

Project Report: Airbnb Dynamic Pricing System

Introduction

This project focuses on building an intelligent Airbnb Dynamic Pricing Recommendation Engine that analyzes historical listing data to predict optimal nightly prices. The system leverages machine learning models, interactive dashboards, and automated reporting to guide hosts in maximizing occupancy and revenue.

Abstract

The goal of this project is to develop a robust pricing engine that generates accurate price recommendations for Airbnb listings based on factors such as location, seasonality, amenities, and guest reviews. Using Python for data processing and machine learning, Tableau for interactive visualization, and automated PDF reporting, the project delivers a scalable solution that assists hosts in adjusting prices dynamically to match market conditions.

Tools Used

- Python (Pandas, NumPy, Scikit-Learn, XGBoost, Matplotlib)
- Tableau (Interactive dashboards and data visualization)
- ReportLab (PDF report generation)
- Excel/CSV (Data storage and manipulation)
- FastAPI (Model serving through API)

Steps Involved in Building the Project

1. Data Collection & Cleaning - Loaded Airbnb dataset and handled missing values - Normalized price fields and transformed categorical features - Engineered features such as seasonality, host tenure, and amenities count
2. Model Building - Trained an XGBoost regression model using log-transformed prices - Performed grid search for hyperparameter tuning - Evaluated using RMSE, MAE, and cross-validation
3. Price Recommendation Logic - Calculated predicted base price - Applied business rules, floors, ceilings, and slider-based adjustments - Generated final suggested price
4. Visualization & Dashboard - Built Tableau dashboard with filters, maps, charts, and a price adjustment slider
5. Automation & Reporting - Developed FastAPI service for real-time predictions - Generated automated PDF reports summarizing insights and suggestions

Conclusion

The Airbnb Dynamic Pricing Engine successfully integrates machine learning, dashboarding, and automation into a unified system that provides dynamic and data-driven price recommendations. This project demonstrates how data analytics can enhance business decision-making and improve listing performance. Future

improvements may include deeper competitor analysis, real-time data integration, and neural network-based models.