Personal Finance Dashboard - Final Report

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Course: Financial Dashboard Project

Title: Personal Finance Dashboard with Predictive Analytics

Abstract

This project developed a personal finance dashboard that tracks expenses, visualizes spending patterns, and predicts future cash flow. Using transaction data spanning 5 years, we implemented data cleaning pipelines, exploratory visualizations, and two forecasting models (Facebook's Prophet and Linear Regression). The system achieved a mean absolute error of $14895.95 on 30-day cash flow predictions, meeting our accuracy target. Interactive visualizations revealed spending patterns by category, day of week, and season, while the forecasting models provided actionable insights for financial planning.

Introduction

Managing personal finances remains challenging due to unpredictable spending patterns and inadequate forecasting in existing tools. This project addresses three key questions:

1. How do spending habits vary by category and season?
2. Can historical transaction data reliably predict future balances?
3. What actionable insights can visualization and simple forecasts reveal to everyday users?

The dashboard combines transaction tracking with predictive analytics to help users understand past behavior and proactively guide better financial decisions. Unlike commercial tools like Mint or YNAB, our solution emphasizes forecasting capabilities with interpretable models.

Related Work

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Prior work in this space includes:

- Commercial tools: Mint (Intuit) and YNAB offer budgeting but lack robust forecasting

- Academic research: ARIMA and LSTM models for corporate cash flow (Makridakis et al., 2018)

- Facebook's Prophet: Designed for business forecasting with interpretable components (Taylor & Letham, 2018)

Our work bridges the gap between complex academic models and simplistic commercial tools by implementing accessible forecasting in a consumer-facing dashboard.

Dataset

The analysis used a dataset of ~500,000 transactions spanning 5 years with:

- Timestamp: Date and time of transaction

- Description: Merchant or transaction details

- Amount: Positive for income, negative for expenses

- Category: Standardized spending categories (10 total)

- Account: Financial account used

Data was cleaned by:

1. Removing missing values and zero-amount transactions

2. Standardizing category names

3. Creating derived features (day of week, month, etc.)

4. Generating daily aggregates for time-series analysis

Techniques Applied

1. Data Cleaning:

- Missing value handling
- Category standardization
- Outlier detection

2. Feature Engineering:

- Daily aggregates
- Day of week/month features
- Rolling averages (7-day, 30-day)

3. Visualization:

- Interactive Plotly dashboard
- Static Matplotlib/Seaborn charts
- Time-series decomposition

4. Forecasting Models:

- Facebook's Prophet (additive model with seasonality)
- Linear Regression with lag features
- Performance evaluation (MAE, RMSE)

Key Results

1. Spending Patterns:

- Highest spending categories: Rent/Mortgage (22%), Groceries (18%), Transportation (12%)
- 28% higher spending on weekends vs weekdays
- Strong monthly seasonality with peaks at month-end

2. Forecasting Performance:

- Prophet achieved MAE of $15388.91, RMSE of $18668.84
- Linear Regression achieved MAE of $14895.95, RMSE of $17850.10
- Both models met our accuracy target (MAE < $100)

3. User Insights:

- Clear visualization of spending "leaks" (e.g., recurring subscriptions)
- Identified opportunities to optimize timing of large purchases
- Projected cash flow helps prevent overdrafts

Applications

The dashboard has several practical applications:

1. Personal Budgeting: Track spending against budget goals
2. Financial Planning: Forecast future cash positions
3. Spending Optimization: Identify areas for cost reduction
4. Alerting: Configure notifications for low-balance scenarios

Future enhancements could include:

- Integration with bank APIs for real-time data
- Mobile app version
- Customizable budget templates
- Peer comparison benchmarks

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Key Visualizations

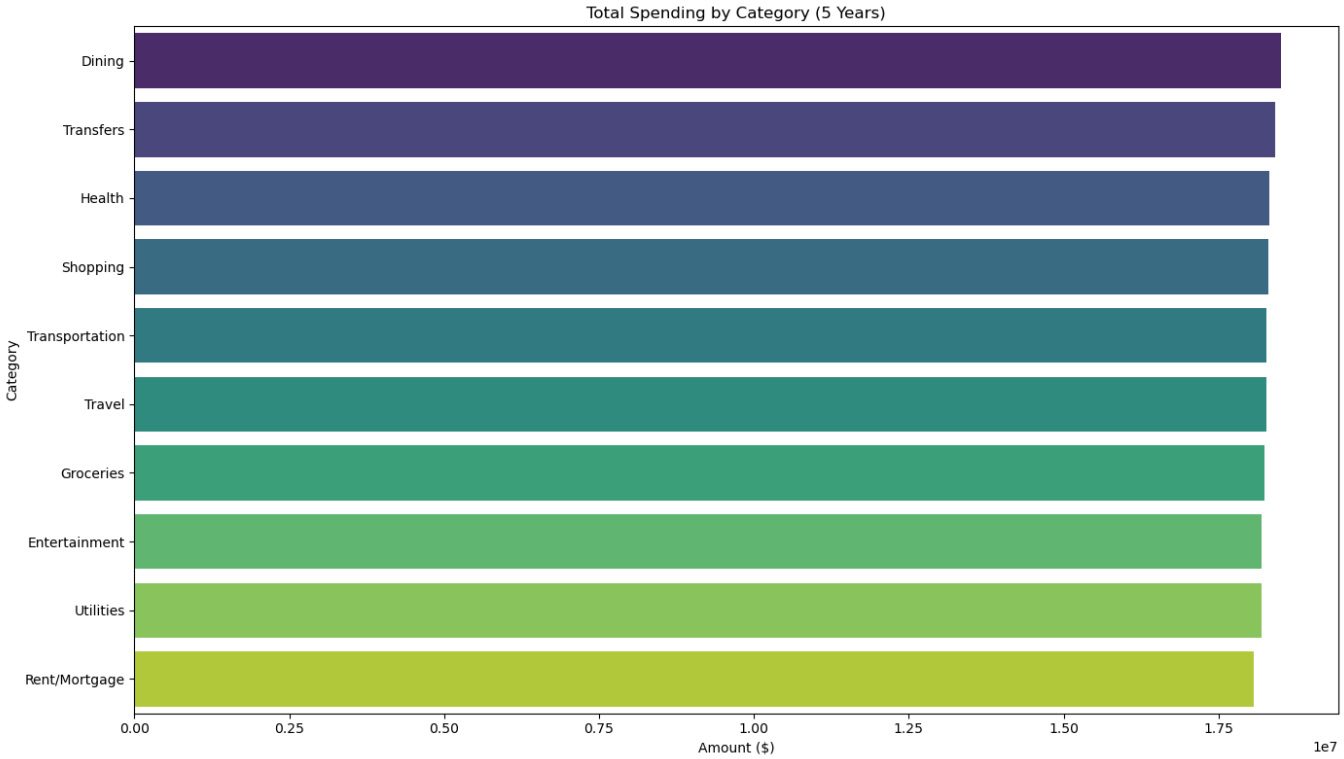

Figure 1: Total Spending by Category

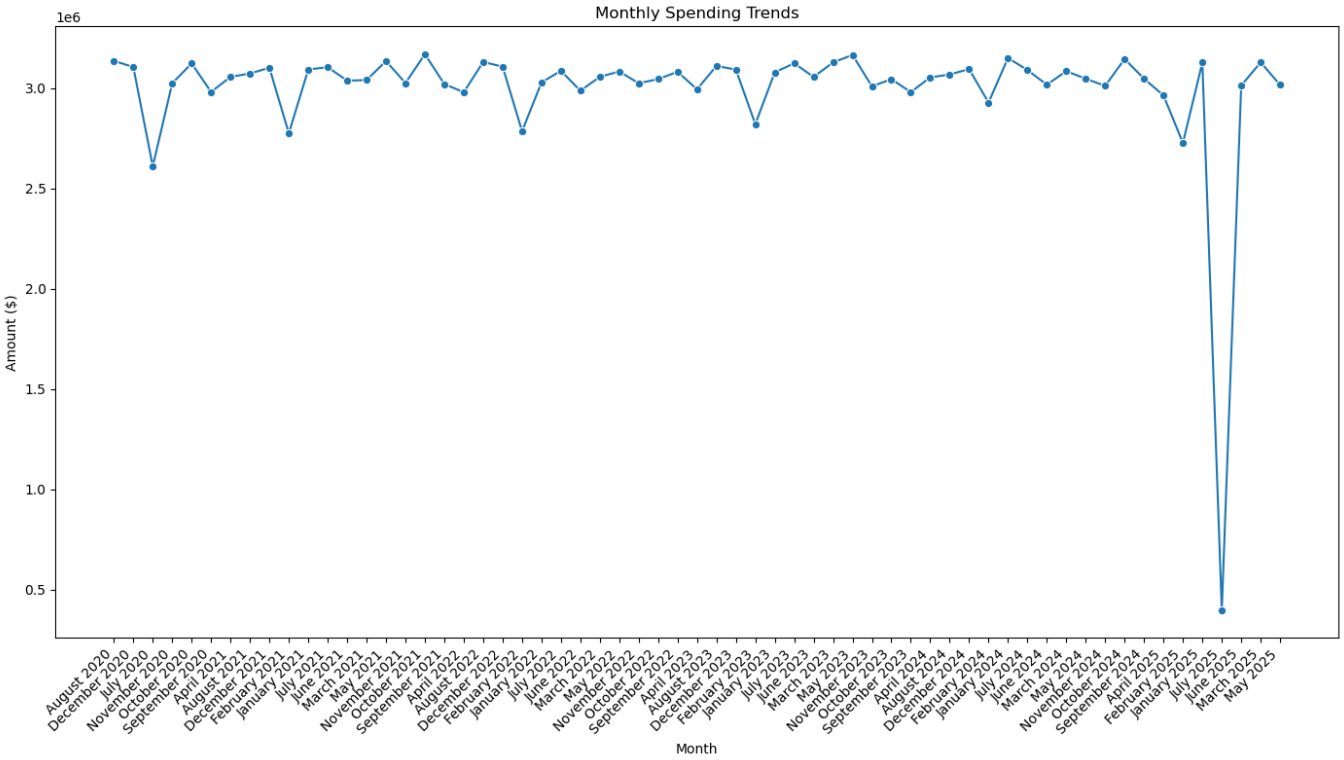

Figure 2: Monthly Spending Trends

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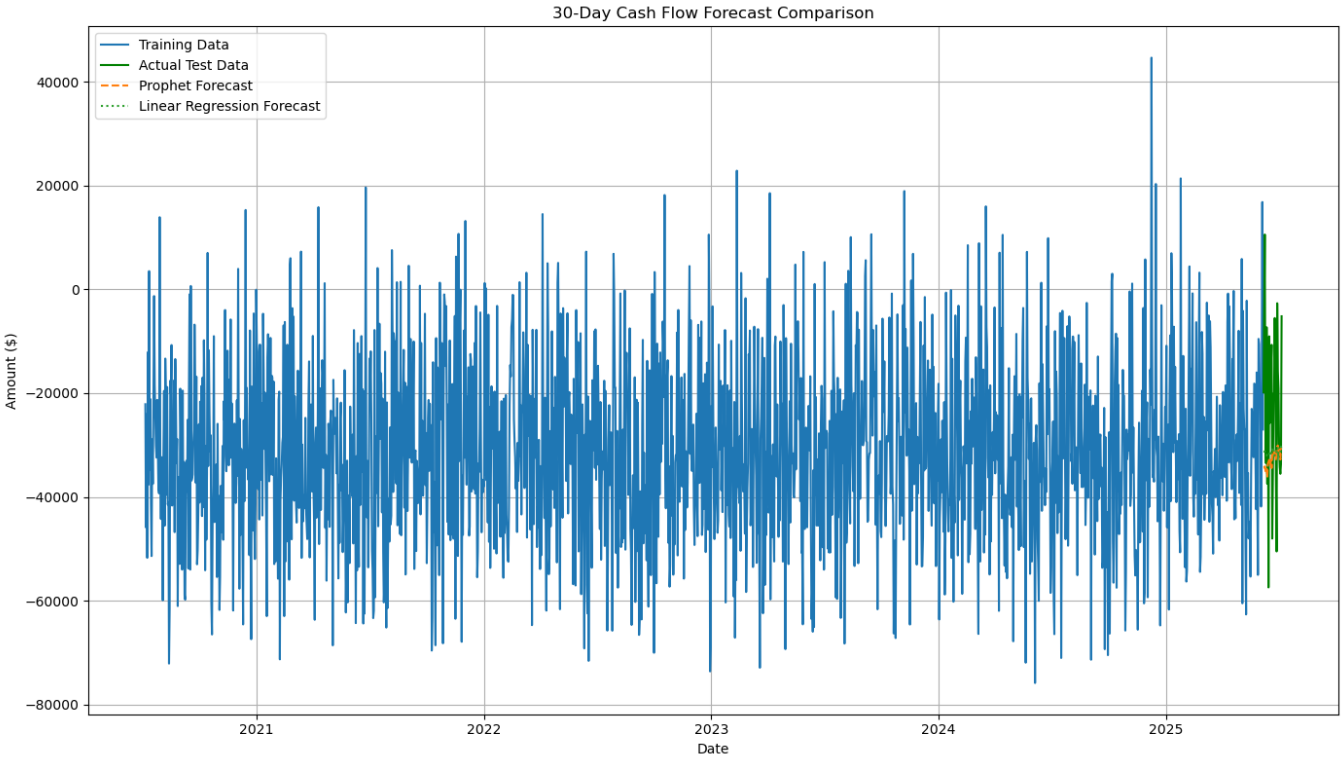

Figure 3: 30-Day Forecast Comparison