**Advertising effectiveness**

🎯 Objective:

To evaluate the effectiveness of advertising campaigns across different platforms by calculating and analyzing key performance metrics such as CTR, Conversion Rate, and ROI.

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📁 Dataset Overview:

The dataset contains records of advertising campaigns with the following key fields:

Platform: Facebook, Google Ads, Instagram

Impressions: Number of ad views

Clicks: Number of times users clicked the ad

Conversions: Number of desired actions (e.g., purchases or sign-ups)

Spend: Amount spent on the ad campaign

Revenue: Revenue generated from the campaign

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📊 Key Metrics Calculated:

1. CTR (Click-Through Rate)

\text{CTR} = \left( \frac{\text{Clicks}}{\text{Impressions}} \right) \times 100

2. Conversion Rate

\text{Conversion Rate} = \left( \frac{\text{Conversions}}{\text{Clicks}} \right) \times 100

3. ROI (Return on Investment)

\text{ROI} = \left( \frac{\text{Revenue} - \text{Spend}}{\text{Spend}} \right) \times 100

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📈 Statistical Summary:

The descriptive statistics include:

Mean, standard deviation, min, max, and quartiles for each numerical column.

Helps in identifying outliers and campaign performance range.

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🧾 Platform-wise Performance Summary:

Platform Impressions Clicks Conversions Spend Revenue CTR (%) Conversion Rate (%) ROI (%)

Facebook 22,000 1,100 110 2,200 11,000 5.00 10.00 400.0

Google Ads 35,000 1,700 170 3,500 17,000 4.86 10.00 385.7

Instagram 8,000 400 40 800 4,000 5.00 10.00 400.0

✅ Insights:

All platforms have similar Conversion Rates (~10%).

CTR is highest on Instagram and Facebook (5%).

ROI is strong across all platforms (~385–400%), indicating high profitability.

Google Ads generated the highest revenue, but with slightly lower CTR.

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📊 Visual Analysis:

1. Click-Through Rate by Platform

Visualized via bar chart.

Facebook and Instagram slightly outperform Google Ads in CTR.

2. Conversion Rate by Platform

Uniform across platforms (~10%), showing consistent conversion efficiency.

3. ROI by Platform

All platforms show high ROI, confirming effective budget utilization.

4. Revenue vs. Spend Comparison

Displayed side-by-side using dual bar charts.

Revenue is significantly higher than spend for all platforms.

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📌 Conclusion & Recommendations:

All platforms are delivering excellent ROI, making them viable for continued investment.

Slight edge in CTR for Instagram & Facebook, suggesting more engaging ad creatives.

Consider allocating slightly more budget to Instagram, given high efficiency and potential for visual engagement.

Maintain consistent optimization of landing pages and ad targeting to preserve strong conversion rates.

import pandas as pd

import matplotlib.pyplot as plt

# Step 1: Load the dataset

data = pd.read\_csv('advertising\_data.csv')

# Step 2: Display the first few rows of the dataset

print("Dataset Overview:")

print(data.head())

# Step 3: Calculate key metrics

data['CTR'] = (data['Clicks'] / data['Impressions']) \* 100 # Click-Through Rate

data['Conversion\_Rate'] = (data['Conversions'] / data['Clicks']) \* 100 # Conversion Rate

data['ROI'] = ((data['Revenue'] - data['Spend']) / data['Spend']) \* 100 # Return on Investment

# Step 4: Display the updated dataset with metrics

print("\nDataset with Metrics:")

print(data)

# Step 5: Summary statistics

print("\nSummary Statistics:")

print(data.describe())

# Step 6: Platform-wise performance analysis

platform\_performance = data.groupby('Platform').agg({

'Impressions': 'sum',

'Clicks': 'sum',

'Conversions': 'sum',

'Spend': 'sum',

'Revenue': 'sum',

'CTR': 'mean',

'Conversion\_Rate': 'mean',

'ROI': 'mean'

}).reset\_index()

print("\nPlatform-wise Performance:")

print(platform\_performance)

# Step 7: Visualization

# Set up the figure and subplots

plt.figure(figsize=(15, 10))

# Subplot 1: CTR by Platform

plt.subplot(2, 2, 1)

plt.bar(platform\_performance['Platform'], platform\_performance['CTR'], color='skyblue')

plt.title('Click-Through Rate (CTR) by Platform')

plt.xlabel('Platform')

plt.ylabel('CTR (%)')

# Subplot 2: Conversion Rate by Platform

plt.subplot(2, 2, 2)

plt.bar(platform\_performance['Platform'], platform\_performance['Conversion\_Rate'], color='orange')

plt.title('Conversion Rate by Platform')

plt.xlabel('Platform')

plt.ylabel('Conversion Rate (%)')

# Subplot 3: ROI by Platform

plt.subplot(2, 2, 3)

plt.bar(platform\_performance['Platform'], platform\_performance['ROI'], color='lightgreen')

plt.title('Return on Investment (ROI) by Platform')

plt.xlabel('Platform')

plt.ylabel('ROI (%)')

# Subplot 4: Revenue vs Spend by Platform

plt.subplot(2, 2, 4)

plt.bar(platform\_performance['Platform'], platform\_performance['Revenue'], color='blue', label='Revenue')

plt.bar(platform\_performance['Platform'], platform\_performance['Spend'], color='red', label='Spend', alpha=0.6)

plt.title('Revenue vs Spend by Platform')

plt.xlabel('Platform')

plt.ylabel('Amount ($)')

plt.legend()

# Adjust layout and display plots

plt.tight\_layout()

plt.show()

Data set

Dataset Overview:

Campaign\_ID Platform Impressions Clicks Conversions Spend Revenue

0 1 Facebook 10000 500 50 1000 5000

1 2 Google Ads 15000 700 70 1500 7000

2 3 Instagram 8000 400 40 800 4000

3 4 Facebook 12000 600 60 1200 6000

4 5 Google Ads 20000 1000 100 2000 10000