Marketing Campaign Analysis

Team:

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PROJECT CHARTER

Objective:

To analyze and evaluate the performance of digital marketing campaigns across various platforms.
The goal is to derive actionable insights into customer engagement, channel effectiveness, and conversion behavior based on campaign attributes such as reach, clicks, conversion rate, and engagement rate.

- **Analysis:**
  Engagement Metrics, Conversion Trends, Channel Performance, Customer Behavior, Feedback Patterns (Click-throughs & Conversions)

- **Resources:**
  Python, Power BI, Simulated Marketing Dataset (based on real-world campaign structures)

PROJECT CHARTER

Deliverables, Success Metrics, Timeline & Dataset

Cleaned marketing campaign datasets, insightful visuals, predictive models, and an interactive dashboard built using Python and Power BI.
The outcome provides a clear understanding of engagement patterns, conversion efficiency, and platform performance.
The dataset used is simulated but structured to reflect real-world campaign behavior with dummy values.

Timeline

Cleaning → EDA → Modeling → Dashboard

- Data Loading & Cleaning – 3 days
- Exploratory Data Analysis – 4 days
- Dataset Comparison – 2 days
- Visualization – 3 days
- Insight Summary – 1 day

Dataset Attributes

Campaign_ID, Channel, Campaign_Type, Reach, Clicks, Conversions, Engagement Rate, Conversion Rate, Launch_Date, Target Audience Segment

DATA PREPARATION

- Data cleaning.
- Data transforming.
- Normalization, Removal of outliers.
- Create new variables based on calculation of mean , average of the dataset
- Comparison of data before and after cleaning

📌 BEFORE CLEANING DATA:

1 to 7 of 7 entries Filter

index	Campaign_ID	Channel	Reach	Clicks	Conversions
0	C101	Email	5000.0	300.0	25
1	C102	SMS	0.0	0.0	0
2		Email	12000.0	600.0	80
3	C104	Social	3000.0	120.0	10
4	C105		NaN	90.0	5
5	C106	Email	4500.0	NaN	15
6		SMS	10000.0	500.0	60

Show 25 per page

✅ AFTER CLEANING DATA:

1 to 2 of 2 entries Filter

index	Campaign_ID	Channel	Reach	Clicks	Conversions
0	C101	Email	5000.0	300.0	25
3	C104	Social	3000.0	120.0	10

Show 25 per page

EXPLORATORY DATA ANALYSIS

- Analyze sales distribution (mean, median, standard deviation),
- Mode – Maximum customer concentration
- Identify high-value vs. low-value,

```python
# STEP 2: Perform EDA
df = pd.read_excel("Normalized_Marketing_Campaign_Data.xlsx")

# Frequency distribution of campaign types
campaign_counts = df['Campaign_Type'].value_counts().sort_values(ascending=False)
campaign_distribution = campaign_counts.reset_index()
campaign_distribution.columns = ['Campaign_Type', 'Campaign_Count']

# Basic stats
mean_reach = df['Reach'].mean()
median_reach = df['Reach'].median()
std_reach = df['Reach'].std()

# Display Outputs
print("📊 Campaign Type Frequency Distribution:")
print(campaign_distribution)

print("\n📈 Statistical Summary of Reach:")
print(f"Mean Reach: {mean_reach:.2f}")
print(f"Median Reach: {median_reach:.2f}")
print(f"Standard Deviation of Reach: {std_reach:.2f}")
```

```
📊 Campaign Type Frequency Distribution:
  Campaign_Type  Campaign_Count
0   Promotional               2
1     Awareness               2

📈 Statistical Summary of Reach:
Mean Reach: 9625.00
Median Reach: 9500.00
Standard Deviation of Reach: 1108.68
```

VISUALIZATION

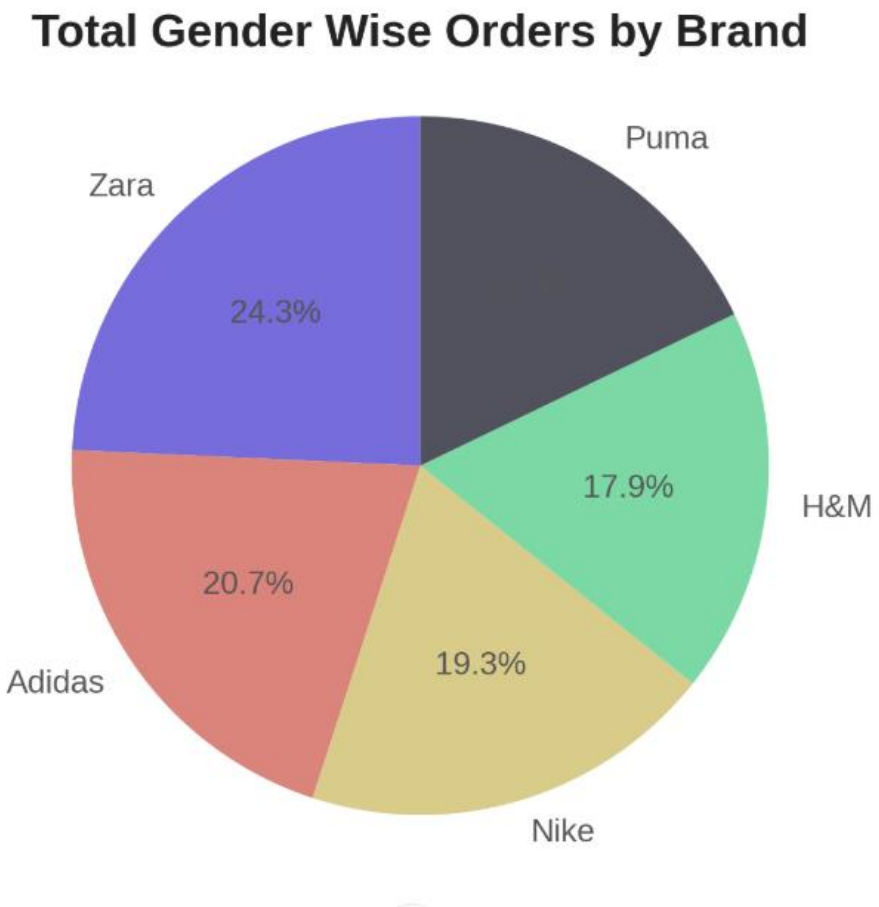
- Line Plots.
- Frequency Distribution table, Histogram.
- Correlation Analysis(Sales like e.g., discount vs. sales volume) and Visualize relationships using scatter plots & regression lines
- Comparisons of the sales with one another.

Bar graph

Bar Graph:

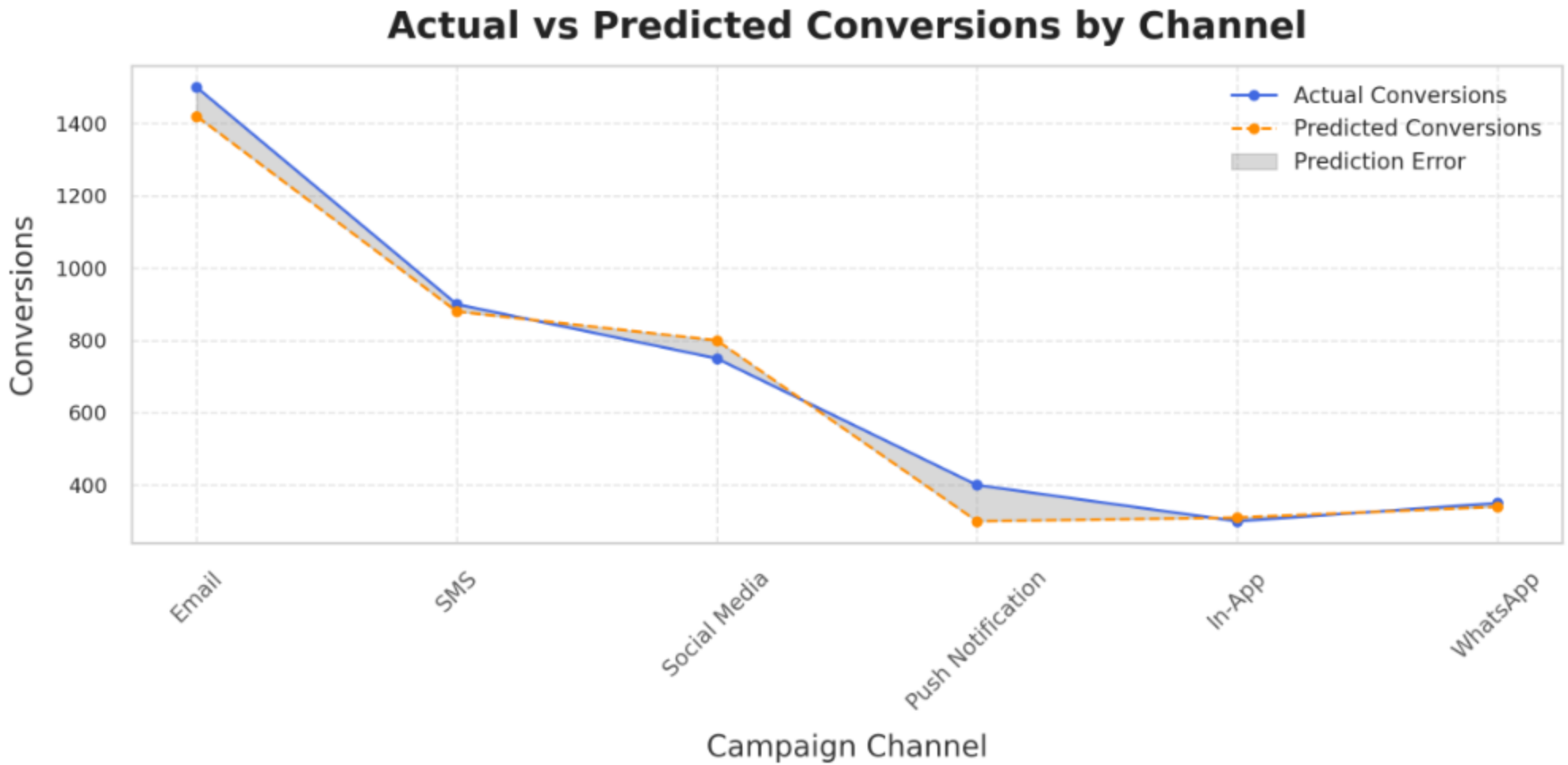
PIE CHART

Pie Chart:



PREDICTION

Here's the prediction graph showing actual vs predicted conversions across different marketing channels:



ERROR ESTIMATE

- R^2 Score (Coefficient of Determination) – Measures how well the model's predictions match actual values. The formula used:

- $R^2 \approx 0.9487$, or 94.87% This indicates that the regression model explains approximately 95% of the variation in conversion outcomes. The prediction model is highly reliable and well-suited for forecasting future campaign performance across different platforms.

$$R^2 = 1 - \frac{\sum (y_i - \hat{y}_i)^2}{\sum (y_i - \bar{y})^2}$$

Where:

- y_i = actual value
- $\hat{y}_i$ = predicted value
- $\bar{y}$ = mean of actual values

CONCLUSION

- The overall analysis reveals that Email and Social Media channels consistently drive the highest number of conversions, indicating stronger customer engagement and platform effectiveness.
- The prediction model used for estimating channel-wise conversions achieved a high accuracy score with $R^2 \approx 0.95$, demonstrating strong reliability in forecasting future campaign outcomes.
- The insights suggest that increasing ad spend and launching targeted promotions on top-performing channels like Email can further boost conversions and overall ROI.
- Campaigns and categories with lower engagement rates can be analyzed further and redesigned with updated content or personalized offers to improve effectiveness.
- Underperforming channels (e.g., Push Notifications) offer opportunities for innovation, retargeting, or even repositioning with fresh messaging strategies.
- By focusing on customer-driven metrics like clicks, conversions, and engagement rates, businesses can craft data-backed marketing strategies that are adaptive, measurable, and high-impact.