Project Summary:

Batch Details	Bangalore, January 2022
Team Members	1. Shravya Pola. 2. Swapnil Sunil Loharkar. 3. Sanjay G K. 4. Nistha Kumari. 5. Raga Bhavana Dana.
Domain of Project	Hotel Industry
Proposed Project Title	Prediction of Booking Cancellation in Hotel Industry.
Group Number	9
Team Leader	Sanjay G K
Mentor Name	Vikash Chandra

Dataset name: Hotel Booking Visualization dataset.

Introduction to the problem/domain/background details:

The domain been chosen for the capstone project is from service sector of hotel industry (Hotel Booking demand dataset). A hotel is an establishment that provides paid accommodation (lodging and usually meals), entertainment, generally for a short duration of stay. Hotels often provide a number of additional guest services, such as restaurants, bars, swimming pools, healthcare, retail shops; meeting, conference services and facilities, banquet halls, boardrooms; and space for private parties like birthdays, marriages, kitty parties, etc.

With increase in the spending capacity of the people, both leisure and business travel spending has seen YoY growth over the past 5 years. The hotel industry has been consistently growing with The Global Hotel Industry revenue. According to the Hospitality Global Market Report 2022 the global hospitality market is expected to grow from $ 3,952.87 billion in 2021 to $ 4,548.42 billion in 2022 at a compound annual growth rate (CAGR) of 15.1%.

There are various challenges that come in the way. Not all of them might be unique but they are certainly worth the notice. Some of the major factors affecting the business are high competition between hotels, improper marketing strategy, Hiring and retaining staff, marinating online reputation; Hotels are not data driven, ineffective pricing model, and customer dissatisfaction due to inability to satisfy their requests.

Problem Statement:

1. To be at top of the competition between other OTA agents and to attract the customers, the OTA platforms offer cancellation of suite/room booking at free of charge. It has been serious issues in respect to the hotel management that leads to the loss of revenue and loss of the customer at the same instance, final minute cancellation leads to lower of price to resell the room. Hence, with the acquired dataset likes to approach and understand to classify/predict how likely the hotel bookings will get cancelled by a customer to strategic better.
2. In recent years, the online booking platforms acts as the middle man between hotels and customers to book a room. As there are large active competitors are in this hotel industry, the competitors tend to offer various better marketing strategized deals in try influencing the customers decision while booking a room. With the available dataset will try identify the ideal time to book a hotel to get the effective prices based on the optimal length of the stay.
3. While booking of room/suite at an effective price for a customer is always been the major problem. So, predicting a particular market segment and customer type affecting the ticket cancellation will add up in increasing the revenue.

Business problem/ Impact in business of your problem/Need for this study/Abstract (Executive summary):

In recent years there has been a rapid increase in hotel cancellations. More and more frequently, guests tend to cancel their room reservation. In many cases the cancellation is free of charge up to 24 hours before arrival.

Cancellations often present a big challenge for hotel managers. Especially since the rise of online travel agents such as Booking.com, Expedia and Co. it became more and more common to enforce free cancellations up to 24 hours before arrival. On one hand, this policy brings a new dimension of flexibility to hotel guests, on the other hand, it means an increasing financial risk for hotels and difficulties while planning their occupancy rate. Due to these developments, it got more and more important to analyze cancellation behavior of hotel guests and find a pattern in order to create a forecast.

What are the numbers telling us?

Duration of stay.

In general, it can be said that the booked period of stay has an actual impact on the risk of cancellation. The following applies here: If a room is booked for only 1 or 2 nights, it is more likely to be cancelled then if the length of stay is 3 nights or longer.

Time of booking.

The time of booking also influences the cancellation behavior. The longer a room is booked in advance, the higher is the risk that it will be cancelled. The actual amount of cancellations from early bookers rises approximately 1 month before arrival.

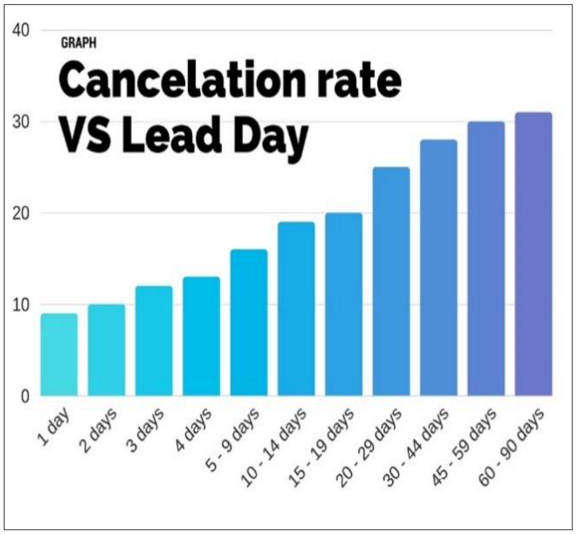
Contrary, the so-called last-minute bookings, which are made up to 10 days before arrival are less likely to be cancelled than the early ones.

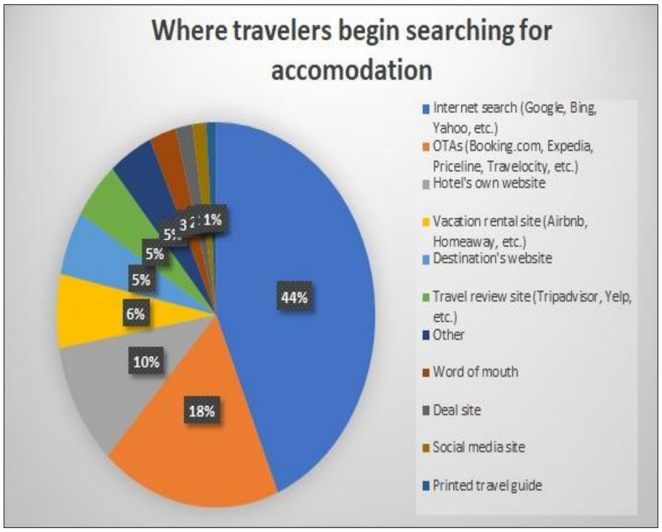
Dealing with cancellations.

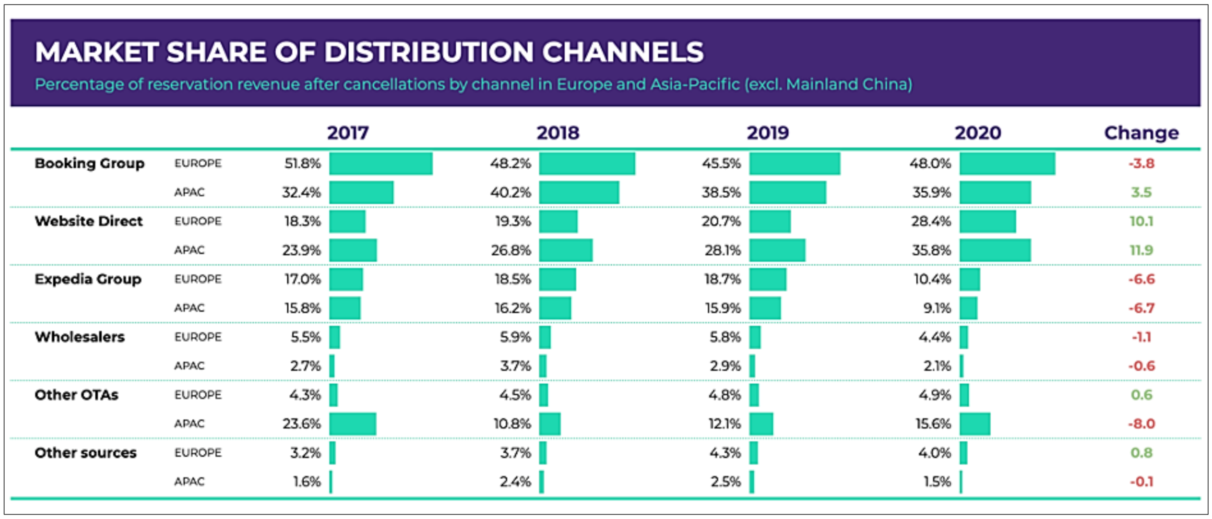
Many hotels have come up with creative ways to counteract the trend of free cancellations up to 24 hours prior arrival. One Option is to offer several different rates and conditions at once. One of these is the Non-Refundable Rate. Although this rate is usually 10 to 20 percent cheaper than the hotel’s standard rate, it needs to be fully paid immediately and is not refundable.

Another focus is to generate more direct bookings via website. Not only does the hotelier avoid commissions from online travel agents like Booking.com who charge about 15%, but also it generates a stronger relationship between the customer and the hotel. Therefore, an attractive concept and benefits have to be developed in order to guide the guest from going through OTAs to booking directly on the hotel’s website.

It is important to regularly check the settings of the cancellation policies on the different distribution channels. Make sure that cancellation conditions on the hotel’s website do not put potential guests at a disadvantage. The hotel’s own cancellation policy should be at least as good or even better than those of online travel agencies.







MARKET SHARE OF DISTRIBUTION CHANNELS

Percentage of reservation revenue after cancellations by channel in Europe and Asia-Pacific (excl. Mainland China)

		2017	2018	2019	2020	Change
Booking Group	EUROPE	51.8%	48.2%	45.5%	48.0%	-3.8
	APAC	32.4%	40.2%	38.5%	35.9%	3.5
Website Direct	EUROPE	18.3%	19.3%	20.7%	28.4%	10.1
	APAC	23.9%	26.8%	28.1%	35.8%	11.9
Expedia Group	EUROPE	17.0%	18.5%	18.7%	10.4%	-6.6
	APAC	15.8%	16.2%	15.9%	9.1%	-6.7
Wholesalers	EUROPE	5.5%	5.9%	5.8%	4.4%	-1.1
	APAC	2.7%	3.7%	2.9%	2.1%	-0.6
Other OTAs	EUROPE	4.3%	4.5%	4.8%	4.9%	0.6
	APAC	23.6%	10.8%	12.1%	15.6%	-8.0
Other sources	EUROPE	3.2%	3.7%	4.3%	4.0%	0.8
	APAC	1.6%	2.4%	2.5%	1.5%	-0.1

Variable identification:

Independent Variables: There are 36 independent variables which are listed below:-

1. Hotel,	2. Is_Canceled,
3. Lead_Time,	4. Arrival_Date_Year,
5. Arrival_Date_Month,	6. Arrival_Date_Week_Number,
7. Arrival_Date_Day_Of_Month,	8. Stays_In_Weekend_Nights,
9. Stays_In_Week_Nights,	10. Adults,
11. Children,	12. Babies,
13. Meal,	14. Country,
15. Market_Segment,	16. Distribution_Channel,
17. Is_Repeated_Guest,	18. Previous_Cancellations,
19. Previous_Bookings_Not_Canceled,	20. Reserved_Room_Type,
21. Assigned_Room_Type,	22. Booking_Changes,
23. Deposit_Type,	24. Agent,
25. Company,	26. Days_In_Waiting_List,
27. Customer_Type,	28. Average Daily Rate (Adr,)
29. Required_Car_Parking_Spaces,	30. Total_Of_Special_Requests,
31. Reservation_Status,	32. Reservation_Status_Date,
33. Name,	34. Email,
35. Phone-Number,	36. Credit_Card,

Target variable:-

1. is_cancelled

Variable information/Data description:

VARIABLE	DATA TYPE	DESCRIPTION
1. Hotel	Object	Hotel (H1 = Resort Hotel or H2 = City Hotel)

2. Is_Canceled	Int64	If booking was cancelled then (1) otherwise (0)
3. Lead_Time	Int.	Number of days that passed between the entering date of the booking into the Property Management System (PMS) and the arrival date
4. Arrival_Date_Year	Int64	Year of arrival date
5. Arrival_Date_Month	Object	Month of arrival date
6. Arrival_Date_Week_Number	Int64	Week number of year of arrival date
7. Arrival_Date_Day_Of_Month	Int64	Day of arrival date
8. Stays_In_Weekend_Nights	Int64	Number of Saturdays and Sunday's guest stayed or booked to stay
9. Stays_In_Week_Nights	Int64	Number of week nights(Monday to Friday) guests stayed or booked to stay
10. Adults	Int64	Number of adults
11. Children	Float64	Number of children
12. Babies	Int64	Number of babies
13. Meal	Object	Types of meals:- Categories are presented in standard hospitality meal packages: Undefined/SC – no meal package; BB – Bed & Breakfast; HB – Half board (breakfast and one other meal – usually dinner); FB – Full board (breakfast, lunch and dinner)
14. Country	Object	country of origin
15. Market_Segment	Object	Market segment designation ; through which hotels were booked. "TA" means "Travel Agents" ; "TO" means "Tour Operators" ; "GROUPS" means customers come in groups; "DIRECT" are those who came by their own; "CORPORATE" who got booked by their company; "COMPLEMENTARY" ; "AVITATION" and "UNDEFINED"
16. Distribution_Channel	Object	Booking distribution channel. "TA" means "Travel Agents" and "TO" means "Tour Operators"

17. Is_Repeated_Guest	Int64	If guest is repeated then(1) otherwise (0)
18. Previous_Cancellation	Int64	Number of previous bookings that were cancelled by the customer prior to the current booking
19. Previous_Booking_Not_Canceled	Int64	Number of previous booking not cancelled by the customer prior to the current booking
20. Reserved_Room_Type	Object	Code of room type reserved. Code is presented instead of designation for anonymity reasons
21. Assigned_Room_Type	Object	Code for the type of room assigned to the booking. Sometimes the assigned room type differs from the reserved room type due to hotel operation reasons (e.g. overbooking) or by customer request. Code is presented instead of designation for anonymity reasons
22. Booking_Changes	Int64	Number of booking changes made till the cancellation
23. Deposit_Type	Object	Indication on if customer is making deposit to guarantee the booking. Assumed by three categories: No Deposit – no deposit was made; Non-Refund – a deposit was made in the value of the total stay cost; Refundable – a deposit was made with a value under the total cost of stay.
24. Agent	Float64	ID of the travel agency that made the booking
25. Company	Float64	ID of the company/entity that made the booking or responsible for paying the booking. ID is presented instead of designation for anonymity reasons
26. Days_In_Waiting_List	Int64	Number of days the booking was in waiting list before it was confirmed.
27. Customer_Type	Object	Type of customer booking can be assumed one of these categories:- Group – when the booking is associated to a group; Transient – when the

		booking is not part of a group or contract, and is not associated to other transient booking; Transient-party – when the booking is transient, but is associated to at least other transient booking
28. Average Daily Rate (Adr)	Float64	Average Daily Rate:- defined by dividing the sum of all lodging transactions by the total number of staying nights.
29. Required_Car_Parking_Space	Int64	Number of car parking space required by the customer
30. Total_Of_Special_Requests	Int64	Number of special requests made by the customer
31. Reservation_Status	Object	Reservation status assuming one of three categories:- Canceled- booking was cancelled; Check-Out – customer has checked in but already departed; No-Show – customer did not check-in and did inform the hotel of the reason why
32. Reservation_Status_Date	Object	Date at which the last status was set. This variable can be used in conjunction with the Reservation Status to understand when was the booking canceled or when did the customer checked-out of the hotel
33. Name	Object	Name of the guest
34. Email	Object	E-mail ID of the guest
35. Phone_Number	Object	Phone number of the guest
36. Credit_Card	Object	Credit-Card number of the guest

Future Work/Methodology (Details of algorithms):

Methodology to be followed:

CRISP-DM which stands for Cross Industry Standard Process for Data Mining is a methodology created to help shape data mining projects. It describes the different phases/tasks involved in the project and provides an overview of data mining life cycle.

1. Business Understanding - It focuses on determining the business requirements/objectives and understanding what outcome to achieve. Also determine the business units being affected. Convert this business problem into a data mining problem and carve out an initial plan.

- Determine the business objectives: Understand what is needed to be accomplished for the customer.
- Assess situation: Determine resources availability, project requirements, assess risks and contingencies, and conduct a cost-benefit analysis.
- Determine data mining goals: Convert business problem to a data mining problem and recognize the data mining problem type such as classification, regression or clustering, etc.
- Produce a project plan: Devise a step-to-step plan for executing the project.

2. Data understanding - This phase starts with collecting the data and then examining the data for its surface properties like data format, number of records, etc. The next step is to better understand the data by understanding each attribute and perform basic statistics on them. Understand the relationship between different attributes. Determine the quality of data by checking the missing values, outliers, duplicates, etc.

- Collect initial data: Acquire the data and load it into the analysis tool to be used. Describe data: Examine the data and document its surface properties like data format, number of records, or field identities. Understand the meaning of each attribute and attribute value in business terms. For each attribute, compute basic statistics so as to get a higher-level understanding.
- Explore data: Find insights from the data. Query it, visualize it, and identify relationships among the data.
- Verify data quality: Identify special values, missing attributes and null data. Determine how clean/dirty is the data.

3. Data preparation - This stage, which is often referred to as data wrangling, has the objective to develop the final data set for EDA and modelling. Covers all activities to construct the final dataset from the initial raw data. Some of the tasks include table, record and attribute selection as well as transformation and cleaning of data for modelling tools.

- Select data: Determine which attributes/features will be used and document reasons for inclusion/exclusion.
- Clean data: Correct, impute and remove the improper data.
- Extract data: Derive new attributes from the existing ones
- Integrate data: Create features by combining data from multiple sources.
- Format data: Re-format data as necessary. For example, convert string values to numeric values so as to perform mathematical operations.

4. Modeling - In this stage we build and assess different models built using various techniques from the training dataset.

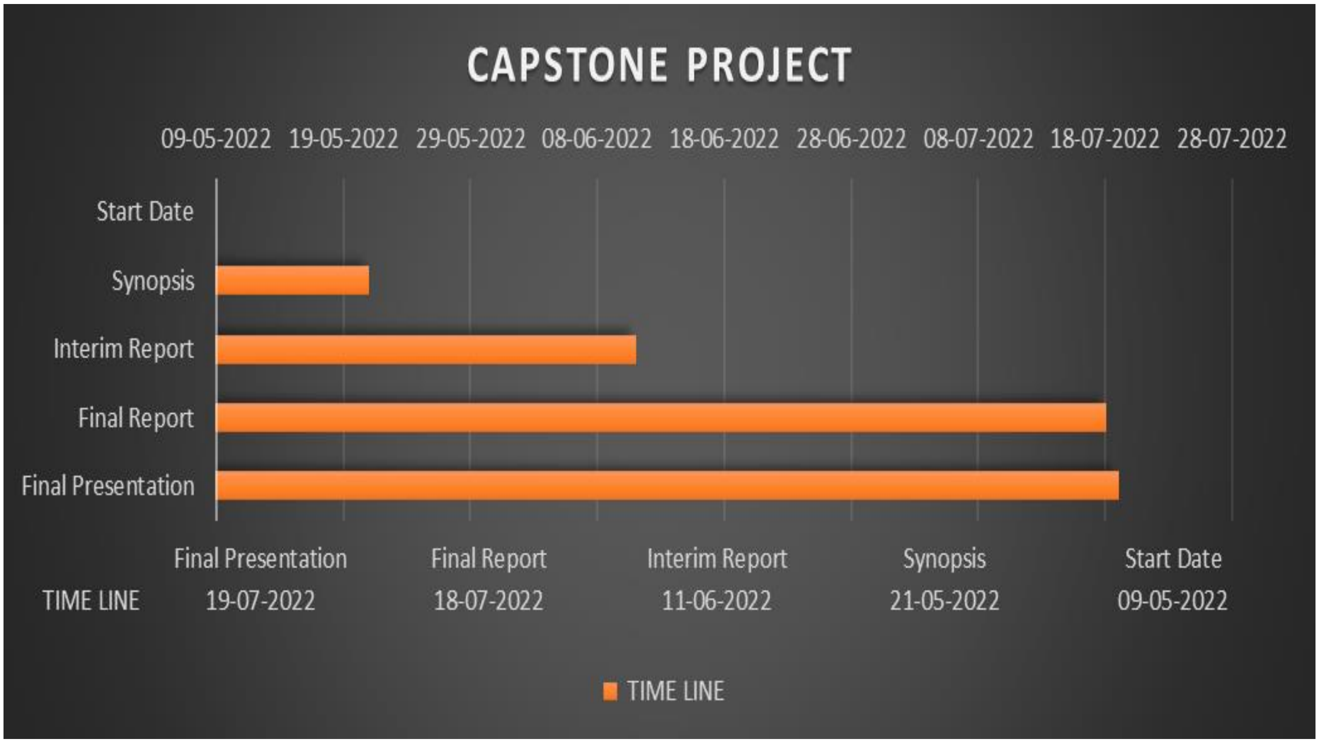
- Select modelling technique: Determine the algorithms to be used to model the data based on the business requirement.
- Generate test design: In order to build and test the model, we need to divide the dataset into training and testing data set. In this step we divide the data into train and test data set.
- Build model: Based on the modelling technique selected, build the model on the input data set.
- Assess model: Compare the results of different models based on confusion matrix. The outcome of this step frequently leads to model tuning iterations until the best model is found.

5. Evaluation - Evaluate the models and review the steps executed to construct the model to be certain it properly achieves the business objectives.

- Evaluate results: Understand the data mining results and check how impactful they are in achieving the data mining goal. Select appropriate model based on confusion matrix.

- Review process: Review the work accomplished and make sure that nothing was overlooked and all steps were properly executed. Summarize the findings and correct anything if needed.
- Determine next steps: Based on the previous three tasks, determine whether to proceed to deployment, iterate further, or initiate new projects.

Timeline Chart (Weekly Plan):



References (Dataset Source/Journals/Articles):

- https://www.kaggle.com/code/touba7/hotel-booking-visualization/data
- https://pbiecek.github.io/xai_stories/story-hotel-booking.html
- http://bright-journal.org/Journal/index.php/JADS/article/view/20/7
- https://opus.govst.edu/cgi/viewcontent.cgi?article=1199&context=capstones
- https://www.researchgate.net/publication/350699766_Performance_Analysis_of_Machine_Learning_Techniques_to_Predict_Hotel_booking_Cancellations_in_Hospitality_Industry
- Antonio, N, et al. 2019. An Automated Machine Learning Based Decision Support System to Predict Hotel Booking Cancellations. Data Science Journal, 18: 32, pp. 1–20. DOI: https://doi.org/10.5334/dsj-2019-032

Declaration: This is to declare that the dataset that we are using for our capstone project does not have any relevant legality associated to it and can be used to showcase the work we do on it as a presentation in Great Learning.