

Adtech Performance Analysis Report

Disclaimers

- This analysis was conducted on a sample adtech dataset found on the internet and a Looker Studio screenshot.
- Conversions were generated synthetically at 8% of clicks.

Executive Summary

Click-through rates (CTR) are strong across several segments, often exceeding 60%. However, the overall conversion rate is low, approximately 5.31%:

$$\text{Conversion Rate} = \frac{531}{531 + 9469} \approx 5.31\%$$

Entertainment and Shopping contexts show the highest performance. Desktop devices and bottom ad placements yield the highest CTR. Engagement is strongest among users aged 35–44. Browsing history features dominate model importance, and XGBoost offers a strong balance of performance and interpretability.

Methodology and Data Notes

- Scope includes funnel charts, CTR distributions, age demographics, device and placement metrics, and model results.
- Conversions were synthetically generated at 8% of clicks.
- Device-level conversion counts from Looker Studio were partially obscured.

Exploratory Data Analysis

Age Distributions

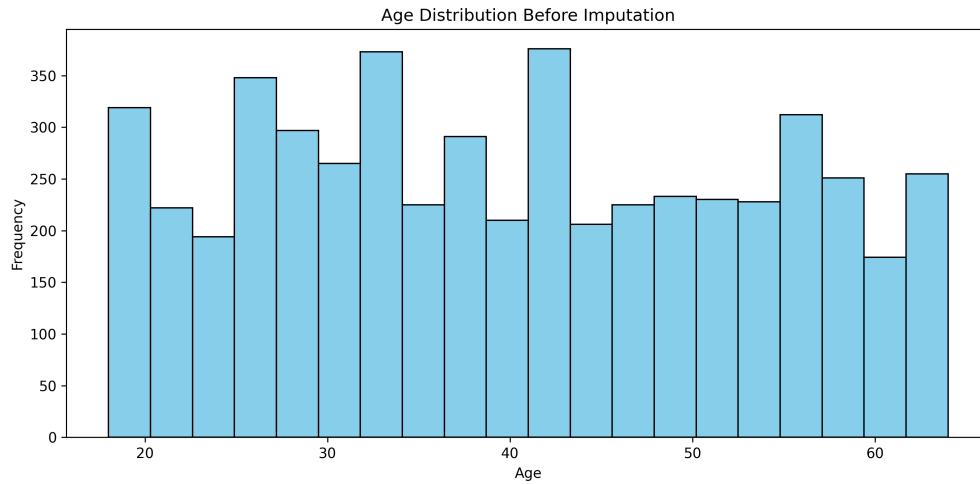


Figure 1: Age Distribution Before Imputation

Interpretation: Ages span 18–65 with uneven frequencies, indicating missing values and incomplete coverage.

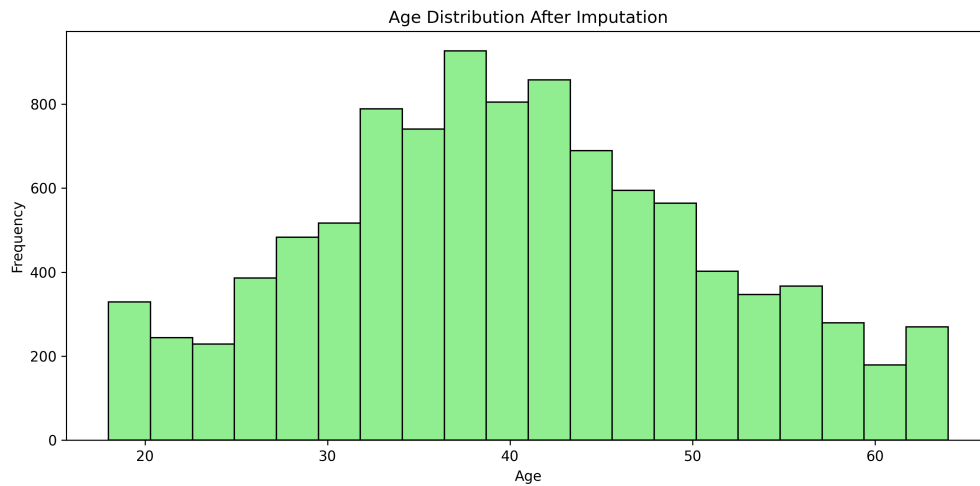


Figure 2: Age Distribution After Imputation

Interpretation: After imputation, the distribution is bell-shaped, peaking near 40, showing smoother coverage and filled gaps.

Age by Time of Day

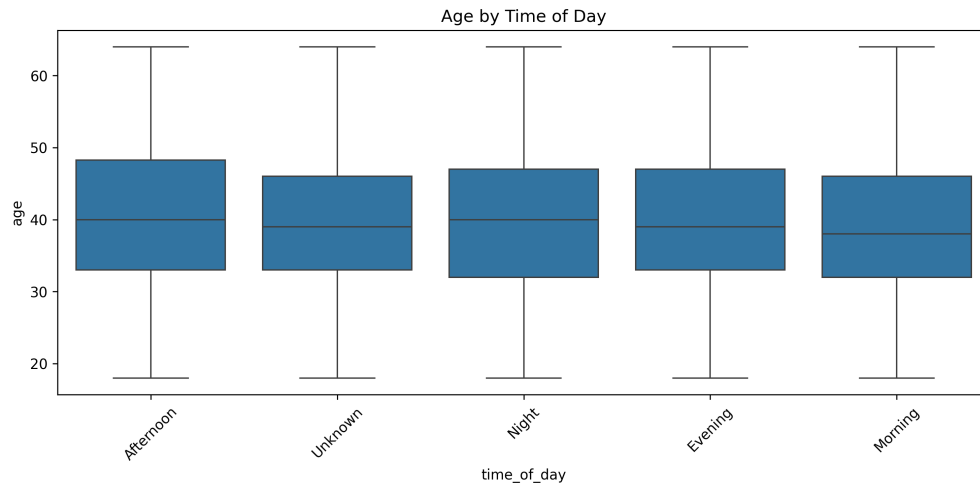


Figure 3: Age Distribution by Time of Day

Interpretation: Median ages are consistent across Morning, Afternoon, Evening, and Night, suggesting no strong age skew by time.

Clicks by Age Group

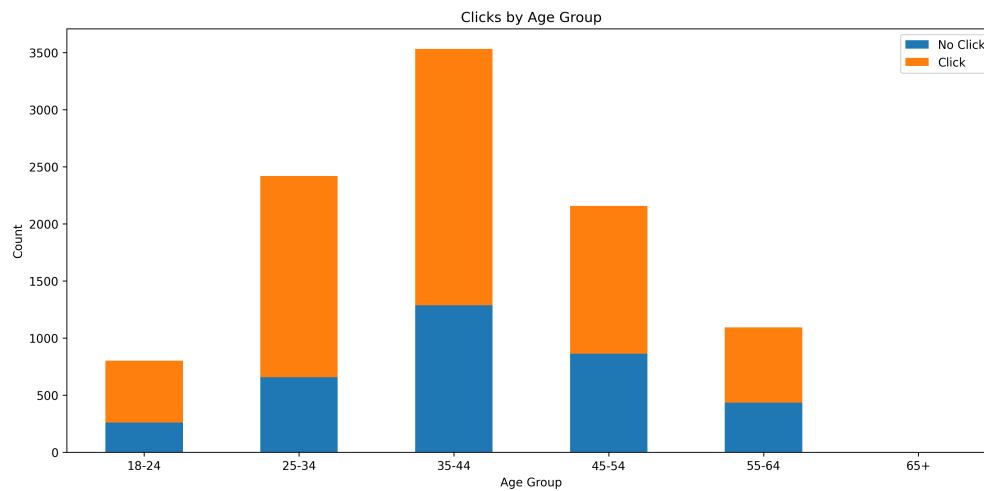


Figure 4: Clicks by Age Group

Interpretation: Engagement peaks in ages 35–44, followed by 25–34 and 45–54. Younger (18–24) and older (65+) groups underperform.

Engagement and Conversion

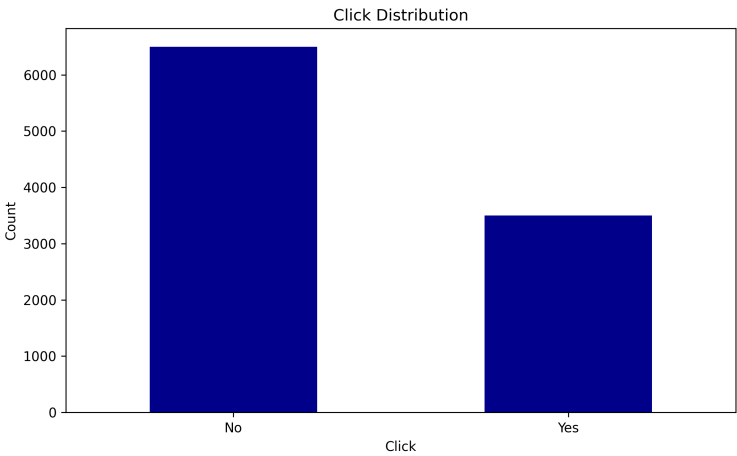


Figure 5: Click Distribution (No/Yes)

Interpretation: CTR is about 40%, showing moderate engagement in this slice.

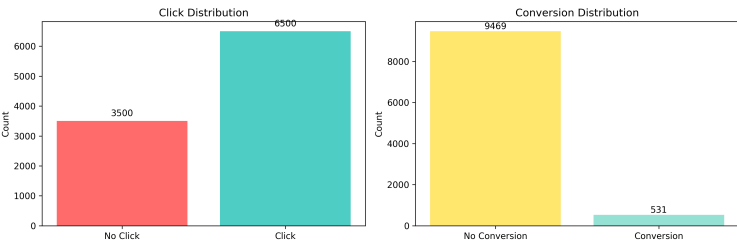


Figure 6: Conversion Distribution

Interpretation: Overall conversion rate is low at 5.31%, indicating post-click friction.

Category	Impressions	Clicks	Conversions	CTR (%)	CVR (%)	CPI (%)
Shopping	984	625	423	63.5	67.7	43.0
Unknown	4782	1064	586	22.3	55.1	12.3
Education	1029	646	405	62.8	62.7	39.3
Entertainment	1175	800	487	68.1	60.9	41.5
Social Media	1154	670	391	58.1	58.4	33.9
News	976	577	370	59.1	64.1	37.9

Table 1: Conversion Funnel Metrics by Browsing History

Interpretation: Entertainment and Shopping lead in CPI and CTR. Unknown has high volume but low efficiency, suggesting poor categorization or low intent.

Browsing Category	Click Share (%)
Unknown	45+
Entertainment	10
Shopping	10
Social Media	10
Education	10
News	10

Table 2: Browsing History Click Share

Interpretation: The Unknown category dominates click share, which may reflect uncategorized traffic or tagging gaps.

Device and Placement Performance

Impressions and CTR by Device

Device	Impressions Share (%)	CTR (%)
Desktop	34.4	66.41
Mobile	33.1	63.34
Tablet	32.5	64.81

Table 3: Impressions and CTR by Device

Interpretation: Impressions are evenly distributed; Desktop leads CTR, suggesting efficiency gains with slight budget tilt.

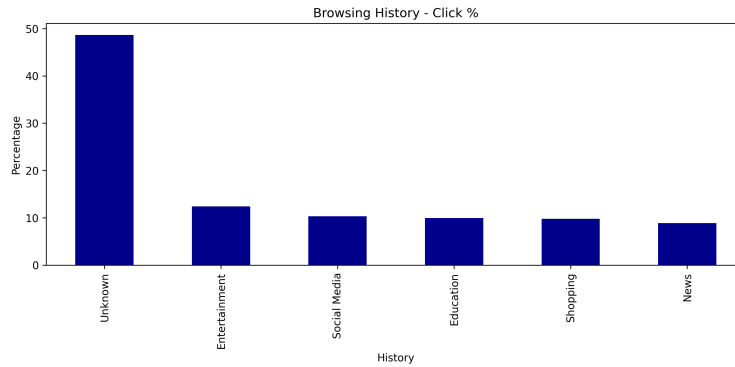


Figure 7: Click-Through Rate by Ad Position

Interpretation: Bottom placements outperform top and side, counterintuitive but consistent in this dataset.

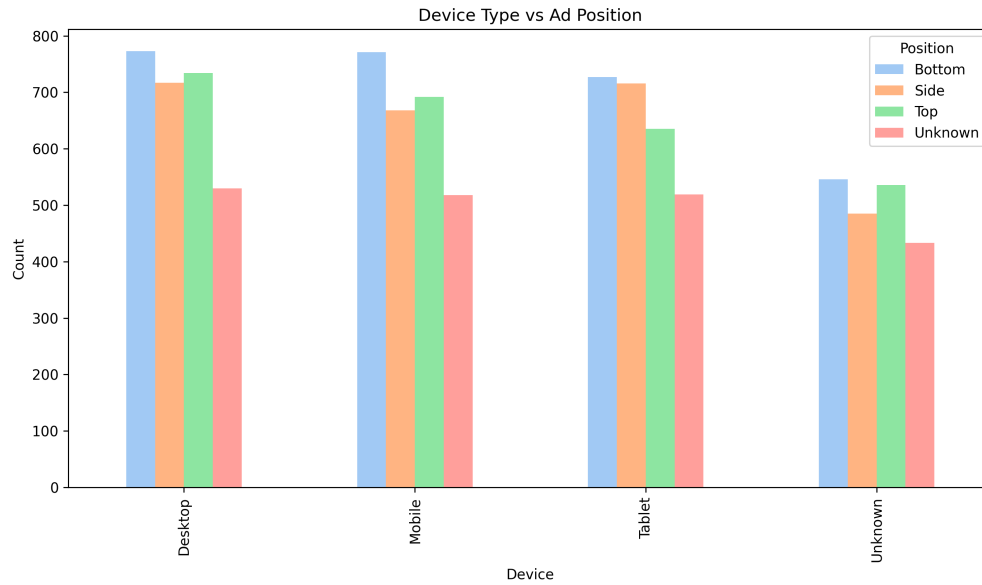


Figure 8: Device Type vs Ad Position

Interpretation: Mobile and Desktop dominate bottom placements; Tablets and Unknown have lower volumes.

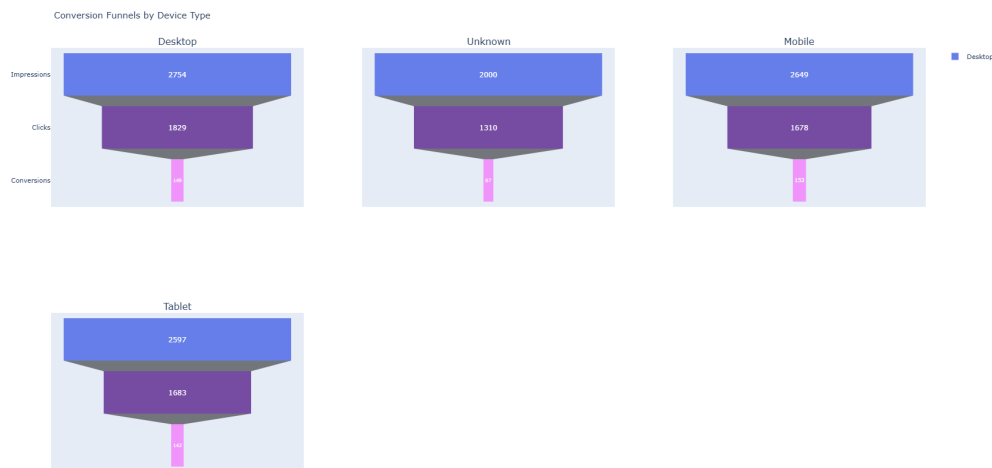


Figure 9: Conversion Funnels by Device Type (Looker Studio)

Interpretation: Impressions and clicks are visible, but conversions are obscured, limiting device-level CVR analysis.

Browsing Context Performance

CTR by Browsing Context

Context	CTR (%)
Entertainment	68.77
Shopping	64.53
Social Media	63.57
Education	62.78
News	59.12

Table 4: CTR by Browsing Context

Interpretation: Entertainment leads CTR, while News lags. Shopping also performs strongly.

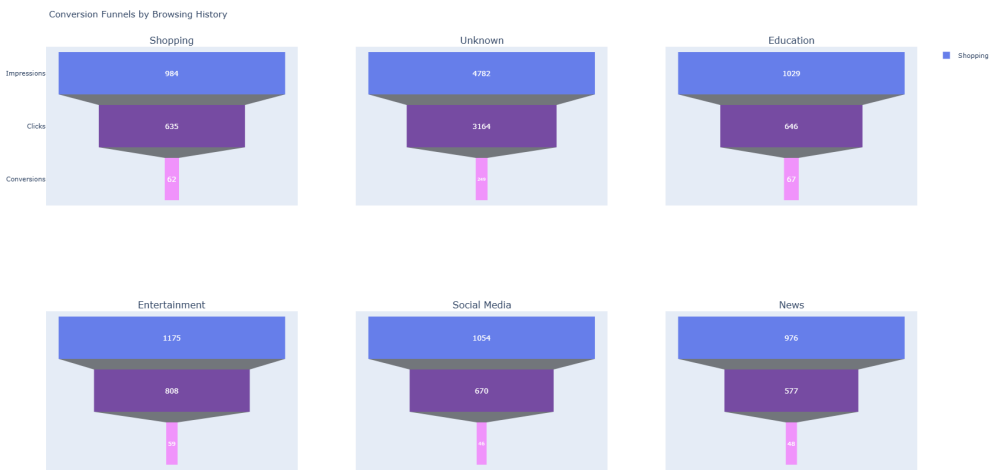


Figure 10: Conversion Funnels by Browsing History

Interpretation: Entertainment and Shopping yield the best conversion per impression. Unknown has high impressions but weak CTR.

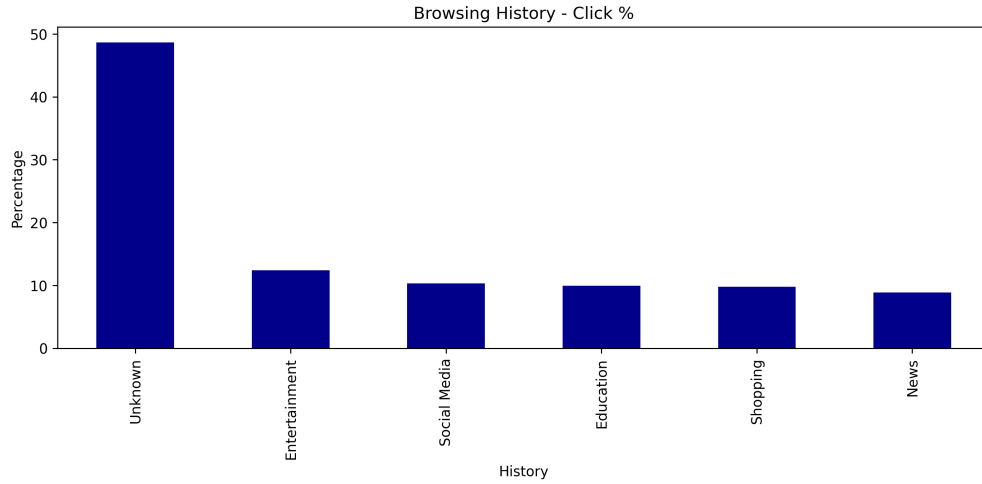


Figure 11: Browsing History - Click %

Interpretation: Unknown dominates click share (45%), suggesting categorization gaps or true distribution imbalance.

Model Development and Results

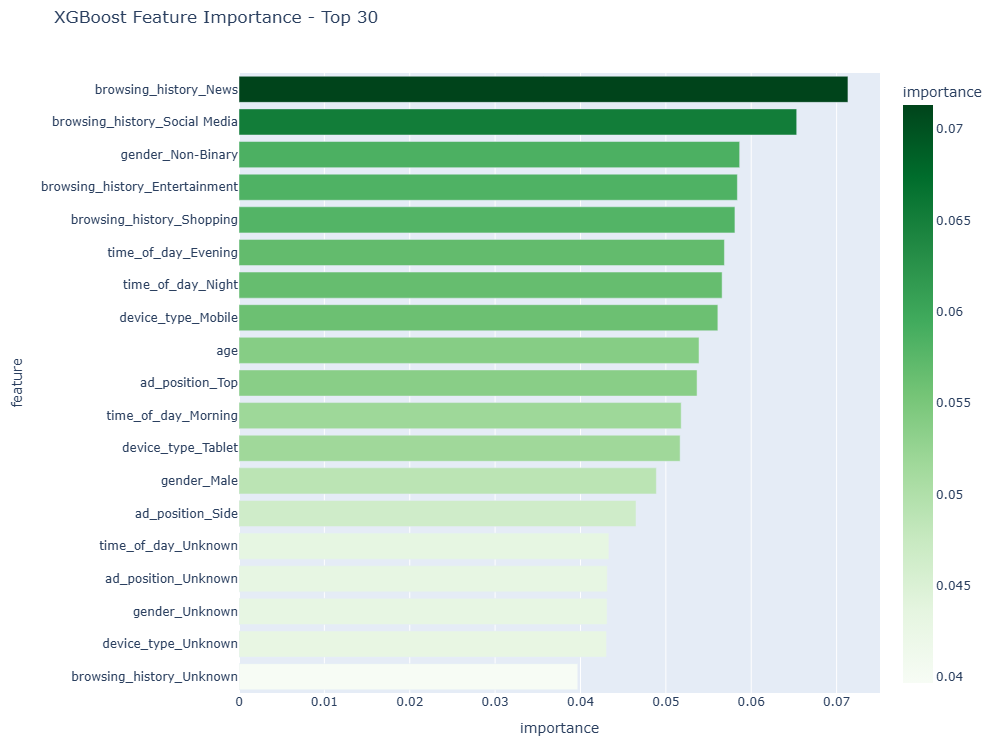


Figure 12: XGBoost Feature Importance - Top 30

Interpretation: Browsing history features dominate predictive power. Gender (Non-Binary) appears highly ranked, requiring fairness checks.

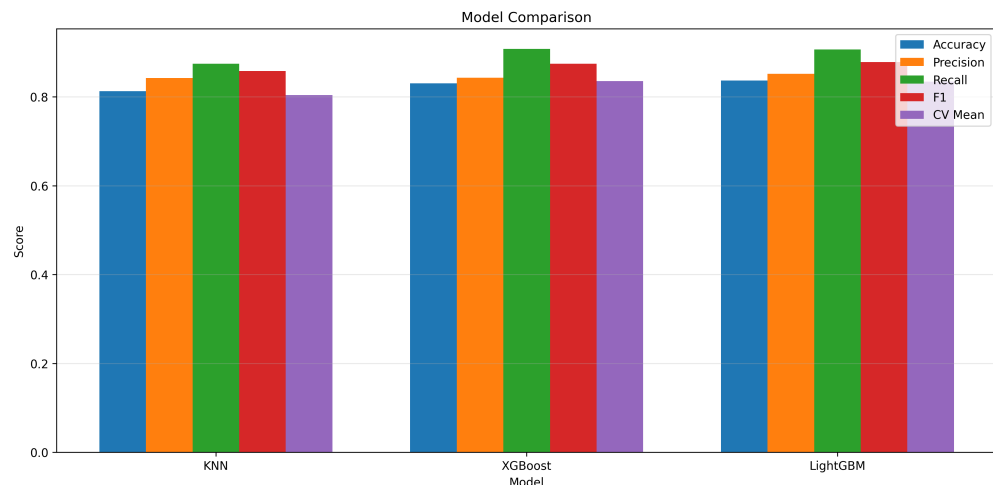


Figure 13: Model Comparison

Interpretation: KNN, XGBoost, and LightGBM perform similarly. XGBoost balances accuracy and interpretability.

Efficiency and Segment Analysis

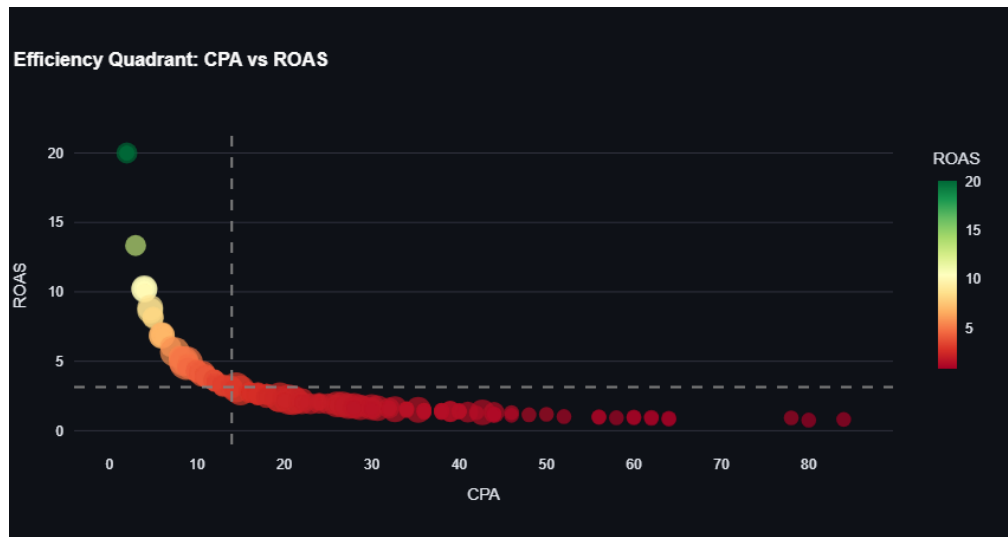


Figure 14: Efficiency Quadrant: CPA vs ROAS

Interpretation: Most campaigns cluster in the high CPA / low ROAS region. The upper-left quadrant (low CPA, high ROAS) contains the most efficient campaigns. Use this quadrant to guide budget reallocation.



Figure 15: Top 10 Segments by Profit

Interpretation: Segments combining Mobile or Tablet with Afternoon or Evening time slots and female or unknown gender identities show the highest profitability. These combinations should be prioritized in future targeting.

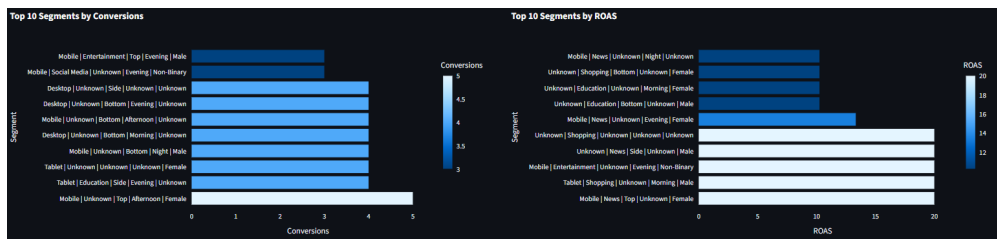


Figure 16: Top 10 Segments by Conversions and ROAS

Interpretation: Conversion leaders are mostly Mobile/Gaming/Male segments, while ROAS leaders are dominated by Unknown device/context combinations. This suggests that high ROI may come from less conventional or under-tracked segments.

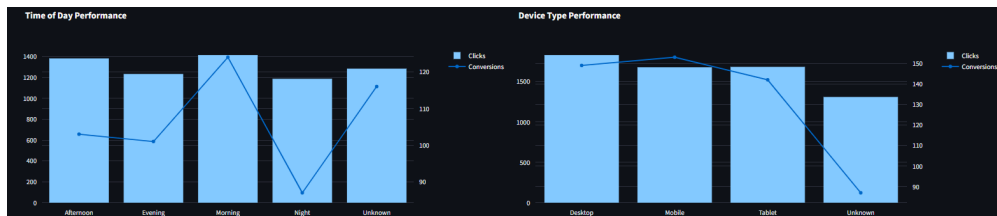


Figure 17: Clicks and Conversions by Time of Day and Device Type

Interpretation: Afternoon yields the highest clicks and conversions. Desktop and Mobile outperform Tablet and Unknown in both metrics. Prioritize afternoon campaigns on Desktop and Mobile for optimal performance.

Recommendations

- Focus bottom placements on Mobile and Desktop for higher CTR.
- Prioritize Entertainment and Shopping contexts.
- Improve post-click experience to raise conversion rate.
- Target 25–54 age groups; test creative for younger and older segments.
- Clean up “Unknown” taxonomy in browsing history.
- Audit sensitive features for fairness and leakage.
- Run A/B tests on ad position, device targeting, and context.

Appendix: Key Formulas

$$\text{CTR} = \frac{\text{Clicks}}{\text{Impressions}} \times 100\%$$

$$\text{CVR} = \frac{\text{Conversions}}{\text{Clicks}} \times 100\%$$

$$\text{CPI} = \frac{\text{Conversions}}{\text{Impressions}} \times 100\%$$