Data Wrangling and Data Science in Revenue Management

A Dynamic Pricing Model for Vacation Rental Industry

Abstract

We develop a dynamic pricing model for the vacation rental industry that fuses public and propriety data to maximize the key performance index (KPI) by recommending pricing strategy. The motivation of this research is the increased interest in expanding data science and analytics capabilities within the revenue management business area. In a bigger picture, it is believed that the future of revenue management will begin to influence other industries where perishability of revenue exists, apart from the traditional service industry. Revenue Management will play vital part in 'As a Service' digital transformation. In the future, data-driven dynamic pricing strategies leveraging external information of the business ecosystem will play an essential role in profitability.

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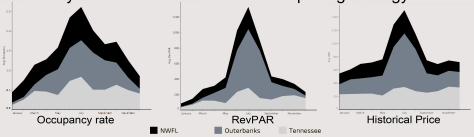
Introduction

- Revenue Management: With predictable demand, fixed capacity, and perishable product, set the right price for right customer at right time;
- Key Performance Measure (KPI):
  - Occupancy Rate (occ)= Room Sold/ Available Rooms
  - Revenue Per Available Room (RevPAR)
    = Sum of room revuenue / Available Rooms
- Seasonality fluctuation existed in KPI and pricing strategy:



Literature Review

Author	Summary	Methodology
Guo et al. (2013)	Maximize revenue by statistical methods	Establish pricing discrimination for different customer segment
p. et al. (2018)	A dynamic pricing done by online home sharing marketplace platform, Airbnb.	Construct pricing suggestion matrix that factors in calendar price set by host, guest booking probability, and market demand signals. The suggested price is further adjusted by considering suggested price vs actual booked price to come up with dynamic pricing strategy.
L. et al. (2012)	The methodology for setting optimal pricing for long term hotel stay.	The short-term stay customer per day for hotel is estimated using Poisson distribution while the probability that long-term stay customers accept room rate follows a non-increasing convex function on the basis that the lower the room rate, the higher the demand and vice versa.
A. et al.(2011)	An optimization model to maximize revenue	$\text{Maximize} \sum_{i=1}^{n} P_i O_i$ Subject to $O_i \leq C_i \ \forall i$, $P_i \leq 0 \ \forall i$ P= Price for one night O= the room occupied C = Total capacity
Tse and Poon(2011)	The demand function is a superior forecasting model	Consider cost function and demand function, and generate the new method to achieve maximized revenue when the rate is , where β is the regression coefficient, r0 is the initial equitable room rate and v is the variable cost per room sold.

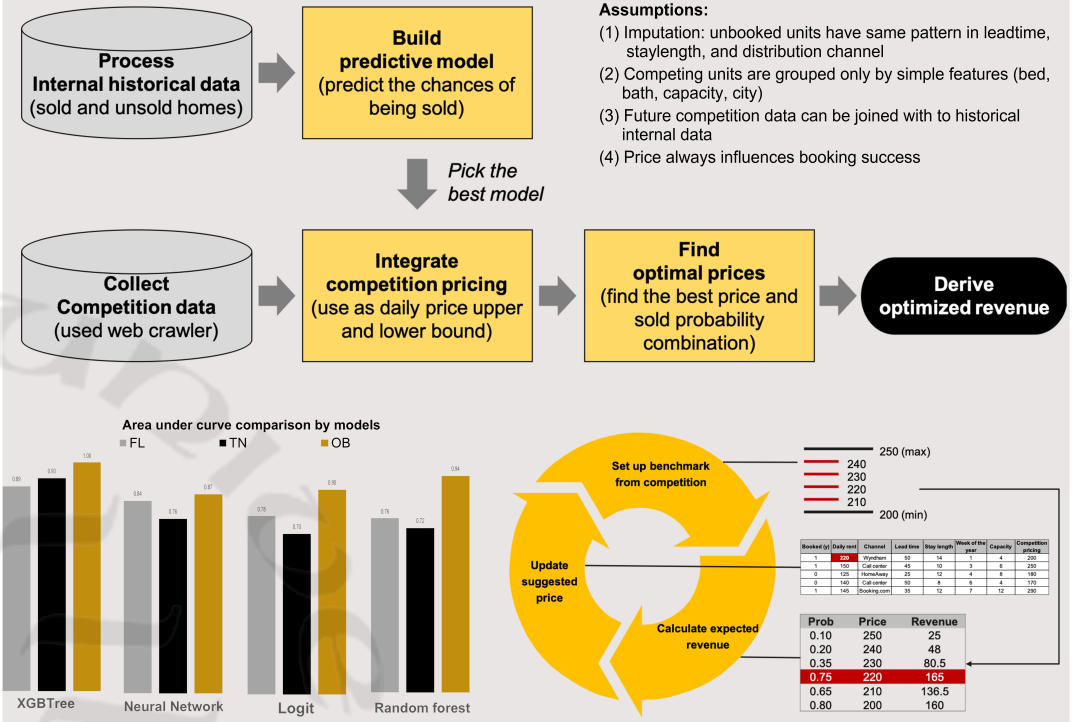
Data

Web harvesting: daily competition data: price, room features (bed, bath, etc) Comptition: National Competitor: AirBnb, local competitors of each region.

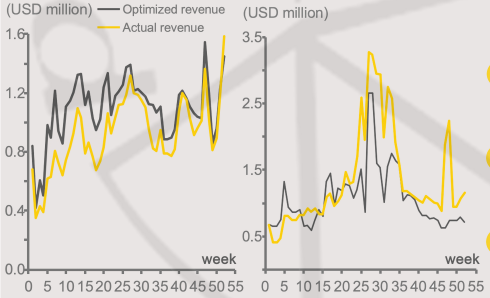
Propietary room inventory with room features (unit type, bed, bath, facilities, etc.) and status (booked/avaiable/canceled/blocked)

Internal data: Successful bookings from 2017 to 2019 (with room info and booking patterns, such as leadtime, stay length, etc.).

Methodology



Results



How can the model be improved:

1. **Complete competition data**
   Collect more competitor information so that the model can be built up matching corresponding year's competition data with more comprehensive information
2. **Consumer behavior**
   Track website's traffic so that the browsing behavior of unbooked unit is captured
3. **Price sensitivity**
   Try different price so that price sensitivity can be captured using A/B testing

Recommendations