Bank Marketing Analysis & Predictive Modeling

Power BI & Machine Learning Report

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1 Project Overview

The bank launched a telemarketing campaign to promote term deposits. This project aimed to analyze customer profiles, evaluate marketing effectiveness, develop a predictive model, and visualize insights using Power BI.

2 Objectives

- Identify customer segments most likely to subscribe
- Analyze call duration & contact method effectiveness
- Improve marketing strategies based on data insights
- Deploy a predictive model to enhance targeting efficiency

3 Dataset Description

Source: UCI Machine Learning Repository
Records: 45,211 customers

Key Features:

- Demographics: Age, Job, Marital Status, Education
- Financial Info: Balance, Loan, Housing
- Campaign Details: Contact Method, Call Duration, Previous Outcomes
- Target Variable: Subscription Status (y)

4 Exploratory Data Analysis (EDA) & Insights

Key Observations:

- **Highest Subscription Rates:** Management & Technicians
- **Education Impact:** Secondary education had the highest subscription rates.
- **Marital Status:** Single customers had a higher likelihood of subscription.

5 Campaign Effectiveness Analysis

Call Duration Impact:

- Calls longer than 300 seconds had the highest subscription rates.
- 100-300 second calls performed well, but shorter calls (<100 sec) had low conversions.

Best Contact Method:

- Cellular contact was the most effective method.
- Landline telephone calls had lower success rates.

6 Machine Learning Model & Performance

Models Trained:

- Logistic Regression - 90.01% Accuracy
- Random Forest - 90.58% Accuracy
- XGBoost (Best Model) - **91.64% Accuracy**

Key Model Insights:

- Call duration was the strongest predictor of subscription.
- Previous campaign success influenced conversions.
- The model underpredicted actual subscriptions (5,289 actual vs. 3,329 predicted).

7 Power BI Dashboard & Key Findings

Dashboard Sections:

1. **Subscription Trends by Customer Profile:**
    - Management & Technician jobs had the highest subscriptions.
    - Calls longer than 300 seconds had the highest subscription success.
2. **Campaign Effectiveness:**
    - Cellular contact method was more effective than telephone.
    - Customers engaged in longer conversations had higher subscription rates.
3. **Model Performance Analysis:**
    - The predictive model achieved **91.64% accuracy**.
    - Actual vs. Predicted Subscriptions visualized using Pie Charts.

8 Recommendations & Business Impact

Future Marketing Strategy Recommendations:

- Target Management & Technician job roles for higher conversions.
- Prioritize calling customers with Secondary & Tertiary education.
- Increase call duration beyond 300 seconds to boost conversions.
- Use cellular as the primary contact method for future campaigns.
- Improve model accuracy by refining features & tuning parameters.

9 Conclusion

This project successfully:

- Analyzed customer demographics & campaign performance using Power BI.
- Built a high-performing XGBoost model (91.64% accuracy).
- Developed an interactive Power BI dashboard for real-time insights.
- Provided data-driven recommendations to improve future marketing campaigns.

Next Steps:

- Deploy the model for real-time customer prediction.
- Optimize campaign strategies using targeted segmentation.
- Perform A/B testing on different call duration strategies.