

Segmentation of Bank Consumers for Artificial Intelligence Marketing

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Abstract

Banks can offer more personalized products and services by using segmentation solutions. By gaining a deeper understanding of client characteristics, marketers can Choose the appropriate promotional content to deliver, choose the right marketing channels for the target market, identify new and profitable market sectors, and introduce new products and services. Artificial intelligence marketing uses artificial intelligence concepts and models such as machine learning and Bayesian networks. Cluster analysis is a machine learning method for classifying entities into groups that are homogenous in terms of observable characteristics. This study included K-means cluster analysis, Elbow, and silhouette approaches to segment the data for cardholders of various banks. According to the results from Elbow and the silhouette, the ideal number of clusters seems to be five. Based on their income and shopping frequencies, which are supposedly the greatest attributes to establish the segments of the customers, this research identified five distinct consumer segments: Savers, General, Targets, and Big spenders. This research recommends leveraging machine learning techniques to devise various marketing tactics and policies to maximize the bank's efficiency, customer satisfaction, and quality of services.

Keywords: *AI marketing, Bank, Card holders, Cluster analysis.*

Article type: research article
Keywords: *AI marketing, Bank, Card holders, Cluster analysis.*
JEL codes: G20: General; G29: Other

Received: 15 October 2021

Revised: 30 November 2021

Accepted: 03 December 2021

Suggested citation:

Raiter, O. (2021) 'Segmentation of Bank Consumers for Artificial Intelligence Marketing', *International Journal of Contemporary Financial Issues*, 1(1), pp. 39–54.

1. Introduction

Banking, along with other financial services such as insurance and credit cards, was one of the first businesses to accept the concept of targeting distinct consumer groups with different goods or services. Since 1956, when Wendell Smith proposed market segmentation as an alternative to product differentiation, various variables have been used as a basis to segment customers in the financial services industry; from well-established segmentation bases, such as spatial and demographic, to more recent strategies, including psychological or benefit segmentation (Smith, 1956).

The financial services business, like any other, has its own peculiarities that distinguish it. The banking business is often seen as distinct from other industries; according to a substantial amount of research, the establishment of a financial system is critical for the overall economy's growth, development, and stability (Jung, 1986).

Bank customers are different in character and need tailored services from banks. Banks, on the other hand, must abandon their conventional thinking and accommodate new types of client preferences. Obviously, no two customers are alike. A few characteristics about one consumer may be matched with another, allowing banks to better serve a group of customers by anticipating their desires and requirements ahead of time (Cheron, McTavish and Perrien, 1989).

AI marketing is a technique for enhancing the consumer experience via the use of technology. It may also be used to improve marketing campaigns' return on investment (ROI) (Conick, 2017). To obtain insight into target audience, banks may use big data analytics, machine learning, and other procedures. Banks can establish more effective client contact points with this data. AI removes most of the guesswork involved in client interactions, whether a bank is doing email marketing or giving customer service (Jarek and Mazurek, 2019). Modern banks harness the power of artificial intelligence and machine learning to segment client data and get a better

knowledge of their data (Wirth, 2018). Segmenting client data allows banks to tailor customer experiences while also improving and defining goods, allowing them to swiftly respond to the demands, habits, and interests of their consumers.

There are many other advantages to market segmentation. Market segmentation, at its most basic level, pushes financial businesses to assess where they are now and where they aspire to go in the future (Edris, 1997). As a result, businesses are forced to consider what they are especially strong at in comparison to rivals, as well as trying to understand what customers want. Market segmentation allows for vital new insights and views, as well as the chance to analyze and reconsider (Calvo-Porrá and Lévy-Mangin, 2020).

When done correctly, market segmentation in banking industry yields real results, such as a greater knowledge of account holder differences, which enhances the match between organizational strengths and account holder demands (Edris, 1997). Such a better fit may therefore serve as the foundation for a long-term competitive advantage in the chosen target areas. Market domination, which emerges from being best equipped to cater to the demands of a highly specialized niche sector, is an extreme form of long-term competitive advantage. Ideal niche sectors have demands that match the organizational skill set, are big enough to be lucrative, have strong growth potential, and are uninteresting to rivals. Taking market segmentation to its logical conclusion would entail being able to provide a tailored product or service to very tiny groups of account holders. Micro marketing or hyper-segmentation are terms used to describe this strategy (Kaur, Sharma and Mahajan, 2014). A step further leads to tighter segmentation, in which each customer represents their own market sector. With the advent of e-banking and the use of sophisticated consumer databases, finer segmentation tactics are becoming more practical, allowing bank and other financial institutions to learn from a person's purchasing history about what to offer them next (Stanley, Ford and Richards, 1985).

2. Theoretical framework

Market segmentation is a decision-making process used by marketing managers to identify a target market for a specific product and create an effective marketing mix. One of the most

important components of strategic marketing is market segmentation. Market segmentation is critical for marketing success: the most successful companies use segmentation to guide their operations. Market segmentation is at the foundation of effective marketing, and techniques like segmentation have the greatest influence on marketing choices.

Smith (1956) was the first to suggest segmentation as a marketing strategy. Market segmentation is defined by Smith as perceiving a heterogeneous market (one with diverging demand) as a collection of smaller homogenous markets. Market segmentation is a concept that is halfway between the two extremes of (a) all items are unique and inviolable and (b) the population is homogenous. Market segmentation is defined as "breaking markets into slices" in a newsletter published by Grey Advertising Inc. and quoted in Haley (1985) as one of the simplest and clearest descriptions (Dolnicar, Grün and Leisch, 2018). Consumers who belong to the same market segments – or sets of purchasers – should, in theory, be highly similar in terms of the consumer attributes that management considers important (Rashid and Hassan, 2009). At the same time, customers from various market categories should be significantly diverse from one another in terms of those consumer attributes (Zakrzewska and Murlewski, 2005). Segmentation criteria are consumer traits that management believes are important for market segmentation.

In order to succeed in today's economy, a financial institution must prioritize its clients. To accomplish so, it must devise a marketing plan that will enable it to build client value and, as a result, lucrative customer relationships (Kotler and Armstrong, 2010). Figure 3 depicts the marketing strategy process, which provides an explanation which consumers to serve and how can value be produced for them.

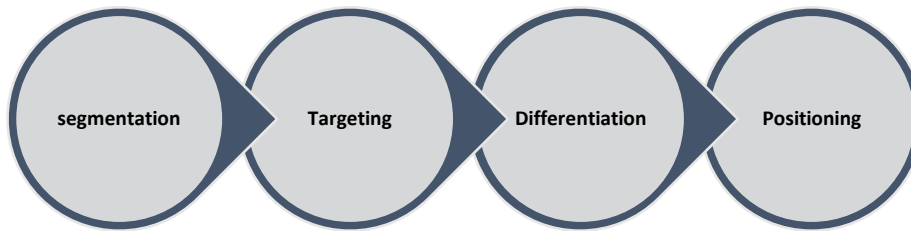


Figure 1. Marketing strategy process for banks and other financial institutions. Source: (Kotler and Armstrong, 2010)

The first phase is market segmentation, which divides a bank's market into smaller groups of clients that react similarly to a marketing campaign. This allows banks to identify which parts are the most appealing and provide the finest prospects, allowing them to focus their efforts on one or more of them (Kotler and Armstrong, 2010). Finally, there's market differentiation and positioning, which is deciding how to deliver the product to the market in a manner that highlights and promotes the bank's competitive advantage (Hiziroglu, 2013).

The process of bank customer segmentation, on the other hand, is shown in further detail in Figure 2. It is divided into four phases: segmentation analysis, segmentation assessment, segmentation implementation, and segmentation control (Goller, Hogg and Kalafatis, 2002) (Weinstein, 2013).

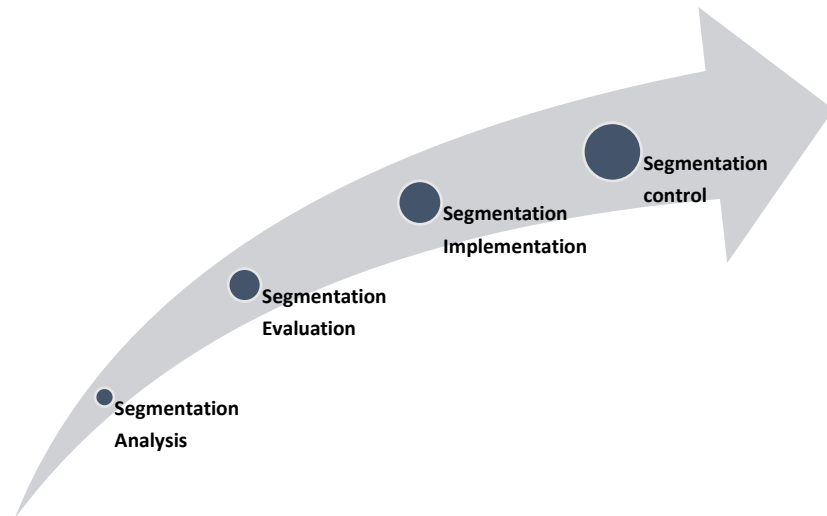


Figure 2. Segmentation process for banks and other financial institutions.

All operations involved in splitting the market into various sub-markets are included in the segmentation analysis phase. It consists of three parts: segmentation bases and phases of the segmentation process, research methodology, and data analysis (Boejgaard and Ellegaard, 2010). The first element is responsible for selecting appropriate models and segmentation bases; the second element's task is to select appropriate research methodologies based on data requirements; and the data analysis element is responsible for selecting appropriate data processing tools.

The second phase, segmentation evaluation, is determining "segmentability" and selecting a target market. The segments that are various in between and comparable inside each other are the ones that are acceptable among all those identified (Piercy and Morgan, 1993). The final categories to be targeted are then chosen based on various other characteristics such as segment size and growth, as well as predicted market shares.

The implementation of segmentation continues; segmentation must be incorporated into all three levels of bank's decision-making: strategic, tactical, and operational. Control is the last step in the segmentation process. It entails keeping track on segment stability in terms of homogeneity, as well as the possibility of re-segmenting the market if the stability detection

changes. It also has to do with the efficacy, or efficiency (i.e. segment profitability, customer retention and attrition rates, and so on) of the initiatives that have been executed under supervision (Palmer and Millier, 2004) (Dibb, 1999). These measures allow for the identification of potential gaps between planned and actualized strategies, as well as the development of certain remedial actions.

3. Methodology

We used cluster analysis in this research. Cluster analysis is an approach for categorizing items (objects, animals, persons, and so on) into groups that are homogenous over a range of observable features (Tan, Steinbach and Kumar, 2013) (Punj and Stewart, 1983). Once those homogenous groups have been developed, the researcher may concentrate his or her efforts on a small number of groups rather than the enormous number of original entities (Bynen, 2012). Rather of working with values for a vast number of items, the researcher concentrates on values for a small number of homogenous groups of the same things. As a result, cluster analysis is often seen as an exploratory data analysis technique, with the goal of creating ideas rather than verifying them. Cluster analysis is utilized in marketing research for more than just data exploration. Clustering techniques are often employed in marketing for the discovery and defining of market segments that constitute the focal point of a company's marketing strategy. Cluster analysis has long been the dominant and favored approach for market segmentation. Its popularity is certainly due to the fact that it is included in many mainstream computer packages (Wierzchoń and Kłopotek, 2018). Cluster analysis is a broad term that refers to a number of methodologies aimed at identifying clusters, groupings with internal cohesiveness, and groups with outward isolation (Dubes, 1999).

The first step is to determine k , the number of clusters to be created. The cluster centers are then chosen at random from a set of k locations (Frades and Matthiesen, 2010). The distance between each cluster center and each observation is determined, and observations are allocated to the cluster center closest to them. The observations are then divided into k clusters for the first time. We next calculate new centers for each of the clusters. The distances between each observation

and the new cluster centers are then calculated, and the observations are reassigned to the cluster center that is closest to them (Kettenring, 2006). Then, for each of the clusters, we calculate new centers, and so on, until the clusters do not change.

The within-cluster sum of squares, often known as the inertia, is a metric measuring the algorithm's performance (Kodinariya and Makwana, 2013). We Define d_i as the distance between the center of the cluster to which the i th observation belongs. Then:

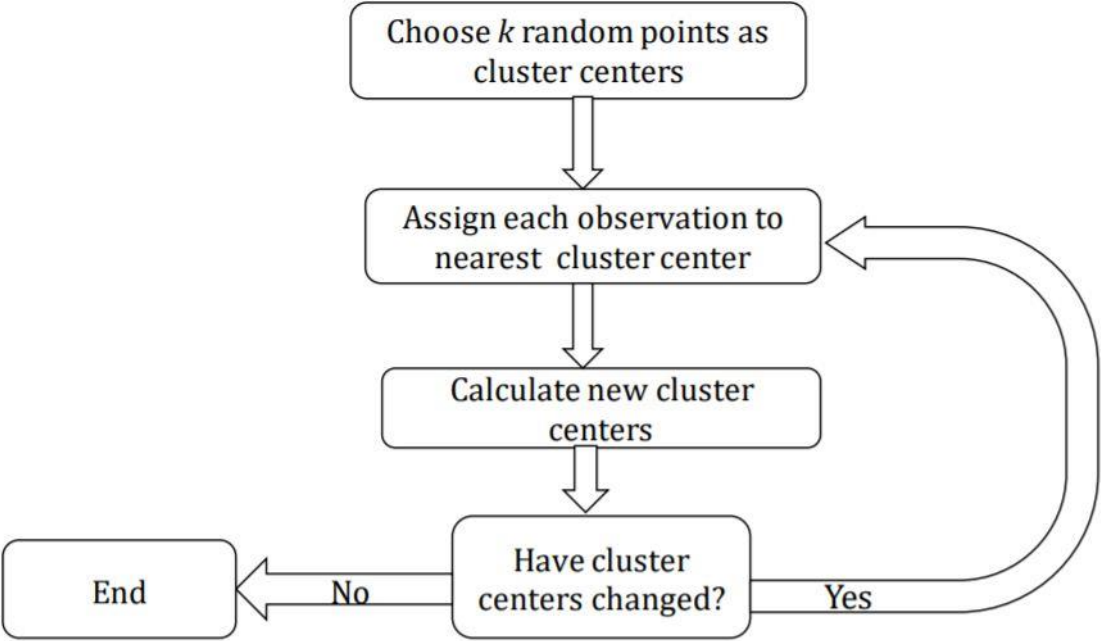


Figure 3: The k-means algorithm (Hamerly and Elkan, 2003) (Pham, Dimov and Nguyen, 2005)

$$Inertia = WCSS = \sum_{i=1}^n d_i^2$$

The quantity of observations is denoted by the letter n . The goal of the k-means algorithm should be to reduce inertia for any given value of k . The initial cluster centers that are picked may have an impact on the outcome of a single run of the algorithm (Burney and Tariq, 2014). As a result, the method must be repeated several times with various starting cluster centers. The best outcome across all runs is the one with the least amount of inertia.

In general, as k grows, the inertia or WCSS decrease. There is one cluster for each observation in the limit where k equals the number of observations, and the inertia is zero. The elbow technique is a common way to figure out how many clusters there are. The silhouette approach is a less subjective means of determining the number of clusters. The dataset came from 391 card holders of various banks.

4. Results

The Distribution structure of Income and Age may be seen in the figure 4. We can deduce from the plots that just a few individuals make more than \$100 thousands. The majority of samples earn between 50 and 75 \$k dollars. We may also estimate that the lowest income is roughly \$20k.

The most loyal patrons are between the ages of 30 and 35. Senior customers, on the other hand, are the most infrequent visitors. In comparison to middle-aged persons, teenagers have less number.

Figure 5 and 6 displays the scatter plots correlation, respectively. It can be seen that there are no discernable relationships among the features. Figure 7 shows the results of the Elbow method. It shows that the kink has occurred in cluster 5. This means that the optimal number of the clusters is 5. Figure 8 shows main results of this research. This Clustering Analysis provides us with a detailed understanding of the various client categories in the bank card holders. Based on their Income and shopping frequencies, which are supposedly the greatest factors/attributes to establish the segments of the customers, there are five distinct consumer segments: Savers, General, Target, Big spender, and Careful. The bank's marketing team can formulate distinct marketing strategies for each of the 5 clusters found in this study. Additionally, in figure 9, the bank clients have been divided into four groups based on clustering plot between their age and their associated spending scores: Usual Customers, Priority Customers, Senior Citizen Target

Customers, and Young Target Customers. After a bank get the data, it may devise various marketing tactics and policies to maximize the customer's satisfaction and the quality of services.

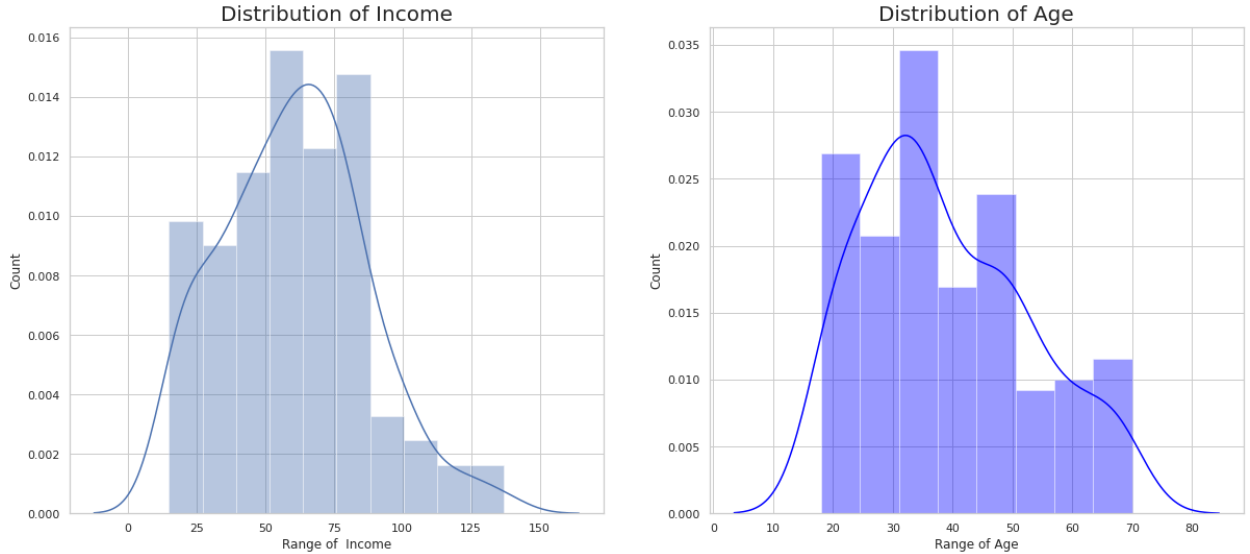


Figure 4. Distribution structure of Income and Age

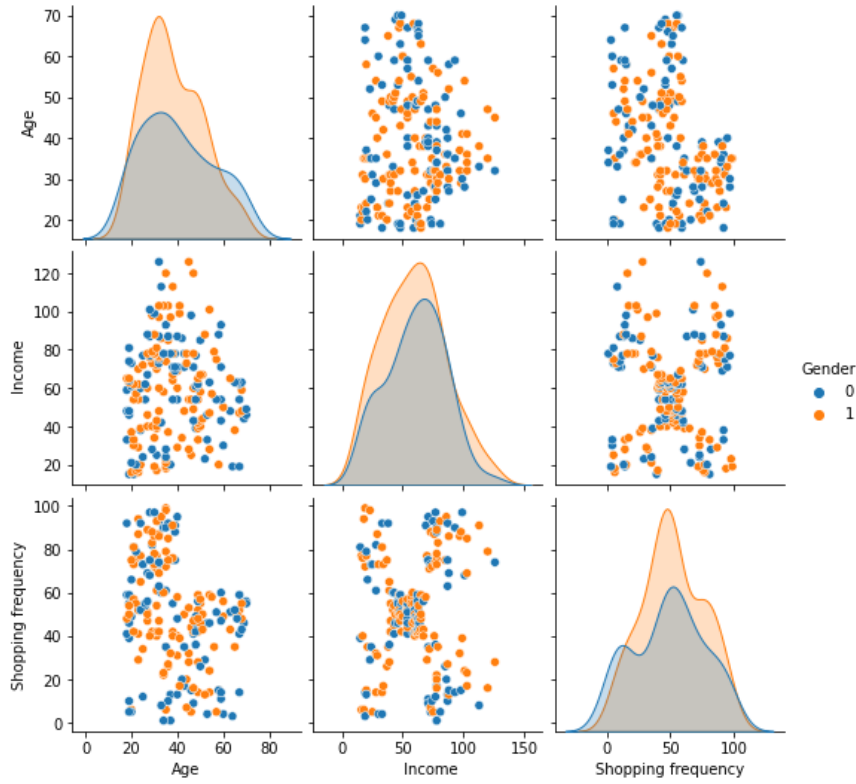


Figure 5. Scatterplots of features

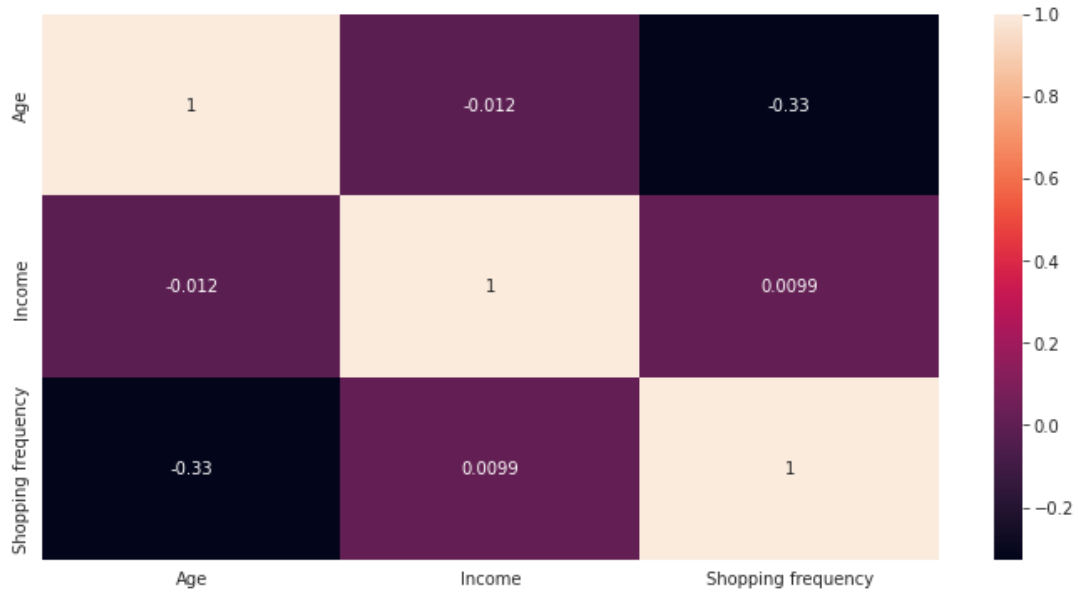


Figure 6. Correlation among the features

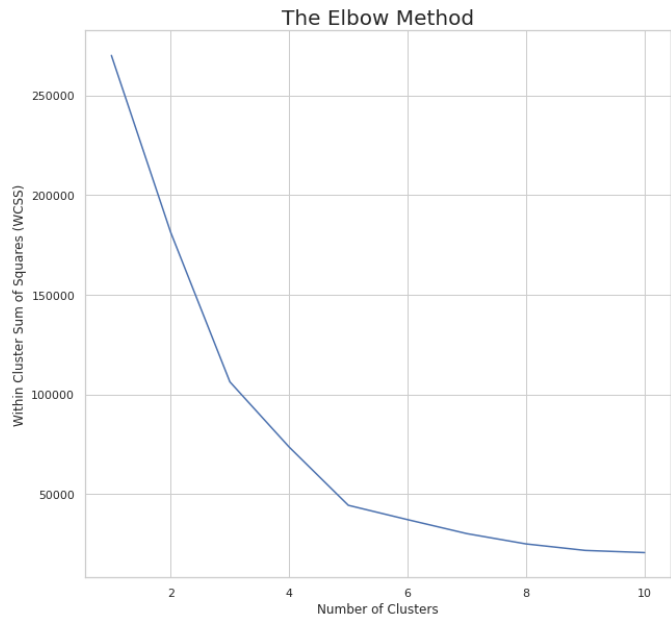


Figure 6. Elbow method result

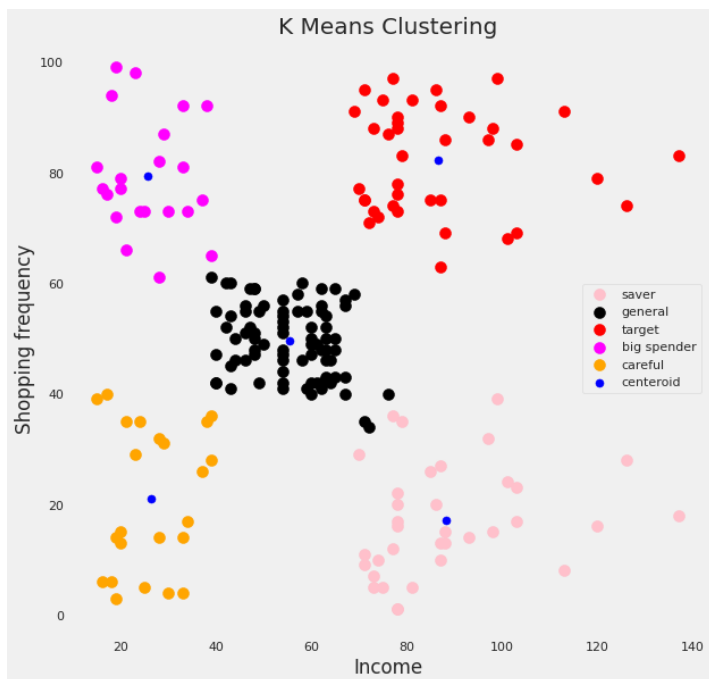


Figure 7. Clusters

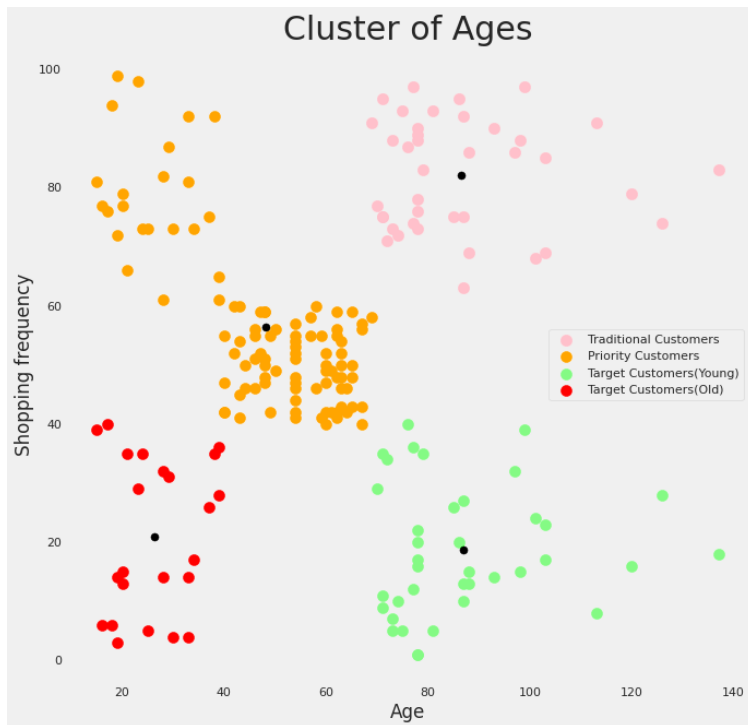


Figure 8. Clusters based on Ages

Table 1 shows the results of the silhouette approach. It can be seen that the average silhouette score is maximum when the number of clusters is five. For this data set, both the elbow technique and the silhouette method point to the use of five clusters.

Number of clusters	Average silhouette score
2	0.34
3	0.36
4	0.31
5	0.39
6	0.30
7	0.32
8	0.31
9	0.29
10	0.31

Table 1. The average silhouette scores

5. Conclusion

Customer segmentation enables banks to have a more detailed understanding of their clients. Segmentation provides specialized insight that would otherwise be hidden in the data. Customer segmentation within the card holder customers is a crucial step toward successful company growth since it allows financial institutions to target homogenous groups of consumers with their goods and services. Banks may use segmentation to better understand and forecast customer behavior across the customer lifecycle. Advanced analytics techniques, such as artificial intelligence and machine learning, can be used to better understand the breadth and depth of customer data, allowing banks to be more adaptable and efficient in translating this data into actionable knowledge and insight that support personalized experiences for their customers.

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