

REDUCTION OF NETWORK TRAFFIC BY CUSTOMER SEGMENTATION IN BANKING SECTOR

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ABSTRACT

Consumer Network Traffic has become a major hurdle in Banking and Financial organizations because a huge number of customers try to access the network at the same time. In order to solve this problem the banks, banking and financial sectors have tried Customer Segmentation as a core function and to provide better customer services. Customer Segmentation is an integrated novel approach that helps to understand the customers based on their similarities and allows marketers to address customers in the most effective way. This approach is very much needed in order to lay successful organizations. The accessible clustering models for customer segmentation, as a general rule, and the significant models are Hierarchical and K-Means Clustering. We have used the K-means clustering algorithm which has high computational speed as a hybrid solution to reduce the consumer network traffic.

Keywords: Network Traffic, Customer Relationship Management, Quality of Service, Customer Segmentation, Hierarchical Clustering, K-Means Clustering, Cluster Analysis.

1. INTRODUCTION

Network Traffic is the amount of data which moves across a network during any given time. It is commonly known as congestion which makes the users to wait significantly more time to reach the destination. In addition, congestion slows down the overall network performance with high latency which in turn decreases the performance speed of the network respective to the bank or financial services leading to displeased users.

However, in order to reduce network traffic or congestion, banks, banking and financial organizations can prioritize explicit organization traffic needs over others. This can be accomplished by giving higher need to the particular sorts of traffic. For little monetary associations empowering Quality of Service (QoS) highlight will get the job done.

In the contemporary day and age, Customer Relationship Management (CRM) has played a vital aspect in every field to better understand their customers and their needs. Taking QoS and CRM as the core function, financial firms prioritize customers of a specific network and provide services. Customer segmentation is quite possibly the most valuable method in business analytics to comprehend customer behaviour and perform classification.

By utilizing clustering methods, customers with similar behaviour are grouped together into homogenous groups. For many organizations, Customer segmentation helps to identify a distinct group of customers who follow varied transactions. Clustering techniques expose homogenous internally and heterogeneous groups externally. Customers differ on their requirements, behaviour and characteristic. Furthermore, the principal aim of grouping procedures is to find out the distinctive customer types and section the ones

similar into groups to achieve target marketing more efficiently. This study has a goal of reducing the network traffic by prioritizing the customers of a bank or financial firm by taking CRM and QoS as the business intelligence tool along with the clustering techniques to help organizations reclaim a superior perspective of their important customers.

For better business analysis of the accessible clustering models in view of customer segmentation, as well as the hybrid solution to reduce network traffic, the two fundamental models were chosen for our study are Hierarchical and K-Means clustering.

2. LITERATURE REVIEW

[1] Research stated that in the banking area, technology plays a crucial role between bank clients and technology. And they found that if any banking sector wants to be top in a competitive market it must focus on innovative ideas to provide products and services to the customers rather than not implementing any ideas. By implementing innovative ideas significantly implementation cost also increases. So, the innovation is directly proportional to cost.

[2] Research stated that e-banking difficulties are important in customer fulfillment. They also stated that e-banking plays a major role in providing fast services to customers. And e-banking components such as speed, cost, efficiency, security, cost, and flexibility provide great services for customer satisfaction.

[3] Examination expressed that investigation contacted that in connection with baffled clients, satisfied clients basically will undoubtedly propose their bank to their own partners and to examine using their present bank later on, and they are increasingly impenetrable to offers from various banks. Reliable customers are increasingly fascinated by the organizations of their particular banks while thinking about interests in all perspectives, for instance, in the money related market, store their own speculation assets to their own bank, take out a home advance from their own bank and use other monetary things and organizations from their ongoing bank. The money-related training of standard bank customers is still to some degree low, be that as it may, altered propositions really work outstandingly here. In the opinion of the results of our investigation, enduring customers with various forces changes into a potential securing of extra monetary things. The best reasonable premium of the bank customers was in keeping save assets in the bank and in agreement credits.

[4] The research that was open, non-open, and overseas stated that clients are more beneficial with the administration's nature of the unfamiliar banks than the private and general banks.

[5] Research stated that e-banking services, customer fulfillment and belief are related to each other. This significant relationship between customers and trust plays an important role in the banking sector for improvising their services to the clients. Like internet banking, data privacy is important for customers to believe in the banking sector, in which customers depend on banks on behalf of the trust to the banking sector. If customer trust in their bank is damaged then the banking sector automatically goes down in a competitive world.

[6] Research stated that regarding customer fulfillment there are some components that are important to provide satisfying services to the customers. The services are accessibility and availability of services for the clients. The components regarding customer satisfaction are fees, loan, and appearance.

[7] Research stated that clients in the banking sector are trustworthy for banks that are providing internet banking services. And it also stated that due to this banking sectors are increasing their market in a competitive world. And also it builds customer trust towards their bank. The banks are facilitating internet banking services to clients to attract customers towards their bank. So, the significant relationship between internet banking services and customer trust plays a significant role in regards to building their prestige.

[8] Research stated that in an aggressive competition where each bank is zeroing in on holding and drawing in new clients, relationship advertising is the important factor embraced by the banks. They likewise found that the financial sector is one of the significant help areas and the matter of banks is pretty much ward on client administrations and satisfaction. Banks ought to extend their organizations and make extraordinary relationships with the customers.

[9] Research stated that banks are relying on variables such as quality, privacy, security, efficiency, accessibility and services rather than the independent variables. As indicated by the discoveries of the examination. The effect of the closeness of bank and monetary variables on consumer loyalty isn't sufficient.

[10] In a fast creative world, banks should accept the development which can incite buyer dedication and faithfulness. Recalling this they researched various estimations like customer care, advancement security and data quality, development solace, and development use viability and reliability. Results express that there is an enormous association between customer support, development usage, effortlessness and constancy and shopper trust. Of course, they found a successful association between development solace and buyer trust. So it was found that advancement accepts a huge part in satisfying the customer unequivocally by virtue of banking.

3. PROPOSED SYSTEM

Key ideas, for example, network traffic, customer segmentation, CRM, and the convenience of client division are inspected and talked about in this part.

A. Network Traffic

Banking and Financial Services provided by financial institutions are disrupted by hackers, identify thieves, and cybercriminals. They attack the network and target confidential information of the customer records. In the worse case, network intrusions often go undetected for months due to poor network traffic patterns and inadequate preservation. Many organizations spend millions to defend their IT networks from attacks by hacks and data breaches – yet don't always have the right tools to thwart their attackers.

The financial sector is one among exponentially increasing wings in today's economy. The banking organizations which differ in size heavily depend on network connectivity for ensuring their important and sensitive tasks compared to other industries. In the banking sector, the ability to increase the customer base

is vital to enhance competitiveness. Bank networks can use this study which is customer segmentation as a hybrid solution in order to reduce the network traffic or congestion by decreasing the data flow in the network.

B. Customer Relationship Management

For developing long-term customer associations an important business approach is CRM. As a matter of fact, for many firms, to retain valuable customers or to enhance customer value, CRM is a great help [6]. Because of heavy competition between companies and the growth of market services, diversity of products and also choosing the possible marketing strategies has become an important component in customer relationship management. Every customer differs relatively so order to identify their customers and to analyze their behaviour requires industry-specific considerations [7]. In particular, for financial institutions identifying and analyzing customer behaviour is very challenging because of diverse customers and their varied expectations [8][9].

C. Customer Segmentation

At the current age, the competition among business organizations is rapidly increasing. Therefore, the popular technique to partition the customers' base into internally unvaried and externally distinct groups to create different strategies for targeting individual groups according to their characteristics is to apply Customer Segmentation. The whole customer dataset can be separated and assembled into clusters based on their demographics, transactions, etc. Hence, firms can gather comparable clients as opposed to concentrating every client exclusively so their requirements can be perceived [11][13].

D. Use of Customer Segmentation

In context to specific customers, customer segmentation is referred to as a unique strategy. Many financial organizations follow three major steps to originate a customer segmentation-based strategy. Initially, the customers are selected and portioned into different gatherings dependent n their behaviour and attributes. In the second place, the acquired segments are analyzed for their properties and various ways in which the strategies can be applied to that particular group. In the end, required examinations and customer behaviour can be completed.

4. METHODOLOGY

The most significant subject in data mining is clustering which is also known as cluster analysis. In this, customers are separated into homogenous bunches in which clients with comparable requirements and qualities are gathered together. In the wake of distinguishing the necessities and upsides of its clients, an organization can offer better types of assistance to their customers which will thus prompt upgraded consumer loyalty and relationship, responsibility will likewise emphatically affect the company's image dedication and brand mindfulness. Clustering is utilized in various applications, including regions, for example, classification, machine learning, and image processing. Clustering algorithms are of different types and they vary from one another as far as the methodology they continue to do the gathering of the items as per their qualities.



Figure : The Architecture of the proposed system

All data points are taken as a solitary group on “Partitioned Based Clustering”. These data points are then isolated into groups. A portion of the partitioning algorithms are K-Medoids, K-Means and K-Modes. For ‘Hierarchical Clustering’, one of the two present methodologies can be followed for execution. One is the Divisive (top-down) approach and the other is the Agglomerative (bottom-up) approach [24]. In the ‘divisive’ methodology, every one of the perceptions starts in one group and afterward is over and again split into various groups. The outcomes are as dendrograms. In the ‘agglomerative’ cycle, every perception starts in its own group or segment and afterward pairs of these framed segments are joined while climbing up the hierarchy. In ‘Density-Based Clustering’, the clusters are characterized as locales of higher density than the remainder of the dataset. Objects are separated as the center, commotion and boundary focus. ‘Lattice-based Clustering’ algorithms segment the data points index into framework structure containing various cells. Based on clustering, the data points are assembled based on different procedures like statistical methods, applied and vigorous clustering strategies [24].

A. K-Means Clustering

K-Means is perhaps the most generally utilized unaided machine learning clustering algorithms, and is straightforward and efficient. The point of K-Means is to characterize an objective number ‘k’, which alludes to the quantity of centroids required in the dataset. A centroid is a nonexistent area addressing the focal point of the cluster. Each data point is distributed to each group by decreasing the in-cluster amount of squares. In this cycle, the centroids change their position stepwise until no further alterations must be done and the area of the centroids stays flawless. K-Means utilizes the Elbow method which is utilized to discover an ideal number of groups as a core function [31].

Here K-Means Clustering algorithm is applied on a moderately small dataset and the outcomes are portrayed. The dataset depends on client data of a bank and has 8 ascribes named balance, balance frequency, purchases, installments purchase, cash advance, credit limit, payments and tenure. It comprises of 8950 records every one of which alludes to an exceptional client.

As the K-Means algorithm requires the number of clusters as input, the elbow method is used to get the optimal number of clusters. The ‘k’ value specifies the number of clusters and also diminishes the sum of squared errors and within-cluster-sum-of-squared-errors) metric [32].

K-Means is broadly acknowledged and generally utilized in client division. One of the serious issues in client examination is the determination of the number of clusters ‘k’. Subsequently, this algorithm gives the ideal number of clusters by performing elbow strategy (figure 1). One more benefit of K-Means is that the computational speed of this algorithm is higher than other various leveled techniques for grouping and is likewise simple to execute [32][33].

B. Clustering for Segmentation Purposes

Clustering procedures uncover inside homogenous and remotely heterogeneous groups. Clients vary as far as necessities, conduct and attributes and the principle objective of clustering methods is to recognize diverse client types and fragment the client base into groups of comparative profiles with the goal that the interaction of the targeted advertising can be executed all the more successfully and productively [25]. Both various leveled and non-progressive grouping calculations are generally utilized in client division, generally conspicuous among them is K-Means. As a piece of clustering approach, K-Means is utilized for customer segmentation [26].

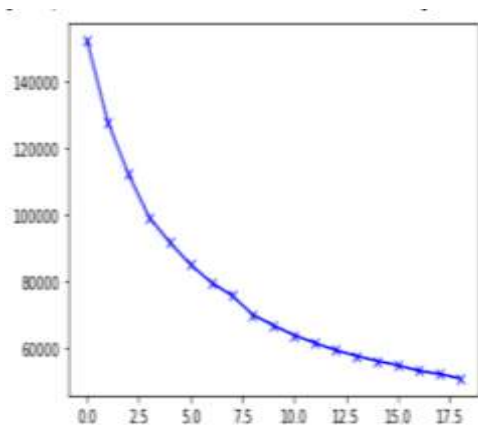


Figure 1: Elbow Method

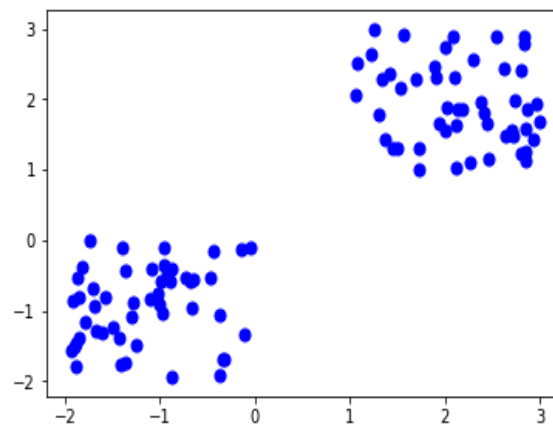


Figure 2: K-Means Clustering

C. Hierarchical Clustering

“Hierarchical clustering” is a strategy utilized for cluster analysis that assembles an order of data points. The primary yield of Hierarchical clustering is a dendrogram, which shows the progressive connection between the groups. Hierarchical clustering can be isolated into two classifications as Agglomerative hierarchical clustering and Divisive hierarchical clustering (Figure 4) [24]. In agglomerative hierarchical clustering, the sequential merging of similar clusters takes place whereas in divisive hierarchical clustering at first every one of the perceptions is assembled into one cluster and the afterward fruitful parting of the groups is performed.

Hierarchical clustering has been generally used for segmentation purposes inability to create bring about a visual way. It tends to be utilized for changed datasets like categorical, spatial and time series. The principle benefit of various leveled grouping is the yield of hierarchy (dendrogram) (Figure 3) which tells, precisely so, all things considered, the cluster is merged or parted. Be that as it may, for a dataset with a huge number of observations its computational speed is low when contrasted with non-hierarchical algorithms for clustering [24].

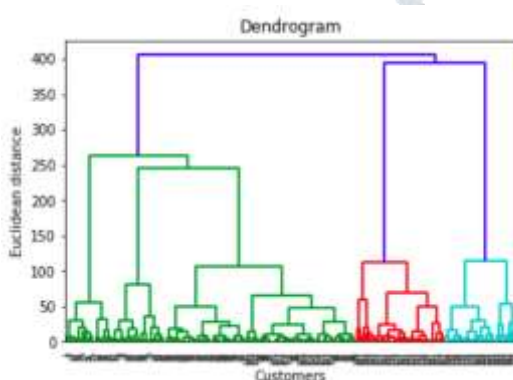


Figure 3: Dendrogram

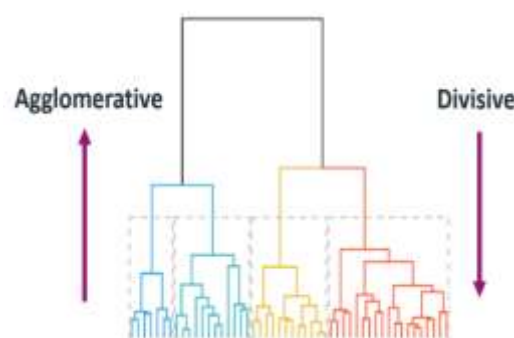


Figure 4: Hierarchical clustering categories

5. RESULTS

Therefore, In order to reduce network traffic, this study has produced an efficient solution which is ‘Customer Segmentation’ by using the K-Means clustering algorithm. The results revealed that a total of six clusters are formed by using the Elbow method which enumerates the optimal number of clusters ‘K’.

Customers in cluster number one are very few compared to other clusters. The sixth cluster has the highest number of customers with similar characteristics. The output is visualized by using Principal Component Analysis (PCA) for a better view of all the clusters (Figure5).

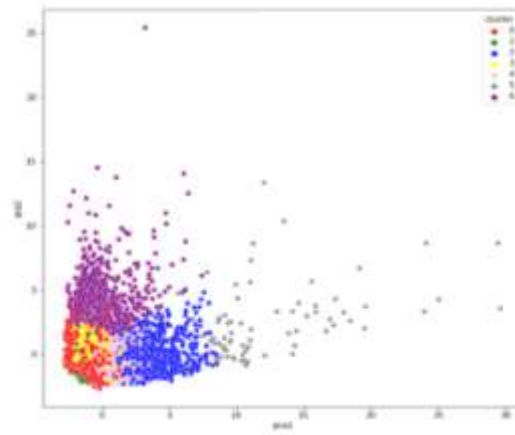


Figure 5: Scatterplot

6. DISCUSSION AND CONCLUSION

Due to heavy network traffic or congestion, the performance decreases with high latency so customers often refrain from services from financial organizations and get unsatisfied. However, this can be solved by prioritizing the network and providing QoS by taking CRM as a core function and also as a hybrid solution. In the financial industry, customer value is useful for providing products and services which are described by the customer. Notwithstanding, the significance of client worth to the monetary administrations industry is only from time to time figured out. To assess banks' presentation and the worth of bank clients, it is important to distinguish their critical qualities by utilizing client grouping. Utilizing client bunching empowers the banks to diminish the organization traffic and distinguish the most productive clients and configuration advertising procedures for each gathering of clients dependent on their traits. K-Means clustering algorithm which is a prominent clustering model and has high computational speed is used for customer segmentation. The client grouping in this investigation was performed by utilizing segment factors, account balance, payments, balance frequency, credit limit, customer location and account. Dissecting dissimilar variables to perform client bunching empowers the directors to get more exact client groups.

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