

# Customer Engagement and Churn Analysis

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline

df =
pd.read_csv("marketing_dummy_datasets/customer_engagement_churn_data.csv")
df.head()
```

	UserID	Acquisition Channel	Engagement Score	Churned
0	U0001	Google Ads	32	Yes
1	U0002	Facebook	0	Yes
2	U0003	Facebook	18	Yes
3	U0004	Facebook	30	Yes
4	U0005	Email	79	No

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
```

```
RangeIndex: 1000 entries, 0 to 999
```

```
Data columns (total 4 columns):
```

#	Column	Non-Null Count	Dtype
0	UserID	1000 non-null	object
1	Acquisition Channel	1000 non-null	object
2	Engagement Score	1000 non-null	int64
3	Churned	1000 non-null	object

```
dtypes: int64(1), object(3)
```

```
memory usage: 31.4+ KB
```

```
df.describe(include= 'all')
```

	userid	acquisition_channel	engagement_score	churned
count	1000	1000	1000.00000	1000
unique	1000	5	NaN	2
top	U0001	Google Ads	NaN	Yes
freq	1	271	NaN	663
mean	NaN	NaN	48.69200	NaN
std	NaN	NaN	29.53719	NaN
min	NaN	NaN	0.00000	NaN
25%	NaN	NaN	22.00000	NaN
50%	NaN	NaN	48.00000	NaN
75%	NaN	NaN	74.00000	NaN
max	NaN	NaN	100.00000	NaN

```
df.columns = df.columns.str.lower().str.replace(' ', '_')  
df.columns  
Index(['userid', 'acquisition_channel', 'engagement_score',  
      'churned'], dtype='object')
```

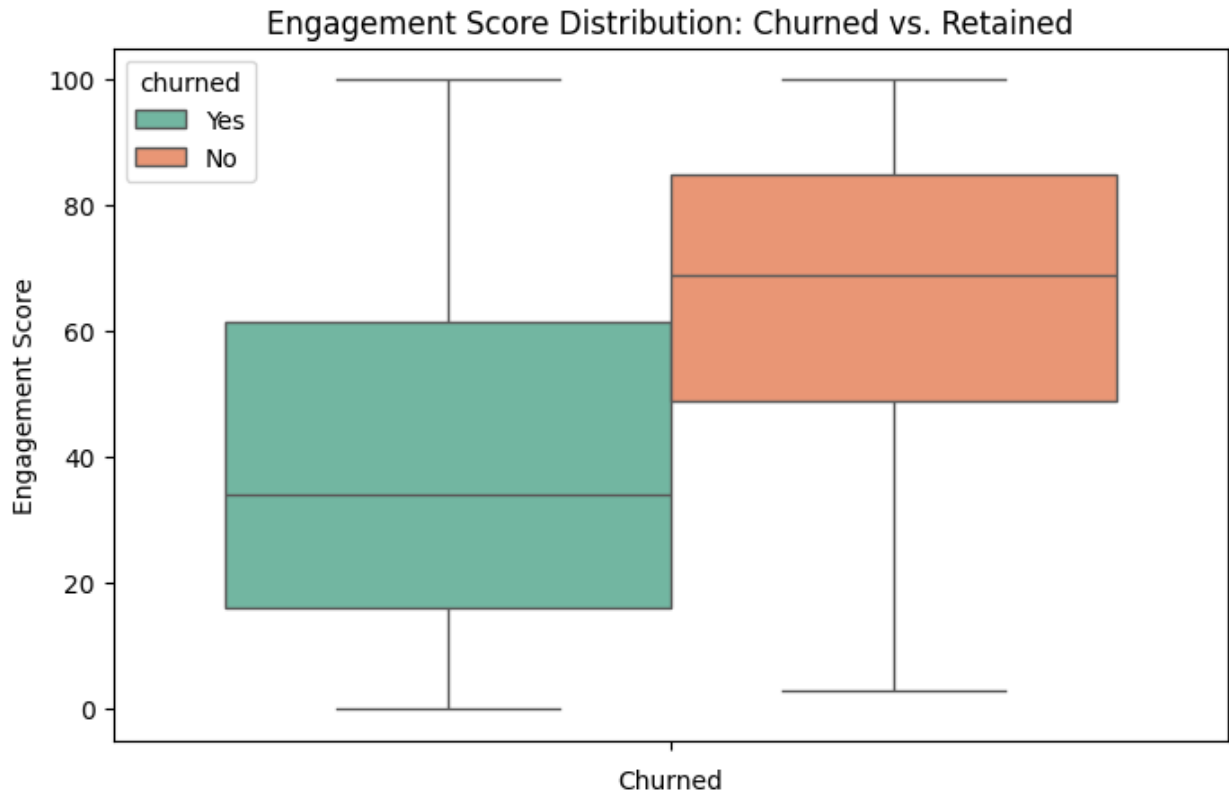
## Overall Churn Rate

```
churn_rate = df['churned_flag'].mean()  
print(f"Overall Churn Rate: {churn_rate:.2%}")  
Overall Churn Rate: 66.30%
```

A churn rate of over 66% indicates a significant retention challenge. Most users are leaving after acquisition, suggesting the need for urgent re-engagement strategies and better onboarding.

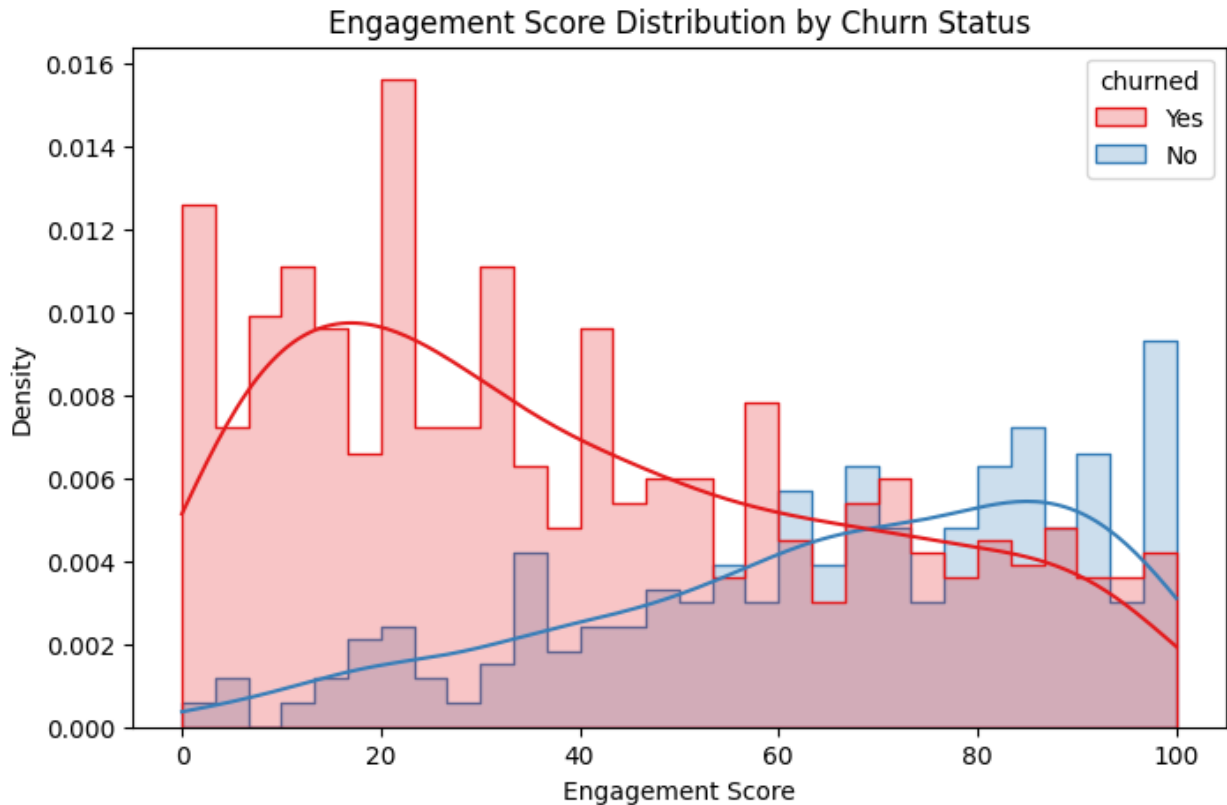
## Engagement Score: Churned vs. Retained

```
plt.figure(figsize=(8, 5))  
sns.boxplot(data=df, hue='churned', y='engagement_score',  
            palette='Set2')  
plt.title('Engagement Score Distribution: Churned vs. Retained')  
plt.xlabel('Churned')  
plt.ylabel('Engagement Score')  
plt.show()
```



Retained users generally have higher engagement scores than churned users. This confirms that user engagement is a strong signal for predicting churn risk.

```
# Histogram
plt.figure(figsize=(8, 5))
sns.histplot(data=df, x="engagement_score", hue="churned", bins=30,
kde=True, palette="Set1", element="step", stat="density")
plt.title("Engagement Score Distribution by Churn Status")
plt.xlabel("Engagement Score")
plt.ylabel("Density")
plt.show()
```

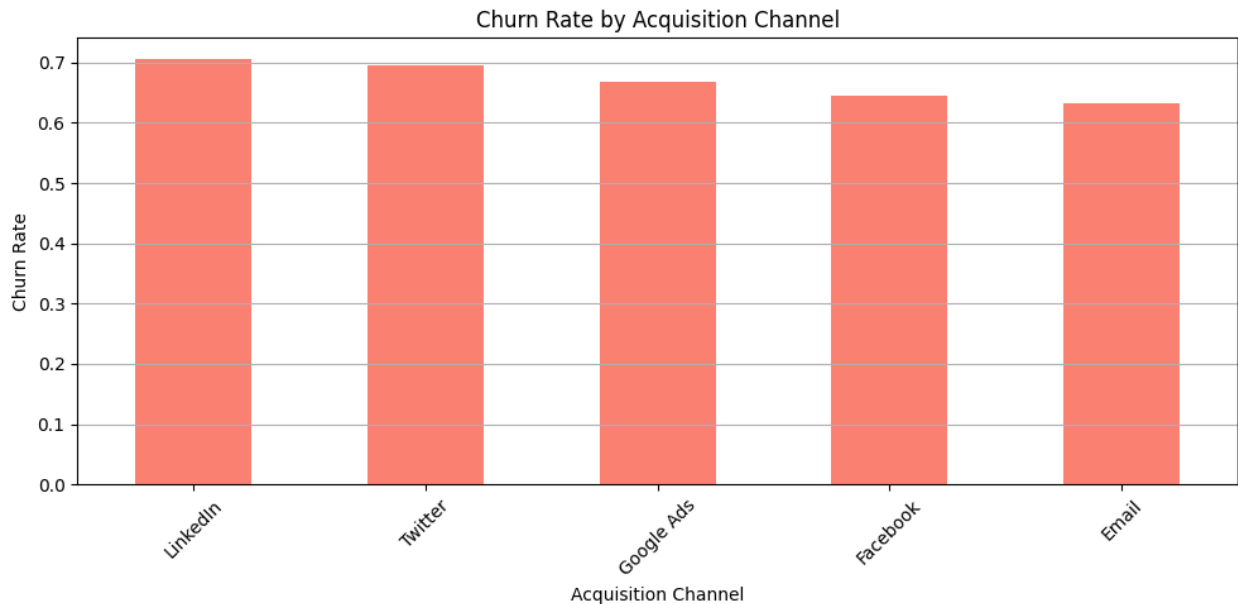


Churned users cluster more around the lower engagement scores, while retained users are skewed toward the higher end. There is a clear gap in engagement behavior between the two groups.

## Churn Rate By Acquisition Channel

```
churn_by_channel = df.groupby('acquisition_channel')
['churned_flag'].mean()
churn_by_channel = churn_by_channel.sort_values(ascending=False)

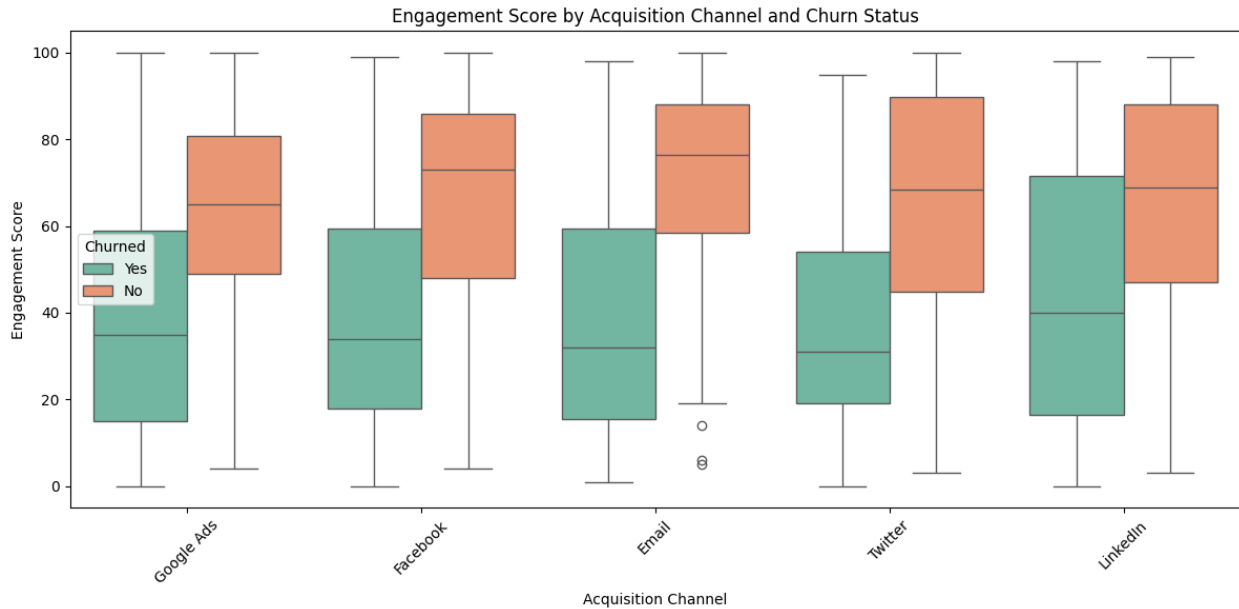
# Bar chart
churn_by_channel.plot(kind="bar", figsize=(10, 5), color="salmon")
plt.title("Churn Rate by Acquisition Channel")
plt.ylabel("Churn Rate")
plt.xlabel("Acquisition Channel")
plt.xticks(rotation=45)
plt.grid(axis="y")
plt.tight_layout()
plt.show()
```



Email show the highest engagement for retained users. Facebook and Google Ads show broader spreads with lower medians, suggesting inconsistency in user quality.

## Engagement Score by Acquisition Channel and Churn Status

```
plt.figure(figsize=(12, 6))
sns.boxplot(data=df, x="acquisition_channel", y="engagement_score",
            hue="churned", palette="Set2")
plt.title("Engagement Score by Acquisition Channel and Churn Status")
plt.xlabel("Acquisition Channel")
plt.ylabel("Engagement Score")
plt.xticks(rotation=45)
plt.legend(title="Churned")
plt.tight_layout()
plt.show()
```



This boxplot highlights how user engagement varies across acquisition channels and churn outcomes:

- **Email and Twitter** show the most favorable engagement profiles for retained users — high medians and tight IQRs.
- **Google Ads and Facebook** display low median scores for both churned and retained users, suggesting these channels bring in less committed users.
- **LinkedIn** presents moderate results but with opportunities for improving engagement post-acquisition.

## Conclusion

- The overall churn rate is high (**66.3%**), highlighting a pressing need to improve customer retention.
- Churned users consistently exhibit **much lower engagement scores** than retained users, confirming **engagement as a strong churn predictor**.
- Engagement distribution varies significantly by acquisition channel:
  - **Email and Twitter** show **high engagement and low churn** — ideal acquisition sources.
  - **Google Ads and Facebook** have **low engagement and high churn**, indicating poor user quality or misaligned targeting.
- This confirms that **where a user comes from** heavily influences both their engagement level and retention likelihood.

Engagement-based segmentation and channel optimization are essential levers to improve customer lifetime value.

## Actionable Recommendations

1. **Prioritize High-Retention Channels**

- Double down on **Email** and **Twitter**, which show strong engagement among retained users.
- Use these channels to attract higher-quality users.
- 2. **Fix or Phase Down High-Churn Sources**
  - Investigate acquisition messaging and onboarding flows for **Facebook** and **Google Ads**.
  - Consider **budget reallocation** away from these unless performance improves.
- 3. **Trigger-Based Re-engagement Strategy**
  - Use **Engagement Score < 30** as an early warning sign.
  - Automatically trigger reactivation emails, in-app nudges, or offers for low-score users.
- 4. **Segment and Personalize Retention Efforts**
  - Bucket users by channel and engagement score to create **targeted retention campaigns**.
  - For example, re-onboard low-score users from Google Ads with guided walkthroughs or support.
- 5. **Ongoing Monitoring**
  - Track churn and engagement metrics **monthly per channel**.
  - Add churn KPIs to marketing dashboards to inform ongoing campaign optimization.

Retention isn't just a product problem — it's a marketing acquisition quality problem too.

