



Customer churn prediction using ML - literature survey

¹Prajwal Waghole, ²Kalpana Saharan, ³Shantanu Wasnik, ⁴Varad Wanwase, ⁵Raj Gokhale

¹B.E 4th year, ²Professor, ³B.E 4th year, ⁴B.E 4th year, ⁵B.E 4th year Department of Computer Engineering, RMDSSOE, Pune-411058, India

Abstract : A significant problem for businesses is customer churn . Business owners now face significant challenges in terms of operations, development, and customer retention when attempting to predict customer churn. The secret to a company's long-term success is churn prediction. The number of customers a business lost over a specific period of time divided by the number of customers it retained at the start of that period is how the churn rate is determined . To predict the churn rate, we have employed machine learning algorithms in this paper.

Index Terms – Machine learning, SVM , random forest, churn .

I. INTRODUCTION

A combination of activities linked to customer (business or individual) cancellation and switching to a competitor is known as customer churn, also known as customer attrition. Because it makes more financial sense to retain current customers than to pursue new ones, reducing customer churn has been one of the top business priorities in many industries . Customer churn breaks are expensive because businesses frequently spend a lot of money on marketing campaigns to bring in new clients in the hopes of receiving a return on investment from the client several times over the course of the client's lifetime. Naturally, a longer customer stay means more money for the business. Customers who plan to move from one telecom service provider to another are known as churners. Researchers have been interested in predicting telecom customer churn, and many have worked on different techniques to make this prediction. The telecom sector has been fighting the prospect of losing over 25% of its clientele annually, which is anticipated to cause a significant loss in revenue . It's also well known that bringing on new business or acquiring a new client costs the company five to ten times as much as keeping an existing one . As a result, it is thought that keeping current subscribers or preventing customer churn is the best marketing strategy. There has been a growing demand over time for the automation of churn techniques.

In order to predict different customer churn patterns, a comparative analysis of techniques like Random Forest, SVM, Extreme Gradient Boosting (XGBoost), Ridge classifier, and decision tree is done in this paper. We investigate the more traditional but reliable and simple divide and conquer technique using Random Forest, which creates decision trees of the numerical kind and applies them based on a random attribute selection. Ultimately, a decision tree is constructed using test data for classification. Random forest is an effective method for handling missing variables and performs well on large datasets

In order to predict different customer churn patterns, a comparative analysis of techniques like Random Forest, SVM, Extreme Gradient Boosting (XGBoost), Ridge classifier, and decision tree is done in this paper. We investigate the more traditional but reliable and simple divide and conquer technique using Random Forest, which creates decision trees of the numerical kind and applies them based on a random attribute selection. Ultimately, a decision tree is constructed using test data for classification. Random forest is an effective method for handling missing variables and performs well on large datasets.

To predict the test dataset, a final decision tree is built. When dealing with a large dataset, random forest performs well and manages missing variables without deleting any of them . Models of the Support Vector Machine (SVM) are parametric. Its performance and accuracy are highly dependent on the initial values of its parameters. In order to maximize SVM's effectiveness for churn management, a new combined evaluation metric is applied .

II. RELATED WORK

In this section, we review prior research relevant to our proposed system. We categorize related work into several key areas that have a direct bearing on our research

Tien-Yu Tsai, Chin-Teng Lin, Mukesh Prasad : had proposed An Intelligent Customer Churn Prediction and Response Framework. .

This paper offers new classifications and definitions for customer churn identification and strategies, as well as identifies related problems in customer churn prediction. Additionally, a framework for predicting and responding to customer churn is established in this paper. It comprises three main stages: understanding, response, and prediction. The framework also outlines the traits and difficulties of related customer churn stages.

Bora Barduk : had proposed modelling time statistics for customer churn prediction.

This paper had proposed A popular approach for these kinds of companies in the literature is the beta-geometric negative binomial distribution (BG/NBD) model of customer behavior. By adding machine learning to the BG/NBD model's decision-making process, this study seeks to enhance it.

Laurie Butgereit : had proposed Work towards using micro services to build a data pipeline for machine learning applications : A case study in predicting customer churn

In this paper Neural networks can be used to reasonably predict when customers are going to churn if large enough data sets are available. If this forecast is accurate enough, the business can take proactive measures to guarantee that the customer doesn't actually churn.

Xin Hu ,yanfei yang,Lanhun chen ,SiruZhu had proposed : Research on a Customer Churn Combination Prediction Model Based on Decision Tree and Neural Network

This paper is based on This work creates a combined prediction model of customer churn and performs empirical research on the model's efficacy based on the prediction results and confidence of decision tree and neural network models. The combined prediction model outperforms the single customer churn prediction model in terms of accuracy and prediction effect, and it is also able to more clearly convey the fundamental traits of the churning customers, according to the prediction results. It provides more accuracy .

Pushkar Bhuse,Aayushi Gandhi,Parth Meswani,Riya Muni had proposed : Machine Learning Based Telecom-Customer Churn Prediction.

In this paper maintain a business's service for the duration of the specified period. The number of customers a business lost over a specific period of time divided by the number of customers it had at the start of that period is how churn rate is determined. One important indicator of a business's long-term success or failure is churn prediction. In order to predict telecom customer churn, this study investigates machine learning and deep learning techniques.

Haotian Wu had proposed : A High-Performance Customer Churn Prediction System based on Self-Attention.

In this paper This paper proposes a novel algorithm, a hybrid neural network with self-attention enhancement (HNNSAE), to enhance the effectiveness of feature extraction and screening, thereby improving the predictive performance of the model. Three major blocks make up this model. The entity embedding layer, which processes the categorical variables converted into 0–1 code, is the first block. The feature extractor, located in the second block, uses the multi-head self-attention mechanism to extract the important features. Furthermore, we stack the residual connection neural network on top of multi-head self-attention modules to enhance the feature extraction effect.

A classifier, or three-layer multilayer perceptron, is the third block. Experiments on a publicly accessible dataset of commercial bank clients are carried out in this work. The outcome shows that HNNSAE performs noticeably better than the other Deep Learning (DL), Ensemble Machine Learning (EML), and Individual Machine Learning (ML) techniques examined in this work.

Asad Khattak,zartashia mehak,Hussain Ahmad had proposed: Customer churn prediction using composite deep learning technique.

In this paper Customer churn has already been successfully identified through the application of ML/DL techniques. However, in certain situations, ML/DL based algorithms fall short of providing encouraging outcomes when it comes to identifying client churn. Prior studies on customer churn estimation have produced surprising results when using both conventional feature encoding techniques and machine learning classifiers. In these attempts, deep neural networks were also

employed to extract features devoid of sequence information. A hybrid deep learning model called BiLSTM-CNN is used in the current study to provide an efficient method of predicting customer churn in light of these issues. When trained, tested, and validated on the benchmark dataset, the proposed BiLSTM-CNN model achieved an impressive accuracy. The objective is to efficiently estimate customer churn using benchmark data and increase the churn prediction process accuracy by 81%.

Jitendra Maan , Harsh Maan had proposed Customer Churn Prediction Model using Explainable Machine learning.

In this paper The main goal of the study is to create a novel customer churn prediction model that will assist in identifying prospective clients who are most likely to leave, allowing for the implementation of preventative measures to keep them around. Here, we assessed and examined the effectiveness of several tree-based machine learning techniques and algorithms, and the Extreme Gradient Boosting, or "XGBOOST," Classifier was found to be the most effective way to address the issue of customer churn. In order to address these real-world issues, the paper highlights the model interpretability, a crucial metric that aids clients in comprehending the prediction process of the Churn Prediction Model. The study presented a novel method to compute Shapley values for potential feature combinations in order to explain which features are the most significant or pertinent features for a model to become highly interpretable, transparent, and explainable to potential customers. This was done in order to improve the explainability and transparency of the model.

Shobhana J,Rakesh Kumar Arora,PN Ranjith,J.Bamini had proposed E-commerce customer churn prevention using machine learning-based business intelligence strategy

In this paper Companies in the e-commerce space, particularly those in the business-to-consumer market, are in a competitive environment as they attempt to maintain their current customer base while gaining access to their competitors' clientele. Client retention is critical for these companies because gaining new customers is becoming more expensive as more competitors enter the market with large upfront costs and innovative penetration strategies. In this case, identifying potential churning customers and preventing churn with interim retention strategies is the best course of action. To implement tailored win-back tactics, it's also critical to comprehend the reasons behind the customer's decision to leave. Use the RFM principle to classify the different lost customer types in order to efficiently identify distinct groups of lost customers and develop a customer churn retention strategy

Youngjung Suh had proposed : Machine learning based customer churn prediction in homeappliance rental business

In this paper A large-capacity operational dataset of rental care services was subjected to a machine learning algorithm in order to extract significant features. The F-measure and area under the curve (AUC) were used to assess the model's performance; an F1 value of 93% and an AUC of 88% were attained. For testing and training, a dataset with about 84,000 customers was utilized. An additional contribution involved assessing the predictive model's inference performance using the contract status of roughly 250,000 active customer data points, confirming an 80% hit rate. In order to help a businessperson (rental care customer management staff) implement customer-tailored marketing to address the concerns raised by each individual customer, this study ultimately determined and computed the influence of key variables on individual customer churn.

Yanxuan li had proposed : Bank Customer Churn Prediction Based on Correlation Analysis and Multiple Linear Regression

In this paper This study employed Binary Logistic Regression to examine a dataset of U.S. bank customers that included 13 factors from Kaggle in order to determine which factor might have the greatest impact on retention and to suggest solutions. The analysis shows that age, credit score, and "is active member" have a big impact on whether or not a customer leaves. Active members are devoted to the bank and are unlikely to leave, even though they are the variable with the biggest impact. Furthermore, Binary Logistic Regression fitted the dataset flawlessly. The model can clearly show how the variables affect the trend of customer loss, even if its accuracy in predicting the behavior of departing customers is not as impressive. These findings assist certain banks in identifying their most important clients, as it is evident that clients with higher churn rate and purpose appropriate solutions.

Yunjie liu , Mu Shengdong, Gu Jijian had proposed Intelligent Prediction of Customer Churn with a Fused Attentional Deep Learning Model

In this paper The bidirectional long short-term memory convolutional neural network (BiLSTM-CNN) model is integrated with convolutional neural networks (CNNs) and recurrent neural networks (RNNs) in parallel. This effectively addresses the flaw that CNNs and RNNs operate independently, as well as the issue that some local information input to the

convolutional layer of a densely-connected LSTM-CNN (DLCNN) model is ignored by the output results of the LSTM layer. Whether the attention bidirectional long short-term memory convolutional neural network (AttnBLSTM-CNN) model can outperform BiLSTM-CNN is the question that requires investigating. Convolutional neural networks (CNNs) and recurrent neural networks (RNNs) are integrated with the bidirectional long short-term memory convolutional neural network (BiLSTM-CNN) model in parallel. This solves the problem of some local information input to the convolutional layer of a densely-connected LSTM-CNN (DLCNN) model being ignored by the output results of the LSTM layer, as well as the shortcoming of CNNs and RNNs operating independently. It is necessary to investigate whether the attention bidirectional long short-term memory convolutional neural network (AttnBLSTM-CNN) model can perform better than BiLSTM-CNN.

III. CONCLUSION

The telecommunication industry has been subjected to major changes in recent years. As a result of being a growing industry, it has now become a competitive market. Due to having increased options of services in this industry, customers tend to switch between these services. Hence, in order to retain their customers, the industry requires a way to understand and predict the customer churn pattern which can be done using churn modelling. Our research was focused on implementing some of these techniques: Random Forest, SVM, decision tree, Ridge classifier, Knearest neighbors (KNN). The dataset used was focused on a customer retention program which included various customer attribute fields and also a column of customer churn.

IV. REFERENCES

=Chih Ping Wei, I-Tang Chiu, "Expert Systems with Applications", Volume 23, Issue 2, August 2002, Pages 103–112

=J Lu., "Modeling Customer Lifetime Value Using Survival Analysis: An Application in the Telecommunications Industry", Data Mining Techniques, 2003, SUGI 28.

=Golshan Mohammadi, Reza Tavakkoli Moghaddam, and Mehrdad Mohammadi, "Hierarchical Neural Regression Models for Customer Churn Prediction", Journal of Engineering, Volume 2013, 2013, Article ID 543940, 9 page

=Abinash Mishra, U. Srinivasulu Reddy, —A Comparative Study of Customer Churn Prediction in Telecom Industry Using Ensemble Based Classifiers I, Proceedings of the International Conference on Inventive Computing and Informatics (ICICI 2017) IEEE Xplore Compliant - Part Number: CFP17L34-ART, ISBN: 978-1- 5386-4031-9.

=Bhawna Nigam, Himanshu Dugar, Niranjnamurthy M, —Effectual Predicting Telecom Customer Churn using Deep Neural NetworkI, International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249- 8958, Volume- 8 Issue-5, June 2019 .

=Pradeep B, Sushmitha Vishwanath Rao, Swati M Puranik, Akshay Hegde, —Analysis of Customer Churn prediction in Logistic Industry using Machine LearningI, InternationalJournal of Scientific and Research Publications, Volume 7, Issue 11, November 2017 ISSN 2250- 3153

=XinHu,YanfeiYang,LanhuaChen,SiruZhu,"Resear chonaCustomer Churn CombinationPrediction Model Based on Decision Tree and Neural Network", 2020 IEEE 5th International Conference on Cloud Computing and Big Data Analytics

=Mohd Khalid Awang, Mokhairi Makhtar, Mohd Nordin Abdul Rahman, —Improving Accuracy and Performance of Customer Churn Prediction Using Feature Reduction AlgorithmsI, Journal of Telecommunication, Electronic and Computer Engineering, e-ISSN: 2289-8131 Vol. 9 No. 2- 3.

=Khan, Muhammad & Manoj, Johua & Singh, Anikate & Blumenstock, Joshua, —Behavioral Modeling for Churn Prediction: Early Indicators and Accurate Predictors ofCustom Defection and LoyaltyI, 10.1109/BigDataCongress.2015.107.

=Reena Pagare, Dr. Akhil Khare, "Churn Prediction by Finding Most Influential nodes in Social Network", 2016 International Conference on Computing, Analytics and SecurityTrends (CAST).

How Costly Is Customer Churn in the Telecom Industry?, The European Business Review, Aug 2020,Accessedon:Nov1,2020.[Online]. Available <https://www.europeanbusinessreview.com/how-costlyis-customer-churn-in-the-telecom- industry/>.

=Ali Rodan, Hossam Faris, Jamal Alsakran, and Omar Al-Kadi, —A Support Vector Machine approach for Churn Prediction in Telecom IndustryI, Information - An International Interdisciplinary Journal, Vol.17(8),2014.ctionI, Proceedings of the 1st International Conference on Statistics and Analytics, ICSA 2019, 2-3August 2019, Bogor,

Indonesia.

=Ionut B. BRANDUSOIU & Gavril TODEREAN —Predicting Churn in mobile telecommunications industry, Volume 54, Number 3, 2013 ACTA TECHNICA NAPOCENSIS Electronics and Telecommunications Universitatea Tehnica, Accessed on Sept 17, 2020 [Online]. Available: <https://users.utcluj.ro>

=Van Gerven, M., & Bohte, S.(Eds.). (2018), —Artificial neural networks as models ofneural information processing, Frontiers Media SA. 201

