



UNVEILING CUSTOMER SEGMENTATION: A COMPREHENSIVE ANALYSIS AND PRACTICAL APPLICATIONS

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ABSTRACT

Nowadays Customer segmentation became very popular method for dividing company's customers for retaining customers and making profit out of them, in the following study customers of different of organizations are classified on the basis of their behavioral characteristics such as spending and income, by taking behavioral aspects into consideration makes these methods an efficient one as compares to others. For this classification a machine algorithm named as k-means clustering algorithm is used and based on the behavioral characteristic's customers are classified. Formed clusters help the company to target individual customer and advertise the content to them through marketing campaign and social media sites which they are really interested in.

Keywords-Customer segmentation, K- means algorithm, Machine Learning.

[1] INTRODUCTION

In today's dynamic business environment, understanding and meeting the diverse needs and preferences of customers is essential for organizations to stay competitive and thrive. Customer segmentation has emerged as a powerful tool that allows businesses to categorize their customer base into distinct groups based on similar characteristics and behaviors. This segmentation process enables companies to tailor their marketing strategies, products, and services to effectively target each customer segment, resulting in improved customer satisfaction, increased sales, and enhanced profitability.

Customer segmentation recognizes that customers are not homogenous; they possess unique characteristics, preferences, and buying behaviors. By dividing the customer base into segments, companies can gain deeper insights into the distinct requirements and motivations of each segment. This knowledge forms the foundation for developing personalized marketing strategies that resonate with customers on a more individual level. Segmentation approaches may vary depending on the nature of the business and the specific objectives. Demographic segmentation considers variables such as age, gender, income, and education level. Geographic segmentation focuses on geographic location, climate, or cultural

differences. Psychographic segmentation explores customers' lifestyle, values, interests, and personality traits.

Lastly, behavioral segmentation examines customers' purchasing habits, brand loyalty, and usage patterns. The benefits of customer segmentation are multifaceted. Firstly, it enables businesses to allocate their resources more efficiently by directing marketing efforts and resources to the segments with the highest potential for conversion and profitability. By understanding the unique characteristics of each segment, companies can craft targeted and compelling marketing messages that resonate with the specific needs and desires of customers. This personalized approach creates a stronger emotional connection between the customers and the brand, fostering loyalty and long-term relationships.

Additionally, customer segmentation enhances customer satisfaction by allowing companies to design products and services that align with the specific needs of different segments. By tailoring offerings to the preferences and requirements of each segment, businesses can provide more relevant and valuable solutions, thereby increasing customer loyalty and retention. However, customer segmentation is not without its challenges. Identifying meaningful and actionable segments requires comprehensive data collection and analysis. Companies must have access to accurate and reliable customer data, which may necessitate the implementation of robust data management systems.

Furthermore, businesses must continuously monitor and update their segmentation strategies to adapt to evolving customer behaviors, market dynamics, and industry trends. Customer segmentation is a vital tool for businesses seeking to maximize their marketing effectiveness and enhance customer satisfaction. By understanding the unique characteristics and preferences of different customer segments, companies can tailor their strategies, products, and services to meet their customers' needs more effectively. In an era of increasing competition and customer demands, customer segmentation provides organizations with a competitive edge, driving growth, and fostering long-term success.

[2] LITERATURE SURVEY

A solution is proposed as distinguish the customers group into two groups named as premium and standard with the help of machine learning methods named as NEM, LiRM and LoRM.

Customer segmentation on Telecom customers is achieved by using information such as age, interest, etc. with the help of cluster analysis method.

- Over the years, the commercial world has become more competitive, as organizations such as these have to meet the needs and desires of their customers, attract new customers, and thus improve their businesses [1]. The task of identifying and meeting the needs and requirements of every customer in the business is very difficult. This is because customers can vary according to their needs, wants, demographics, size, taste and taste, features etc. As it is, it is a bad practice to treat all customers equally in business. This challenge has adopted the concept of customer segmentation or market segmentation, where consumers are divided into subgroups or segments, where members of each subcategory exhibit similar market behaviors or characteristics [2]. Accordingly, customer segmentation is the process of dividing the market into indigenous groups.
- Big Data research has gained momentum. Defines big data - a term that describes a large number of formal and informal data, which cannot be analyzed using traditional methods and algorithms. Companies include billions of data about their customers, suppliers, and operations, and millions of internally connected sensors are sent to the real world on devices such as mobile phones and cars, sensing, manufacturing and communications

data [10]. Ability to improve forecasting, save money, increase efficiency and improve various areas such as traffic control, weather forecasting, disaster prevention, finance, fraud control, business transactions, national security, education and healthcare. Big data is mainly seen in three Vs: volume, variability, and speed. Other 2Vs are available - authenticity and price, thus making it 5V.

- Data collection is the process of collecting and measuring information against targeted changes in an established system, which enables one to answer relevant questions and evaluate the results [12]. Data collection is part of research in all fields of study including physical and social sciences, humanities and business. The purpose of all data collection is to obtain quality evidence that leads the analysis to construct concrete and misleading answers to the questions presented. We collected data from the UCI machine learning repository.
- Clustering is the process of grouping information into a dataset based on some commonalities. There are several algorithms, which can be applied to datasets based on the provided condition [7]. However, no universal clustering algorithm exists; hence it becomes important to choose the appropriate clustering techniques. In this paper, we have implemented three clustering algorithms using the Python scalar library.
- K-means that an algorithm is one of the most popular classification algorithms. This clustering algorithm relies on centro, where each data point is placed in one of the overlapping ones, which is pre-sorted in the K-algorithm. Clusters are created that correspond to hidden patterns in the data that provide the necessary information to help decide execution process. There are many ways to make assembling K-means, we used the elbow method.

[3] USE CASE DIAGRAM

Use case diagram of proposed system consist of 4 users namely 1. Data Analyst, 2. Marketing Analyst, 3. Data Warehouse Manager, and 4. Customer.

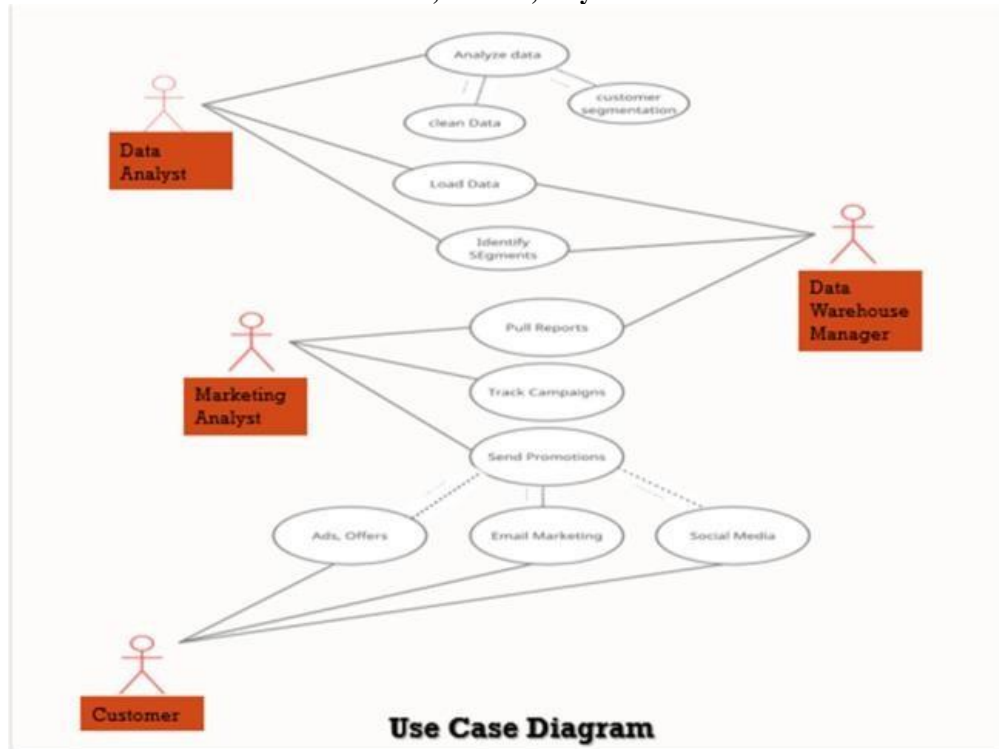


Fig. 1 Use case Diagram

- Analyze Data: analyst has the access to loaded data and analyst clean the data and perform analysis to form clusters.
- Load Data: analyst log into database & view data & load into memory to work on it.
- Identify Segments: analyst form report for segmented customer data and send to data warehouse and marketing analyst can access that data to form marketing strategies.
- Pull Reports: marketing team can view & make edits on the reports, data for report is pulled from DW system.
- Track Campaigns: The customer’s interaction tracked by marketing team for success report.
- Send Promotions: Marketing team send promotions through mail, social media ads, paid ads, coupons.

[4] K-MEANS CLUSTERING ALGORITHM

K-means Clustering is a clustering Algorithm in which we are given with data points with its data set and features and the mechanism is to categories those data points into clusters as per their similarities. The algorithm forms K clusters based on its similarity.

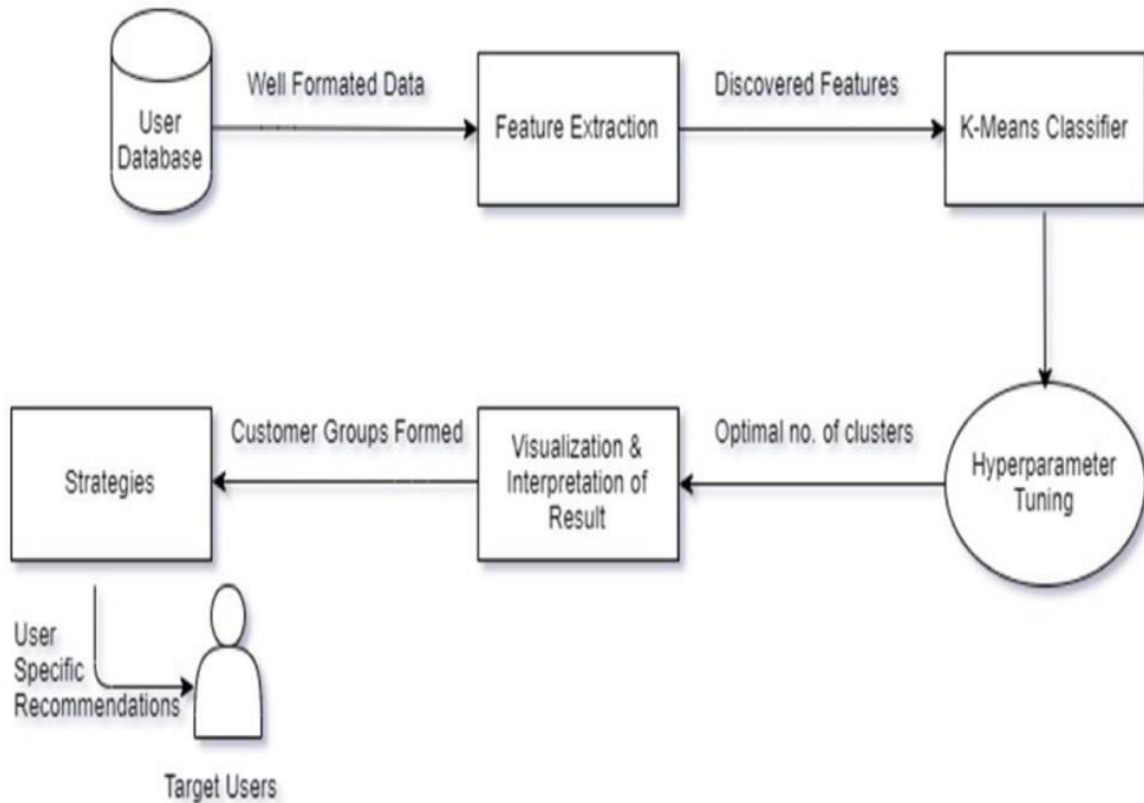


Fig. 2 K-means Method

To calculate the similarity K- means uses Euclidean distance measurement method.

Steps:

- In first step, we randomly initialize k points.
- K-means classifier categorizes each data point to its nearest mean and rewrite the mean's coordinates.
- Iteration is continuing up till all data points are classified.

[5] PROPOSED SYSTEM

In our system we included annual income and total spending as a feature for classification:

- **Data Gathering:** first, Data analyst fetch data required for analysis from database, format data i.e., remove all NA values from data & make data ready for processing.
- **Feature Extraction:** Selects features which makes model more accurate, in our case features are annual income and spending score for efficient analysis.
- **K-means Classifier:** After that, K means classifier performs clustering with respect to features provided to it.
- **Hyper Parameter Tuning:** during forming groups to select optimal no of clusters we applied hyper parameter tuning which is achieved by Elbow method to choose optimal no of clusters. Below graph is for elbow method which shows curve is getting flatter after 5 which indicates that 5 is optimal no of clusters we can form for better classification.

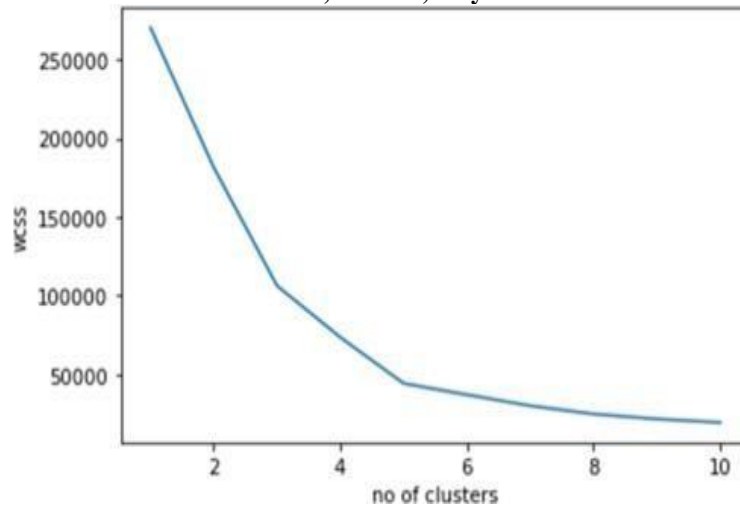


Fig. 3 Elbow Method

[6] DATA VISUALIZATION

With the formed clusters marketing team can make different strategies for better targeting customers in figure 3.



Fig. 4 Types of Customer Segmentation [4]

[7] RESULTS

After analysis of data and classifying customers with features annual income and spending score, we got clusters of customers & with formed clusters marketing team form strategies for customers specific recommendation to make.

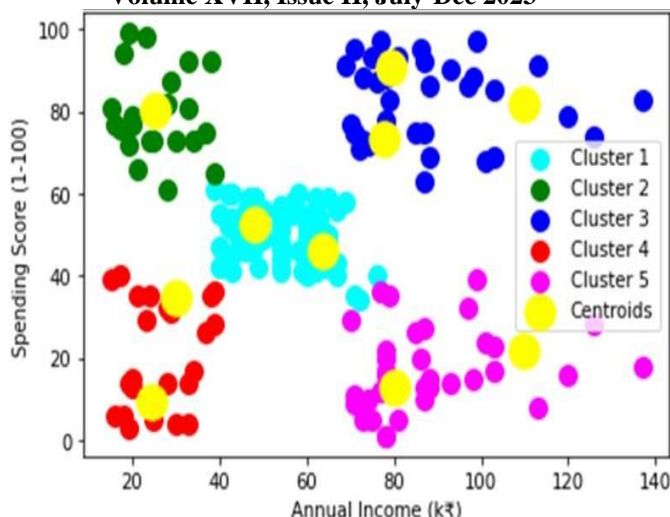


Fig. 5 Final Cluster Formed

Drawback of System:

- Marketing will become expensive.
- Because of having less no. of customers in a segment problem of limited production occurs.

[8] SUMMARY

Customer segmentation is a fundamental concept in marketing that enables businesses to understand their customers better and tailor their strategies to meet their unique needs and preferences. This research article has explored the various aspects of customer segmentation, including its theoretical foundations, methodologies, benefits, and challenges. The article highlighted the significance of customer segmentation in developing effective marketing strategies. By dividing the customer base into distinct segments based on characteristics such as demographics, geography, psychographics, and behaviors, businesses can target their marketing efforts more efficiently. This targeted approach leads to increased customer satisfaction, improved customer retention, and enhanced profitability.

The review of literature emphasized the evolution of customer segmentation practices, from traditional demographic-based approaches to more sophisticated methods like value-based segmentation and data-driven segmentation. It also discussed the application of advanced techniques such as machine learning and data mining in customer segmentation, showcasing their potential to improve accuracy and efficiency. The practical implications of customer segmentation were also examined, with examples of successful implementation in real-world scenarios. These applications included developing targeted marketing campaigns, customizing products and services, and creating personalized customer experiences. The case studies demonstrated the positive impact of customer segmentation on businesses, showcasing its role in gaining a competitive edge and driving growth.

However, customer segmentation is not without challenges. Obtaining accurate and reliable customer data, identifying meaningful segments, and adapting to evolving customer behaviors are among the key challenges faced by organizations. It is important for businesses to continuously monitor and update their segmentation strategies to stay relevant in a dynamic market environment. In conclusion, customer segmentation provides valuable insights for businesses to understand their customers and effectively meet their needs. It enables companies to allocate resources efficiently, design personalized marketing

campaigns, and foster long-term customer loyalty. By incorporating customer segmentation into their marketing endeavors, organizations can stay competitive, maximize customer satisfaction, and achieve sustainable growth in today's complex marketplace.

REFERENCES

- [1] <https://www.kaggle.com>, last retrieved on March 19, 2023.
- [2] <https://towardsdatascience.com>, last retrieved on March 13, 2023.
- [3] <https://www.qualtrics.com/au/experience-management/brand/customer-segmentation>, last retrieved on March 17, 2023.
- [4] <https://www.netsuite.com/portal/resource/articles/human-resources/customer-churn-analysis.shtml>, last retrieved on March 19, 2023.
- [5] <https://openviewpartners.com/blog/customer-segmentation>, last retrieved on March 13, 2023.
- [6] Bhatnagar, Amit; Ghose, S. (2004), 'A latent class segmentation analysis of e-shoppers', *Journal of Business Research* 57, 758–767.
- [7] Ahn, J., Han, S., & Lee, Y. (2006). Customer churn analysis: Churn determinants and mediation effects of partial defection in the Korean mobile telecommunications service industry. *Telecommunications Policy* , 30, 552-568.
- [8] Peppard, J. (2000). Customer relationship management (CRM) in financial services. *European Management Journal* , 18 (3), 312-27.
- [9] H. Mehta, V.S. Dixit and P. Bedi, "Refinement of recommendations based on user preferences".
- [10] K. Windler, U. Juttner, S. Michel, S. Maklan, and E. K. Macdonald, "Identifying the right solution customers: A managerial methodology," *Industrial Marketing Management*, vol. 60, pp. 173–186, 2017.
- [11] R. Thakur and L. Workman, "Customer portfolio management (cpm) for improved customer relationship management (crm): Are your customers platinum, gold, silver, or bronze?" *Journal of Business Research*, vol. 69, no.10, pp. 4095 – 4102, 2016.
- [12] Sukru Ozan, "A Case Study on Customer Segmentation by using Machine Learning Methods", IEEE, Year: 2018.
- [13] Potharaju, S. P., Sreedevi, M., & Amiripalli, S. S. (2019). An Ensemble Feature Selection Framework of Sonar Targets Using Symmetrical Uncertainty and Multi-Layer Perceptron (SU-MLP). In *Cognitive Informatics and Soft Computing* (pp. 247-256). Springer, Singapore.
- [14] Tanupriya Choudhury, Vivek Kumar, Darshika Nigam, Intelligent Classification and Clustering Of Lung and Oral Cancer through Decision Tree and Genetic Algorithm, *International Journal of Advanced Research in Computer Science and Software Engineering*, 2015.
- [15] Tanupriya Choudhury, Vivek Kumar, Darshika Nigam, An Innovative and Automatic Lung and Oral Cancer Classification Using Soft Computing Techniques, *International Journal of Computer Science and Mobile Computing*, 2015.