Market Research Modernization with Machine Learning and Power BI

Introduction

In today's competitive business environment, understanding competitor behaviors, marketing investments, and public sentiment is essential for strategic decision-making. This project demonstrates how Machine Learning (ML) combined with Business Intelligence (BI) tools can modernize and enhance traditional market research methods. Our approach utilized Python for data generation and machine learning, and Power BI for visualization, storytelling, and insight delivery.

1. Dataset Creation

Since no real-world dataset was available, we created a synthetic but realistic dataset using Python.

- **Key Features:**
    - Brand (Competitor names)
    - Mentions (Public/media mentions count)
    - Sentiment (Public sentiment score)
    - Ad_Spend_USD (Marketing budget estimate)
    - Engagement_Score (Audience engagement metrics)

A large dataset of over 400 records was generated to ensure diversity, volume, and realism for meaningful analysis.

2. Machine Learning for Behavioral Clustering

We applied machine learning techniques to uncover hidden competitor patterns:

- **Standardization:** Used StandardScaler to normalize features.
- **Clustering:** Employed K-Means to group brands into 3 clusters:
    - Smart Spenders (efficient marketing)
    - Big Spenders (high investment, varied outcomes)
    - Low Visibility Players (low spend, low engagement)

This clustering provided an intelligent segmentation of the market based on actual behavior, not assumptions.

3. Visualization in Python

Preliminary visualizations were created to validate clusters:

- Scatter Plot: Ad Spend vs Engagement Score colored by cluster.

This confirmed that the clusters were meaningful and separable.

4. Power BI Dashboard Development

The final dataset was imported into Power BI to build a two-page professional dashboard.

Page 1: Market Overview

- Bar Chart: Total mentions per brand.
- Scatter Plot: Ad Spend vs Engagement.
- KPI Cards: Key market indicators.

Page 2: Competitor Deep Dive

- Pie Chart: Sentiment distribution per brand.
- Enhanced Scatter Plot: Ad Spend vs Engagement (bubble size = Mentions, color = Cluster).
- Matrix Table: Comprehensive competitor performance metrics.
- Slicers: Interactive filtering by brand and cluster.

The dashboard offered an interactive and intuitive experience, from top-level summaries to deep-dive analyses.

Conclusion

This project showcased the powerful combination of Machine Learning and Power BI to transform raw data into actionable market insights.

Key Achievements:

- Successfully simulated real-world market behavior.
- Applied unsupervised learning for hidden pattern discovery.
- Built a clean, professional, and insightful dashboard.