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Customer Segmentation Based On Age, Gender, Income, And Spending Score At Mall Abc Using The K-Means Clustering Model With SPSS Program

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Abstract: *Due to covid 19 pandemic, retail market has been rapidly changing and malls have been impacted quite significantly ever since. Therefore, it is important for malls' management to understand the characteristics of their customers better in order to develop effective marketing strategies. Customer segmentation (STP) is a good and simple method that can be used to understand customer characteristics. The objective of this research is to create a customer segmentation model (STP) using the K-Means Clustering algorithm on Mall ABC customer profile data. This research utilizes Mall ABC's two hundred customer profile data which includes variables such as age, gender, income, and spending score. Data is analysed using the K-Means Clustering algorithm to divide customers into six groups. The persona of these six groups are average housewife, older housewife, successful working female, young male entrepreneur, average working class, and female supervisor. The most strategic target segment is female supervisor. This segment can be attracted by inviting more tenants that are suitable for their needs and wants such as mid-end cafes, restaurants, female clothing stores, and children apparel stores. Creating cross-merchant promotions and point redemption programs can also create better experience and increase customer loyalty. The results of this segmentation can be a reference for Mall ABC to develop a more targeted and effective marketing strategy. Malls can focus on offering products and services that suit the needs and characteristics of each customer segment.*

INTRODUCTION

In the rapidly changing retail market, understanding customer behaviours has become essential for businesses aiming to remain competitive and relevant, especially in the post-COVID-19 era. The pandemic fundamentally shifted consumer habits, preferences, and spending patterns, leading to a landscape where traditional marketing approaches no longer suffice. For

businesses, adapting to these shifts means finding ways to directly connect with diverse customer needs and preferences, rather than using a blanket approach. Mall ABC, aware of these changes, has committed to refining its marketing strategy to better cater to its broad and varied customer base. To do so, it focused on a technique called customer segmentation, which enables more targeted and effective marketing.

Customer segmentation is the process of dividing a broad customer base into smaller, distinct groups, each characterized by shared attributes and behaviours. For Mall ABC, this segmentation is crucial for crafting targeted marketing strategies that resonate with each unique segment, ultimately boosting customer satisfaction, engagement, and loyalty. Recognizing that no two customers are exactly alike, Mall ABC chose to focus on specific demographic and behavioural parameters: age, gender, income, and spending score. These factors not only provide insights into who the customers are but also help the mall understand their spending habits, preferences, and purchasing power. This approach offers Mall ABC the opportunity to customize its product offerings, promotions, and overall customer experience to better meet the needs of each segment.

To segment its customers effectively, Mall ABC employed the K-Means clustering model, a machine learning algorithm widely regarded for its simplicity and effectiveness in grouping similar data points. This model works by clustering data points (in this case, customer profiles) based on their proximity to a set of centroids, creating distinct clusters. Each of these clusters represents a customer segment with similar attributes, making it easier for Mall ABC to design marketing efforts that appeal directly to the characteristics of each group. By applying K-Means clustering, Mall ABC aimed to gain clear insights into its customer base, enabling it to structure its marketing strategies around the distinct needs and behaviours of each segment.

The parameters Mall ABC chose for its segmentation study—age, gender, income, and spending score—are crucial indicators of consumer behaviours. Age and gender offer basic demographic insights, which can reveal preferences and shopping habits. For instance, younger customers may lean toward trendier, tech-savvy products, while older individuals might prefer more traditional offerings. Gender can also shape product preferences and shopping habits, as men and women sometimes have distinct approaches to shopping and consumption.

Income serves as a key indicator of purchasing power, influencing the types of products customers are likely to consider. Higher-income customers, for example, may be drawn to premium or luxury items, while budget-conscious shoppers might prioritize value-driven purchases. Spending score, another critical parameter, reflects each customer's shopping activity at Mall ABC, assessing how frequently they visit and how much they typically spend. In this study, Mall ABC assigned a spending score out of 100 to each customer, based on their expenditure. By analyzing these four variables, Mall ABC aimed to build a comprehensive profile of its customer base, identifying distinct groups with shared characteristics and needs.

The results of the K-Means clustering analysis revealed several distinct customer segments, each with unique demographic and behaviorsal profiles. For example, one segment comprised young, high-spending customers who frequently visited the mall, suggesting a high level of brand loyalty and engagement. This group’s spending score and purchasing power positioned them as ideal targets for premium products, exclusive events, and loyalty rewards. Another segment included budget-conscious middle-aged shoppers, who tended to make fewer purchases but valued practical, cost-effective products. This group might respond well to promotions, discounts, and bundle deals, which align with their price-conscious approach to shopping.

Other segments identified by the analysis included casual visitors with lower spending scores, who visited the mall less frequently and made smaller purchases. While these customers might not currently be high spenders, they represent an opportunity for engagement. By offering personalized promotions or highlighting events and experiences, Mall ABC could work to increase the engagement and spending of this segment over time.

In addition to segment-specific insights, the clustering analysis showed Mall ABC which customer groups contributed the most to the mall's revenue. Identifying high-spending clusters allows Mall ABC to allocate resources toward these groups, ensuring that its marketing efforts prioritize the segments with the most financial potential. For instance, high-spending young adults might benefit from targeted communication around luxury brands, new product launches, or events that align with their preferences. Budget-conscious shoppers, meanwhile, could be engaged through loyalty programs or seasonal sales.

With these insights, Mall ABC is positioned to refine its marketing strategies to create a more personalized shopping experience across its customer segments. This data-driven approach is advantageous because it enables the mall to address each segment's specific preferences, leading to higher customer satisfaction and loyalty. High-spending customers, for example, might receive exclusive invitations to events, access to new product releases, or rewards that incentivize repeat visits. Budget-conscious shoppers, on the other hand, may appreciate promotions that emphasize value and affordability, helping them feel they are getting the most for their money.

Beyond marketing, Mall ABC's segmentation results offer opportunities for operational optimization. For example, knowing that high-spending customers frequently visit specific areas of the mall, Mall ABC could adjust store placement or tenant mix in those areas to cater to these shoppers. High-traffic zones could feature stores that appeal to younger, high-spending consumers, while quieter sections might offer shops that cater to older, budget-conscious customers. By organizing the mall layout around these insights, Mall ABC can enhance the shopping experience and create an environment that reflects the preferences of each segment.

This essay underscores the critical role of segmentation in today's retail market. However, effective segmentation requires a commitment to continuous analysis and adaptation. Mall ABC can strengthen its approach by incorporating additional data points, such as customer psychographics or geographic information, to gain a more nuanced view of its audience. Furthermore, integrating real-time data collection through mobile apps, loyalty programs, and social media can help Mall ABC monitor evolving customer preferences and update its segmentation model as needed.

Another recommendation is to combine the quantitative data from the K-Means model with qualitative insights from customer surveys or focus groups. This blended approach allows Mall ABC to capture the motivations and attitudes that influence customer behaviours, helping validate and enhance the accuracy of its segmentation efforts.

In conclusion, Mall ABC's use of K-Means clustering for customer segmentation illustrates the potential of data-driven insights to transform marketing strategies in the retail sector. By segmenting its customer base based on age, gender, income, and spending score, Mall ABC gained a clear understanding of its customer segments, enabling it to create targeted marketing campaigns that resonate with each group's unique preferences. These insights also guide operational adjustments, from store placement to tenant selection, allowing Mall ABC to cultivate a shopping environment that appeals to its diverse clientele. Through continuous analysis, adaptation, and a focus on customer-specific strategies, Mall ABC is well-prepared to create long-term loyalty and remain relevant in an ever-changing retail landscape.

METHODS

K-Means Clustering

K-means is unsupervised machine learning algorithm which is commonly used for clustering. Data (Object) will be divided into k set of groups using this technique based on the similarity of data points. This method is suitable for customer segmentation as it can handle large datasets and identify natural groupings within the data.

The term "k-means" was first used by James MacQueen in 1967, though the idea goes back to Hugo Steinhaus in 1956. The standard algorithm was first proposed by Stuart Lloyd of Bell Labs in 1957 as a technique for pulse-code modulation, although it was not published as a journal article until 1982. In 1965, Edward W. Forgy published essentially the same method, which is why it is sometimes referred to as the Lloyd–Forgy algorithm. By applying K-Means clustering to the customer data, Mall ABC seeks to get patterns and insights that can inform which marketing strategies are best-suited for its customers.

SPSS Statistics Software

SPSS Statistics is a statistical software suite developed by IBM for data management, advanced analytics, multivariate analysis, business intelligence, and others. SPSS is a widely used program for statistical analysis in social science. It is also used by market researchers, health researchers, survey companies, government, education researchers, industries, marketing organizations, data miners, and others. The original SPSS manual (Nie, Bent & Hull, 1970) has been described as one of "sociology's most influential books" for allowing ordinary researchers to do their own statistical analysis. In addition to statistical analysis, data management (case selection, file reshaping and creating derived data) and data documentation (a metadata dictionary is stored in the datafile) are features of the base software.

SPSS was released in its first version in 1968 as the Statistical Package for the Social Sciences (SPSS) after being developed by Norman H. Nie, Dale H. Bent, and C. Hadlai Hull. Early versions of SPSS Statistics were written in Fortran and designed for batch processing on mainframes, including for example IBM and ICL versions, originally using punched cards for data and program input.

In 1992, SPSS also developed the Windows version in conjunction with the popularity of Windows Operating System.

Research Workflow

Figure 1 below illustrates the main steps of this research.

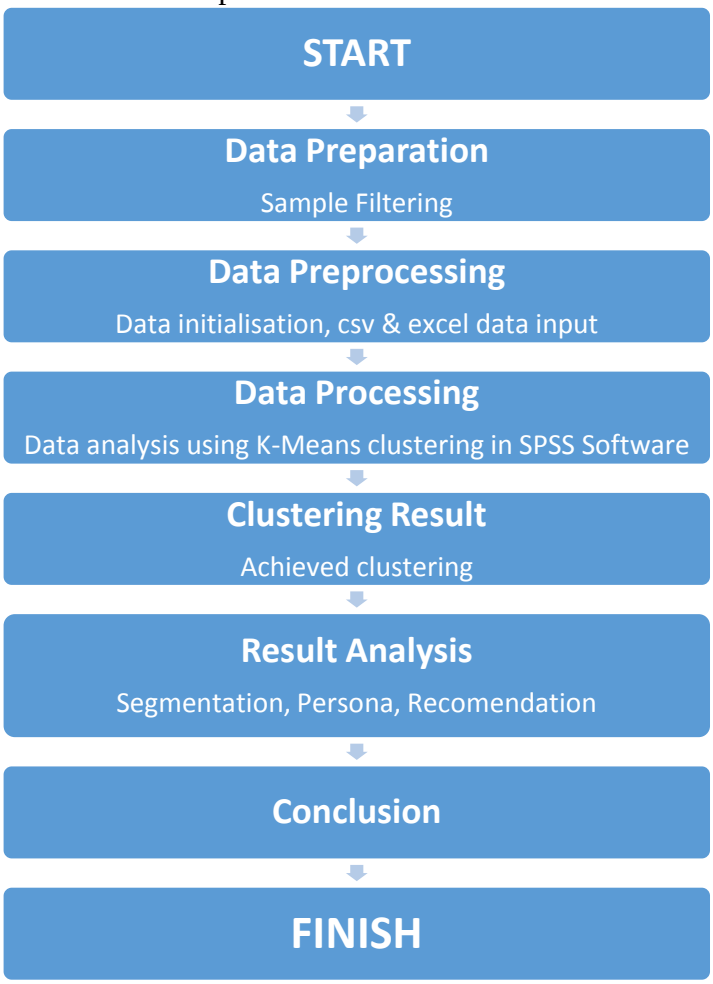
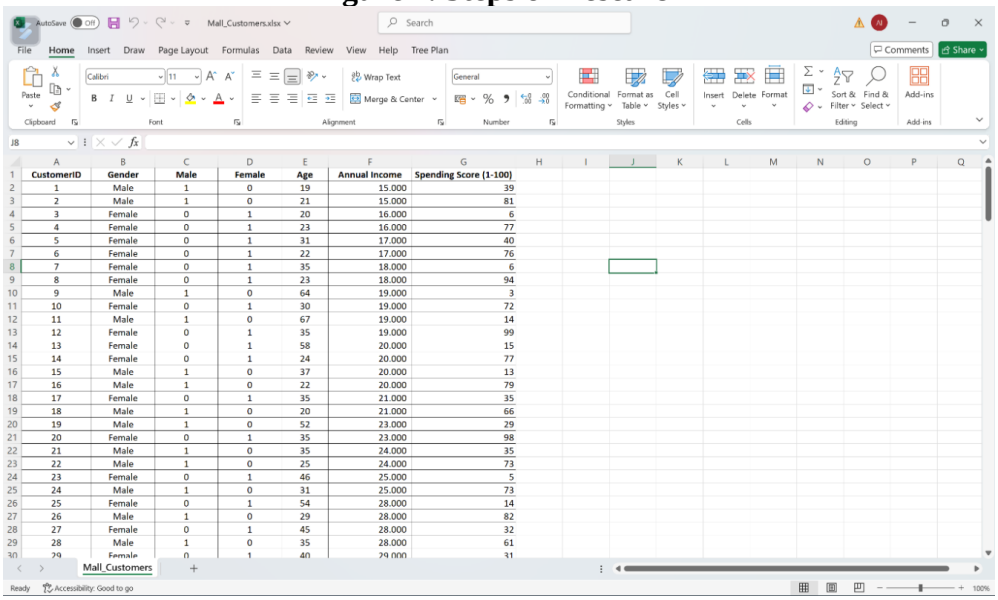


Figure 1. Steps of Research



CustomerID	Gender	Male	Female	Age	Annual Income	Spending Score (1-100)
1	Male	1	0	19	15.000	39
2	Male	1	0	21	15.000	81
3	Female	0	1	20	16.000	6
4	Female	0	1	23	16.000	77
5	Female	0	1	31	17.000	40
6	Female	0	1	22	17.000	76
7	Female	0	1	35	18.000	6
8	Female	0	1	23	18.000	94
9	Male	1	0	64	19.000	3
10	Female	0	1	30	19.000	72
11	Male	1	0	67	19.000	14
12	Female	0	1	35	19.000	99
13	Female	0	1	58	20.000	15
14	Female	0	1	24	20.000	77
15	Male	1	0	37	20.000	13
16	Male	1	0	22	20.000	79
17	Female	0	1	35	21.000	35
18	Male	1	0	20	21.000	66
19	Male	1	0	52	23.000	29
20	Female	0	1	35	23.000	98
21	Male	1	0	35	24.000	35
22	Male	1	0	25	24.000	73
23	Female	0	1	46	25.000	5
24	Male	1	0	31	25.000	73
25	Female	0	1	54	28.000	14
26	Male	1	0	29	28.000	82
27	Female	0	1	45	28.000	32
28	Male	1	0	35	28.000	61
29	Female	0	1	40	29.000	31

Figure 2. Excel Data which was converted from CSV file

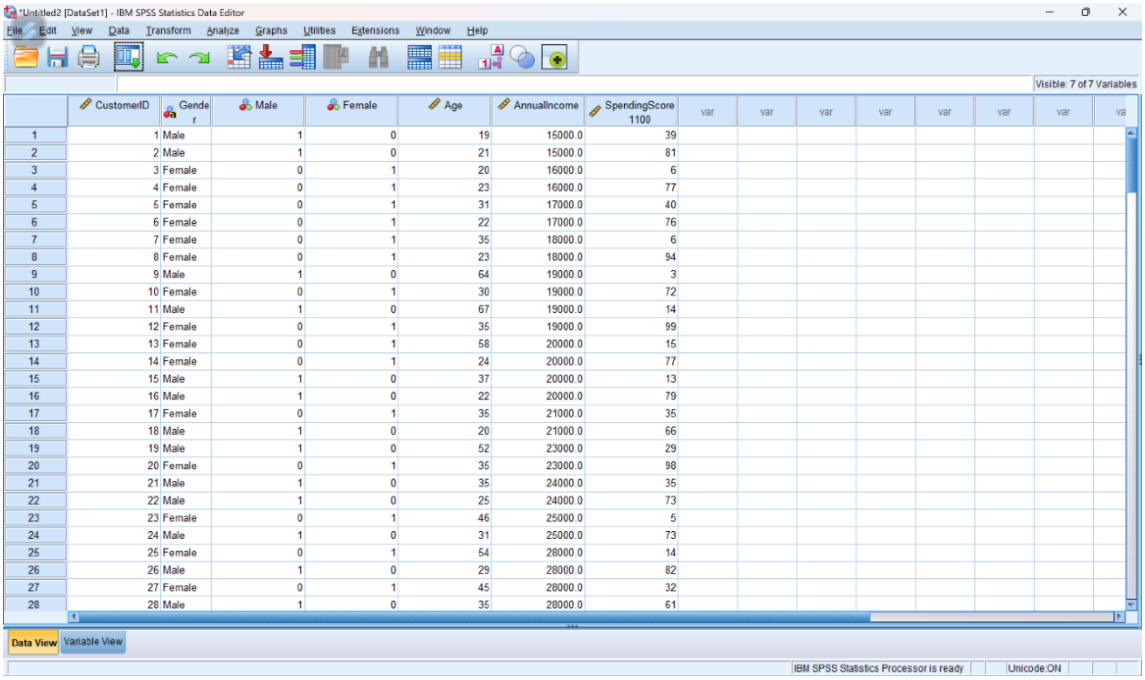


Figure 3. SPSS Data which was imported from excel data

RESULTS

By using K-Means clustering, this research looks into four parameters in Mall ABC's customer profile data. These parameters are age, gender, income, and spending score. Total population of this research is 200 participants.

With SPSS Software, we can see the final cluster centers and the number of members of each cluster. The results are shown in table 1 below. The customers had been divided into 6 different clusters based on above mentioned parameters.

	Cluster					
	1	2	3	4	5	6
Male	36%	46%	33%	100%	50%	36%
Female	64%	54%	67%	0%	50%	64%
Age	35,28	43,97	38,33	31,00	36,50	38,14
Annual Income	27.400,00	54.764,71	119.666,67	137.000,00	77.300,00	99.142,86
Spending Score (1-100)	49,48	50,01	49,33	50,50	50,35	53,36

Table 1. Final Cluster Centers

Cluster	1	50.000
	2	68.000
	3	6.000
	4	2.000
	5	60.000
	6	14.000
Valid		200.000
Missing		.000

Table 2. Number of Member of Each Cluster

Persona

Cluster 1. Average Housewife

Age : 35 years old
Annual Income : USD 27,400
Spending Score : 49 out of 100
Lifestyle :

- Has small children, busy taking care of them
- Very Active in social media
- The husband is probably still striving to have a good carrier
- Buy groceries and take her kids to play in the mall

Cluster 2. Older Housewife

Age : 44 years old
Annual Income : USD 54,765
Spending Score : 50 out of 100
Lifestyle :

- Has child/children in junior/high school, has more free time
- Quite active in social media
- The husband probably has a good and stable job
- Buy groceries, eat and hang out in the mall

Cluster 3. Successful Working Female

Age : 38 years old
Annual Income : ~USD 120,000
Spending Score : 49 out of 100
Lifestyle :

- Maybe married, maybe not
- Surely active in social media
- Have meetings and eat at the café in the mall

Cluster 4. Young Male Entrepreneur

Age : 31 years old
Annual Income : USD 137,000
Spending Score : 51 out of 100
Lifestyle :

- Most likely not married yet and still enjoying being single
- Surely active in social media
- Have meetings and eat at the expensive café in the mall

Cluster 5. Average Working Class

Age : 38 years old
Annual Income : USD 77,300
Spending Score : 50 out of 100
Lifestyle :

- Most likely married, maybe with child/children
- Surely active in social media
- Buy groceries and hang out a little in the mall

Cluster 6. Female Supervisor

Age : 38 years old
Annual Income : USD 99,143
Spending Score : 53 out of 100
Lifestyle :

- Maybe married with child/children
- Surely active in social media
- Hang out in the café in the mall

Based on the K-Means Segmentation results using SPSS Program, we can see that the cluster with most spending score is cluster six, female supervisor. Therefore, the Mall is recommended to focus the marketing strategy and offer value proposition to fit the needs and wants of this cluster.

To attract more people in cluster six, the mall can do following approaches:

- Invite more tenants that are suitable for the income and behaviours of cluster 6, such as:
    - Mid-end cafés and restaurants. More café and restaurant choices can attract more female supervisors to hang out and eat in the mall.
    - Mid-end female clothing stores. These stores can provide more options for female supervisors to shop.
    - Mid-end children apparel stores. These stores will add more value for female supervisors so they can buy apparels for their children.
- Create marketing campaign and promotions, such as:
    - Social media advertisement about the new tenants mentioned above. The mall can reach more female supervisors most likely through Instagram, Facebook, and LinkedIn.
    - Point redemption programs to retain customer loyalty.
    - Cross-merchant promotions. If the customers buy from a store, they can get vouchers or points to other stores. This promotion can trigger more sales in another stores.

These marketing approaches are expected to attract more female supervisors, enhance their shopping experience, and increasing their satisfaction, resulting not only in driving customer loyalty but also in contributing to the overall growth and success of Mall ABC in the competitive retail market.

CONCLUSION

This study effectively applied customer segmentation based on several factors namely age, gender, income, and spending score using K-Means analysis to define specific customer personas for Mall ABC. Through this segmentation method, six different customer groups were identified: average housewife, older housewife, successful working female, young male entrepreneur, average working class, and female supervisor. Among these six groups, the female supervisor segment emerged as the most strategic target for Mall ABC. To serve this segment's preferences, the mall could consider attracting more tenants that align with their needs, such as mid-tier cafes, restaurants, women's fashion stores, and children's apparel shops. Enhancing customer experiences through cross-merchant promotions and loyalty programs with point redemption options could further drive customer satisfaction and retention.

The K-Means segmentation model proves to be a significant and important information for Mall ABC, enabling a more data-driven approach to marketing. By using insights from the K-Means clustering analysis, the mall can refine its tenant mix and optimize product offerings, creating a more personalized shopping experience for its diverse customer base. This targeted strategy not only enhances marketing efficiency but also positions Mall ABC to improve customer satisfaction and loyalty, ultimately contributing to its competitive edge in the retail market.

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