

# A COMPARATIVE STUDY OF TECHNIQUES TO PREDICT CUSTOMER CHURN IN TELECOMMUNICATION INDUSTRY

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**Abstract** - In present days there is huge competition between various companies in the industry. Due to this companies pay more attention towards their customers rather than their product. They become aware of customer churn issue. Basically when a customer ceases one's relationship with the company, this misfortune of relationship is known as customer churn. Various data mining approaches are used to predict customer's churn attitude. Many algorithms have been proposed to predict these results. In this paper, we have discussed about various methods used to predict customer churn in telecommunication industry and propose a technique using Correlation based Symmetric uncertainty feature selection and ensemble learning for customer churn prediction in telecommunication industry.

**Key Words:** customer churn, data mining, algorithm, telecommunication, feature selection

## 1. INTRODUCTION

One of the main concerns of telecommunications companies is the customer retention. These days, in order to predict customer churn, many companies in the telecommunications sector make use of the data mining techniques [1]. The term churn refers to the change of the service provider, triggered by better rates or services or by the benefits offered at signup by a competitor company [2]. It is measured by the rate of churn and is an important indicator for organizations. In the telecommunications industry, the mobile market is the segment that sees the fastest growth and is almost saturated. In order to keep their customers, telecommunications companies are making use of a defensive marketing strategy. One such company must identify customers who are at risk of churn before they are actually going to act so they can send proactive retention campaigns [3]. To correctly identify only the customers who are going to churn, the predictive model has to be very accurate, to avoid contacting customers who will be using the services anyway. To achieve this task is not easy and well defined because the pre-paid customers do not have a contract. The predictive model will accelerate the retention process and the mobile telecommunications companies will achieve positive results in this competitive market. This prediction process depends strongly on the data mining techniques mainly because of the increased performance obtained by the machine learning algorithms [4]. To extract knowledge from data, the data mining process makes use of machine learning algorithms, statistics, pattern recognition, and visualization techniques [5]. This paper is

organized as follows: in Section 2, we describe data mining and its techniques. In Section 3 we discuss about customer behavior analysis for customer churn. We then discussed literature survey related to this work in Section 4. Section 5 discusses about drawback of current system and proposed work. Finally, Section 6 concludes this review process.

## 2. DATA MINING

Originally, "DATA MINING" is a statistician's term for overusing data to draw invalid inferences. So, it's Discovery of useful summaries of data [1,2]. Data Mining [1] is a process that discovers the knowledge or hidden pattern from large databases. DM is known as one of the core processes of Knowledge Discovery in Database (KDD). It is the process that results in the discovery of new patterns in large data sets. It is a useful method at the intersection of artificial intelligence, machine learning, statistics, and database systems. It is the principle of picking out relevant information from data. It is usually used by business intelligence organizations, and financial analysts, to extract useful information from large data sets or databases DM is use to derive patterns and trends that exist in large data sets involving methods at the intersection of artificial intelligence, machine learning, statistics, and database systems. The goal of this technique is to find accurate patterns that were previously not known by us. So, the overall goal of the DM process is to extract information from a data set and transform it into an understandable structure for further use.

Many DM techniques and systems have been developed and designed. These techniques can be classified based on the database, the knowledge to be discovered, and the techniques to be utilized.

**Based on the database** - There are many database systems that are used in organizations, such as relational database, transaction database, object-oriented database, spatial database, multimedia database, legacy database, and Web database. A DM system can be classified based on the type of database it is designed for. For example, it is a relational DM system if the system discovers knowledge from relational database and it is an object-oriented DM system if the system finds knowledge from object-oriented database [5].

**Based on the techniques** - DM systems can also be categorized by DM techniques. For example, a DM system

can be categorized according to the driven method, such as autonomous knowledge mining, data driven mining, query-driven mining, and interactive DM techniques. Alternatively, it can be classified according to its underlying mining approach, such as generalization based mining, pattern-based mining, statistical- or mathematical-based mining and integrated approaches [1].

**Based on the knowledge** - DM systems can discover various types of knowledge, including association, classification, clustering, prediction, sequential patterns and decision tree. DM systems can also be classified according to the abstraction level of the discovered knowledge. The knowledge may be classified into general knowledge, primitive-level knowledge, and multilevel knowledge. We will briefly examine those DM techniques in the following sections:

**Association:** Association is one of the best known DM techniques. In association, a pattern is discovered based on a relationship between items in the same transaction.

**Classification:** Classification is a classic DM technique based on machine learning. Basically classification is used to classify each item in a set of data into one of predefined set of classes or groups. Classification method makes use of mathematical techniques such as decision trees, linear programming, neural network and statistics.

**Clustering:** Clustering is a DM technique which makes meaningful (i.e. useful) cluster of objects having similar characteristics using automatic technique. The clustering technique defines the classes and puts objects in each class, while in the classification techniques, objects are assigned into predefined classes.

**Prediction:** The prediction, as it name implied, is one of a DM techniques that discovers relationship between independent variables and relationship between dependent and independent variables.

**Sequential Patterns:** Sequential patterns analysis is one of DM technique that seeks to discover or identify similar patterns, regular events or trends in transaction data over a business period. **Decision trees:** Decision tree is one of the most used DM techniques because it is easy to understand by users. In decision tree, the root of the decision tree is a simple question or condition that has multiple answers. Each answer then leads to a set of questions or conditions that help us determine the data to make the decision[7].

### 3. CUSTOMER BEHAVIOUR ANALYSIS

In recent years, management of organizations is moving from "Product-Centric" to "Customer-Centric" [13]. They are not only provides products to meet the need of customers but also improving their services to increase the loyalty and

satisfaction of the customers. Intense competition in the market has increased the need for retailers to use strategies focused on retaining the right customers. Acquiring the new customers is more expensive than retaining the existing customers. To retain the customers, organizations are more concern about the customer behavior analysis. The major factors of success include learning costumers' purchase behavior, developing marketing strategies to discover latent loyal customers [14]. However a strategy that is effective in acquiring new customers may not be the most effective in retaining existing customers so in order to design the effective activity to retain customers they need to use the effective strategy for this. So different marketing strategies can be devised that will target different sets of customers. Predicting those profitable customers is important to inform and guide the decision making to keep the products and services competitive. Consumer behavior is the study of individual, or group about their process of selecting and using the product, services, ideas or experiences to satisfy needs. It involves ideas, services and tangible products.

Data mining techniques shows effectively and easily business solution can be made and to beat the competition. New technologies of data mining can be used for Customer Relationship Management (CRM) and with this different marketing strategies are devised for different set of customers [15]. Organizations need to understand the customer behavior to improve their marketing strategies. They must understand few things about their customers such as what is the psychology of the customer while purchasing the products, what the customer thinks, feel and select between different alternatives, how the customer is influenced by environment, and how customers' decision strategy differs between products that differ in their level of importance or interest.

The customer behavior is analyzed to making the marketing strategies and public policy. The stored data contains the information of about the spending behavior of customer, how much they buy, which day at what time he/she does the shopping, and what they buy most often, in that locality etc. The purchasing sequences of the customers are stored in the database so it is easy to fetch that data and determined those customers which have made repeat purchases [14]. These sequences can determine the changes in customers' preferences over time.

### 4. LITERATURE REVIEW

**Berry and Linoff, (1997)** described that data mining techniques can be used to retain the loyal customers, look out the right prospects, identify new markets for products and services, and recognize cross-selling opportunities on and off the web. Data mining techniques are effective tool for analyzing consumer behaviors. There are seven powerful techniques with are useful for this purpose [11] such as Cluster Detection, Memory-Based Reasoning, Market Basket

Analysis, Generic Algorithms, Link Analysis, Decision Trees, Neural Nets.

**Vadakattu R. et al, (2015)** In this paper the author has described the process of building a churn prediction platform for large-scale subscription based businesses and products. The novel technique of using data segmentation and past prediction of the customer to further increase the precision and recall of the model is proposed. Running such a model at large-scale possesses several challenges which we cover in our description of extract, transform, and load and architecture diagram of the platform. The author has developed novel tools of model tuning to generate three types of list of "potential churn customers" categorized into high risk, medium risk and low risk. Such a classification enables the business units to tailor customized retention strategies, since each strategy has an associated marketing cost. The Churn prediction is a continuous process and it becomes imperative to track customers. We describe the novel implementation of an index/score which we use to track and monitor customer receptiveness to retention schemes and performance over a period of time. The developed platform is deployed on several eBay sites and has resulted in the increase of key business metrics. [12]

**Amin A. et al, (2014)** The author has discussed the customer churn in telecommunication industry. It is important to forecast customer churn behavior in order to retain those customers that will churn or possibly may churn. This study is another attempt which makes use of rough set theory as one-class classifier and multi-class classifier to reveal the trade-off in the selection of an effective classification model for customer churn prediction. Four different rule generation algorithms (i.e. Exhaustive, genetic, covering and LEM2) are analyzed and out of which rough set as one-class classifier and multi-class classifier based on genetic algorithm yields more suitable performance out of four rule generation algorithms. [13]

**Mestre M.R. et al, (2013)** described the analysis of customer behavior to find churn customers. They tell that from the profiles of variety of customers and their changing behavior over time, organizations can make marketing strategies to know the group of customers and to decide whether those customers are profitable or not. They proposed an algorithm which is hybrid from hierarchical clustering and hidden markov model (HMM). They compare augmented method with the non-augmented method with real data and synthetic data to represent that their proposed model performs better in predicting customer behavior. They use different clustering algorithms for segmentation of the customers [14]. Then they use decision theory to check whether their proposed model is financially beneficial for an organization.

**Nabavi S. et al, (2013)** described the data mining abilities, design and implementation of customer churn prediction

model with CRISP-DM based on RFM and Random Forest Technique. Customer behavior analysis tells that the length of relationship, average purchase time, and relative frequency are the best predictors [15]. For the segmentation of churn customers they use random forest technique and boosted tree as a hybrid technique.

**Wang C. et al, (2012)** proposed a new methodology to predict customers' purchasing behavior using purchase sequences of customers. Then sequential purchase patterns are extracted using association rule. Using purchase transactional records of customers, profile of the customers is build that describes the likes and dislikes of the customers [16]. Then a group of customers detected who have similar purchasing behavior using the calculations of correlations among customers. Transaction clustering is used to cluster all the transactions of the customers. Then SOM technique is used to detect customer purchase sequences. Sequential purchase patterns are extracted using association rule mining. They predict the customer behavior using customer's purchase sequence base on transaction data.

**Basiri J. et al, (2010)** discussed new approach, the ordered weighted averaging (OWA) technique to improve the prediction accuracy of existing churn management systems. In this paper, they used the strengths of both bagging and boosting and LOLIMOT algorithms and proposed OWA approach to combine these algorithms [17].

## 5. PROPOSED WORK

In the existing work, PCA is used to feature selection which is based on a Gaussian process (assumption), to measure the variance and sort the eigenvalues which are proportional to the variances in descending order. The assumption is that the main Eigenvalues (EVs) contains most of the information and therefore, we use the main components (EVs) for data reduction. This approach for feature reduction is risky because this assumes that the feature in itself is stable (invariant) AND the feature's variance contains all information for classification. To eliminate such drawbacks, we propose a technique using Correlation based Symmetric uncertainty feature selection and ensemble learning for customer churn prediction in telecommunication industry.

## 6. CONCLUSION

In this paper, we have discussed about the present scenario of customer churn. Further we have discussed about data mining and its techniques. Customer behavior analysis is studied to understand the behavior of customer related to churn. Literature survey is done to study various techniques to predict customer churn. Section 5 explains that present work use PCA for feature selection but this system has some drawbacks. So to remove these drawbacks, a technique is proposed using Correlation based Symmetric uncertainty

feature selection and ensemble learning for customer churn prediction.

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