Customer Acquisition Cost Analysis Report

Ayush Sonekar

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1 Introduction

This report presents a detailed analysis of Customer Acquisition Cost (CAC) across various marketing channels. The primary objectives are to calculate key metrics such as CAC, conversion rates, and break-even customers, and to visualize these metrics to evaluate the efficiency and effectiveness of different marketing strategies. This project utilizes Python, Pandas, and Plotly to process the data and generate interactive visualizations, demonstrating skills in data analysis, metric computation, and data visualization.

2 Data and Methodology

2.1 Dataset

The analysis is based on the dataset customer_acquisition_cost_dataset.csv, which comprises 500 entries representing marketing campaigns. The key columns include:

- Customer_ID: Unique identifier for each customer.
- Marketing_Channel: The channel used (Email Marketing, Online Ads, Social Media, Referral).
- Marketing_Spend: The expenditure on each campaign (in dollars).
- New_Customers: The number of new customers acquired.

A preview of the dataset shows varied spending and customer acquisition across channels, with no missing values.

2.2 Methodology

The analysis was implemented in Python using Pandas for data manipulation and Plotly for visualization. The steps are as follows:

1. Data Loading and Inspection: Load the CSV file, display a preview (data.head()), and dataset information (data.info()).
2. Metric Calculation:
    - CAC = Marketing_Spend / New_Customers
    - Conversion Rate = (New_Customers / Marketing_Spend)×100.
    - Break-Even Customers = Marketing_Spend / CAC (which simplifies to New_Customers, but used for comparison).
3. Summary Statistics: Grouped descriptive statistics for CAC by marketing channel.
4. Visualization: Generate four interactive Plotly charts, saved as HTML files:
    - Bar chart: CAC by marketing channel.
    - Bar chart: Conversion rates by marketing channel.
    - Scatter plot: New customers vs. CAC with OLS trendline.
    - Grouped bar chart: Actual vs. break-even customers.

The code is modular, with dedicated functions for each step, ensuring reusability.

3 Results and Analysis

3.1 Dataset Overview

The dataset contains 500 records with four columns: Customer_ID (object), Marketing_Channel (object), Marketing_Spend (float64), and New_Customers (int64). Memory usage is approximately 15.8 KB, with no null values.

3.2 Summary Statistics

The CAC summary statistics by marketing channel are presented in Table 1.

Marketing Channel	Count	Mean	Std	Min	25%	50%	75%	Max
Email Marketing	124	132.91	89.60	23.49	68.23	106.94	177.44	434.38
Online Ads	130	122.14	79.54	24.78	62.21	97.74	163.47	386.75
Referral	128	119.89	74.10	22.01	71.35	99.84	137.58	366.53
Social Media	118	126.18	77.50	21.62	75.63	102.62	167.35	435.49

Table 1: CAC Summary Statistics by Marketing Channel (values rounded to two decimals).

Key insights: - Referral has the lowest mean CAC (119.89), indicating it is the most cost-efficient channel on average. - Email Marketing has the highest mean CAC (132.91) and the widest variability (std 89.60).
- All channels show a broad range in CAC, suggesting campaign-specific factors influence costs.

3.3 Visualizations

The following visualizations provide graphical insights:

1. CAC by Marketing Channel (Bar Chart): Displays average CAC for each channel. Referral shows thelowest bar, while Email Marketing has the highest, aligning with summary statistics.

2. Conversion Rates by Marketing Channel (Bar Chart): Shows conversion rates ranging from approximately 0.2% to 4.6% across channels. Higher rates indicate better efficiency in converting spend to customers.

3. New Customers vs. CAC (Scatter Plot with Trendline): Points are colored by channel, revealing ageneral negative trend (higher customers often correlate with lower CAC). The OLS trendline confirms economies of scale in acquisition.

4. Actual vs. Break-Even Customers (Grouped Bar Chart): Compares acquired customers (blue) tobreak-even points (red) per channel. Most channels exceed break-even, indicating profitability, but variations highlight optimization opportunities.

These visualizations are interactive and saved as HTML files for detailed exploration.

4 Conclusion

This analysis reveals that Referral is the most cost-effective marketing channel with the lowest average CAC, followed closely by Online Ads. Email Marketing, while effective in volume, incurs higher costs and variability, suggesting a need for targeted improvements. The visualizations underscore the importance of balancing spend with acquisition efficiency. Overall, the project highlights data-driven strategies to optimize marketing budgets

and improve ROI. Future work could incorporate additional metrics like customer lifetime value for a more holistic view.

5 Technical Details

The full code is available on Git hub repository.

GitHub Repository: https://github.com/Ayush-Sonekar/customer-acquisition-cost-analysis