Title : Airbnb Dynamic Pricing Recommendation Engine

1. Introduction

The hospitality industry, particularly platforms like Airbnb, experiences high variability in pricing due to fluctuations in customer demand, location popularity, seasonal trends, and listing features. To address these challenges, this project focuses on building a dynamic pricing recommendation engine that leverages data science techniques to provide optimal pricing suggestions for hosts. This approach aims to maximize occupancy and revenue while ensuring competitive pricing.

2. Abstract

This project analyzes historical Airbnb booking data to understand how factors such as property type, location, reviews, guest count, and seasonal variations affect pricing. Advanced feature engineering techniques were applied to derive actionable insights. We used regression models, including Random Forest and Linear Regression, to predict optimal prices. A dynamic pricing engine was developed to offer tailored pricing recommendations based on listing inputs. Additionally, a Tableau dashboard was created to allow users to interact with the data and view suggested pricing ranges using filters and sliders.

3. Tools Used

- Python: For data preprocessing, modeling, and feature engineering (libraries: Pandas, NumPy, Scikit-learn, SHAP, Matplotlib, Seaborn)
- Tableau: To build an interactive dashboard for visualizing insights and pricing suggestions
- Microsoft Excel: Used for early-stage data exploration and basic cleanup

4. Steps Involved in Building the Project

1. Data Cleaning: Removed missing values, duplicates, and non-essential columns to ensure data quality.
2. Feature Engineering: Derived meaningful variables like TotalStay, TotalGuests, Price per Guest per Night, and Days Until Booking to enhance model accuracy.
3. Exploratory Data Analysis (EDA): Conducted detailed visual and statistical analysis to understand trends across location, seasonality, reviews, and guest profiles.
4. Model Development: Trained and evaluated models such as Linear Regression and Random Forest Regressor. Applied hyperparameter tuning using GridSearchCV.
5. Model Interpretation: Used SHAP values to interpret model predictions and identify the most impactful features on pricing.

6. Dynamic Pricing Engine: Built a Python function to recommend optimal prices based on user input and trained model output.
7. Dashboard Creation: Developed an interactive Tableau dashboard with filters for city, property type, and review count, including a pricing suggestion slider.

5. Conclusion

This project highlights the effectiveness of data science in addressing real-world pricing challenges in the Airbnb ecosystem. By leveraging historical data and advanced analytics, we created a reliable and explainable pricing engine that can guide hosts in setting optimal nightly rates. The combined use of Python and Tableau allowed for both deep analysis and intuitive visualization. Our solution not only improves revenue potential but also enhances user trust by providing transparency in pricing logic. This project can be extended further by incorporating real-time data feeds and integrating with Airbnb APIs for live recommendations.