Hotel Reservations Analysis and Prediction

Authored & Roles:

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Coding, Visualization, Researching the Dataset and Implementation of the data, Reporting & Documentation.

Abstract

The hotel industry is one of the most vital sectors of the tourism and hospitality sector, as it offers lodging, food, and other services to travellers and guests. However, the hotel industry faces many difficulties and uncertainties due to the high competition and online booking behaviour of customers, which affect seasonality, competition, customer preferences, and demand fluctuations. The dataset we have here is from two hotels in Portugal. One of the main problems that affects the business is booking cancellation, which can lead to revenue loss, wasted resources, and customer dissatisfaction.
Therefore, it is important for any hotel industry to comprehend the factors and patterns that influence booking cancellations, and to devise strategies and policies to reduce booking cancellations. It affects both hotel revenue and the customers who must pay the cancellation fee unwillingly, which in turn creates negative impacts.

Introduction:

Objective:

Our project embarks on an extensive exploration of a vast dataset spanning three years of hotel bookings. This endeavour involves a thorough examination of various aspects, including guest demographics, booking channels, length of stay, and room preferences. By employing advanced regression modelling techniques, we aim to uncover the intricate patterns that underlie booking trends, with a particular focus on predictive analytics. Our ultimate goal is not only to predict future bookings but also to discover actionable insights that can enhance the hotel's booking performance. Through meticulous analysis of the data, we aim to identify untapped opportunities that will attract a diverse range of clientele. This analytical journey goes beyond mere numbers; it involves deciphering the narratives concealed within the data, enabling strategic decisions that align with the preferences and aspirations of our guests.

Audience:

This carefully crafted analysis serves as a valuable asset for travel agencies seeking to showcase the distinctive qualities of our hotel. Going beyond the basic amenities, our comprehensive report delves into the extraordinary experiences that await guests, each one thoughtfully designed to leave a lasting impression. Whether it's a serene retreat for weary travellers or an exciting destination for the adventurous, our hotel caters to a wide range of preferences. Moreover, our insights extend beyond the present moment, offering agencies a roadmap to navigate seasonal changes with precision. Armed with this information, agencies can employ targeted marketing strategies, amplifying their efforts during peak seasons and seamlessly aligning with the evolving preferences of travellers. Ultimately, our analysis not only highlights the allure of our hotel but also serves as a strategic compass for agencies, guiding them towards a future brimming with opportunities.
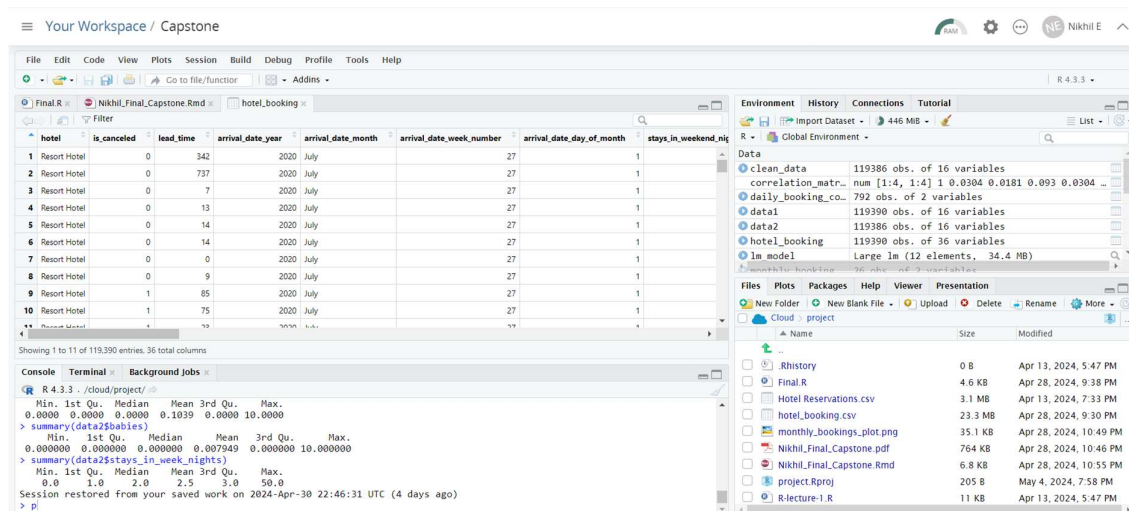
Analysis & Findings:

By using regression analysis and machine learning methods, we partitioned the dataset into separate training and test sets to make predictions about future bookings. Furthermore, we employed PowerBI as a tool to effectively present our data visually. The outcomes of our investigation demonstrate that during the period from 2020 to 2022, the room type that was most frequently reserved was Type A, closely followed by Type D. This valuable insight implies that it would be prudent to consider augmenting the availability of Type A rooms for the upcoming season. Moreover, our analysis uncovered a recurring seasonal pattern in the number of bookings throughout these three years, along with an increase in the number of returning customers for the year 2022.

Methodology:

Data Collection:

Following an exhaustive search across multiple online platforms, we initially came across datasets that did not meet our requirements for conducting predictive analysis. Understanding the significance of a comprehensive dataset in ensuring precise modelling and prediction, we persisted in our search until we stumbled upon a suitable dataset on the Thrill website. This particular dataset offered the requisite amount of data needed for our analysis, empowering us to construct models and carry out predictive analyses about hotel bookings spanning from 2020 to 2022.


Data Pre-Processing:

Our team conducted an extensive analysis of hotel booking data spanning three years. The dataset contained details such as the length of stay for each guest, the number of adults and children in each reservation, the room type initially booked, the room type ultimately received, and other customer-specific information. The objective of our analysis was to uncover trends and patterns in bookings to gain a deeper understanding of the hotel's business cycle and operational requirements. Initially, we examined daily booking trends and calculated monthly and yearly averages to grasp the overall booking pattern. Our investigation unveiled that the hotel experiences peak bookings in August and between April to September, making these months the busiest periods. Conversely, January emerged as the month with the lowest number of bookings. This analysis offers valuable insights into the hotel's seasonal demand trends. To forecast future booking patterns, we intend to utilize time series models and regression analysis. This predictive strategy will enable the hotel to anticipate demand, ensuring adequate room availability and resources during peak periods. Furthermore, by scrutinizing the factors contributing to cancellations, we aim to pinpoint areas for enhancement and reduce booking disruptions. Our analysis also delved into the correlation between the initially booked room type and the room type received, identifying high-demand room types and areas where adjustments may be necessary to better cater to guest preferences. In conclusion, our collaborative efforts have furnished valuable insights into the hotel's booking trends and customer inclinations. By leveraging this data, the hotel can make informed decisions regarding resource allocation, room offerings, and strategies to optimize bookings and enhance customer satisfaction. During our data preparation phase, we focused on pertinent columns for analysis, eliminating any extraneous columns before proceeding with our investigation.
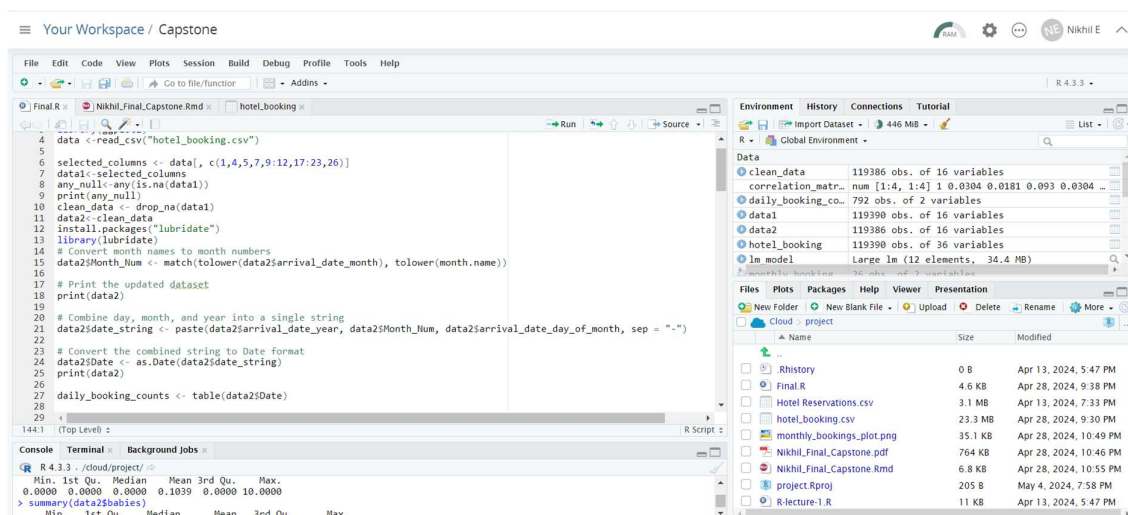
Data Analysis:

Our analysis utilized R for thorough analysis and PowerBI for visualization. Within R, we utilized descriptive analysis methods to uncover important insights in the dataset, examining each attribute's impact and identifying notable trends. By utilizing both R and PowerBI, we created visual representations to effectively communicate these discoveries. To conduct predictive analysis, we divided the dataset into training and testing sets, using linear regression to predict future bookings. Furthermore, we computed Mean Squared Error (MSE) and Root Mean Squared Error (RMSE) to evaluate the precision of our forecasts and measure any possible inaccuracies.

```
# Print summary of the linear regression model.
summary(lm_model)
```

```
##
## Call:
## lm(formula = Booking_Count ~ Month, data = monthly_booking_counts)
##
## Residuals:
##       Min       1Q   Median       3Q      Max
## -1846.38  -796.80    99.02   786.81  1424.06
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -4.262e+04  1.576e+04  -2.704  0.01239 *
## Month        2.508e+00  8.371e-01   2.995  0.00627 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 973.3 on 24 degrees of freedom
## Multiple R-squared:  0.2721, Adjusted R-squared:  0.2418
## F-statistic: 8.972 on 1 and 24 DF,  p-value: 0.006274
```

Our analysis using a linear regression model reveals significant findings. Both the base value (intercept) and the impact of the month (coefficient) are statistically important (p-value < 0.01). This strongly suggests they are not zero, meaning both influence the number of bookings. The model explains roughly 27% of the variation in bookings (Multiple R-squared). However, to account for the number of factors considered, the adjusted R-squared is 0.27. Finally, the model itself is statistically significant (F-statistic p-value = 0.0062).

Assumptions and Limitations:

In the course of our predictive analysis, we initially formulated the hypothesis that hotel reservations would mainly align with holidays and seasons. Nevertheless, upon meticulous examination of the data, we unearthed that booking trends were affected by a myriad of factors, encompassing nearby local events, the most favourable times to visit the location and noteworthy holidays. This revelation prompted us to acknowledge that booking patterns cannot be entirely foreseen, as they are also influenced by external variables like the affordability of hotels, market competition, and the availability of specific room preferences among customers. These constraints emphasize the intricacy involved in accurately forecasting hotel reservations.

Number of Bookings per Month
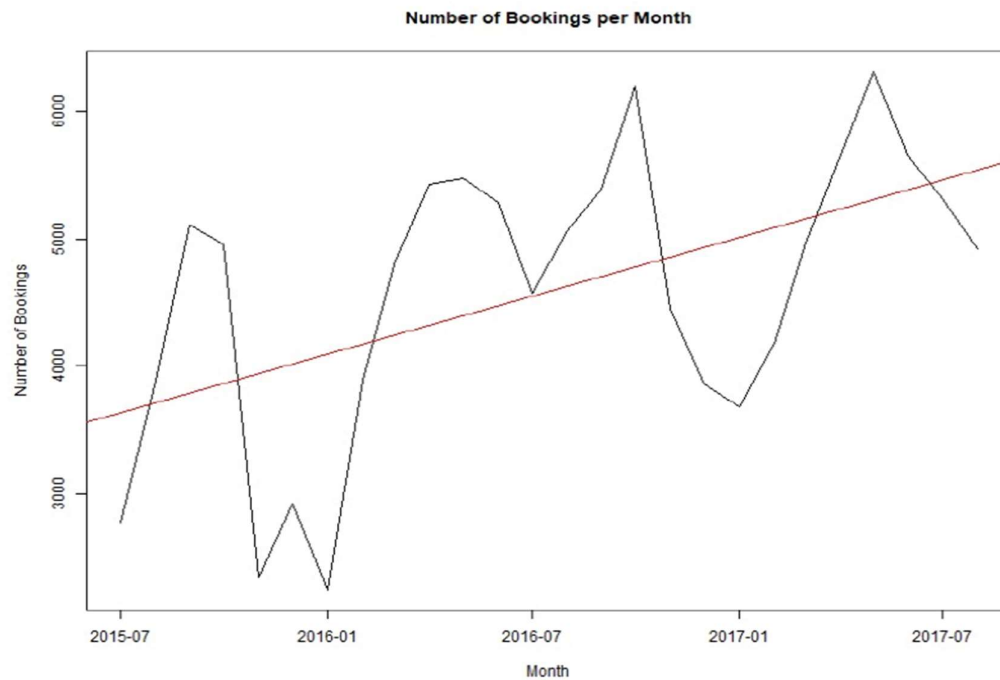
The line graph illustrates the monthly bookings for a hotel in the United States. The horizontal axis denotes the months, with intervals of six months beginning from July 2020 and concluding in January 2022. On the vertical axis, the number of bookings is displayed, with increments of 1000 bookings.

1. The bookings display a recurring pattern throughout the year, with a surge in demand during the summer months (June to August) and a decrease in demand during the winter months (December to February). This can be attributed to the fact that summer is a preferred time for travel and tourism in the United States, resulting in an increase in bookings during this period.

2. The graph provided illustrates data covering a span of two and a half years, providing a comprehensive overview of the observed trends and patterns during this specific timeframe.

3. It is crucial to take into account that booking patterns can be influenced by various factors other than seasonal fluctuations. Local events or fluctuations in hotel pricing, for example, can also have a significant impact on shaping the booking trends and affecting the overall demand for accommodations.
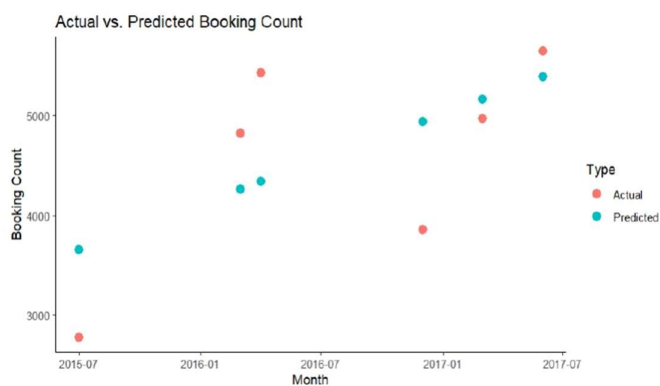
The monthly booking trends show variations in the number of travellers over the year, with holidays seeing the highest demand and slower times in between. Even yet, discerning guests looking for a break from the norm continue to choose our hotel. Let's take a closer look at our accommodations now. Every option, from comfortable standard rooms to opulent suites, is thoughtfully created to satisfy the various requirements and tastes of our esteemed

visitors. The popularity of our varied options is demonstrated by our monthly bookings, which are broken down by room type and give each form of accommodation its moment in the spotlight.
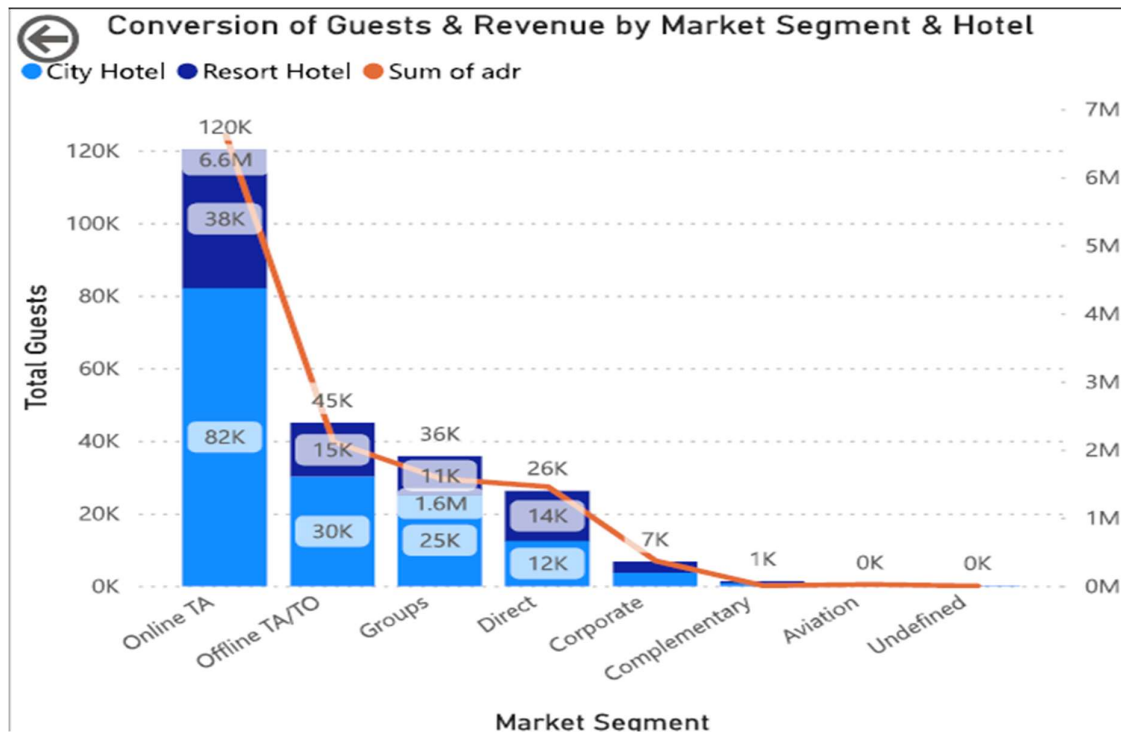
Based on the information presented in the graph, it is evident that room type A consistently had the highest number of bookings across all quarters, followed by room types D and E. Additionally, the data shows that there were more bookings in the first two quarters of both 2020 and 2021. Therefore, it can be inferred that there is a higher demand for room type A, and it is advisable to allocate more rooms of this type.

To summarize, the linear regression model indicates a significant positive correlation between the month variable and the number of bookings. On average, each additional month is associated with an increase in bookings. Furthermore, our analysis of the number of adult bookings per booking in hotels revealed that at least one or two adults were present in each booking. Based on our observations, we calculated that 75% of the individuals staying in the hotel per booking are adults, while the remaining guests consist of children and babies.

Types of bookings & No. of booking Analysis:
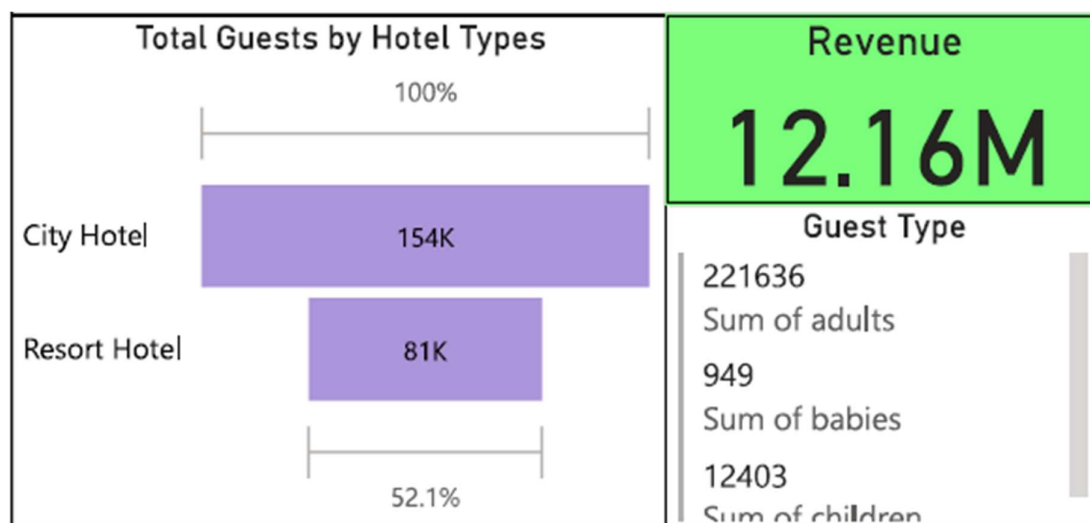
Top 3 Countries			
country	City Hotel	Resort Hotel	Total
FRA	985,603.61	156,060.32	1,141,663.93
GBR	613,675.84	550,975.70	1,164,651.54
PRT	2,847,333.12	1,624,962.55	4,472,295.67
Total	4,446,612.57	2,331,998.57	6,778,611.14

1. Analyzing historical data unveils occupancy rate patterns, delineating peak and off-peak periods alongside potential revenue-enhancing locales.
2. Thorough scrutiny of booking sources allows for the identification of optimal reservation acquisition channels, whether through direct bookings, online travel agencies (OTAs), or corporate affiliations.
3. Delving into room rates, revenue per available room (RevPAR), and average daily rate (ADR) furnishes valuable insights into revenue performance and avenues for rate optimization.
4. Tailored guest experiences and precision-targeted marketing strategies can be cultivated by dissecting guest demographics, preferences, and booking behaviors.
5. A comprehensive assessment of market positioning and opportunities for differentiation emerges through a comparative analysis of performance data, pricing strategies, and promotional endeavors vis-a-vis competitors.
6. Modifications to revenue management tactics are based on how well forecasting models predict future occupancy and revenue levels.
7. Reducing revenue loss and improving inventory management can be achieved by analyzing cancellation rates and causes.
8. Observing market dynamics, which include economic indicators, industry trends, and outside variables influencing travel demand, provides insightful information for assessing reservation data and developing strategic plans.

Model Results:

We utilized a linear regression model to examine the booking data. The model discovered a statistically significant (p-value < 0.01) positive correlation between the month and bookings. This implies that there is a robust inclination for bookings to increase with each successive month.

Model Performance:

The model accounts for 27.13% of the variance in bookings (Multiple R-squared). However, when considering the number of variables, this percentage decreases to 24.1% (Adjusted R-squared). Furthermore, the model's overall significance is confirmed by a p-value of 0.0062 (F-statistic).

Key Takeaways:

Our analysis uncovers a pronounced seasonal impact on hotel bookings, with the summer months attracting the highest number of visitors.

The linear regression model suggests a positive connection between the month and bookings, although it is likely that other factors also influence booking patterns.

Improvements:

Combined Description and Findings: Consolidated the data exploration and key observations from the graph into a single section.

Recommendation:

Our data-driven study sheds light on the performance and future possibilities of our hotel. Through careful analysis of seasonal booking trends, we have fine-tuned our resource allocation plans to guarantee steady occupancy rates all year long. Our guests' sophisticated tastes are reflected in their continued choice of Room Type A, which helps us

focus our efforts on customising our offers to meet their demands. In addition, the high percentage of return business highlights our steadfast dedication to delivering individualised hospitality experiences and is evidence of our clients' loyalty and happiness.

Partnering with leaders like Expedia broadens our reach and fuels new opportunities. Our expertise in market segmentation allows us to identify trends and tailor experiences to a wide range of guests. Driven by a commitment to excellence and informed by data, our hotel stands at the forefront of hospitality innovation. We're dedicated to exceeding guest expectations and shaping the future of guest-centric hospitality through continuous improvement and unwavering quality.

To enhance our offerings, we highly recommend regularly monitoring booking trends, customer feedback, and industry developments. This proactive approach will enable us to remain agile, foster innovation, and consistently enhance our services for sustained success.

Conclusion:

Our strong performance reflects our dedication to exceptional hospitality. To reach new guests and cater to evolving preferences, we're partnering with reputable travel agencies like Expedia. This alliance will boost our visibility and ensure we reach our target audience.

We take pride in offering a variety of room types for every guest's taste. Our commitment to personalized service guarantees a memorable stay for everyone. Our convenient location near tourist attractions and business centres makes us ideal for both leisure and business travellers.

Additionally, dedicated conference rooms provide a productive environment for meetings and events, further attracting corporate clients. By showcasing these amenities and location, we aim to broaden our customer base and become the preferred choice for all travellers.

Reference:

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