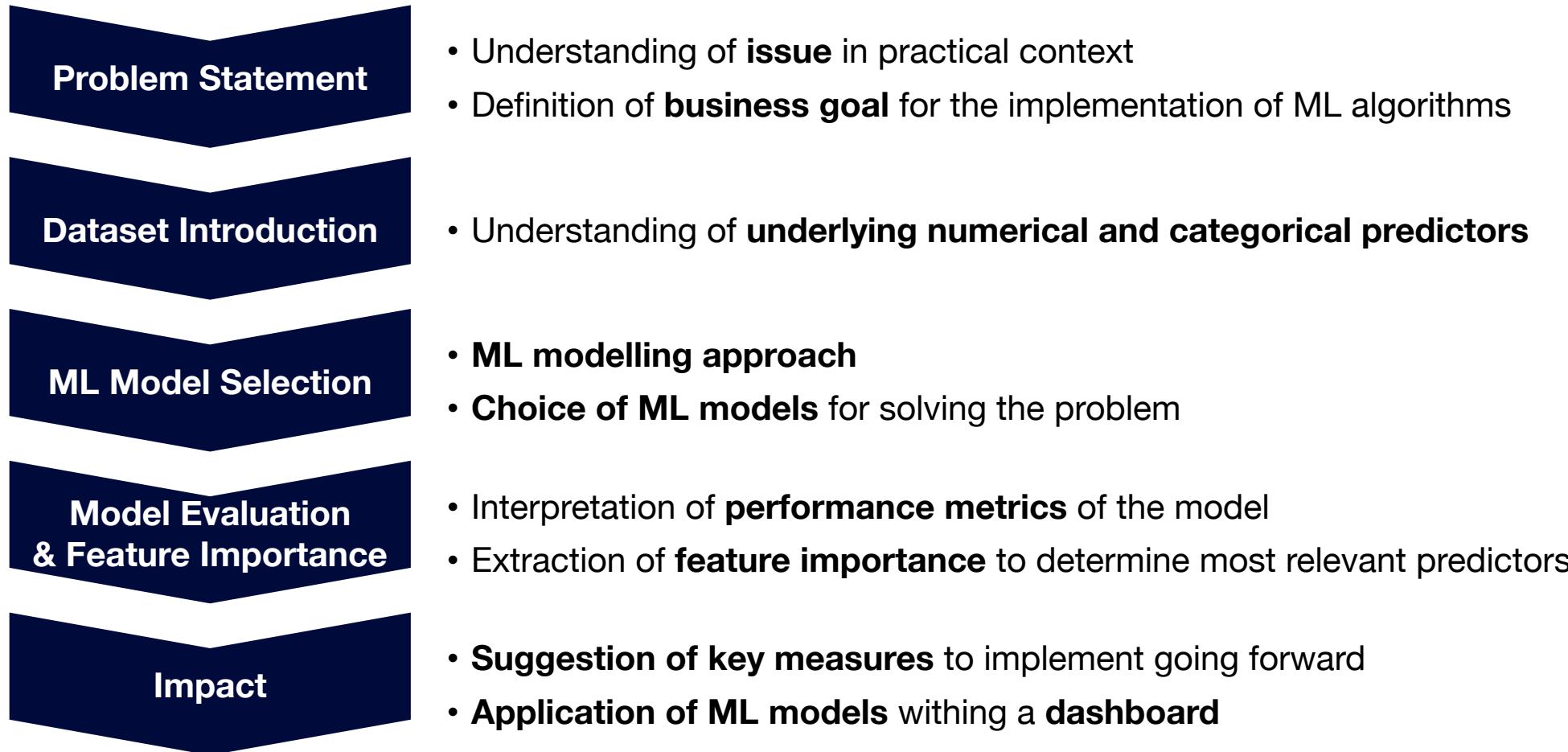


A large commercial airplane is captured in flight against a vibrant orange and yellow sunset sky. The aircraft is positioned centrally, angled slightly upwards and to the left. Its wings are spread wide, and the engines are glowing with a bright white light. Below the plane, the silhouette of an airport terminal building is visible, along with several palm trees and other airport infrastructure. The overall atmosphere is one of travel and adventure.

Predicting Customer Satisfaction for Airlines

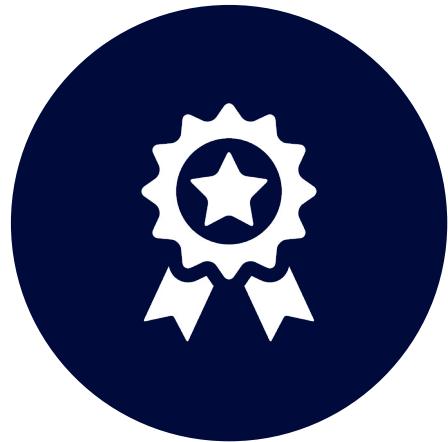
Final Presentation | Group A | June 17th, 2024

Approach



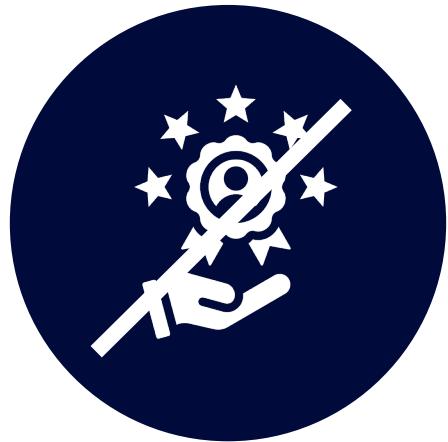
- Approach
- Problem Statement
- Dataset Introduction
- ML Model Selection
- Model Evaluation & Feature Importance
- Impact

Dissatisfied customers have detrimental consequences



Negative Impact on Reputation

Bad reviews, damaged brand image



Decreased Customer Loyalty

Loss of repeat business, higher customer acquisition costs



Negative Financial Consequences

Refunds, compensation, costly operational adjustments

- Approach
- Problem Statement
- **Dataset Introduction**
- ML Model Selection
- Model Evaluation & Feature Importance
- Impact

Our dataset is sourced from an undisclosed airline

Data Source¹



Undisclosed airline
company

Details



Customer survey

Scores from customer survey questions



Passenger details

e.g., age, booked class, travel type



Flight information

Departure and arrival delay

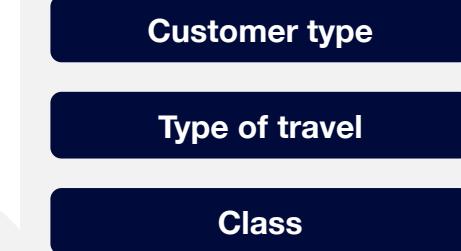
¹ Source: <https://www.kaggle.com/datasets/raminhuseyn/airline-customer-satisfaction>

In our models, we rely on 19 flight-related predictors

Numerical Predictors



Categorical Predictors



- Approach
- Problem Statement
- Dataset Introduction
- **ML Model Selection**
- Model Evaluation & Feature Importance
- Impact

We decided to compare 6 different ML model algorithms

Binary classification

Will a customer
be satisfied or
dissatisfied
after the flight?



Decision Tree



Logistic Regression



XGBoost



Support Vector Classifier



NN (MLP Classifier)



AutoML (TPOT Classifier)

- Approach
- Problem Statement
- Dataset Introduction
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- Impact

XGBoost performs best with a Validation AUC of 0.992

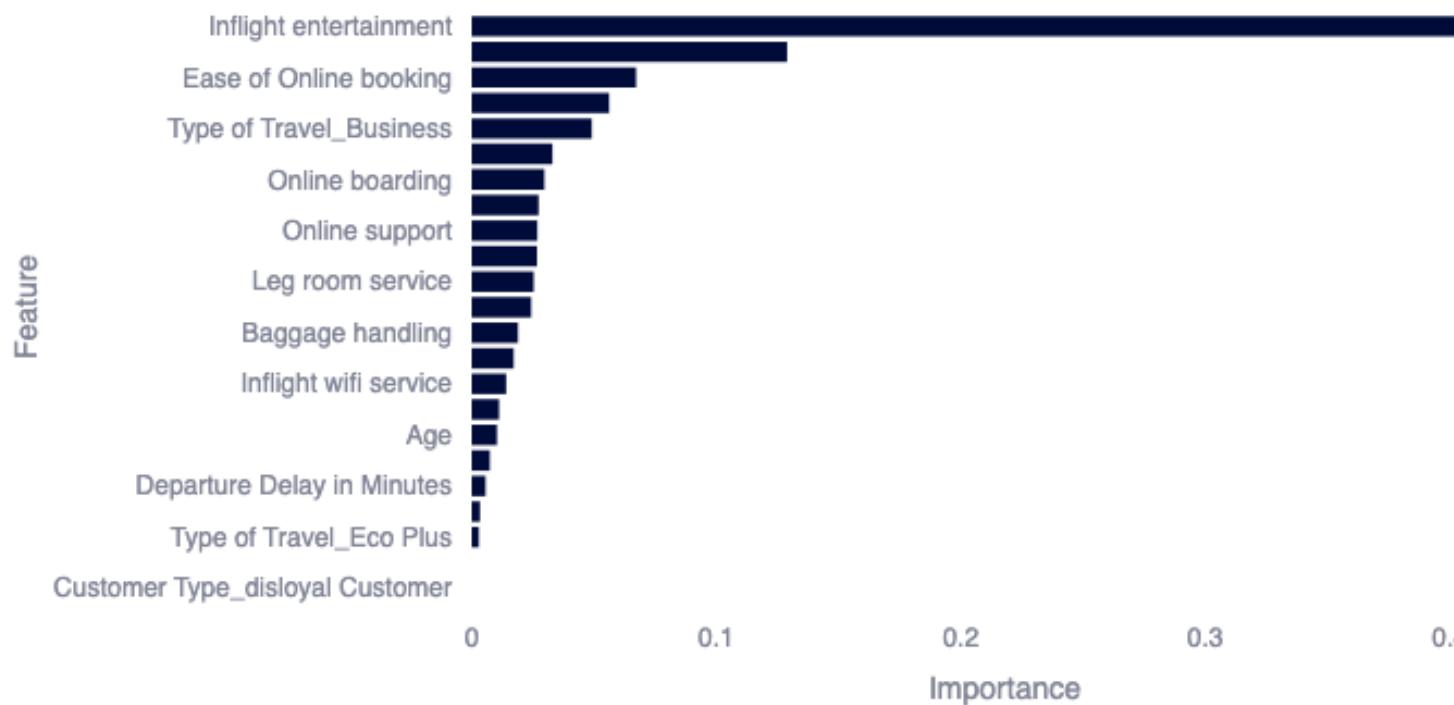
Criterion: Validation AUC (Area under curve)

- 1 AUC is independent of setting a classification threshold, which makes it robust even when the threshold is not known
- 2 AUC considers both the True Positive Rate (Sensitivity) and the False Positive Rate (Specificity), ensuring that the model performs well in identifying both satisfied and dissatisfied customers, which is relevant in our business context
- 3 AUC evaluates how well the model distinguishes between the two classes regardless of their distribution, making it robust against class imbalance

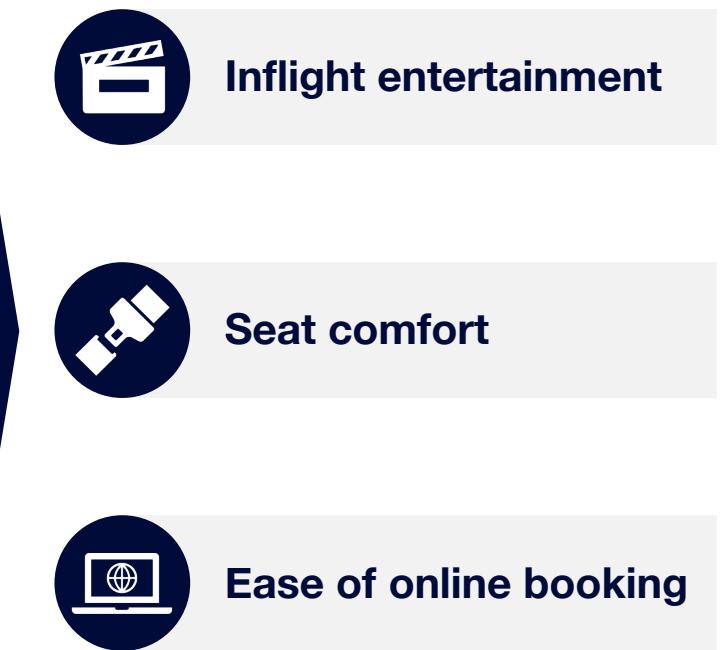
	XGBoost	NN	AutoML (XGBClassifier)	SVC	Decision Tree	Logistic Regression
Validation AUC	0.992	0.991	0.988	0.986	0.974	0.900
Rank	1	2	3	4	5	6

Top 3: entertainment, seat comfort & online booking

Feature Importance (XGBoost model)



Top 3 Features



- Approach
- Problem Statement
- Dataset Introduction
- ML Model Selection
- Model Evaluation & Feature Importance
- Impact

Airlines can focus on 3 main areas of improvement



Inflight entertainment

Action Items:

- 1** Expand variety of content available to cater to wider passenger preferences (incl. different age groups, languages)
- 2** Invest in high-quality screens with better resolution and responsiveness and user interfaces
- 3** Update the entertainment content regularly to include the latest content



Seat comfort

Action Items:

- 1** Work with seat manufacturers to design more ergonomic seats that provide better lumbar support and adjustable features like headrests
- 2** Reconfigure the seating layout to offer more legroom, especially in economy class
- 3** Use higher-quality, more comfortable seat cushions that offer better support during long flights

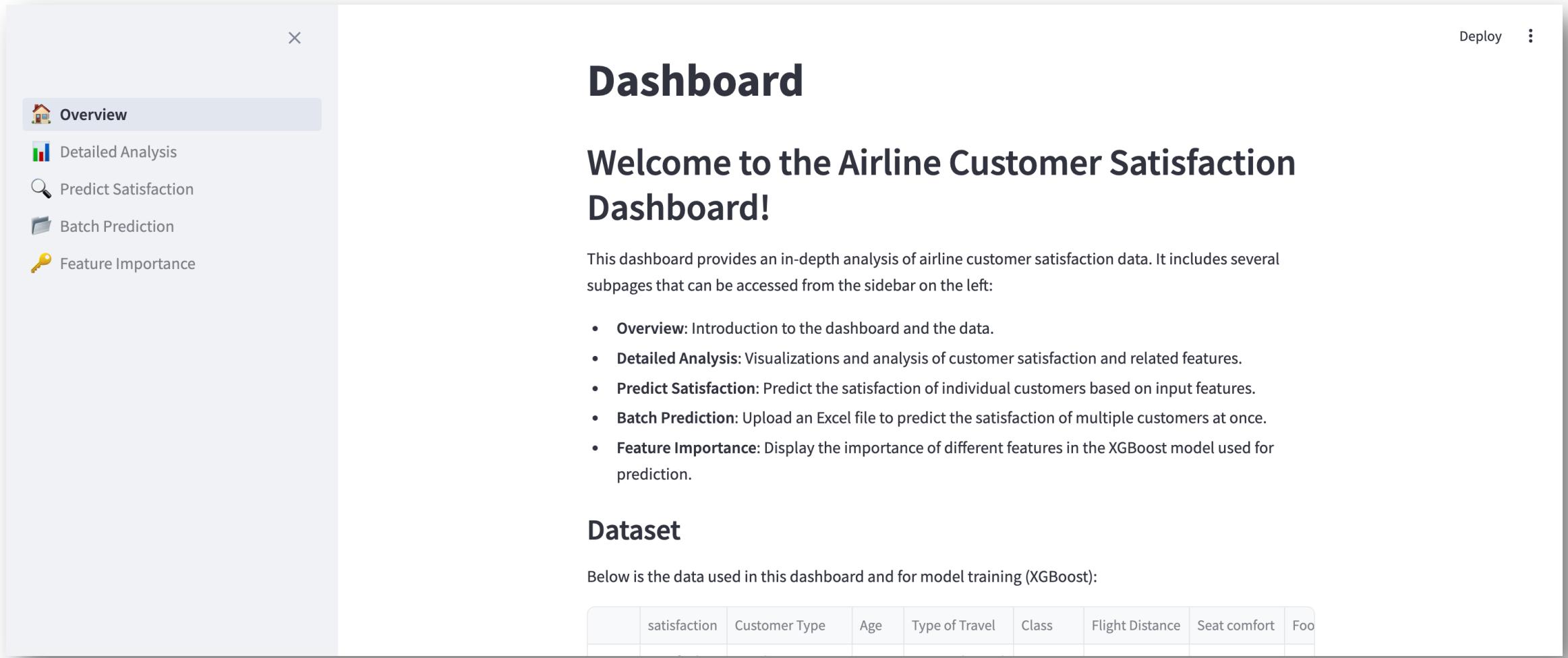


Ease of online booking

Action Items:

- 1** Simplify the online booking interface to reduce the number of steps required to complete the booking
- 2** Ensure the online booking system is fully optimized for mobile devices, including through an own app
- 3** Integrate real-time customer support options, such as chatbots and live chat, withing the booking process

A dashboard serves as insight hub to airline managers



The screenshot shows a dashboard titled "Dashboard" with the subpage "Overview" selected. The sidebar on the left lists other subpages: "Detailed Analysis", "Predict Satisfaction", "Batch Prediction", and "Feature Importance". The main content area features a large heading "Welcome to the Airline Customer Satisfaction Dashboard!" followed by a descriptive paragraph and a bulleted list of features. Below this is a section titled "Dataset" with a table preview.

This dashboard provides an in-depth analysis of airline customer satisfaction data. It includes several subpages that can be accessed from the sidebar on the left:

- **Overview:** Introduction to the dashboard and the data.
- **Detailed Analysis:** Visualizations and analysis of customer satisfaction and related features.
- **Predict Satisfaction:** Predict the satisfaction of individual customers based on input features.
- **Batch Prediction:** Upload an Excel file to predict the satisfaction of multiple customers at once.
- **Feature Importance:** Display the importance of different features in the XGBoost model used for prediction.

Dataset

Below is the data used in this dashboard and for model training (XGBoost):

	satisfaction	Customer Type	Age	Type of Travel	Class	Flight Distance	Seat comfort	Foo
1	3	Business	32	Business	Business	1000	Very Good	1
2	5	Business	32	Business	Business	1000	Very Good	1
3	3	Business	32	Business	Business	1000	Very Good	1
4	5	Business	32	Business	Business	1000	Very Good	1
5	3	Business	32	Business	Business	1000	Very Good	1
6	5	Business	32	Business	Business	1000	Very Good	1
7	3	Business	32	Business	Business	1000	Very Good	1
8	5	Business	32	Business	Business	1000	Very Good	1
9	3	Business	32	Business	Business	1000	Very Good	1
10	5	Business	32	Business	Business	1000	Very Good	1
11	3	Business	32	Business	Business	1000	Very Good	1
12	5	Business	32	Business	Business	1000	Very Good	1
13	3	Business	32	Business	Business	1000	Very Good	1
14	5	Business	32	Business	Business	1000	Very Good	1
15	3	Business	32	Business	Business	1000	Very Good	1
16	5	Business	32	Business	Business	1000	Very Good	1
17	3	Business	32	Business	Business	1000	Very Good	1
18	5	Business	32	Business	Business	1000	Very Good	1
19	3	Business	32	Business	Business	1000	Very Good	1
20	5	Business	32	Business	Business	1000	Very Good	1
21	3	Business	32	Business	Business	1000	Very Good	1
22	5	Business	32	Business	Business	1000	Very Good	1
23	3	Business	32	Business	Business	1000	Very Good	1
24	5	Business	32	Business	Business	1000	Very Good	1
25	3	Business	32	Business	Business	1000	Very Good	1
26	5	Business	32	Business	Business	1000	Very Good	1
27	3	Business	32	Business	Business	1000	Very Good	1
28	5	Business	32	Business	Business	1000	Very Good	1
29	3	Business	32	Business	Business	1000	Very Good	1
30	5	Business	32	Business	Business	1000	Very Good	1
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32	5	Business	32	Business	Business	1000	Very Good	1
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35	3	Business	32	Business	Business	1000	Very Good	1
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73	3	Business	32	Business	Business	1000	Very Good	1
74	5	Business	32	Business	Business	1000	Very Good	1
75	3	Business	32	Business	Business	1000	Very Good	1
76	5	Business	32	Business	Business	1000	Very Good	1
77	3	Business	32	Business	Business	1000	Very Good	1
78	5	Business	32	Business	Business	1000	Very Good	1
79	3	Business	32	Business	Business	1000	Very Good	1
80	5	Business	32	Business	Business	1000	Very Good	1
81	3	Business	32	Business	Business	1000	Very Good	1
82	5	Business	32	Business	Business	1000	Very Good	1
83	3	Business	32	Business	Business	1000	Very Good	1
84	5	Business	32	Business	Business	1000	Very Good	1
85	3	Business	32	Business	Business	1000	Very Good	1
86	5	Business	32	Business	Business	1000	Very Good	1
87	3	Business	32	Business	Business	1000	Very Good	1
88	5	Business	32	Business	Business	1000	Very Good	1
89	3	Business	32	Business	Business	1000	Very Good	1
90	5	Business	32	Business	Business	1000	Very Good	1
91	3	Business	32	Business	Business	1000	Very Good	1
92	5	Business	32	Business	Business	1000	Very Good	1
93	3	Business	32	Business	Business	1000	Very Good	1
94	5	Business	32	Business	Business	1000	Very Good	1
95	3	Business	32	Business	Business	1000	Very Good	1
96	5	Business	32	Business	Business	1000	Very Good	1
97	3	Business	32	Business	Business	1000	Very Good	1
98	5	Business	32	Business	Business	1000	Very Good	1
99	3	Business	32	Business	Business	1000	Very Good	1
100	5	Business	32	Business	Business	1000	Very Good	1

A dashboard serves as insight hub to airline managers

Detailed Analysis

This page provides detailed analysis of the airline customer satisfaction data which was used to train the model. Several visualizations are included to help understand the distribution of customer satisfaction, customer types, classes, and other key features. Use the filters in the sidebar to explore specific segments of the data.

Key Metrics

Avg Departure Delay (min)	Avg Arrival Delay (min)	Avg Flight Distance (miles)
14.64	15.09	1981.01

Satisfaction Distribution

The following chart shows the distribution of customer satisfaction.



Customer Type

- Loyal Customer
- disloyal Customer

Type of Travel

- Personal Travel
- Business travel

Class

- Eco
- Business
- Eco Plus

Age Range

7 - 85

Predict Customer Satisfaction

Input features for prediction

This page allows you to predict the satisfaction of an individual customer based on the input features provided. The model used for prediction is an XGBoost trained on airline customer data. It helps to identify the factors that influence customer satisfaction and make recommendations to improve it.

Customer Type

- Loyal Customer

Type of Travel

- Personal Travel

Class

- Eco

Age

30

Flight Distance

500

Seat comfort

3

Food and drink

3

Upload Excel File for Prediction

Upload an Excel file with customer data

Drag and drop file here
Limit 200mb per file + .XLSX

template_airline_customer_satisfaction (5).xlsx 5.6KB

Input Data

	Customer Type	Class	Type of Travel	Age	Flight Distance	Seat comfort	Food and drink
0	Loyal Customer	Eco	Business travel	35	500	3	4
1	disloyal Customer	Eco Plus	Personal Travel	45	1,500	4	5
2	Loyal Customer	Business	Business travel	60	200	5	1
3	disloyal Customer	Eco	Personal Travel	25	1,000	2	3
4	disloyal Customer	Business	Personal Travel	40	3,000	3	2

Predict Batch Satisfaction

Prediction Results (see last column of dataframe)

	Customer Type	Class	Type of Travel	Age	Flight Distance	Seat comfort	Food and drink
0	Loyal Customer	Eco	Business travel	35	500	3	4
1	disloyal Customer	Eco Plus	Personal Travel	45	1,500	4	5
2	Loyal Customer	Business	Business travel	60	200	5	1
3	disloyal Customer	Eco	Personal Travel	25	1,000	2	3
4	disloyal Customer	Business	Personal Travel	40	3,000	3	2

Number of Satisfied Customers: 2 out of 5

Seat comfort vs Satisfaction



Food and drink vs Satisfaction



Customer Type

- Loyal Customer
- disloyal Customer

Type of Travel

- Personal Travel
- Business travel

Class

- Eco
- Business
- Eco Plus

Age Range

7 - 85

Predict

Arrival Delay in Minutes: 0

Predicted Satisfaction: Dissatisfied

Show Recommendations

Based on the customer profile, here are some recommendations to improve satisfaction:

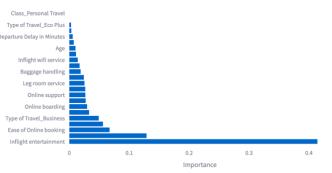
- Consider upgrading the seating comfort to improve customer satisfaction.
- Enhance the quality and variety of food and drinks offered during the flight.
- Improve the reliability and speed of inflight WiFi services.
- Provide a wider selection of entertainment options including movies, music, and games.
- Enhance online support with quicker response times and more helpful information.
- Simplify the online booking process and ensure the website is user-friendly.
- Train staff to be more attentive and responsive to customer needs during the flight.
- Increase the legroom available to passengers to make their flight more comfortable.
- Ensure that baggage handling is efficient and that luggage is delivered promptly.
- Streamline the check-in process and reduce waiting times.
- Maintain high standards of cleanliness throughout the flight.
- Improve the online boarding process for a smoother experience.

Feature Importance

Importance of Features in the Decision Tree Model

The feature importance values represent the relative importance of each feature in predicting customer satisfaction. It helps understand which features have the most impact on the model's predictions. Thus, airlines can focus on improving these key features to enhance customer satisfaction.

Feature Importance



Feature Importance Results

The top 3 most important features airlines should focus on to improve customer satisfaction are:

1. Inflight entertainment - Importance: 0.41 of 1.0