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A Review of Customer Churn Prediction Related Issues Using Data Mining Methods

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***Abstract*—** Customer churn prediction is a challenging target but a very necessary and essential in emerging service-oriented businesses. It is also one of the important issues in customer relationship management. To predict a customer there is a number of data mining techniques applied for churn prediction, this paper reviews some recent developments and compares them in terms of data pre-processing and prediction techniques.

***Keywords*—**Customer Churn, Customer Retention, Customer Relationship Management, Logistic regression, Linear regression, Knowledge discovery, Data mining.

I. INTRODUCTION

Customer churn is the specific term used to denote the minimized count in the customers who abandoned the financially profitable company. It is one of the key issues in Customer relationship management (CRM). Leading key aspect in the business technique of every financial profit organization is that the capability to carry existing consumer and attain newly planned purchasers. The appearance of the latest competitors and technologies entails a considerable increase in competition [1]. It additionally entails a growing preoccupation among service providing corporations with the creation of stronger bonds with customers in a context, during which they're needed to fight over their customer portfolios in progressively shifting markets. Several of those corporations or fun resources far away from the goal of capturing new customers and are instead concentrating in retentive the prevailing ones, significantly those who represent the next to come back on investment. During this context, anticipating the customer's intention to abandon, a development conjointly referred to as churn and facilitating the launch of retention-focused actions each could become components of competitive advantage. Data Mining was originally formed as a method for business analytics, organized as a succession of stages outlined in line with a strategy. Intelligent information analysis, within the variety of pattern recognition, machine learning, statistics, and connected approaches, remains at the core of Data Mining. Data mining is adapted to play a crucial role in these efforts.

II. LITERATURE REVIEW

A. Customer relationship management(CRM)

CRM, that has additionally been delineated as 'information-enabled relationship selling'is an enterprise-wide initiative that belongs to all or any areas of a corporation. It includes processes used by organizations to manage client relationships, which additionally embody collection, storing and analyzing knowledge.It is commonly termed as data-driven selling. CRM makes an attempt to provide a strategic bridge between data technology and selling methods geared toward building long relationships and profitability [2]. This requires 'information-intensive methods'. It is essential to take care of applicable client Information Management systems by customer databases and consolidating client feedback. Companies move with customers, treat them as structure assets, find out about them and through the method of incorporating feedback and co-creation, develop the level of intimacy with them. In this context, we tend to arrange to use the ideas of data extraction and data mining to extract shopper connected information from comments denote by customers on a company journal.

B. Retention of Existing Customers

Customer retention needs understanding however client loyalty construction mechanisms work, so as to anticipate Customers intention to abandon and facilitate the launch of retention-focused actions as a result. This understanding allows defensive industrial strategies adjusted to retain and to build loyalty bonds with existing

customers, and the approach that is likely to be simpler and less price than an aggressive strategy to expand the size of the market by attracting potential customers [3].

C. Customer Churn Prediction

When we speak the word churn the one factor that comes in mind is that client churn is that the massive issue of the retail market. The churn means that those customers who like to go away in the close future. There is essential want to predict those customers on behalf of some parameter to initiate some appropriate action to reduce their deed. Customer churn would definitely proceed in the business loss. Churn prediction has a huge attraction in the management and marketing literature over recent time. Moreover, there appears a minimum change in the retention rate and ends in significant business impact [4].Customer churn can be observed as a customer who intends to change their purchase activities to a competing service provider. So the companies are in a need to assess their customer interests to maintain and develop the profit of their own.

III. PREDICTIVE MODEL CONSTRUCTION

A. *The issue needs the stratification of consumer fragments by utilizing current division show with the top goal to:*

Develop models that foresee the purchasers may be too worn down within the near future. Establish the qualities of the maximum gainful/alluring shopper fragments with the top goal to make methods to ensure they are proceeded with facilitating, to become the cluster, and to obtain additional purchasers with comparative attributes.

B. *Consumer Activation Strategies*

Recognize consumer bunches whose qualities loan them to moving from unprofitable/torpid to gain able one. Once identified, the attributes will empower the development of hazard, repairs and chance ways custom fitted to a fruitful relocation.

C. *Data Extraction*

The information preprocessing state contains the arrangement of exercises necessary to create a compact file that:

- Reflects info changes when it is slow.
- Acknowledges and evacuates factually insignificant fields
- Defines and presents the "objective" field
- Permits for second stage preprocessing and factual investigation.

This was skilled through 3 stages, step by step within the segments underneath:

- Time arrangement "unrolling"
- Target esteem definition
- First stage factual investigation

D. Data Cleaning and Transformation

The noisy, irrelevant data or outliers may affect the performance of the learning algorithms if we use the raw data. The motive of cleaning the data is to decrease the number of inconsistent values, reduce the noise and incomplete attributes. Since our dataset is enough big, we have to remove all erroneous tuples. And the transformation of data using relevant potential techniques we saw in experiments increases the performance of the churn prediction. The churn prediction will produce the best results when normalization is done for data [5].

E. Knowledge discovery and Data pre-processing

Knowledge discovery is that the non-trivial method of identifying valid, novel, probably helpful and ultimately comprehensible patterns with huge collections of information. Data processing is bothered by the particular extraction of information from data. The net captures many aspects of human endeavors and provides a fertile ground for data processing, that is taking part in a very important role in meeting the challenges of the intelligent web. Within the case of a company weblog, the purpose of the analysis would be to view insight into the pattern thought method, thereby enabling prediction of shopper behavior, creating segments of shoppers, to find out consumers at the chance of churn, analyzing responses to campaigns and retention ways. Data mining applications perform the analysis and extract relevant shopper data.

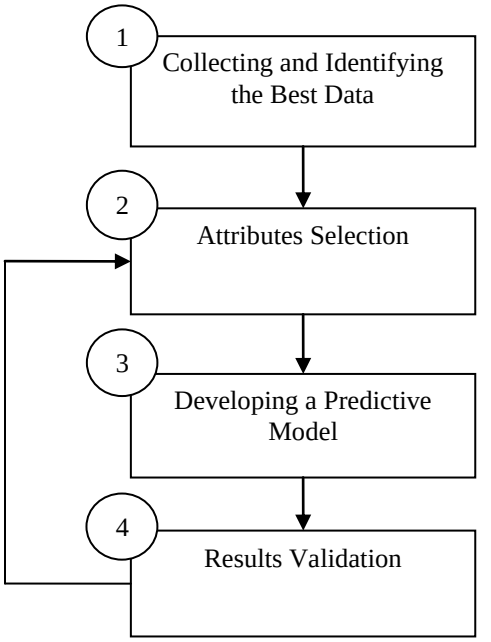

Fig 1. Stages in the predictive model construction process

F. Data Mining Model Development Strategy

A. Assessment Criterion: Carry Prediction truth was used to assess the mining calculations, is certifiably not a good assessment basis for the data mining applications, as an example like Churn experiments.

B. The basic reasons are:

- Classification mistakes (false negative, false positive) square measure treated as same, nevertheless in Churn experiments. False positive and false negative have numerous impact with the distinctive result, and that they need to be managed in the surprising method.

- Precision is employed to quantify the execution of the learning algorithm in full dataset, the target of the Churn experiment is not to anticipate the conduct of every consumer, nevertheless find a good set of shoppers wherever the amount of Churner is high. For steady loss investigation, the informational index is deeply inclined and uproarious; it's extraordinarily tough to fabricate a model with nice truth.

IV. DATA MINING TECHNIQUES USED IN CHURN PREDICTION

It is the fundamental necessity of the businesses to develop an economical and effective model to manage customers churn. There are lot of modeling techniques that are accustomed to predict customers churn in numerous organizations. Artificial neural networks, linear regression model, the Naïve Bayes model, decision trees, and support vector machines are most often used techniques for Churn Prediction.

In the following, we briefly present five well established and popular techniques used for churn prediction, taking into consideration efficiency, reliability and familiarity in the research areas.

- Artificial Neural Network

Artificial Neural Networks (ANN) is a familiar technique to face complex problems. It could be the best option to apply for churn prediction issues. Neural networks can use various terminologies and learning methods. Multi-Layer Perceptron is one familiar supervised model trained with variations of the Back-Propagation algorithm (BPN). BPN is a feed-forward model with supervised learning. In the customer churn issue, ANN shows a better outcome than Decision Trees. Moreover, experiments show that ANN has better performance than Logistic Regression for churn prediction [6].

- Support Vector Machines

Support Vector Machines (SVM) was introduced by Guyon, Boser, and Vapnik. They are also known as Support Vector Networks. SVM is a supervised network model together with learning algorithms which recognize patterns by analyzing the data and the patterns which are used for classification and regression analysis. In SVM learning algorithm the structural risk is minimized. Kernel functions are used to develop the performance of the network. Research processes are undergoing to choose the best kernels and the combination of kernels. SVM overcomes Decision trees and sometimes even ANN in churn prediction depends on the nature of data and data transformation takes place among them.

- Decision Trees

Decision Trees (DT) are binary trees presenting sets of decisions able to create classification rules for a particular data set, or as Berry and Linoff denoted "a structure that can be used to divide up a large collection of records into successively smaller sets of records by applying a sequence of simple decision rules". Additional elaborate names for such tree structures are Classification Trees or Regression Trees. In these tree arrangements, leaves denote class labels and branches denotes conjunctions of features that results in those class labels. DT has no huge outcome on earning complicated and non-linear connections between the attributes. Again in the customers churn issue, the accuracy of the DT can be huge based on the data.

- NAIVE BAYES MODEL

Naive Bayes algorithm is a probabilistic classifier by applying Bayes' theorem using rigid individual assumptions. An additional elaborate term for the present probability model would be a separate feature model. Simply a Naïve Bayes (NB) algorithm fixes that the presence of a noted feature of a group which is not connected to the presence of any other feature. The NB algorithm earned good outcomes on the churn prediction issue for the telecommunications industry and it can also earn developed prediction rates compared to other popularly used algorithms.

- REGRESSION ANALYSIS-LOGISTIC REGRESSION ANALYSIS

In statistics, Regression is used to value the relationships between variables. Regression analysis introduces many techniques for analysing and modelling more variables, during the concentration upon the relationship between one or more independent variables and a dependent variable. Linear Regression models were previously used widely in the prediction of continuous values and so far Regression analysis is not that much used in customer churn. On another side, Logistic Regression analysis (LR) is a type of probabilistic statistical classification model and also produces a binary prediction of a categorical variable which depends on one or more predictor variables.

V. CONCLUSION

The financial profitable organizations are facing major changes due to the strong competitions among them and their growth became temporarily static since the Customers are in thirst of attractive services and less price. It is complex to serve customer problems and to fulfil their varied interests. To overcome these customer related issues which are directly linked with the financial growth of the organization's Retention of existing customers, and CRM emerge as key factors. Customer churn prediction plays a vital role to maintain the growth in major financial sectors.

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