, customer id and customer profit of the respective customer. For each customer in the database, the extraction process is performed to obtain the customer information for the mining process. As a result of querying process, we could obtain the information of the individual customers.

Association rule mining using apriori algorithm

We discuss the association rule mining Apriori algorithm that is used in analyzing the customer data to find the frequent items or customers from the transaction database. For example we considered the association rule in length 2, the rule antecedent X represents the frequent item profit value and Y represents the associated profit part of the antecedent part.

After mining the frequent customers (items), the total profit values of these frequent customers are calculated by using mathematical operations. Here, the selected frequent items are added by their profit and the profit value is multiplied by number of times the frequent items procure by the particular customer. As a result, the total profit value of each individual customer is obtained. Use the original historical database to calculate the entire profit value for all customers present in the database. We set the threshold based on this historical database profit value for select the customer. The each individual customer profit value is equal to or greater than the threshold value; these customers are select from this process. The profit value is less than the threshold value those customers are not considered. If one customer providing profit value is high but those customers frequent value is less so that the customer getting offer value is less than other customers. Then the selected customers from the above process are optimized by using Particle Swarm Optimization technique.

PSO-based customer selection process

In the proposed CRM system, we use the PSO methodology to obtain optimum number of customers among a large customers obtained from ARM. Here, the qualified customers are selected based on profit and frequency levels. The Fig. 2 shows the routine of this algorithm. Using this procedure we select the optimal customer to maintain the customer relationship.

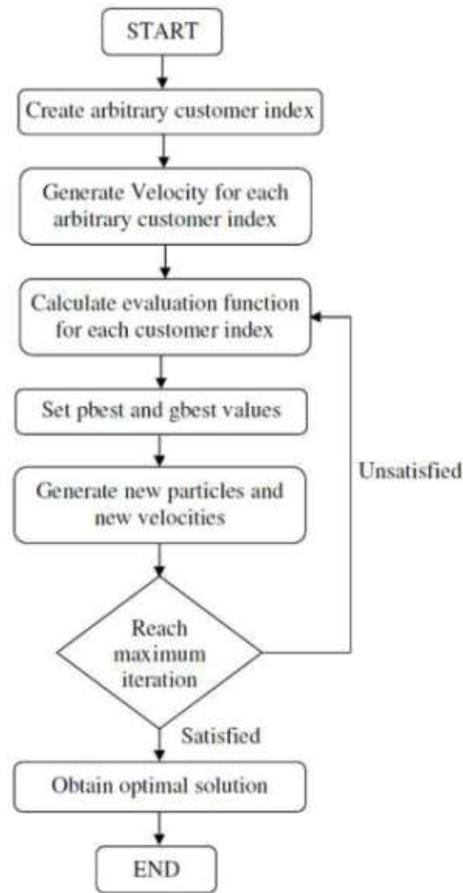


Figure 2. Customer selection.

Determination of evaluation function

The evaluation values are calculated for each individual particle to determine the optimal solution. The result of fitness values for all particles, the maximum fitness value is selected as an optimum value, the optimum value initially in pbest value and so far gbest value.

Evaluation value can be calculated by:

$$V = \log\left(\left[\sum_{i=1}^N (p_i * a + [(\sum_{j=2}^n q_j) * b] + [(\sum_{k=1}^Y r) * c]]\right)\right] \quad (1)$$

In the Eq.1

N = randomly generated particles elements

p_j = Consequent element profit value

q_j = Element frequency value

n = Frequency length

Y = is the number of years taken in the historical database.

r = Number of times particular element is presented

A, b, c = Weights

After finding the best values every particle tries to modify its position and velocity. To modify its position uses two data. First one is the distance between the

current particle position and pbest and second one is the distance between the current position and gbest. This modification can be represented by the velocity. Velocity of each particle can be modified by the following equation:

$$V_i^{(n+1)} = V_i^{(n)} + C_1 * r_1() * (flocal_i - x_i^n) + C_2 * r_2() * (fglobal_i - x_i^n) \quad (2)$$

$$x_i^{(n+1)} = x_i^n + V_i^{(n+1)}$$

In the Eq.2

V_i = Velocity of i th particle at iteration n

C_1, C_2 = commonly referred as the learning factors

r_1, r_2 = Random numbers generated in the range of $[0, 1]$

$Flocal$ = Position of the best fitness value of the particle at the current iteration

$Fglobal$ = Position of the particle with the best fitness value in the swarm

X_i = Current position of the particle i at iteration n

Each particle knows its best value (pbest) and its position. Moreover, each particle knows the best value in the group (gbest) among the pbests. Particles update their position and velocity for each iteration until it reaches the termination criteria.

This process will be repeated until the maximum number of iterations is reached. Once the maximum number of iterations is produced the process will be terminated. The last solution pointing the particle (customers) is considered as the best possible customers. The company decides to provide offer to these customers, these customers are the regular customers of this company. Following this procedure we effectively maintain the customer relationship between customer and company.

RESULTS AND DISCUSSION

Database description

The customer database contains the customer information, we extract the relevant customer information using above mentioned querying methods. The querying method result gives a large dataset; we have minimized the number of customers using the proposed apriori algorithm. Using this apriori algorithm, we have produced frequent items and association rules are generated for these frequent items. The generated association rules combination lengths are 2, 3 and 4. We have calculated the total profit value for selected customers and original database customers in the querying process. Based on the threshold value we have selected the eligible customers and again using PSO algorithm the customers are selected from the eligible customers to produce the optimal result.

We have compared selected customer against the original database customers and the selected customer's profit, frequency are individually compared to their five year data. Fig. 3 shows the comparison result of customer ID 14 with profit and frequency to their five years data.

We optimize the selected customer's result, so the result of selected customers is compared with the remaining customers in the database. First we compare the frequency value of selected customers in opposition to frequency value of remaining customers in an original customer database and another one comparison have made on

profit value of the selected customers against the profit value of remaining customers in a database.

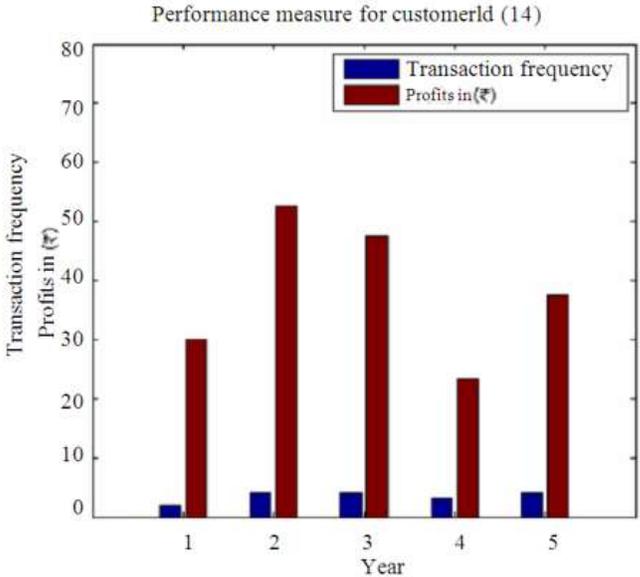


Figure 3. Performance of customer.

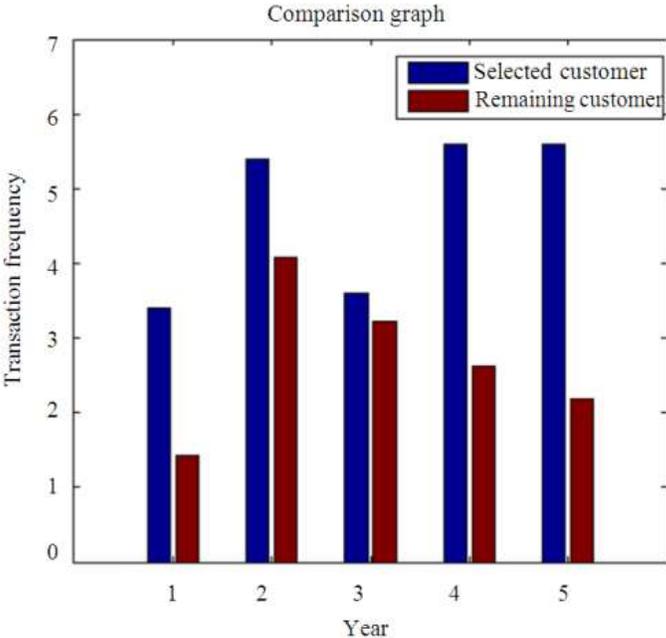


Figure 4. Comparison result of selected and remaining customer's frequency value.

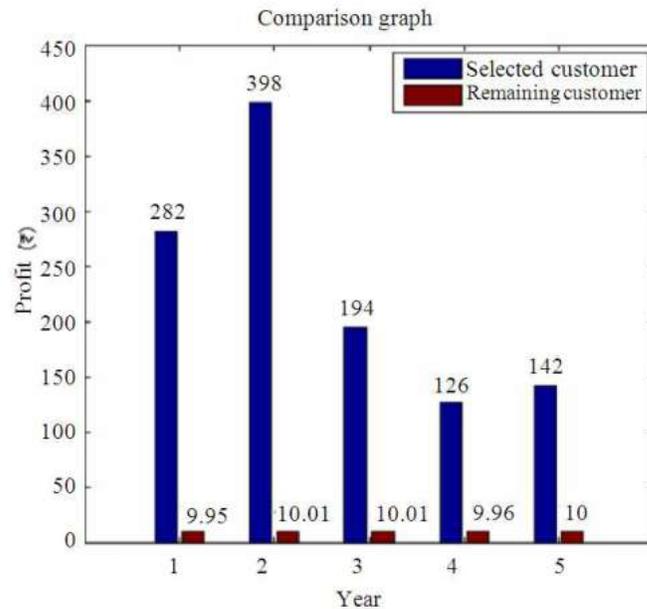


Figure 5. Comparison result of selected and remaining customer's profit value.

The comparison result shows the higher performance of selected customers than remaining customers in both frequency and profit values.

CONCLUSION

In this study, we have developed the efficient CRM system using the data mining and artificial intelligence techniques for maintaining the customer relationship. This study introduces a data mining ARM technique to mine the customer information and PSO algorithms which are used to select the optimal customers. These results have explained that the selected customers are optimal when compared to other customers in the database. Using this method, companies or organizations maintains and improves the relationship with customers.

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