Telecom Churn

# Mở đầu

Hiện nay, sự phát triển của internet và công cuộc toàn cầu hóa đang phát triển không ngừng[] đặt ra vấn đề về sự kết nối của con người trên thế giới gặp rất nhiều về rào cản của địa lý. Để giải quyết được vấn đề kết nối giữa con người và tổ chức này thì nghành viễn thông là nghành mũi nhọn để giải quyết vấn đề này. Phạm vi bài toàn này không chỉ nằm ở các khu vực trên thế giới mà nghành viễn thông đóng vai trò quan trọng với sự kết nối ngay chính các khu vực trong mỗi nước hay hẹp hơn là những kết nối ở trong phạm vi thành phố. Những người cung cấp dịch vụ viễn thông họ có thể giúp chúng ta trao đổi liên lạc thông tin một cách nhanh chóng và dễ dàng hơn, vượt qua các rào cản. Ta có thể liên lạc gọi điện và trao đổi với người khác bằng các công cụ có kết nối internet do các nhà viễn thông cung cấp để trao đổi với bất kỳ ai cho dù họ ở trong nước hay ở các châu lục khác một cách dễ dàng. Lấy ví dụ, điện thoại đang được mọi người sử dụng rất nhiều và đóng vai trò ngày càng quan trọng trong cuộc sống mỗi con người (@article{Thakkar2022ClairvoyantAW) do chúng có thể giúp ta thực hiện công việc rất tiện lợi. Chính vì thế mà nghành viễn thông là một trong những nghành quan trọng với nhu cầu của liên lạc rất cao trong bối cảnh hiện nay. Dựa vào sự phát triển về công nghệ, nghành viễn thông đang ngày cảng cải thiện dịch vụ và cung cấp các dịch vụ viễn thông rất tốt và đem lại rất nhiều lợi ích cho người sử dụng. Vì đây là một lĩnh vực quan trọng và có nhu cầu cao nên ngày càng có nhiều những nhà cung cấp dịch vụ viễn thông đang xâm nhập vào thị trường này. Điều này dẫn đến một viễn cảnh đó là rất nhiều các nhà cung cấp dịch vụ đang cạnh tranh với nhau rất khốc liệt để giành lại khách hàng cho mình và giữ được chân khách hàng luôn ưu tiên sử dụng dịch vụ viễn thông và họ cung cấp (@article{M2023ACA). Từ đây, ta có thể nhận thấy rằng khách hàng đóng vai trò rất quan trọng (@article{Xiahou2022B2CEC) quyết định đến doanh thu và chỗ đứng của nhà cung cấp viễn thông trên thị trường xa hơn nữa là quyết định đến việc nhà cung cấp dịch vụ viễn thông ấy có tồn tại được không. Chính vì sự cạnh tranh khốc liệt như vậy cho nên việc khách hàng đang sử dụng dịch vụ một thời gian rồi sau đó chuyển sang dùng dịch vụ viễn thông của nhà cung cấp khác. Từ đây khái niệm churn ra đời. Chỉ số churn tức là khách hàng không sử dụng dịch vụ mà nhà viễn thông cung cấp nữa họ tức nghĩa là khách hàng sẽ rời bỏ dịch vụ và chuyển sang dùng dịch vụ viễn thông của những nhà cung cấp khác (<https://bcpublication.org/index.php/BM/article/download/4840/4705>, <https://ijsdr.org/papers/IJSDR2304233.pdf>, @article{Ahmadzai2023DataMT, @inproceedings{Kingly2023ComparativeAO, @article{Jeyaprakaash2022AccuracyMO). Về lý do của khách hàng từ bỏ dịch vụ hiện tại có rất nhiều nhưng phổ biền đều là dịch vụ được cung cấp chưa đảm bảo nhu cầu cho khách hàng (https://ijsdr.org/papers/IJSDR2304233.pdf), tốc độ mạng chậm, các gói cước có giá cao hơn so với các nhà cung cấp khác với dịch vụ kém, các dịch vụ của đối thủ có nhiều ưu đãi hơn, không đám ứng đủ việc hỗ trợ và chăm sóc khách hàng, các dịch vụ đi kèm thiếu hấp dẫn, … Chỉ số này đang ngày càng được các nhà cung cấp dịch vụ viễn thông giành nhiều thời gian để ý tới và đóng vai trò quan trọng trong các quyết định kinh doanh tiếp theo. Việc phân tích chỉ số này đòi hỏi các nhà cung cấp dịch vụ viễn thông phải có cũng như nắm bắt được dữ liệu về khách hàng của họ. Theo như các bài nghiên cứu (<https://www.semanticscholar.org/paper/A-Survey-and-Implementation-of-Machine-Learning-for-Rathi/c99f00e62e078ef587fcc3667ad5d20b88a8e62f>, @article{Ahmad2024CustomerPA) thì lượng dữ liệu của khách hàng là rất lớn cũng như nhiều chiều, mỗi bộ data về khách hàng đều có những khuyết điểm riêng biệt. Để xử lý vấn đề này, ta cần tới 1 database đủ để lưu trữ được dữ liệu khổng lồ của khách hàng. Chỉ riêng 1 database sẽ không có dữ liệu nếu như không có luồng vào. Luồng vào ở đây là các dữ liệu thô của khách hàng được lưu trữ dưới các dạng thủ công bằng các file excel hay các file text hay lạc hậu hơn nữa là trên sổ sách giấy tờ. Để biến được các dữ liệu này lưu trữ được dưới dạng 1 database thì các doanh nghiệp viễn thông này cần rất nhiều thời gian cũng như chi phí để trải qua các bước chuyển đổi thành dữ liệu số rồi sau đó qua khâu clean data rồi lưu trữ các dữ liệu này thành một định dạng thống nhất phục vụ cho việc trích xuất để phân tích. Quá trình cần phải thực hiện một cách tự động để đạt hiệu quả cao và tránh mất nhiều thời gian xây dựng. Khi có 1 database hoàn chỉnh về dữ liệu khách hàng rồi, bước tiếp theo các doanh nghiệp cần sử dụng ngôn ngữ thao tác và trích xuất dữ liệu, ở đây cụ thể là ngôn ngữ phổ biến sql. Việc này cũng rất quan trọng khi có được dữ liệu rồi ta cần phần trích xuất dữ liệu sao cho hợp lý để lấy dữ liệu sử dụng cho việc phân tích. Về phân tích churn rất có nhiều phương pháp phân tích, thì các công cụ phân tích phổ biến hiện này là dùng machine learning và deep learning[@article{Thakkar2022ClairvoyantAW] để phân tích đem ra các dự bảo về Churn một cách hiệu quả và gần như chính xác nhất. Dựa vào các dự đoán này, doanh nghiệp sẽ có cái nhìn cụ thể hơn về việc hiệu quả của chiến thuật kinh doanh hiện tại có khả quan hay không. Con số dự báo này cũng cho thấy rằng những phán ứng của tệp khách hàng khác nhau, mọi tương tác tích cực hay tiêu cực với dịch vụ doanh nghiệp cung cấp cũng sẽ được hiện rõ. Kết quả dự báo này cũng sẽ là một cơ sở để các doanh nghiệp trong nghành dịch vụ viễn thông thay đổi chiến và đưa ra các chiến lược cụ thể trong thời gian tới làm sao cho các tệp khách hàng có những phản hồi tích cực và ở lại với doanh nghiệp lâu hơn.

# Các nghiên cứu liên quan

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| OD | Source | Content |
| 1 | https://link.springer.com/content/pdf/10.1007/s10479-023-05259-9.pdf | 1 Introduction  Customers are a critical asset for every company operating in a contractual setting. The ability to retain profitable customers is a significant determinant of customer equity, i.e., the total lifetime value of a company’s customers (McCarthy et al., 2017). Consequently, customer retention is a strategic imperative (Rust et al., 2004) and customer churn prediction (CCP) models are a crucial tool for data-driven customer relationship management (Wu et al., 2022). CCP models exploit data at the individual level (e.g., demographic, socio-economic, behavioral data, etc.) to predict whether customers will terminate an existing business relationship within a future time window. These models help companies anticipate and remedy decreases in the stream of cash flows associated with customer churn. Moreover, CCP models can help uncover the underlying drivers of churn or decaying customer loyalty. Such insights are useful to revisit business processes and service offerings and raise customer equity in the long run. Further applications include the estimation of customer lifetime value, which relies on high-quality estimates of customer retention (Schweidel et al., 2014). Finally, CCP models can be deployed to govern the targeting of retention campaigns, either as standalone solutions or as a component of (causal) uplift models (Janssens et al., 2022) |
| 2 | https://www.semanticscholar.org/reader/2fa34f42b5823c9ccb761a4100066644d9bcacd5 | Introduction  In the current environment where domestic mobile communication users are close to China’s total population and the three major telecom operators share the entire telecommunications market equally. The remaining customer market is becoming more and more sparse, and the gap between the maintenance costs of new and old customers is becoming more and more obvious. According to the American Marketing Association’s Customer Satisfaction Hand-book, it costs five times as much to attract a new customer as to maintain an existing one. Therefore, the strategic focus of communication operators should change from ‘product- centric’ to ‘customer-centric’. Telecom operators possess a huge user group, which means it is unrealistic to pay attention to the demands of each customer. If the company can accurately predict the future loss of customers, it can not only save a lot of human, material and financial resources, but also implement targeted retention strategy, improve customer stickiness, and better explore the high sustainable profit and low maintenance cost brought by old customers, thereby improve the core competitiveness of the enterprise |
| 3 | https://www.semanticscholar.org/reader/ef568ec0280ff1ca22098397d730d391600620fb | 1 Introduction  With the rapid development of the Internet and the financial industry, Internet finance has become an emerging model in the financial industry and occupies an important position in market competition [1]. The development of the Internet continues to influence the develop-ment of the banking industry, on the one hand, financial products flow to the Internet, on the other hand, the profits of the traditional banking industry continue to decline, and the compe-tition for the traditional fixed deposit business continues to increase. Customer retention and a customer-centric service approach have become the key to competitive advantage for any bank. In the traditional banking industry, the impact of Internet finance has diversified and personalized customer needs, resulting in the loss of a large number of existing customers. Customer churn is the behavior of a customer who, due to subjective or objective factors, ter-minates their current banking relationship for a period of time in favor of another bank. Cus-tomer churn is an important part of customer management system, it is understood that the cost of developing a new user is 5–6 times more than the cost of retaining an old customer [2], the user’s choice determines the development of the enterprise, if we can predict the direction of customer churn through the factors affecting customer churn, and dig out the valuable con-tent of potential lost customers, it will be necessary to help the banking industry to develop customer retention strategies and gain a competitive advantage. In recent years, for the cus-tomer churn prediction problem, scholars at home and abroad have used data mining tech-niques to analyze and establish customer churn prediction models, and applied classification algorithms to the field of customer churn, which is of great practical significance for enter- prises to tap effective customers. |
| 4 | https://www.semanticscholar.org/paper/A-Survey-and-Implementation-of-Machine-Learning-for-Rathi/c99f00e62e078ef587fcc3667ad5d20b88a8e62f | I. INTRODUCTION  Customer churn prediction is a critical problem for companies across various industries. It refers to the task of identifying customers who are likely to discontinue using a company's products or services. From a business perspective, customer churn poses significant challenges and can have a substantial impact on a company's profitability and growth. Retaining existing customers is the most important task for the survival of the business, which has become common sense in the business world. [15]. Customer acquisition requires substantial marketing and promotional efforts while retaining loyal customers can lead to repeat business and increased customer lifetime value. Therefore, accurately predicting customer churn allows companies to proactively address the underlying issues and take appropriate measures to retain valuable customers. Customer churn prediction relies on analysing historical customer data, such as demographic information, transactional records, service usage patterns, and customer interactions. Different data types have different analysis capabilities. It is necessary to determine the most appropriate data for the type of analysis performed. Different datasets provide better metrics for different problems and services. [11] In order to find trends and signs that assist in identifying high-risk customers, the organization employs sophisticated analytics as well as machine learning approaches. |
| 5 | https://bcpublication.org/index.php/BM/article/download/4840/4705 | 1. Introduction   Customer churn, or customer attrition, is the phenomena where clients of a firm stop doing business with them or making purchases from them. Customer churn can be caused by many factors, such as the success of competitors, rising prices, bad customer service. Mathematically speaking, customer churn rate is a calculation of the percentage of customers who stop using a company’s products or services within a given period of time. A high customer churn rate is a poor indication for the company since it suggests that existing customers are leaving the business. A churned customer could be a dissatisfied customer who may negatively impact a company’s reputation. In addition to the loss of those churned customers’ spending, the company can also get unfavorable press that damages its reputation. |
| 6 | https://pdfs.semanticscholar.org/5556/95a4a1e2177d4700fccdfda454f6c09c07cc.pdf?\_gl=1\*1kfyahm\*\_ga\*MjExNzA1MTI1MC4xNzA2MTcxNTY4\*\_ga\_H7P4ZT52H5\*MTcwNjE4NDE1My4yLjEuMTcwNjE4NjUwNy41MS4wLjA. | 1. INTRODUCTION   GLOBALIZATION dand advancements in the telecommunications industry result in an exponential expansion in the number of operators in the market, increasing competition. It is vital to optimize earnings on a regular basis in this competitive period, which has led to the creation of several approaches such as recruiting new customers [1], up-selling existing customers [2], and increasing client retention time [3], [4]. Marketing’s focus has transitioned from products to consumers, as the marketing method has shifted from product to customer. Poor service quality, unhappiness with customer service, and high expenses are the primary causes of customer churn [5]. Customer acquisition and retention are two of the most crucial parts of any company’s success. The process of recruiting new customers or persuading individuals to buy something is known as customer acquisition [6], [7]. It is a strategy for moving customers from brand awareness to purchase choices through the marketing funnel. |
| 7 | https://drpress.org/ojs/index.php/HBEM/article/download/8051/7836 | 1. Introduction   In recent years, the market has become very competitive, and companies are looking for ways to balance the retention of existing customers with the expansion of new ones. It is well known that retaining existing customers requires less costs [1]. Therefore, companies need to have appropriate systems and mechanisms in place to analyze and predict customer churn. Customer churn prediction is the prediction of the likelihood of a customer leaving a product or service, which means that the customer chooses to move to a competitor of the company in a highly competitive market. Its purpose is to predict the possibility of such behavior occurring before it happens and to take some action in time [2]. As more and more companies focus on customer retention, the development and application of smarter machine learning models for analysis and prediction is also becoming a major trend. In an ever-changing market, product quality, service, and market fluctuations can cause loss of customer. Identifying early signs of churn and potential lost customers can help companies reduce losses to a certain extent [3]. In recent years, the research community has also conducted a lot of research and proposed some mainstream machine learning algorithms in related fields |
| 8 | https://ijsdr.org/papers/IJSDR2304233.pdf | 1. INTRODUCTION   If you're a service provider, "churning" is often defined as the percentage of consumers that end their contracts due to competition. Churners are people who have stopped doing business with a firm because they were unhappy with the service they received. An examination of the likelihood of a customer discontinuing use of a service or product is what is meant by a customer churn analysis. Preventive measures are necessary to avoid a customer's items or services being left behind in the case of a circumstance like this. The marketplace is very dynamic and distinctly aggressive in recent times. It is because of the supply of a big wide variety of service providers. Customers are a company's most valuable asset since they represent its primary source of revenue. Businesses are now cognizant of the fact that they must pay close attention not just to get new clients but also to keep their existing ones satisfied. A churner is a person who moves around a lot and has a variety of reasons for doing so. Customer churn is minimised when the organisation can accurately forecast the customer's mindset and establish linkages between client attrition and things thatare under their control. Predicting churn rates is a binary classification job that separates churners from non-churners. For any enterprise, vanquishing commercial enterprise from new customers means going through the sales pipeline, using their sales and advertising belongings in the cycle. Customer retention, then again, is generally extra budget- effective, due to the fact they have already won the confidence and loyalty of current customers. So, predicting customer churn rate at the earlier stages is really important for an organization. |
| 9 | https://ieomsociety.org/proceedings/2023manila/58.pdf | Introduction  The rapid growth of technology, as brought by the Fourth Industrial Revolution, advances the adoption of gamechanging technologies such as Artificial Intelligence (AI), Internet of Things (IoT), Cloud Computing and Analytics. This also pushed the massive digital transformation across industries in the Philippines. As reported by the World Bank, 56% of the Micro, Small and Medium Enterprises (MSMEs) have adopted technology, although this was described as still “at the basic level” of adoption rate compared to other Southeast Asian nations. From the user adoption standpoint, the country’s internet penetration rate at the start of 2022, has grown to 68% of the population, as reported by DataReportal. This only shows the growing traction that the digital transformation in the country has gained and is expected to sustain its momentum in the next few years |
| 10 | https://www.irjet.net/archives/V4/i3/IRJET-V4I3422.pdf | 1. INTRODUCTION   Today is the competitive world of communication technologies. Customer Churn is the major issue that almost all the Telecommunication Industries in the world faces now. In telecommunication paradigm, Churn is defined to be the activity of customers leaving the company and discarding the services offered by it due to dissatisfaction of the services and/or due to better offering from other network providers within the affordable price tag of the customer. This leads to a potential loss of revenue/profit to the company. Also, it has become a challenging task to retain the customers. |
| 11 | https://pdfs.semanticscholar.org/80cc/061c45591870ca17381b3517fb4d1764f1ed.pdf?\_gl=1\*1nl143y\*\_ga\*MjExNzA1MTI1MC4xNzA2MTcxNTY4\*\_ga\_H7P4ZT52H5\*MTcwNjE5Mjg4MS4zLjEuMTcwNjE5NDIwMi41NC4wLjA. | I. INTRODUCTION  Recently, the telecommunication industry has proved to be one of the fastest-growing industries and has evolved to encompass various components of customer satisfaction that require improvement. Today companies under this subdivision of the economy are doing everything in their efforts to maintain and retain their teeming customers by satisfying them through offers and rebates. Telecommunication industries operate based on selling certain products to customers. Finding the target group that is more interested in a certain product is the main task of a company. Creating, maintaining, and retaining relationships with a company’s customer base is one of the crucial business and marketing tasks in heavily competitive markets such as telecommunications or subscription-based models. The process of determining the target group interested in a certain product is at the top of the agenda of every business company. Technical implementation of these methods is widely spreading in various countries’ telecommunication industries with limited impact in African countries. It is a consequence of this fact that the acquisition of a new customer is far more costly than the absorbent of an existing one [1]. To retain existing customers, companies including telecommunication sectors provide incentives and special packages to them. Therefore, determining the customers that need these special packages and making sure the customer did not churn or move to competitors’ services is very important [2]. |
| 12 | @article{Khan2024CustomerCA,  title={Customer Churn Analysis Using Deep Reinforcement Learning Approach},  author={Taiyab Khan and Shakir Ali Idrisi and Dr. Harshali Patil and Dr. Jyotshna Dongradive},  journal={International Journal For Multidisciplinary Research},  year={2024},  url={https://api.semanticscholar.org/CorpusID:267126832}  } | 1. Introduction   Customer churn analysis is a crucial process for businesses in today's competitive landscape,especially those operating in subscription-based models, telecommunications, e-commerce, and various other industries. It refers to the examination of customer attrition or the rate at which customers cease their relationship with a company's products or services. Understanding and predicting customer churn is essential because retaining existing customers is often more cost-effective than acquiring new ones. |
| 13 | @article{Ahmad2024CustomerPA,  title={Customer Personality Analysis for Churn Prediction Using Hybrid Ensemble Models and Class Balancing Techniques},  author={Noman Ahmad and Mazhar Javed Awan and Haitham Nobanee and Azlan Mohd Zain and Ansar Naseem and Amena Mahmoud},  journal={IEEE Access},  year={2024},  volume={12},  pages={1865-1879},  url={https://api.semanticscholar.org/CorpusID:265334784}  } | 1. INTRODUCTION   In the current dynamic and highly competitive business landscape, it is imperative for companies to carve out a unique niche by understanding and addressing the nuanced preferences of their customer base [1]. Customer personality analysis emerges as a pivotal strategy in this endeavor, enabling businesses to dissect large datasets of customer attributes and thereby tailor their offerings to distinct consumer categories, enhancing both engagement and loyalty [2,3]. Identifying customer personality classifications poses a significant challenge for tech-based companies in the contemporary business environment [3]. Such companies often incur substantial losses due to customer churn. Early identification of customer personality traits is pivotal in mitigating churn and fostering customer loyalty, especially in the context of fake profiles [4]. Numerous studies have been undertaken in the past to analyze customer churn and devise strategies to curb it. |
| 14 | @article{Mogare2023TELECOMCP,  title={TELECOM CHURN PREDICTION USING MACHINE LEARNING ALGORITHM},  author={Pallavi Mogare and Vaishnavi Kadam and Mohini Pawar and Gayatri Kadam},  journal={International Research Journal of Modernization in Engineering Technology and Science},  year={2023},  url={https://api.semanticscholar.org/CorpusID:259591391}  } | INTRODUCTION  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.. |
| 15 | @article{Hussien2024ANA,  title={A novel artificial intelligent-based approach for real time prediction of telecom customer’s coming interaction},  author={Reyad Hussien and Mohamed Mahgoub and Shahenda Youssef and Ashraqat Torky and Nermin K. Negied},  journal={Indonesian Journal of Electrical Engineering and Computer Science},  year={2024},  url={https://api.semanticscholar.org/CorpusID:266988167}  } | 1. INTRODUCTION   Predicting a customer’s next interaction in real-time for companies, especially in telecommunications field, has significant impact on their revenue and sales. This will not only reduce the huge amount of money paid for advertisement but will also improve the customer’s satisfaction by offering better alluring deals to their customers at the time of their next interaction, which could be recharge or bundle renewal, or cash transaction. The capability of predicting a customer’s intended actions would help the companies to detect any problem with the system early if there is a huge gap between the predictions and the actual values of the recharge amounts.  Moreover, this can facilitate the discovery of what is trendy, interesting, and most popular for the different customers’ segments. Furthermore, this can provide an interactive dashboard with peaks and troughs of recharges for the company sales department to analyze and extract useful insights from it. Forecasting customer interaction could be through their historical call logs, short message service (SMS) logs, billing logs, and bundle renewal logs. Moreover, this can facilitate gathering their reviews and ratings of customer services. Most related work done is specifically aiming at predicting customer churn or downgrade based on aggregating the historical data and feeding them into machine learning models. However, this research differs in two ways. First, the problem definition itself as we focus on predicting the next customer action rather than whether the customer would churn or not. Second, the way we deal with the problem. We did not use traditional machine learning models, we applied two different methodologies and in each one of them, we tried several different models. The rest of this paper is organized as follows: section 2 introduces a literature review for past related work. In section 3 describes the dataset used in this work. In section 4 demonstrates the data preparation steps conducted to get data ready to be fed to our model. A detailed explanation of the proposed approach is in section 5. Section 6 demonstrates the experimental work and discusses the results. Section 7 summarizes the evaluation of the proposed approach, and finally section 8 concludes the paper. |
| 16 | @article{Ahmadzai2023DataMT,  title={Data Mining Techniques in Telecommunication Company},  author={Nazak Ahmadzai and Hameedullah Mohammadi and Naqibullah Mangal},  journal={Journal for Research in Applied Sciences and Biotechnology},  year={2023},  url={https://api.semanticscholar.org/CorpusID:256804152}  } | 1. INTRODUCTION   Data mining used to remove non-trivial forms and valuable information out of historical data, which will be suitable in solving many real world problems, one those problems is the existence of Customer shake in Telecommunication Company. By definition the Customer Churn happens when one customer shifts the using of the service provided by a Company to another Company, in Telecommunication Companies Avoiding the Customers from Churn play an important role on having a maintainable Business Development and has incredible effect on overall total income of the company. The forecast of Churn helps a company to be upbeat against the existence of its Customer Churn; it means it can get the chance to hold its customers. |
| 17 | @article{Thakkar2022ClairvoyantAW,  title={Clairvoyant: AdaBoost with Cost-Enabled Cost-Sensitive Classifier for Customer Churn Prediction},  author={Hiren Kumar Thakkar and Ankit Desai and Subrata Ghosh and Priyanka Singh and Gajendra Sharma},  journal={Computational Intelligence and Neuroscience},  year={2022},  volume={2022},  url={https://api.semanticscholar.org/CorpusID:246411106}  } | 1. Introduction In developing countries, smartphones play a significant role in human life, and the number of mobile operators is rapidly increasing in every technologically advanced country. By the end of 2019, several billion people subscribed to mobile services, accounting for nearly two-thirds of the global population [1]. \*ese incessantly growing telecom operators are coming up with various value-added subscriptions to retain their loyal customers. Hence, customer retaining with the same service provider became questionable. In this fierce competitive nature of the wireless telecommunication industry, customers have unlimited freedom to migrate from one service provider to another. \*is phenomenon is known as churn. A few reasons for churn are dissatisfaction in services such as unattractive recharge plans, frequent call drops, insufficient bandwidth, frequent customer care calls, unreachable networks, and slow Internet speed. In general, several techniques are used to address the customer churn prediction such as statistical learning [2], machine learning [3], evolutionary optimization technique [4], and deep learning [5]. Boosting is an ensemble technique that at- tempts to create a robust classifier from several weak clas- sifiers. AdaBoost (adaptive boosting) is the first successfull algorithm developed for binary classification to improve accuracy. It has now become a somewhat feasible method for different kinds of boosting in machine learning paradigms. However, AdaBoost is inherently a cost-insensitive boosting algorithm; therefore, it has limited applications where costs need to be treated differently for different misclassification errors. \*is study is interested in attempting to mitigate the limitation. |
| 18 | @article{Xiahou2022B2CEC,  title={B2C E-Commerce Customer Churn Prediction Based on K-Means and SVM},  author={Xiancheng Xiahou and Yoshio Harada},  journal={J. Theor. Appl. Electron. Commer. Res.},  year={2022},  volume={17},  pages={458-475},  url={https://api.semanticscholar.org/CorpusID:248009771}  } | 1. Introduction   Customers are one of the most important assets of an enterprise, and they play a very important role in improving the market competitiveness and performance of the enterprise [ 1 ]. Amid fierce market competition, customers can easily choose among numerous products or service providers [ 2 ]. Studies show that the cost of developing a new customer is often higher than the cost of retaining an old customer [ 3 ]. If an enterprise maintains a good relationship with customers for a long time, it will gain more profits from existing customers. If the customer retention rate increases by 5%,the net present value of the enterprise will increase by 25–95% [ 4 ]. When the customer churn rate is reduced by 5%, the average profit margin of an enterprise will increase by 25–85% [ 5 , 6 ]. In order to maintain market advantages, it has become important for enterprises to determine how to make use of existing customer resources and avoid the loss of existing customers |
| 19 | @article{Zhuo2023PredictionOT,  title={Prediction of Telecom Customer Churn Based on MIPCA-XGBoost Method},  author={Chen Zhuo},  journal={Frontiers in Computing and Intelligent Systems},  year={2023},  url={https://api.semanticscholar.org/CorpusID:258307484}  } | 1. Introduction   Nowadays, the market of China's telecom industry is becoming increasingly saturated, the competition between enterprises is becoming more and more fierce, and the customer churn rate is gradually rising. Many enterprises focus on how to use novel marketing models to attract new customers and further develop them into loyal customers. However, studies show that the cost of time and money required for a company to develop a new customer is far greater than the cost of maintaining an existing customer [1]. Therefore, it is imperative for enterprises to build a model that can accurately predict the customer churn tendency, understand the customer churn tendency in time and adjust the customer maintenance strategy to reduce the customer churn rate. Customer churn is a complex problem, and the prediction methods for different industries are different. At present, there are a large number of domestic literatures on customer churn, involving a wide range of fields. Zhang Lili [2] and others used decision tree algorithm to predict airline customer churn, and successfully improved the seating rate; Yan Chun [3] and others used BP-Adaboost algorithm to predict the clustered life insurance industry customers, providing a higher prediction accuracy; In the field of e-commerce, Wu Yongchun [4] fused multiple methods to establish a prediction model, which shortened the prediction time. However, the customer data in the telecommunications industry has the characteristics of large quantity and high dimension. Although the above research has made important contributions to the research on customer churn prediction in the fields of aviation, life insurance, e-commerce and so on, it does not mine the important features of the data set, resulting in information redundancy and even dimension disaster [5], which will have an impact on the customer churn prediction in the telecommunications industry and reduce its prediction efficiency and accuracy |
| 20 | @article{M2023ACA,  title={A Comparative Analysis of Serial and Parallel Data Mining Approaches for Customer Churn Prediction in Telecom},  author={Dr. Mallegowda M and Sanjana R and Swapna Ramineni},  journal={International Research Journal on Advanced Science Hub},  year={2023},  url={https://api.semanticscholar.org/CorpusID:266700073}  } | 1. Introduction   The telecommunications industry is a dynamic and fiercely competitive arena where customer loyalty is a coveted asset. In this landscape, the ability to predict and mitigate customer churn—the phenomenon where subscribers abandon one service provider for another—holds profound significance. Concurrently, the telecommunications sector grapples with another relentless adversary—fraud. The specter of fraudulent activities, ranging from SIM card cloning to callspoofing, presents a multifaceted threat to both customers and service providers. Swift detection and prevention of such fraudulent actions are imperative not only for safeguarding customers but also for upholding the industry’s integrity and reputation (Khodabandehlou and Rah- man). This research paper embarks on a jour- ney to explore the intricate interplay between data mining approaches for customer churn prediction and their implications for the detection and pre- vention of fraud in the telecommunications sector. Our focus revolves around the comparative analy- sis of two distinct data mining paradigms: serial and parallel processing (Vafeiadis et al.). We delve into the methodologies, algorithms, and real-world applications of these approaches, seeking to unravel their strengths, weaknesses, and the consequences of their implementationSerial data mining, as its name implies, adheres to a sequential, single-core processing model. It has long been the cornerstone of predictive analytics, providing valuable insights into customer behavior and churn patterns. However, serial processing has its limitations, particularly in the domains of processing time, scalabil- ity, and the ability to respond in real-time—a con-straint that can be especially critical in the fast-paced world of telecommunications. In contrast, parallel data mining leverages the computational prowess of multi-core architectures and distributed computing clusters to process vast datasets at speeds hitherto unattainable by serial methodologies. It introduces the promise of real-time data analysis and the scalability required to handle the colossal volumes of data generated in the telecom sector. Yet, with this promise comes a heightened complexity and cost of implementation that warrant careful considera- tion (Burez and D. V. D.Poel). |
| 21 | @article{M2023ACA,  title={A Comparative Analysis of Serial and Parallel Data Mining Approaches for Customer Churn Prediction in Telecom},  author={Dr. Mallegowda M and Sanjana R and Swapna Ramineni},  journal={International Research Journal on Advanced Science Hub},  year={2023},  url={https://api.semanticscholar.org/CorpusID:266700073}  } | 1. Introduction   The telecommunications industry is a dynamic and fiercely competitive arena where customer loyalty is a coveted asset. In this landscape, the ability to predict and mitigate customer churn—the phenomenon where subscribers abandon one service provider for another—holds profound significance. Concurrently, the telecommunications sector grapples with another relentless adversary—fraud. The specter of fraudulent activities, ranging from SIM card cloning to callspoofing, presents a multifaceted threat to both customers and service providers. Swift detection and prevention of such fraudulent actions are imperative not only for safeguarding customers but also for upholding the industry’s integrity and reputation (Khodabandehlou and Rah- man). This research paper embarks on a jour- ney to explore the intricate interplay between data mining approaches for customer churn prediction and their implications for the detection and pre- vention of fraud in the telecommunications sector. Our focus revolves around the comparative analy- sis of two distinct data mining paradigms: serial and parallel processing (Vafeiadis et al.). We delve into the methodologies, algorithms, and real-world applications of these approaches, seeking to unravel their strengths, weaknesses, and the consequences of their implementationSerial data mining, as its name implies, adheres to a sequential, single-core processing model. It has long been the cornerstone of predictive analytics, providing valuable insights into customer behavior and churn patterns. However, serial processing has its limitations, particularly in the domains of processing time, scalabil- ity, and the ability to respond in real-time—a con-straint that can be especially critical in the fast-paced world of telecommunications. In contrast, parallel data mining leverages the computational prowess of multi-core architectures and distributed computing clusters to process vast datasets at speeds hitherto unattainable by serial methodologies. It introduces the promise of real-time data analysis and the scalability required to handle the colossal volumes of data generated in the telecom sector. Yet, with this promise comes a heightened complexity and cost of implementation that warrant careful considera- tion (Burez and D. V. D.Poel). |
| 22 | @article{Jing2023DataAA,  title={Data analysis and machine learning in the context of customer churn prediction},  author={Changran Jing},  journal={Applied and Computational Engineering},  year={2023},  url={https://api.semanticscholar.org/CorpusID:260218506}  } | 1. Introduction   Customer churn is a problem that modern merchants in all fields need to carefully analyze. According to related research [1], in order to reduce costs, merchants should focus more on retaining existing customers rather than attracting new ones. At the same time, since customers often have a variety of similar choices when choosing goods and services, if merchants cannot provide customers with satisfactory services, there will be a great trend of customer churn. Therefore, it is one of the important topics in the field of business data analysis to study the characteristics of customers, analyze the main factors leading to customer churn, and establish a set of accurate and effective customer churn prediction models. For the above problem, Benlan He et al. first used an SVM model to predict customer churn based on a Chinese commercial bank consumer dataset containing 46,406 valid data records [2]. Research by Abdelrahim Kasem Ahmad et al helps telecom operators predict the customers most likely to churn [3]. Meanwhile, the study by T. Vafeiadis et al. compares the performance of different machine learning models on the same dataset, including SVM, artificial neural network (ANN), naive Bayes, decision tree learning and logistic regression, and successfully integrates augmented [4]. The accuracy of the model SVM (SVM-POLY and AdaBoost) is improved to nearly 97% [5]. However, the above-mentioned studies were limited by the time of publication, and failed to conduct comparative studies on some of the latest models. At the same time, they were lacking in researching user characteristics and giving relevant financial explanations. |
| 23 | @article{Wu2023CustomerCP,  title={Customer Churn Prediction in the Telecommunication Industry},  author={Shaohua Wu},  journal={Advances in Economics, Management and Political Sciences},  year={2023},  url={https://api.semanticscholar.org/CorpusID:258160101}  } | 1. Introduction  1.1. Background  With the popularity of mobile phones, the telecommunication industry has developed significantly, and more and more telecom providers are entering this field. At the same time, the competition among cellphone operators has intensified. The churn rate is the most important factor affecting customer churn prediction, the churn rate is the number of consumers that leave and come back over a certain period. Lower turnover rates derive from excellent client relationships. According to Dahiya and Bhatai, the essential goal of every organization from now on is to check the things that might affect this connection that influences the consumer beat and review it properly to avoid such churn rate [1]. What variables are contributing to customer churn and what actions can be taken to stop them from leaving should be explored first.   * 1. Factors influence customer churn   Torsten et al. used Markov Logic Networks methods to investigate the influence of word of mouth on subscriber churn and switching [2]. By using data usage, the number of calls, kind of mobile set, contract type, tenure, usage trend, data plan, service calls, and customer demographics such as age and gender as independent variables. They discovered a close link between the duration of their calls and clien7t attrition. Coussement et al. showed service quality is an important factor. a slow or inadequate response to complaints, as well as invoicing problems, are other variables that raise the likelihood of consumers defecting to the competition. Customers may defect to the competition due to factors such as packing costs, insufficient features, and outdated technology and frequently compare suppliers and churn to whatever they believe gives the best overall value [2-3]. According to Wong and Sohal, the effect of service quality on customer loyalty ultimately helps to retain customers and minimize customer churn. They stated that the relationship is stronger at the store level than at the salesperson level and service quality had a close association with consumer loyalty [4-5]. Yu et al., Zhang et al. and Kassem et al. stated fee and convenience as characteristics to determine their influence on consumer satisfaction. They discovered that customer retention is affected by customer satisfaction and socio-demographic variables and found that while the industry is in its early stages, the fee is more important [6-8]. Cheng et al. suggested the difference in perception of service quality for customers who renew contracts in advance and customers who don’t renew contracts, as well as its impact on customer churn and found that prepaid customers are more satisfied with the quality of service as compared to other customers [9]. Based on investigating the factors of customer churn and customer loyalty in the Korean telecommunication industry. Li et al discovered that the primary elements impacting consumers' switching behaviour were degree of happiness, call quality, day call times and minutes, account weeks, brand image, income, and tenure. Customers will have a sense of dependence as a result of good call quality and using time [10]. This paper uses logistic regression to predict probable churners' behaviour patterns, categorize these at-risk consumers, and take necessary activities to regain their confidence and boost their retention rate. This article aims to categorise consumers as churners or non-churners using data from a telecommunications firm. The author concludes service quality influences other factors such as contract renewal, roam mins and account weeks, it presents that service quality is the most essential factor which affects customer retention. The conclusion helps telecommunication companies reduce the customers churn and increase the company's revenue, by analyzing the data on telecom customer churn, the paper gives telecom companies inspiration to take more targeted measures to meet the customer's demand and retain customers. |
| 24 | @inproceedings{Kingly2023ComparativeAO,  title={Comparative Analysis of Customer Churn Prediction},  author={Anithaa Kingly},  year={2023},  url={https://api.semanticscholar.org/CorpusID:259953329}  } | 1. INTRODUCTION   If you're a service provider, "churning" is often defined as the percentage of consumers that end their contracts due to competition. Churners are people who have stopped doing business with a firm because they were unhappy with the service they received. An examination of the likelihood of a customer discontinuing use of a service or product is what is meant by a customer churn analysis. Preventive measures are necessary to avoid a customer's items or services being left behind in the case of a circumstance like this. The marketplace is very dynamic and distinctly aggressive in recent times. It is because of the supply of a big wide variety of service providers. Customers are a company's most valuable asset since they represent its primary source of revenue. Businesses are now cognizant of the fact that they must pay close attention not just to get new clients but also to keep their existing ones satisfied. A churner is a person who moves around a lot and has a variety of reasons for doing so. Customer churn is minimised when the organisation can accurately forecast the customer's mindset and establish linkages between client attrition and things thatare under their control. Predicting churn rates is a binary classification job that separates churners from non-churners. For any enterprise, vanquishing commercial enterprise from new customers means going through the sales pipeline, using their sales and advertising belongings in the cycle. Customer retention, then again, is generally extra budget- effective, due to the fact they have already won the confidence and loyalty of current customers. So, predicting customer churn rate at the earlier stages is really important for an organization. |
| 25 | @article{Chinnaraj2023BioInspiredAT,  title={Bio-Inspired Approach to Extend Customer Churn Prediction for the Telecom Industry in Efficient Way},  author={Ramesh Chinnaraj},  journal={Wirel. Pers. Commun.},  year={2023},  volume={133},  pages={15-29},  url={https://api.semanticscholar.org/CorpusID:265110088}  } | 1. Introduction   For telecommunications firms, client churn is a major issue because it lowers profits [1]. This is especially important given that telecommunications businesses compete in a crowded global market where it is getting harder to keep customers. Even though these businesses spend a lot of money on marketing to attract new customers, keeping an existing customer is typically less expensive [2]. Due to these factors, preventing customer turnover has elevated to a top priority for telecom firms. Customer churn is the loss of a client in favour of a rival [3], signifying the breakdown of the partnership. Customer churn prediction enables one to pinpoint the reasons why a connection is ending and put up a plan that will reduce churn rate while boosting earnings. Therefore, for telecommunications firms, being able to predict a customer's desire to terminate a connection is essential and is regarded as a competitive advantage. Customer attrition has been the subject of earlier investigations. For churn management, for instance, a clustering and classification system [1] is recommended. On the basis of ensemble and clustering classifiers, a new combination model is predicted [4]. The principles of data anonymization are used to predict client attrition [5]. However, no study has attempted to forecast telecom client attrition using discriminant analysis and logistic regression, despite the fact that numerous studies have attempted to explain and predict consumer churn |
| 26 | @article{Ele2023RegressionBasedML,  title={Regression-Based Machine Learning Framework for Customer Churn Prediction in Telecommunication Industry},  author={Sylvester I. Ele and Uzoma Rita Alo and Henry Friday Nweke and Ofem Ajah Ofem},  journal={Journal of Advances in Information Technology},  year={2023},  url={https://api.semanticscholar.org/CorpusID:264121272}  } | 1. INTRODUCTION   Recently, the telecommunication industry has proved to be one of the fastest-growing industries and has evolved to encompass various components of customer satisfaction that require improvement. Today companies under this subdivision of the economy are doing everything in their efforts to maintain and retain their teeming customers by satisfying them through offers and rebates. Telecommunication industries operate based on selling certain products to customers. Finding the target group that is more interested in a certain product is the main task of a company. Creating, maintaining, and retaining relationships with a company’s customer base is one of the crucial business and marketing tasks in heavily competitive markets such as telecommunications or subscription-based models. The process of determining the target group interested in a certain product is at the top of the agenda of every business company. Technical implementation of these methods is widely spreading in various countries’ telecommunication industries with limited impact in African countries. It is a consequence of this fact that the acquisition of a new customer is far more costly than the absorbent of an existing one [1]. To retain existing customers, companies including telecommunication sectors provide incentives and special packages to them. Therefore, determining the customers that need these special packages and making sure the customer did not churn or move to competitors’ services is very important [2]. Customer churn is a major problem in the telecommunication industry, and one of the most significant concerns for large companies. Due to the direct effect on the revenues of the companies, especially in the telecommunication field, companies are seeking to develop means to predict potential customers that might churn in the future [3]. Customer churn could be the result of low-level customer satisfaction, aggressive competitive strategies, new products, regulations, etc. Consequently, churn models aim to identify early churn signals and recognize customers with an increased likelihood to leave voluntarily [4]. Companies use various prediction tools, such as descriptive statistics, rule-based, and machine learning to predict customer churn. However, the statistics method is too simplistic and analyzes data in small quantities, Manuscript received November 21, 2022; revised March 1, 2023; accepted June 19, 2023; published October 8, 2023. Journal of Advances in Information Technology, Vol. 14, No. 5, 2023 doi: 10.12720/jait.14.5.1046-1055 1046 therefore, it is difficult to use the method to accurately predict customer churn [5]. The rule-based method expresses data patterns and uncovers meaning in data using an if-then rule. Nonetheless, rule-based methods lack scalability and robustness to uncover the pattern that might show customer churn. The machine learning model seeks to improve churn prediction models and ascertain customers that might leave the company using past experiences and packages. The recent implementation of machine learning models for customer churn prediction in telecommunication industries includes Linear Regression [6, 7], Neural Network Model [8, 9], Decision Tree [10, 11], Support Vector Machine [12, 13], etc. The use of these machine learning algorithms is useful for the correct identification of customer retention and the type of products that are essential for telecommunication companies [1]. However, some of the machine learning models implemented for customer churn prediction in telecommunication industries are unsuitable due to their computational complexity, prone to model over-fitting, and require lots of training data [14]. |
| 27 | @article{Xia2022AnalysisAP,  title={Analysis and Prediction of Telecom Customer Churn based on Machine Learning},  author={Ye Xia and Bohan Cui and Yunhuai Duan},  journal={Highlights in Science, Engineering and Technology},  year={2022},  url={https://api.semanticscholar.org/CorpusID:253652399}  } | 1. Introduction   Based on the communication services (network infrastructure, data transmission and basic voice communication services, etc.) Provided by telecom operators, communication between people through the intelligent mobile terminals (mobile phones, computers, etc.) has become an integral part of daily social life [1]. However, with the diversification of user demands and the continuous improvement of communication service quality requirements, the pressure of competition among telecom operators has gradually increased, which is directly reflected in the competition for customer resources [1]. In order to win more customers, telecom operators not only develop new customers through price advantage or launch new products but also retain existing customers as much as possible by improving service quality. Compared with developing new customers, retaining and enhancing the value of existing customers has become the preferred solution for operators due to their relatively low cost. The basis and key to retaining existing customers is to achieve customer churn prediction, early warning, cause analysis and retention. To this end, we urgently need to develop an efficient prediction model for telecom customer churn to provide decision-making basis for improving customer experience. Lost customers usually refer to customers who stop using the company's services or products within a certain period of time. At present, the research objects of telecommunication customer churn mainly focus on the prediction of traditional telecommunication customer churn and the network customer churn. The research method is mainly to introduce a prediction of customer churn using feature vector selection and classifier optimization, where the representative technologies includes artificial neural network algorithm, association rule algorithm, decision tree algorithm, SVM(support vector machine) algorithm and so on. For example, HS Kim (2003) used association rules to analyze Highlights in Science, Engineering and Technology AMMSAC 2022 Volume 16 (2022) 132 the factors of Korea Telecom users' choice of operators and drew a conclusion that it was related to signal quality and discount of call charges. M.C.Mozer (2000) used logistic regression, decision tree, neural network and other methods to study the personal information, bill, credit, application program, complaint history and other data of 47,000 Telecom users in the United States, and predicted the customers who are imminent leave [2]. Eria Kamya and Marikannan Booma Poolan used logistic regression and random forest models to exclude the feature variables that were least relevant to the model prediction, so as to accomplish the user churn prediction model based on the remaining feature variables. Machine learning algorithm enables the model to get rid of irrelevant variables and provide reliable correlation features relate to user churn. In addition, the study also pointed out the possible prediction errors in the model for predicting user churn, which can be reduced continuously after consideration and finally improve the accuracy of the model for testing user churn. Deri et al. applied graph method to analyze the network of mobile communication users to predict the number of customers which may be lost. Backiel et al. constructed the user's relational network based on the data about Call Detail Records, then extracted the characteristics of the network and compared the methods of predicting user loss by using user attributes. The methods proposed by them scored higher in AUC [3]. Amin et al. used Rough Set based on genetic algorithm to predict churn. NTT DoCoMo Company, a Japanese company, had subdivided customers according to their consumption level, reputation and functional service requirements. Lightbridge collected data from a mobile service provider in New England and then built a model about customer churn based on the CART algorithm. |
| 28 | @article{Jeyaprakaash2022AccuracyMO,  title={Accuracy Measure of Customer Churn Prediction in Telecom Industry using Adaboost over K Nearest Neighbor Algorithm},  author={P Jeyaprakaash and Sashi rekha},  journal={Journal of Pharmaceutical Negative Results},  year={2022},  url={https://api.semanticscholar.org/CorpusID:252887377}  } | INTRODUCTION  Customer attrition rate is known as the rate of consumers being transferred from a particular telecom service to choose another service or the percentage of subscribers to a service that discontinues their subscription to that service in a given period. In many telecom companies, customer churn is the biggest problem for their company because customers contribute nearly the entire profits and values of a company by paying for their services, so they are the asset of the company. The remedy to the drawback of consumers moving in the telecom industry who are at risk of churning which was referred to in the paper (Labhsetwar 2020). The relevance of customer churn prediction is accurately predicting future churn so that businesses can improve and make more money. The telecom company is also able to improve the accuracy in the areas where customer service is lacking (Hadaschik 2017) .Some of the examples in which customer churn has happened in some telecom industry such as Idea,Vodophone to telecom companies like Airtel, Jio, etc because of their poor service to customers,these are some applications of telecom customer churn. The customer churn prediction is also useful in various industrial sectors such as banking, insurance, and mobile phone companies. (Kassem et al. 2020) These two papers have ample points about the applications of customer churn prediction which provides evidence about the usage of churn prediction using machine learning techniques in the field of telecom industry as well as other fields like banking sector (Lu et al. 2014) . Recently, a lot of researchers have done a variety of customer churn prediction in telecommunications using data analytics as it is the part of data science and ML algorithms for customer churn prediction. There were about 482 articles published in ScienceDirect in recent years and about 128 articles were published in IEEE Xplore journal.(Zhang et al. 2007)(Nawab, Sapuan Sapuan, and Shaker 2021)This work introduced another arrangement of elements for the client stir expectation in the media transmission, some of those are, the collected call types, data of account, bill ,line , installment data, grumble data, administration data, etc. (Huang, Kechadi, and Buckley P Jeyaprakaash, et.al: Accuracy Measure of Customer Churn Prediction in Telecom Industry using Adaboost over K Nearest Neighbor Algorithm 2012; Keramati et al. 2014) From this work,we gained our best classification techniques using data from various sources of a dataset. Artificial Neural Network (ANN) outplayed the other three algorithms used along with this . (Vafeiadis et al. 2015)Here, we discovered the effect of the utilization of boosting to the related classifiers utilizing the AdaBoost. (Lu et al. 2014) Rather than most agitated expectation models, our model takes into consideration an "Execution Zone" where clients with the most noteworthy stir affinity can be tended to for maintenance activities. From all the papers, we can arrive at a solution that the algorithm Ada-boost has the highest efficiency of 84% when compared with other algorithms (J, Rahul, and T. 2011). Our institution is passionate about high quality evidence based research and has excelled in various fields (Parakh et al. 2020; Pham et al. 2021; Perumal, Antony, and Muthuramalingam 2021; Sathiyamoorthi et al. 2021; Devarajan et al. 2021; Dhanraj and Rajeshkumar 2021; Uganya, Radhika, and Vijayaraj 2021; Tesfaye Jule et al. 2021; Nandhini, Ezhilarasan, and Rajeshkumar 2020; Kamath et al. 2020). From the literature survey, it is found that the Adaboost ML algorithm has been widely used to predict the accuracy of the customer churn rate. Predicting the output as the improved accuracy to promote the telecommunication industry services in order to increase the customer rate. So, the research focuses on improving the previous study accuracy with respect to the customer churn rate |
| 29 | @article{Jeyaprakaash2022AccuracyMO,  title={Accuracy Measure of Customer Churn Prediction in Telecom Industry using Adaboost over Random Forest Algorithm},  author={P Jeyaprakaash and Sashi rekha},  journal={Journal of Pharmaceutical Negative Results},  year={2022},  url={https://api.semanticscholar.org/CorpusID:252885882}  } | INTRODUCTION  Customers are the valuable asset of the telecom company because they fetch more profit and benefits to the telecom industry. Customer churn is a rate of attrition or the percentage of customers that stops their subscription or service in a given period. In many telecom companies, customer churn is the biggest problem for their company. The solution to the problem is predicting the customers who are likely at risk of churning which was discussed in the paper (Geetha et al. 2020). The importance of customer churn prediction is accurately finding the future churn to ameliorate their business to gain more profit. The telecom industry is also able to improve the accuracy in the areas where customer service is lacking (Kassem et al. 2020). The applications of the customer churn prediction are to improve the accuracy and regulate the fields where the improvement is necessary for the telecom companies for instance Jio, Airtel, BSNL, VI, etc. The customer churn prediction is also useful in various industrial sectors such as banking, insurance, and mobile phone company.(Lariviere and Vandenpoel 2005) (Xia, Wang, and Jiang 2016) these two papers have convincing points about the applications of customer churn prediction. Recently, a lot of researchers have done a variety of customer churn prediction in telecommunications using data analytics as it is one of the applications of data science and machine learning algorithms for customer churn prediction. About 482 articles had been published in ScienceDirect in the past 5 years and nearly 127 articles were published in IEEE Xplore. (Huang, Kechadi, and Buckley 2012) This work introduced another arrangement of of 84% when compared with other algorithms (Lalwani et al. 2021). elements for the client stir expectation in the media transmission, including the collected call subtleties, Henley division, account data, bill data, dial types, line data, installment data, grumble data, administration data, etc.(Huang, Kechadi, and Buckley 2012; Keramati et al. 2014) From this work, classification techniques using data from various sources of a dataset. Artificial Neural Network (ANN) significantly exceeds the other three algorithms, namely K-Nearest Neighbors (KNN), Decision Tree (DT), and Support Vector Machine (SVM). (Vafeiadis et al. 2015)Here, we discovered the effect of the utilization of boosting to the related classifiers utilizing the AdaBoost. (Lu et al. 2014) Rather than most agitated expectation models, our model takes into consideration an "Execution Zone" where clients with the most noteworthy stir affinity can be tended to for maintenance activities. From all the papers, we can arrive at a solution that the algorithm Ada-boost has the highest efficiency |
| 30 | @article{Papa2022DevelopmentOI,  title={Development of information technology for analyzing the customer churn of a telecommunication company},  author={Andrii Papa and Yevgen Shemet and Andrii Yarovyi and Lyubov Vahovska},  journal={Technology audit and production reserves},  year={2022},  url={https://api.semanticscholar.org/CorpusID:248913859}  } | 1. Introduction Currently, most companies that collect a large amount of data suitable for analysis use artificial intelligence methods, in particular machine learning and data mining [1, 2]. One of the popular examples of using machine learning in real life is the task of predicting customer churn. Telecom - munications companies, banks, insurance companies and others are engaged in forecasting and managing customer churn. In a highly competitive environment, predicting customer churn in order to retain them is becoming one of the most important areas in modern business. As a rule, existing developments are based on the personal data of the client, as well as data on its activity in the com - pany: the services and products that it uses, the history of ransactional activity, the history of requests, information about purchases [3]. The data obtained are large arrays with structured and unstructured information, in which neural networks, data mining and machine learning methods are widely used to analyze and identify hidden patterns [4]. Despite the serious interest of analysts and scientists in the problem of preserving service consumers, based on the analysis of professional sources, one can state a certain limitation in the description of specific models, algorithms and software solutions. On the one hand, this is due to the significant specifics of the applied problem and the diversity of practical aspects of solving a specific problem in full for a specific service in a specific region. In addition, most economic problems have to be solved under conditions of initial information uncertainty [1, 4]. Thus, in order to solve the problem of analysis customer churn to retain existing users, in this study it is advisable to analyze machine learning methods [5], with the possibility of using them using the bagging method. |