

# Capstone Project Report: Dynamic Customer Segmentation

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## 1. Executive Summary (The "Elevator Pitch")

This project is an intelligent customer segmentation tool. Instead of treating all customers the same, it uses machine learning to analyze their transaction history and automatically group them into distinct behavioral segments. By understanding these groups, a business can create targeted marketing strategies to increase loyalty, prevent customer churn, and boost revenue. The application also forecasts the future spending of each group, allowing for proactive business planning.

## 2. Analysis of Customer Segments

The core of this project is the identification and analysis of four distinct customer segments based on their transaction history throughout 2017.

### A. Visualizing Spending Behavior

The line chart below plots the average monthly spend for a customer in each of the four identified clusters. Each colored line represents a different segment, revealing their unique purchasing patterns.

- **Cluster 1 (Green Line): The High-Value Champions.** This group is our most valuable segment. Their spending is consistently the highest, often peaking at nearly \$1,500 per month on average. They are the financial engine of the business.
- **Cluster 2 (Red Line): The Consistent Spenders.** This is our largest and most stable group of customers. They spend a moderate and consistent amount, typically between \$500 and \$750 per month, forming the reliable backbone of the customer base.
- **Cluster 0 & 3 (Blue & Purple Lines): Low Spenders / Occasional Buyers.** These two groups represent our lower-value segments. Their spending is consistently the lowest, rarely exceeding \$500. There is a clear opportunity to understand their needs better and encourage more frequent buying.

### B. Defining Cluster Characteristics

The summary table below explains *why* the clusters behave differently. It shows the average LRFM (Length, Recency, Frequency, Monetary) values that define each group.

cluster	length	recency	frequency	monetary	customer_
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	(days)	(days)	(purchases )	(\$)	count
0	150.2	120.5	2.1	350.7	850
1	310.8	35.1	11.5	1450.2	450
2	280.5	40.2	6.8	720.9	1250
3	90.1	180.3	1.5	150.3	940

- **Length:** How long has the customer been with us? (Higher is better)
- **Recency:** How long since their last purchase? (Lower is better)
- **Frequency:** How often do they buy? (Higher is better)
- **Monetary:** How much do they spend? (Higher is better)

### 3. Customer Personas & Strategic Recommendations

Translating data into strategy is key. Based on the analysis, we have defined four customer personas and recommended a specific business action for each.

#### Persona 1: "Loyal Champions" (Cluster 1)

- **Profile:** Our best 450 customers. They have been with us the longest (high length), buy very frequently (high frequency), spend the most (high monetary), and have purchased recently (low recency).
- **Recommended Action: Retain & Reward.**
  - Launch a VIP rewards program.
  - Offer exclusive early access to new products.
  - Provide personalized, high-touch customer service.

#### Persona 2: "Steady Supporters" (Cluster 2)

- **Profile:** Our largest group (1250 customers). They are loyal and purchase regularly, but their average spend is moderate. They are the stable foundation of our business.
- **Recommended Action: Grow & Upsell.**
  - Create targeted promotions to upsell them to more premium products.
  - Offer product bundles to increase their average transaction value.
  - Market related product categories to them.

#### Persona 3: "At-Risk Sleepers" (Cluster 3)

- **Profile:** A group of 940 customers who are a major concern. Their recency is very high, meaning it has been a long time since they last bought anything. They are in danger of churning.
- **Recommended Action: Re-engage Immediately.**

- Launch a "We Miss You!" email or text campaign.
- Provide a compelling, time-limited discount to win them back.
- Conduct surveys to understand why they stopped purchasing.

## Persona 4: "New Potentials" (Cluster 0)

- **Profile:** These 850 customers are either relatively new (low length) or only buy infrequently and spend little. They represent an opportunity for growth.
- **Recommended Action: Nurture & Develop.**
  - Create a welcome email series for new customers.
  - Offer a special discount on their second or third purchase.
  - Send targeted content that showcases the value and range of our products.

## 4. Forecasting Future Value

The final step is to predict the future spending trends for each customer segment over the next 6 months.

### Explanation of the Forecast Charts

- **Black Dots:** The actual, historical spending data points.
- **Dark Blue Line:** The model's prediction for future spending.
- **Light Blue Area:** The "uncertainty interval," representing the most likely range for future spending. A wider band means more uncertainty.

### Business Value

This forecast allows the business to be proactive rather than reactive. For example, if we see a predicted dip in spending for our "Loyal Champions," we can launch a marketing campaign *before* that happens to keep engagement high. This is invaluable for managing inventory, setting realistic sales targets, and planning marketing budgets effectively.