AIT- 664: Represent, Process & Visualize Applied Information

Data Analysis on Airline Passenger Satisfaction

PROJECT MILESTONE 2

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Introduction

A crucial component of the aviation sector, airline passenger happiness has a significant impact on the financial performance, customer loyalty, and general market standing of airlines. In this milestone, we explore the fundamental issue and the reasons behind the necessity of a thorough data analysis of passenger happiness on airlines.

There is intense competition in the aviation industry as several airlines compete for passengers in a highly commoditized market. While pricing, destinations, and travel times are important considerations, the Caliber of the passenger experience is a key differentiator. In order to gain repeat business from satisfied passengers and to draw in new ones through positive word-of-mouth and reviews, airline companies work hard to meet and surpass passenger expectations.

Thus, airlines must comprehend passenger satisfaction above anything else. They can use it to identify areas that need improvement, streamline services, and improve the flying experience as a whole. Airlines can obtain valuable information for their marketing campaigns, operational enhancements, and strategic decision-making by performing a data study on passenger satisfaction. Satisfied passengers are more likely to become devoted customers, which increases revenue and fosters long-term growth. This directly affects profitability.

By demonstrating the vital significance of researching airline passenger pleasure, we established the foundation for our data analysis journey in this milestone. We will go more deeply into the information, approaches, and insights that will help us comprehend how to enhance the flying experience and, consequently, support airlines' performance in this fast-paced and cutthroat sector.

Problem Statement:

The problem that we aim to address is the need to improve passenger satisfaction levels in the airline industry, which has become a pressing concern due to its direct impact on airlines' financial performance, customer retention, and competitive standing. In a market where consumers have many options and competition is fierce, airlines must find a way to both draw in new business and hold onto their current clientele. Reaching these two goals is contingent upon having a high level of passenger satisfaction.

Low passenger satisfaction can have a number of negative effects, such as a drop in an airline's reputation, a reduction in customer loyalty, and unfavourable word-of-mouth publicity. Disgruntled travellers are more inclined to look into other airlines for their upcoming trips, and they might also post their negative experiences on social media and review sites, which would further harm the airline's reputation.

Airlines stand to gain a great deal by taking steps to improve passenger satisfaction and solving this issue. These consist of heightened patronage, favourable referrals, greater ticket sales, and a competitive advantage in the industry. This problem statement essentially acts as the cornerstone of our data analysis, directing our efforts to pinpoint the primary factors that influence passenger happiness and offer practical recommendations to the airline sector to improve the quality of the flying experience.

Key Challenges Associated with This Problem Include:

Data Availability: Airlines collect vast amounts of data related to passenger satisfaction, including surveys, feedback, and operational data. However, this data is often dispersed and unstructured, making it challenging to gain meaningful insights.

Multi-faceted Nature of Satisfaction: Passenger satisfaction is influenced by various factors, such as in-flight services, punctuality, baggage handling, and customer service. Analysing these factors and their interactions is complex.

Competitive Pressure: As more airlines enter the market, the competition intensifies. Passengers have more choices than ever before, which means airlines must strive to provide an exceptional experience to retain their customer base.

Economic Implications: High passenger satisfaction correlates with increased repeat business and positive word-of-mouth. On the other hand, dissatisfied passengers might choose alternative airlines for their future travels, affecting airlines' profitability.

Regulatory Requirements: Regulatory bodies often require airlines to meet certain passenger satisfaction standards, and failing to do so can lead to legal issues and fines.

Motivation:

The motivation behind conducting data analysis on airline passenger satisfaction is multi-faceted and extends beyond addressing the problems mentioned above:

Improving Customer Experience: By identifying the areas of passenger dissatisfaction, airlines can tailor their services to better meet customer expectations. This leads to a more enjoyable and stress-free travel experience for passengers.

Revenue Enhancement: Satisfied passengers are more likely to book with the same airline for future travel, leading to increased customer loyalty and revenue growth.

Operational Efficiency: Data analysis can help airlines optimize their operational processes, such as baggage handling, scheduling, and customer service, leading to cost savings and increased efficiency.

Reputation Management: A positive reputation is a valuable asset for any airline. Analysing passenger satisfaction data can help airlines identify and address issues that might harm their brand image.
Compliance with Regulations: Airlines need to meet regulatory requirements related to passenger satisfaction. Data analysis ensures that they remain in compliance and avoid legal issues.

Literature Review:

An article published by J.D. Power, an analytics firm, cites the differences in the satisfaction levels of customers at various airlines. They have ranked various airline companies according to their class, such as business, premium economy, and economy. This shows the preference of customers when they wish to travel in their desired class. The satisfaction levels have also been affected due to several reasons, such as an increase in the ticket price, and dissatisfaction with the meals, fees, and other costs. [1]

Some of the key findings of this article depict that overall passenger satisfaction across first/business, premium economy, and economy/basic economy is 798 (on a 1,000-point scale), down more than 20 points from a year ago when the study was conducted. Owing to the pandemic restrictions on serving liquor in the premium economy and business class, a sharp decline in food and beverage satisfaction was recorded. The cost of air travel which has consistently increased since March 2022 has led to customer dissatisfaction. [1]

Hasan and Farooqi (2020) investigated how service quality and brand image influence the satisfaction of airline passengers in India. They found that both service quality and a positive brand image have a direct and positive impact on passenger satisfaction. This highlights the importance of these factors for airlines in India aiming to enhance passenger contentment. This research can also have practical implications for the decision-making of airlines pertaining to inflight services and by extension their brand image. This leads to the conclusion that the inflight staff must always be well-dressed, well-behaved, and courteous to all passengers. By drawing a direct comparison between how the inflight staff is perceived by passengers and the general sentiment of passengers, the authors of this paper aim to show a correlation between the tangible and intangible aspects of an airline company. [5]

The study is in conformity with the previous studies that the brand image of the airlines has a direct and significant impact on passenger satisfaction and loyalty. An airline company that pays attention to its brand image will produce higher passenger satisfaction and consequently instill higher customer loyalty. The hypothesized theoretical model was a good fit, but the data was generated from a sample of passengers from the New Delhi domestic airport, which is a major limitation of the study. Further, the study focused only on the services provided on-board the airlines and did not consider the airport services. [5]

Pabla and Soch (2023) investigate the link between airline passengers' brand experience and brand satisfaction, with brand love as a mediator. They emphasize that a positive brand experience is crucial in fostering brand love, which in turn enhances overall brand satisfaction. The study delves into the multifaceted nature of brand experience, emphasizing various touchpoints, and highlights the importance of emotional attachment in passenger satisfaction. It

offers valuable insights for airlines to strategically manage brand experience dimensions to create strong emotional connections and boost passenger satisfaction. [6]

This study has several practical implications, brand experience as a metric to measure an airline's customer experience is almost unheard of. It addresses this void and helps in understanding the interactions between the model's constructs (event marketing, marketing communication, brand experience, brand love, and brand satisfaction) in the aviation industry. It revealed that brand experience has a significant impact on brand love and investigated the effects of both event marketing and marketing communication strategies by airlines collectively on brand experience. It was found through a systemic philosophical and methodological integration that positive brand experience has an impact on airline customer satisfaction. Brand experience has positive effects on brand satisfaction and is supported in a variety of sectors. [6]

Hannigan, Hamilton, and Mudambi (2015) examined competition and competitiveness in the US airline industry. They emphasized the impact of market deregulation on competition, the role of alliances and partnerships, and the significance of technology and innovation. External factors like economic conditions and regulatory changes were also highlighted as influential in shaping competitiveness within the industry. This study provides valuable insights into the complex dynamics of competition in the US airline sector. [7]

Proposed Approach:

In accordance with our objective to understand the key features and predict the satisfaction of the airline service, we have planned to proceed by understanding the two issues, satisfaction, and dissatisfaction.
As of the current stage, we have implemented the use of the R programming language for data analysis. In further stages, we will be implementing various other tools, such as Python and Tableau, for detailed data analysis and visualization.
We followed the data analysis pipeline procedures to explore our dataset.

Data gathering: For this project we were specifically looking for dataset that would have a considerable number of records (rows) and variables/features (columns). This is necessary as it would help us analyse the data extensively and perform machine learning procedures such as creating training and testing datasets as we progress. We were interested in dataset that will have business implications so that we can provide suggestions to improve the business and its growth.

Libraries: It is crucial to use libraries (containing various packages) to perform data analysis. Here, we used "tidyverse," "dplyr," and "ggplot2." These were used for data cleaning, data processing, data exploration, and data visualization.

Data Cleaning and Testing: This is one of the essential steps required for data analysis. The data we referred to did not require any extreme data cleaning. We tested the class of every feature and the dataset using the command class ("<column_name>"). This returned values such as "numeric," "character," and "dataframe." We also tested for any null values present in the dataset using the command is.na. The values returned were "False" indicating absence of any null values.

Data analysis: Our approach was to understand the satisfaction levels given by every passer and classify the output based on the class, type of passenger, and travel type.

In addition, we created a variable (new column) that shows mean of all the services provided by the airlines called "overall.service.score," which consisted of over 10 distinct types of services, and a mean called "avg.delay," which is the mean of departure and arrival delays for each passenger.

We created these new columns to get an overview of the dataset. We considered the possibility for satisfaction or dissatisfaction may be related to the services provided by the airlines or the delays in the flight.

Using the dplyr package, we used the 'mutate' function in creating the two new variables.

We created a new sub-dataset that contained only certain variables (columns) from the original dataset. In doing so we were able to focus on a narrower objective which was to understand the satisfaction levels of the passengers considering their type, class, and the travel reason.
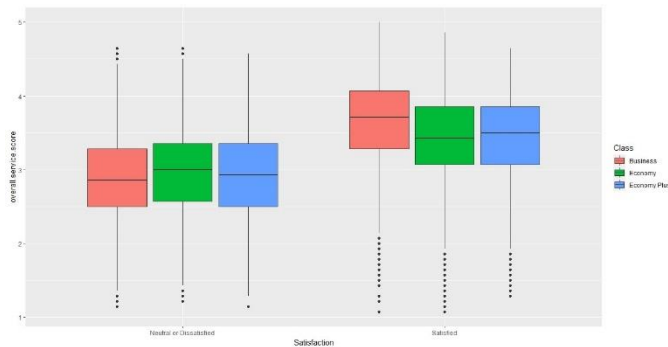
Data Visualization: We created boxplots, assigning satisfaction status on the x-axis and the overall.service.scores on the y-axis. Moreover, we classified the boxplots based on the passenger's class such as economy, economy-plus, and business.

Further, we also created tile plot graph. For this we assigned, type of customer (returning or first-time) on x-axis, travel reason on y-axis (business or personal), and faceted (segmented) the graph by the travel class. We filled the tiles with a colour range that depicted average delay the passengers in every combination faced.

Preliminary Results:

From our preliminary analysis, we observed that the passengers who rated high and dissatisfied had longer delays than the contrary passengers. The most affected passengers were the ones who were traveling for business purposes in business class and were returning customers. These customers typically faced extensive delays as compared to any other customers. The tile plot displays such conditions with wide contrast.
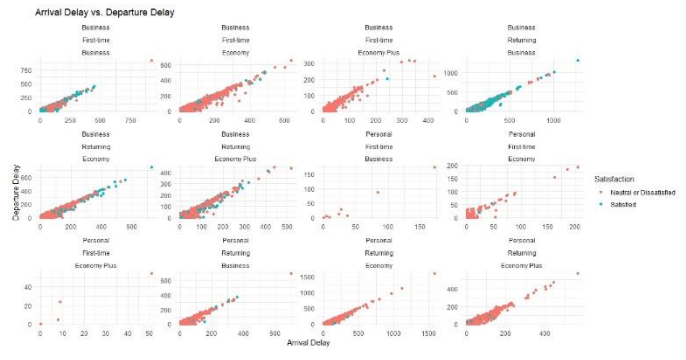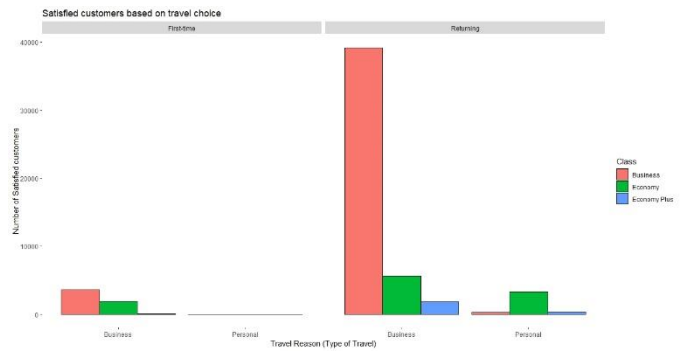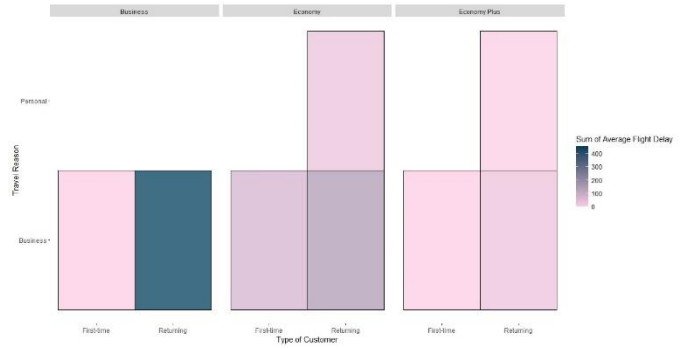
This analysis was to provide an overview of the dataset. In the following stages of this project, we will be exploring the dataset variables and their importance in accordance with the satisfaction levels of the customer ratings.
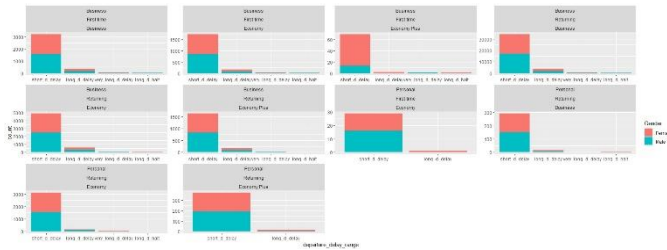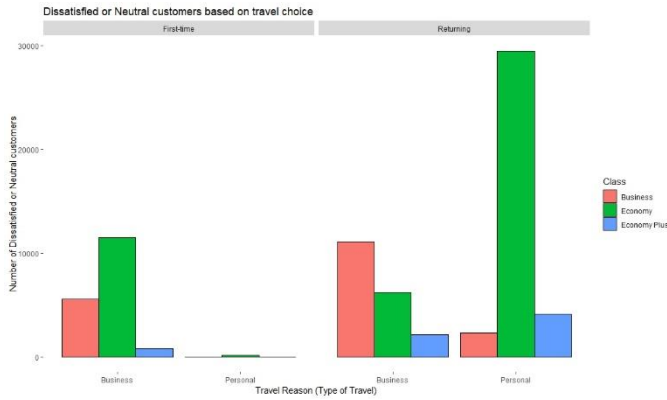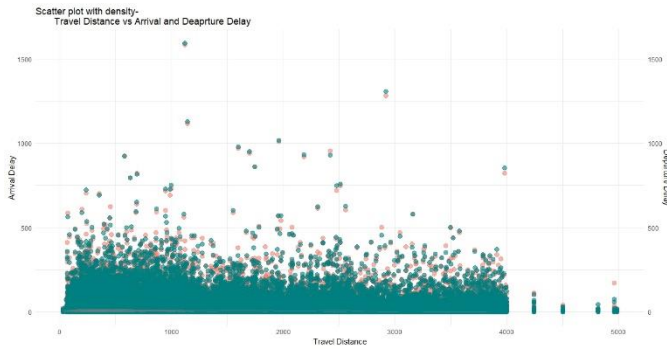

Dissatisfied Customers.

Satisfied Customers

Scatter plot with density-
Travel Distance vs Arrival and Deaprture Delay
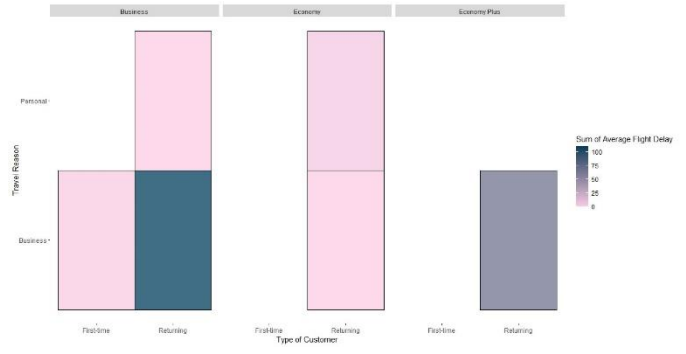
Dissatisfied or Neutral customers based on travel choice

The project is anticipated to be finished in 8 to 10 weeks, with the following timeline:

Task	Completion Date
Project Proposal	Week 0
Data Collection and Pre-processing	Week 1-2
Exploratory Data Analysis	Week 3-4
Predictive Modelling	Week 5-6
Analysis and Report Generation	Week 7-8
Final Project Presentation	Week 9-10

Progress so far: Previously we presented the dataset and the proposal with an overview of the dataset and our objective. In this milestone, we initiated exploring our dataset and chose a narrower approach to understand the data and the output variable (satisfaction level). This preliminary study will be extended with further exploratory data analysis, feature engineering, hyper parameter tuning, and ML classification models to summarize impactful variables and understand the pattern for the satisfaction levels.

References:

1.Effler, G. (2022, May 11). 2022 North America Airline Satisfaction Study. J.D. Power. https://www.jdpower.com/business/press-releases/2022-north-america-airline-satisfaction-study

2.Hibović, L., Smajić, S., & Yaman, E. (2022, October 1). Predicting Satisfaction of Airline Passengers Using Classification. https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9932850

3.Maven Analytics. (n.d.). Maven Analytics. https://mavenanalytics.io/data-playground?page=2&pageSize=5

4.Singh, P. P. (n.d.). Ancillary Rev strategies - Airlines. www.linkedin.com. https://www.linkedin.com/pulse/ancillary-rev-strategies-airlines-pramod-pal-singh/

5. Hasan, M., & Farooqi, R. (2020, January 1). Impact of Service Quality and Brand Image on Satisfaction of Airline Passengers in India: A SEM Approach. Amu-in. https://www.academia.edu/46847784/Impact_of_Service_Quality_and_Brand_Image_on_Satisfaction_of_Airline_Passengers_in_India_A_SEM_Approach

6. Pabla, H., & Soch, H. (2023, March 1). Up in the air! Airline passenger's brand experience and its impact on brand satisfaction mediated by brand love. Journal of Air Transport Management; Elsevier BV. https://doi.org/10.1016/j.jairtraman.2022.102345

7. Hannigan, T. J., Hamilton, R. D., & Mudambi, R. (2015, March 16). Competition and competitiveness in the US airline industry. Competitiveness Review; Emerald Publishing Limited. https://doi.org/10.1108/cr-11-2014-0036

8.Stavrinoudis, D., & Orfanou, F. (2019). Airline passenger satisfaction: a structural equation model. Journal of Air Transport Management, 74, 142-148.

9.Han, Y., Karpova, E. G., & Logar, J. (2019). Airline customer satisfaction, trust, and loyalty: An examination of the moderating role of the type of a passenger. Journal of Air Transport Management, 81, 101720.

10.Chang, Y. (2018). Analysis of Factors Affecting Customer Satisfaction in Airline Service Quality. Journal of Air Transport Management, 66, 36-42.

11.Soteriades, M., & Stavrinoudis, D. (2020). Passengers' Expectations, Perceptions, and Satisfaction in Full-Service Airlines: The Case of Athens International Airport. Journal of Air Transport Management, 84, 101735