Dynamic Churn Prediction using Machine Learning Algorithms - Predict your customer through customer behaviour

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Abstract— In current days, the customers are getting more attracted towards the quality of service (QoS) provided by the organizations. However, the current era is evidencing higher competition in providing technologically advanced QoS to the customers. Nevertheless, efficient customer relationship management systems can be advantageous for the organization for gaining more customers, maintaining customer relationships and improve customer retention by adding more profit to the organizational business. Furthermore, the machine learning models such as support vector machine algorithms can add more value to the customer retention strategies.

Keywords—customer relationship management, customer retention, machine learning, support vector algorithm

I. INTRODUCTION

Customers always play vital role in increasing profit and revenue of every organization; hence, to gain customer satisfaction it is important for the organizational managers to maintain one efficient customer relationship management system by selecting the target customers and maintaining effective relationship with them. Moreover, the CRM system will be helpful for the organization in identifying the most prominent group of customers and their behavior; which will become beneficial for the organization in understanding the retention strategies in a better way. Additionally, higher the customer loyalty, lesser is the customer churn rate; hence using machine learning algorithm such as support vector algorithm can add value in preventing the customer churn. This report will focus on the customer retention with the usage of support vector machine learning in gaining customer loyalty and increasing retention.

II. BACKGROUND.

Churning manifests either voluntarily which means the consumer willingly decides to terminate relations with a given seller or involuntarily where the consumer's action renders them to their evacuation from undertaking any form of business relations with a given entity. Forceful churning arises in cases where the customer does not comply to the stipulated set of rules that conducts commerce within a given premise, and for this case, it may be due to illegal practices like stealing or refusing to pay timely [2]. Matters to do with consumer satisfaction or deprivation of an organization's competitive advantage stimulates a voluntary form of churning. Churning evaluation practice is healthy for any organization that deals with customers of different types.

III. CAUSES OF CHURNING.

The influence by customers who churned earlier to those who are willing to carry on exchange with an organization negatively impacts the revenue collected by a company regarding a given service or product. The expectations of consumers may not go in line with what they find after purchasing products from a given company as depicted by customers opting for newer producers. The performance of a commodity basically for machinery producing companies, it is hard to convince buyers about a given machine that they test only to find it underperformed. If the gadget has other compliances, the customer will opt for another seller. Consumer management strategies fall into pay, especially in such instances hence making the organization to improve their quality production, raising their brand portfolio [4].

Price is among the key factors that drive customers away from a given commodity. Buyers feel the pinch on their acquisition of expensive commodities and services primarily if there exist options with cheaper products that can perform the intended job. Price variations in the product market ruin the customer retention capacity of an organization in correspondence to that of their competitors. In terms of the motive of hedonic pricing, the customers gauge the pricing of a particular corporate to that of a similar company to establish the value of the commodity. If his pricing model is perceived to be faulty by the consumers, a corporation's commodities are on the verge of being turned down by the potential buyers.

Consumer satisfaction is core determinant on whether a particular buyer will abide by the conditions of a particular company or else to retreat the option. Customers feel satisfied if their expectations are in line or fall below the performance
of a particular good or service to be purchased. In most cases, the customers feel it best to stick to entities with excellent customer care services. Once the process of buying commodities from a specific seller becomes a habit, an organization wins the loyalty of the customer, and it is upon a corporation to maintain the customer by all means.

IV. CONCEPTUAL FRAMEWORK.

Aspects of marketing mix theory give better explanations on why customers initiate the action of moving away from a given business hub. Product features and mainly the quality and price topples the perceptions held by customers towards a given company. For instance, in a study in an Australian telecommunications industry, it is proved that the quality of the network used by the customers was an underpinning feature to the customers' decision of not using the local networks [1]. Poor network quality nearly affected most of the users typically due to the large number of small-scale users who only call and surf the internet. Pricing and promotions also dramatically determine consumer behavior in any market. Once a firm tag favorable prices to its customers, it will, in return, increase and maintain their customers' loyalty.

Expectation and confirmation theory is a scope that tends to give a clear explanation of why consumer conducts themselves in churning ways. Figure 1 shows the generic idea of the consumer behavior in general. As earlier explained, what a customer expects is so crucial in determining whether they will purchase any given commodity, and it is the role of a marketing team of a company to ensure the prices are satisfactory [3]. Once the consumers service and confirm it is within the standards, it always increases their bond with a given company and the converse is also true as seen in the case of the Australian telecommunications where consumers fell the connections are not within the standards.

V. CHURN PREDICTION

Examining the customer attrition rate in an organization implies the process of churn analysis. In the telecommunication industries, the churn can be identified as the number customers who had discontinued their subscription in a certain time period [4]. A typical churn rate measures the number of customers moving in and out within a given time period. Moreover, for the telecommunication industry, the movement of the customers from one company to another, is

![Conceptual model of consumer behavior.](image-url)
called churn [5]. The current scenario is evidencing a higher number of churn customers as the particular industry is trying hard to retain more profitable customers. The algorithm the train your data set and model is shown in the Figure 2. Moreover, the churn can be classified into two types. In case of nonpayment of the bills, fraud activity or any such activity, when the industry itself decides to remove the consumers, it is named as involuntary churn. In contrast to this, when the customer intended to change or leave the organization, the particular activity becomes a voluntary churn [6]. However, in case of the telecom industry, the continuous increase in the number of service providers, is becoming the vital reason for creating more churn customer for the companies. Nevertheless, understanding the customer demand and gaining loyal customer can eliminate the churn in a higher rate.

VI. PREDICTION OF THE CHURNING THROUGH A MACHINE ALGORITHM.

Data analysis is one of the most convenient ways of perceiving instances of customer's deprival in business, for instance, the use of E-commerce conveniently utilizes the databases of consumers in strategizing on the way forward to be adopted by a firm in pursuit of maintaining a smooth flow of commerce in the product market. Preprocessing of data is a hub that puts a producer on the limelight of being familiar with consumer behavior in association with their premises. For instance, it is considerably better to utilize the machine algorithm in running a regression analysis that will depict the consumer behavior in correspondence to various organizations and products. It is recommendable to present the results in graphical presentations that will convince the managing team on the way to combat the malpractice by customers. Analytical data analysis tools should fall into play, especially in giving the marketing team a quick capture of the ongoing typical market behavior. Categorization plays a critical role in identifying the strongholds and weak points of a company to its trading behavior [5]. Also, in the broader context, the variable distribution tables will give clear evidence of the mean and the mode aspects of the purchasing teams.

VII. SUPPORT VECTOR MACHINE LEARNING ALGORITHM

Machine learning can be considered as the effective application of the artificial intelligence, which has been widely used by the telecom industries in evaluating and nullifying the customer churn. Support vector machine learning is one vital machine learning algorithm that efficiently performs the data analysis for predicting the churn [7]. Moreover, the support vector machine (SVM) algorithm encompasses with a series of supervised learning methods for separating the data points [8]. The support vector machine works by mapping the data in order to create hyper planes. The optimal hyper plane in the support vector machine can be described as indicated in Fig. 3.
Furthermore, those data points are mapped to higher dimensional space for identifying the suitable hyper planes among the instances of several classes. The new instances are classified into specific classes depending upon their proximity[9]. The mapping functions used in this algorithm are generally obtained from a combination of labeled training data set, such as, \( \{x_i, y_i\} \mid i = 1, \ldots, n \). Hence, the modeling objective for finding the linear decision function can be described as follows;

\[
f(x) = < w, \phi(x) > + b
\]  

(1)

In the above equation,

\( w \) = weight vector

\( \phi \) = nonlinear mapping function

\( b \) = constant

This particular regression problem is formulated for minimizing the below risk function

\[
R(C) = \frac{C}{n} \sum_{i=1}^{n} L_\varepsilon(f(x_i), y_i) + \frac{1}{2} ||w||^2
\]  

(2)

In the above equation,

\( \varepsilon \) = intensive loss function and,

\[
L_\varepsilon(f(x), y) = \begin{cases} 
|f(x) - y| - \varepsilon & |f(x) - y| \geq \varepsilon \\
0 & \text{otherwise}
\end{cases}
\]  

(3)

After introducing the slack variables,

Minimize:

\[
|R(w, \xi^*)| = \frac{1}{2} ||w||^2 + C \sum_{i=1}^{n} (\xi_i + \xi_i^*)
\]  

(4)

Subject to:

\[
\begin{align*}
 y_i - < w, x_i > - b & \leq \varepsilon + \xi_i \\
 < w, x_i > + b - y_i & \leq \varepsilon + \xi_i^* \\
 \xi_i, \xi_i^* & \geq 0
\end{align*}
\]  

(5)

In the above, \( C \) is the regularized constant having value greater than 0. This constant is taken to make a balance between the model flatness and training error. Moreover, this constant is responsible for representing penalty for any kind of predicton error. The objective of support vector is to minimize \( w^2 \). Hence, the above equations can be changed by means of the lagrangian multiplies into one quadratic equation as follows;

\[
f(x) = \sum_{i=1}^{n} (\alpha_i - \alpha_i^*) K(x_i, x) + b
\]  

(6)

\( K(.) \) represents a Kernel function, which value calculated by the inner products of the vectors \( x_i \) and \( x_j \), which represented by the future space \( \phi(x_i) \) and \( \phi(x_j) \).

\( \alpha_i \) and \( \alpha_i^* \) represents the lagrange multiplies. These multipliers are subjected to the following:

\[
\sum_{i=1}^{n} (\alpha_i - \alpha_i^*) = 0
\]

\[
0 \leq \alpha_i \leq C \quad i = 1, \ldots, n
\]

\[
0 \leq \alpha_i^* \leq C \quad i = 1, \ldots, n
\]  

(7)

Furthermore, the kernel function satisfies Mercer’s condition. Hence,
There exist several useful kernel functions; however, the radial basic kernel function will become beneficial in classifying the customer churn in the telecommunication industries. This radial basic kernel function is represented by

$$K(x_i, x_j) = \exp\left(\frac{-|x_j - x_i|^2}{2p^2}\right)$$

The correctness of a SVM model depends on the efficient selection of the associated model parameters. A list of parameters such as error trade off parameter (C), parameter for controlling the width of intensive zone and many others, which needs cross validation.

Support vector machine algorithm is one of the powerful prediction method for identifying the churn rate. In contrast to the traditional churn prediction methods, SVM allows the problem solution to depend upon the subsets of the data set, which provides comparative computational advantages to the technique [10]. Apart from that, instead of minimization of training error, the support vectom machine algorithm focuses on minimizing the generalization error. Adoption of this technique is turning out to be the vital impeding factor for the churn prediction in the telecom industries. The following image, Fig. 4, shows the SVM based framework in order to predict the churn.

VIII. CONCLUSION

Therefore, from the above discussion, it can be concluded that, regardless of the type of organization, every organization need to concern about the customer churn. Customer retention is the process of maintaining the loyalty of the customer by understanding the customer demand and serving them accordingly. Powerful churn prediction model will help the organizational management to predict the customer churn. Depending on the complex data of the telecommunication industry, support vector machine can turned out advantageous for predicting the churn rate. The above report has focused on the concept of customer retention along with the churn prediction. Apart from that, the use of support vector machine in order to enhance the churn prediction process has been discussed here along with the algorithm.

IX. REFERENCES


