Business Understanding

The airline industry faces substantial challenges with customer satisfaction and retention. Low satisfaction leads to a loss of loyalty and revenue. This project aims to identify the key service factors that influence customer satisfaction so that the airline can make data-driven decisions to improve it. By focusing on the biggest drivers of satisfaction, the airline can potentially increase retention and revenue.

Data Understanding

The dataset contains 103,904 rows and 24 features related to customer demographics, flight details, service ratings, delays, and satisfaction labels. Features include:

- Passenger information: Gender, Age, Customer Type
- Flight information: Travel Type, Flight Class, Flight Distance
- Service ratings: WiFi, Food, Entertainment, Check-in, Cleanliness, etc.
- Flight delays: Departure and Arrival delays in minutes
- Satisfaction: Label with 3 classes - Satisfied, Neutral, Dissatisfied

Some pre-analysis and visualizations revealed useful insights like the distribution of satisfaction by gender, travel type, and customer type. Around 58% of the customers are dissatisfied indicating significant room for improvement.

Data Preparation

The following data preparation steps were taken:

- Missing values in Arrival Delay were filled using KNN imputer.
- Categorical variables like Gender, Travel Type, etc. were labeled encoded to numeric.
- Features were normalized using MinMaxScaler to handle varying scales.
- Boruta feature selection retained 13 relevant features out of 24.
- Data split into 80% train and 20% test sets.

Modeling

The modeling objective was to train a classifier to predict customer satisfaction levels. The following models were trained and evaluated:

- Random Forest
- Support Vector Machine
- Logistic Regression
- Gradient Boosting
- XGBoost
- Gaussian Naive Bayes

The evaluation metrics calculated were Accuracy, Confusion Matrix, Classification Report, and R-squared. XGBoost had the best performance with 95% test accuracy.

Results & Insights

The feature importance scores from XGBoost were extracted to understand the most influential factors:

- Inflight wifi service
- Online boarding
- Inflight entertainment
- Checkin service
- Cleanliness
- Departure delay

Enhancing services like wifi, ease of check-ins, boarding, entertainment, and maintaining cleanliness will likely improve customer satisfaction. Reducing delays is also important.

Recommendations

Here are some detailed recommendations for improving airline customer satisfaction based on the analysis:

Inflight WiFi Recommendations

- Upgrade connectivity technology to provide faster wifi speeds and bandwidth. Emerging solutions like Starlink satellite can enable 50Mbps+ speeds.
- Extend wifi access to cover the entire fleet of planes rather than just certain aircraft.
- Implement tiered wifi pricing like basic free access and paid premium plans for a better experience.
- Add content partnerships (e.g. movies, TV shows, magazines) to the wifi portal to enhance inflight entertainment.
- Set up regional servers to cache and serve popular content while in flight to improve streaming speeds.

Online Check-in Recommendations

- Allow check-in from the airline app or website starting 24 hours before the flight departure.
- Implement advance seat selection and upgrade purchases during online check-in.
- Provide baggage tracking and notifications during the web/mobile check-in process.
- Send push notifications to mobiles when check-in opens and at completion to reduce anxiety.
- Set up self-service kiosks at the airport for check-ins requiring baggage drop-offs.
- Integrate TSA data to reduce or eliminate the need for physical documents at the airport.

- Analyze and fix tech issues causing delays or failures in the online check-in process.

Cleanliness Recommendations

- Perform a thorough cleaning of the cabin before each flight turnaround including disinfecting trays, and windows.
- Implement the use of anti-microbial surfaces and HEPA filters to improve air quality.
- Schedule deep-cleaning sessions every night for each aircraft involving scrubbing, and steam cleaning.
- Provide hand sanitizer, masks, and wipes for customers on board to improve the experience.
- Train cleaning staff on the most effective methods and inspect work done randomly for quality control.
- Standardize cleanliness with a detailed checklist of tasks and items to cover for each cleaning session.

The recommendations aim to provide ideas aligned with the key drivers identified from the analysis. A combination of technology upgrades, process improvements, and policy changes could help enhance satisfaction.

Conclusion

In conclusion, this project provided a machine learning workflow to derive data-driven insights on improving airline customer satisfaction. The top drivers were identified and recommendations were proposed. Operationalizing these could potentially increase retention and revenue. In the future, collecting more customer feedback data could give additional insights.