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A Study on Customer Segmentation Using Machine Learning at TVS Sai Hemanth Motors, Srikalahasthi

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Abstract: In today's competitive market, understanding customer diversity is essential for tailoring marketing strategies and improving sales. This study focuses on customer segmentation at TVS Sai Hemanth Motors, Srikalahasthi, using K-Means clustering, a machine learning technique. The aim is to classify customers based on demographic and behavioral factors and identify meaningful patterns in purchasing and non-purchasing behavior. Data was collected from both buyers and non-buyers, and the Elbow Method was applied to determine the optimal number of segments. The analysis resulted in clearly defined clusters that revealed specific customer characteristics and preferences. This enables the dealer to make informed decisions regarding marketing strategies and customer relationship management. The study not only enhances understanding of customer profiles but also demonstrates the practical application of data-driven segmentation in a real-world context

Keywords: K-means analysis, Elbow method, Customer segmentation, Demographic variables

I. INTRODUCTION

Customer segmentation is a critical aspect of marketing strategy in today's competitive business environment. It involves dividing a heterogeneous customer base into smaller, more homogeneous groups based on shared characteristics, such as demographics, behavior, and preferences. The goal of customer segmentation is to enable businesses to target specific customer groups more effectively, thereby optimizing marketing efforts and improving customer satisfaction. In this context, businesses use various data analytics and machine learning techniques, such as K-Means clustering, to identify distinct customer segments and develop tailored strategies that enhance both customer acquisition and retention.

II. REVIEW OF LITERATURE

- 1) Priya and Sharma (2019) This research applied machine learning techniques for customer segmentation in the automobile industry. The study showed how clustering customers based on demographic and behavioral attributes helps improve lead conversion rates.
- 2) Naveen and Srivastava (2021) The authors examined how customer segmentation using unsupervised machine learning can help dealerships increase efficiency in customer targeting. They concluded that segmenting both buyers and non-buyers offered deeper insights.
- 3) Kavitha and Anil (2018) This paper discussed how data mining techniques, particularly clustering, can be used for strategic decision-making in automotive sales. The study highlighted that integrating behavioral variables enhances the accuracy of segments.
- 4) Rajesh and Meena (2022) The study utilized K-Means clustering to analyze consumer behavior in two-wheeler dealerships. It suggested that recognizing different clusters like price-sensitive, brand-conscious, and first-time buyers helps in tailoring product offerings and promotions.
- 5) Chatterjee and Das (2020) This research showed the application of clustering techniques on both demographic and behavioral data in order to differentiate between potential buyers and non-buyers in the vehicle sales industry.
- 6) Srinivas and Latha (2023) They applied Python-based machine learning algorithms, including K-Means, for customer segmentation in dealership data. Their work supports the use of elbow methods

A. Objectives of the study:

- 1) To classify customers into different segments based on demographic factors such as age, income level, and profession
- 2) To analyze the purchasing behavior of different customer segments and identify key patterns.
- 3) To evaluate the impact of demographics, financial status, and product preferences on customer segmentation.
- 4) To apply machine learning techniques (such as K-Means clustering) for automated and data-driven segmentation

B. Need for the study:

The increasing competition in the two-wheeler market demands a deeper understanding of customer behavior to retain and attract buyers. The market needs to take necessary steps to identify distinct customer groups and address their specific needs effectively. Customers exhibit diverse preferences and behaviors, which influence their decision to buy or not buy from a shop. The growing competition forces much more attention on understanding these differences to improve sales strategies. Customer segmentation helps the business by enabling targeted marketing and optimizing resource allocation for future growth. This study, based on the segmentation of buyers and non-buyers using K-means clustering, is quite essential for the TVS Sai Hemanth Motors to thrive in the present-day competitive market.

C. Scope of the study:

The increasing competition in the two-wheeler market demands a deeper understanding of customer behavior to retain and attract buyers. The market needs to take necessary steps to identify distinct customer groups and address their specific needs effectively. Customers exhibit diverse preferences and behaviors, which influence their decision to buy or not buy from a shop. The growing competition forces much more attention on understanding these differences to improve sales strategies. Customer segmentation helps the business by enabling targeted marketing and optimizing resource allocation for future growth. This study, based on the segmentation of buyers and non-buyers using K-means clustering, is quite essential for the TVS Sai Hemanth Motors to thrive in the present-day competitive market.

III. RESEARCH METHODOLOGY

A. Research Design:

Exploratory Research

B. Data Collection:

Data were collected from 100 customers (50 buyers and 50 non-buyers) at TVS Sai Hemanth Motors in Srikalahasthi between March 30 and April 12, 2025. Primary data were gathered through surveys, interviews, and feedback forms, capturing demographic details (age, gender, income, occupation, marital status) and preferences (style, speed, mileage, price, features, EMI, location, referrals, test rides). Secondary data were sourced from the dealership's sales records, CRM system, and historical transaction data spanning the past 2-3 years. A convenience sampling technique was used due to the accessibility and willingness of customers to participate.

C. Data Analysis Tools:

Following are the different tools used for analyzing the data

Data analytical tools for clustering

- python
- Matplotlib library (used for scatter plots, line graphs)

D. Limitations of The Study:

- 1) The study is based on only 50 buyers and 50 non-buyers, which may not fully represent all types of customers visiting the dealership.
- 2) The segmentation is based only on demographic data. Behavioural, transactional, or service-related data were not included, which could provide deeper insights.
- 3) The study uses static data collected at one point in time. Customer behaviour and preferences may change over time.
- 4) The findings are specific to one TVS Sai Hemanth Motors located in Srikalahasthi and may not be applicable to other regions with different customer demographics

- 5) The study doesn't include how buyers behave after the purchase (like service visits, satisfaction), which is crucial for long-term segmentation.

IV. DATA ANALYSIS & INTERPRETATION

A. Determining the Optimal Number of Clusters – Elbow Method

To perform effective customer segmentation using K-Means clustering, it is essential to determine the optimal number of clusters (K). The Elbow Method was used for this purpose. This technique involves plotting the Within-Cluster Sum of Squares (WCSS) against a range of K values

B. Use of Python for Efficient Clustering and Visualization:

Performing K-Means clustering and related computations manually is not only time-consuming but also prone to errors, especially when dealing with multiple variables and larger datasets. To overcome these limitations, Python programming was utilized in this project.

C. Buyers Distribution Across Clusters:

After applying K-Means clustering, the customers were segmented into distinct groups based on their demographic characteristics and preferences. Out of 100 total respondents (50 buyers and 50 non-buyers), the distribution across

PYTHON CODE FOR CUSTOMER SEGMENTATION USING K-MEANS:

```
from sklearn.preprocessing import LabelEncoder, StandardScaler
from sklearn.cluster import KMeans

# Encode categorical features
df_encoded = df.copy()
label_encoders = {}
for col in df.columns[1:]:
    le = LabelEncoder()
    df_encoded[col] = le.fit_transform(df[col])
    label_encoders[col] = le

# Standardize the data
scaler = StandardScaler()
X_scaled = scaler.fit_transform(df_encoded.drop(columns=['sl no']))

# Apply KMeans
kmeans = KMeans(n_clusters=3, random_state=42, n_init=10)
df_encoded['Cluster'] = kmeans.fit_predict(X_scaled)

# Analyze clusters
cluster_summary = df_encoded.groupby('Cluster').mean().round(2)
print(cluster_summary)
```

Table 1. Clustersolutionsforthebuyer'sdata

Feature	Cluster0	Cluster1	Cluster2
Age	1.0(18-25)	2.5(26-35)	3.8(45+)
Gender	0.6	0.55	0.65
Qualification	1.2	2.1	3
Occupation	1.5	2.3	1
MaritalStatus	0.3	0.8	4
Annual Income	1.2	2.8	0.6
Style	0.5	0.7	0.4
Speed	0.3	0.6	0.5
Mileage	0.8	0.5	0.5
Price	0.6	0.7	0.7
Features	0.4	0.6	0.3
EMI	0.9	0.6	0.6
Location	0.7	0.5	0
Referral	0.82	0.6	0.4
TestRide	0.7	0.6	0.4

Table 2. InterpretationofFinalClusterCenters

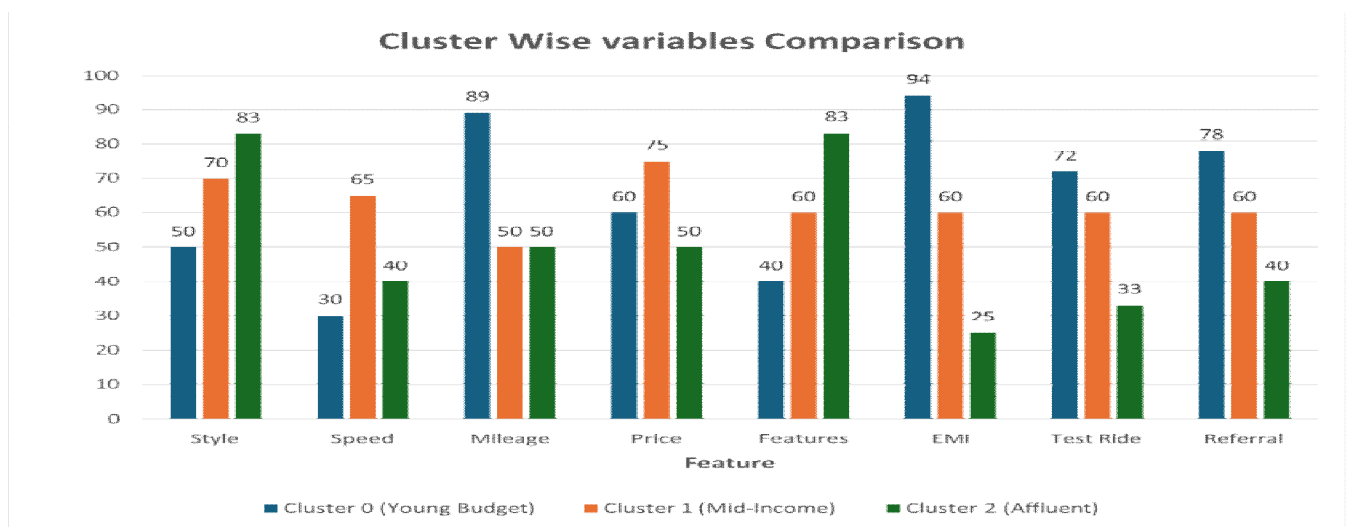
Variable	Cluster0	Cluster1	Cluster2
Age	18-25Age group	Mostly26-35	mostly45+
Gender	60% aremale	Balancedgender	65% aremale
Qualification	MostlyUG students	MixofUG/PG job holders	Predominantly PG/PhD
Occupation	Students,entry- level job holders	Jobholders,self-employed	Business owners,senior professionals
MaritalStatus	Mostly unmarried (70%)	Mostlymarried (80%)	100% married
AnnualIncome	₹0–2.5L	₹2.5–10L	₹10L+
Style	Moderate interest(50%)	Highinterest (70%)	Stronginterest (83%)
Speed	Lowpriority (30%)	Highpriority (65%)	Moderate priority(40%)
Mileage	Critical(89%)	Moderate importance (50%)	Lowpriority (50%)
Price	Veryhigh(94% EMI users)	Moderate(60% EMI users)	Low(25% EMI users)

Features	Some interest in features	Want more features	Low priority (30%)
EMI	Strong EMI preference	EMI interest is moderate	EMI interest is low
Location	61% Local, 39% Non-local	60% Local, 40% Non-local	58% Local, 42% Non-local
Referral	Highly influenced by referral	Moderate (60%)	Low (40%)
Test Ride	High (72%)	Moderate (60%)	Low (33%)

- Cluster 0: Representing young price-conscious buyers (36%), shows a strong preference for mileage (89%) and EMI (94%), reflecting their focus on affordability and fuel efficiency as unmarried students or entry-level job holders aged 18-25 with low income (₹0-2.5L). This cluster also values referrals (78%), indicating trust in peer recommendations, but places less emphasis on style (50%) and speed (30%).
- Cluster 1: Representing the mid-income balanced buyers (40%), aged 26-35 with moderate income (₹2.5- 10L), demonstrates a more balanced preference profile, prioritizing price (75%), style (70%), and speed (65%), while showing moderate reliance on EMI (60%) and test rides (60%), suggesting a practical yet aspirational approach to purchasing.
- Cluster 2: Representing the affluent feature-seeking buyers (24%), aged 36-45+ with high income (₹10L+), exhibits a clear preference for style (83%) and features (83%), with minimal reliance on EMI (25%) or test rides (33%), highlighting their focus on premium offerings and brand image over financing options.

Table 3. Clustered Data Set

Number of buyers in each cluster			
CLUSTER	NO OF BUYERS	PERCENTAGE	Assigning buyers of to clusters
0	18	36%	1,2,3,13,17,19,25,25,33,40,41,48,50
1	20	40%	4,5,7,8,9,10,11,12,14,15,16,20,21,22,24,26,29,32,35,44
2	12	24%	6,18,23,27,30,31,34,37,38,38,42,43,47



Interpretation: The bar graph illustrating cluster-wise preferences at TVS Sai Hemanth Motors delineates distinct behavioral

patterns across three customer segments for both buyers and non-buyers, offering valuable insights for targeted marketing. Among buyers, Cluster 0, young price-conscious buyers (36%), aged 18-25 with incomes of ₹0-2.5L, prioritizes mileage (89%) and EMI (94%), reflecting their focus on fuel efficiency and affordable financing, while also valuing referrals (78%) but showing limited interest in style (50%) and speed (30%). Cluster 1, mid-income balanced buyers (40%), aged 26-35 with incomes of ₹2.5-10L, demonstrates balanced preferences for price (75%), style (70%), and speed (65%), with moderate engagement in EMI (60%) and test rides (60%), indicating a pragmatic yet aspirational purchasing approach. Cluster 2, affluent feature-seeking buyers (24%), aged 36-45+ with incomes exceeding ₹10L, emphasizes style (83%) and features (83%), with minimal reliance on EMI (25%) or test rides (33%), highlighting a preference for premium offerings. For non-buyers, Cluster 0, young price-conscious non-buyers (32%), aged 18-25 with incomes of ₹0-2.5L, mirrors its buyer counterpart by prioritizing mileage (80%), EMI, and referrals (85%), with strong interest in test rides (70%), suggesting potential for conversion with enhanced trust-building measures. Cluster 1, mid-income uncertain non-buyers (44%), aged 26-35 with incomes of ₹2.5-6L, shows moderate interest in style (59%), speed (52%), and features (51%), but lower engagement in test rides (45%) and referrals (50%), indicating uncertainty in the buying process. Lastly, Cluster 2, affluent indifferent non-buyers (24%), aged 36-45+ with incomes of ₹6L-10L+, prioritizes style (72%) but exhibits low engagement with features (25%), test rides (20%), and referrals (30%), reflecting disinterest or unmet expectations. This graph underscores the varying engagement levels across segments, informing tailored strategies to address customer needs effectively.

D. Non-Buyers Distribution Across Clusters:

After applying K-Means clustering, the customers were segmented into distinct groups based on their demographic characteristics and preferences. Out of 100 total respondents (50 buyers and 50 non-buyers), the distribution across

Table 4. Clusters solutions for the non-buyers

Feature	Cluster 0	Cluster 1	Cluster 2
Age	0.25	1.8	2.75
Gender	0.9	0.85	1
Qualification	1.2	1.75	2.5
Occupation	0.6	2.1	3
Marital Sta	0.3	0.9	1
Annual Inc	0.45	1.6	2.8
Style	0.4	0.7	0.85
Speed	0.3	0.65	0.45
Mileage	0.8	0.5	0.4
Price	0.75	0.6	0.25
Features	0.35	55	0.2
Location	0.6	0.55	0.4
Referral	0.85	0.5	0.3
Test Ride	0.7	0.45	0.25

Table2. Interpretation of Final Cluster Centers

Variable	Cluster0–Budget-Conscious	Cluster1–Mid-Tier	Cluster2–Affluent
Age	18–25 Age group	Mostly 26–35	Mostly 45+
Gender	90% are male	85% are male	100% male
Qualification	Mostly UG students	Mix of UG/PG jobholders	Predominantly PG/PhD
Occupation	Students, entry-level jobholders	Self-employed, business professionals	Business owners, senior professionals
Marital Status	Mostly unmarried (70%)	Mostly married (90%)	All married
Annual Income	₹0–2.5L	₹2.5–6L	₹6L–10L+
Style	Low to moderate interest (40%)	Moderate interest (70%)	High interest (85%)
Speed	Low priority (30%)	Moderate priority (65%)	Low to moderate (45%)
Mileage	Critical factor (80%)	Moderate importance (50%)	Low priority (40%)
Price	Very price-sensitive (75%)	Moderate price concern (60%)	Low sensitivity (25%)
Features	Some interest (35%)	Moderate interest (55%)	Low interest (20%)

Location	Mostly local customers (60%)	Local (55%)	40% are non-local
Referral	High influence of referrals (85%)	Moderate influence (50%)	Low influence (30%)
Test Ride	High interest in test rides (70%)	Moderate interest (45%)	Low interest (25%)
EMI	Strong EMI preference	EMI interest is moderate	EMI interest is low

- Cluster 0: Representing young price-conscious non-buyers, constitutes 32% of the non-buyer base, reflecting a significant group of younger individuals aged 18-25 with low incomes (₹0-2.5L), who prioritize affordability factors like mileage (80%) and EMI, yet remain unconverted, possibly due to trust or pricing barriers.
- Cluster 1: Representing mid-income uncertain non-buyers, emerges as the largest segment at 44%, indicating that nearly half of the non-buyer population consists of individuals aged 26-35 with moderate incomes (₹2.5-6L), who exhibit uncertainty in the buying process, as evidenced by their moderate engagement with style (59%), speed (52%), and test rides (45%).
- Cluster 2: Representing affluent indifferent non-buyers, accounts for the smallest share at 24%, mirroring the proportion of affluent buyers, but these high-income individuals aged 36-45+ (₹6L-10L+) show disinterest through low engagement with features (25%) and test rides (20%), suggesting unmet expectations or lack of motivation to purchase.

Table3. Clustered Data Set

Cluster	NonBuyerCount	Percentage	Assigned non buyer to clusters
0	16	32%	1,3,6,10,13,15,16,17,19,24,25,28,33,39,41,45

1	22	44%	2,4,5,7,8,9,11,12,14,20,21,22,23,26,29,30,31,32,34,35,40,46
2	12	24%	18,27,36,37,38,42,43,44,47,48,49,50

V. FINDINGS

The Elbow Method confirmed that $K=3$ is optimal for both buyers and non-buyers, enabling meaningful segmentation into three distinct customer types in each group

1) Buyer Segmentation:

- Cluster 0: Young, low-income individuals focused on price and mileage.
- Cluster 1: Mid-income professionals who balance cost, style, and EMI options.
- Cluster 2: High-income buyers highly influenced by features, style, and test rides.

2) Nonbuyer Segmentation:

- Cluster 0: Students or young individuals exploring options with low intent.
- Cluster 1: Moderately interested individuals who might buy with the right offers.
- Cluster 2: Uninterested group, mainly older individuals with low engagement.

3) Comparison:

- Buyers are more engaged with features, EMI & test rides
- Non buyers lacked motivation due to income limitations and awareness

VI. SUGGESTIONS

- 1) Offer Deals to Cluster 0 Non-Buyers: These people care about EMI and mileage. Give them low EMI and fuel-efficient options to encourage buying.
- 2) Support Cluster 1 Non-Buyers: They're unsure. Let them try test rides and explain features clearly to build confidence.
- 3) Attract Cluster 2 Non-Buyers: They have money but low interest. Show premium features or special deals to catch their attention.
- 4) Use Referrals & Test Rides: Encourage word-of-mouth and offer test rides to increase customer interest.
- 5) Send Right Offers to Right Groups: Use cluster data to match offers with the right people for better results.

VII. CONCLUSION

K-Means clustering algorithm is successfully applied to segment both buyers and non-buyers based on demographic and behavioral variables. The analysis revealed clear patterns in customer preferences and highlighted key differences between similar customer groups who did and did not make a purchase. These insights help the dealers understand their customers better and craft targeted strategies for each segment. By bridging the gap between buyers and non-buyers through focused offers and engagement, the dealership can increase conversions and optimize its marketing efforts. Overall, this study demonstrates the practical value of machine learning in solving real-world business problems

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