International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 13 Issue 3 ǁ March 2025 ǁ PP. 76-78

Customer Satisfaction Analysis Based On Travel Mode Preference Using Machine Learning

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ABSTRACT
Customer satisfaction is a critical factor in evaluating the performance of travel services and their ability to meet user expectations. In the modern travel industry, customers have access to both offline and online travel modes, each offering unique benefits. Traditional offline travel modes, including buses, trains, and taxis, have long been the backbone of transportation, providing reliability and accessibility. On the other hand, online travel services—such as app-based ride-hailing platforms, digital booking services, and automated ticketing systems—have revolutionized the way people travel by offering convenience, real-time tracking, and cashless transactions.
This study employs machine learning techniques to assess the relationship between customer satisfaction and travel mode preferences across different age groups. A dataset containing customer attributes was collected from surveys, online booking platforms, and feedback systems to analyze factors such as travel frequency, waiting time, price sensitivity, and app usability. By preprocessing the data and applying predictive models, we identified key factors influencing customer recommendations and travel choices.
The results indicate that younger individuals prefer online travel modes due to their digital convenience, while older passengers continue to rely on offline services for their reliability and familiarity. Additionally, factors such as price sensitivity and waiting time significantly impact customer satisfaction levels. The study's findings can help businesses optimize their travel services, improve customer engagement, and develop personalized offerings to enhance user experiences. The integration of artificial intelligence (AI) in customer analytics further enables service providers to predict future trends and address evolving consumer needs.

Date of Submission: 09-03-2025 Date of acceptance: 23-03-2025

I. INTRODUCTION

The rapid advancement of digital technology has transformed the global travel industry, giving rise to diverse transportation options that cater to different customer needs. Traditionally, people relied on offline travel modes, such as public transport systems, taxis, and long-distance bus or train services, to reach their destinations. However, the emergence of online travel solutions has reshaped the industry by providing on-demand ride-hailing services, real-time tracking, and digital booking options, significantly enhancing convenience and accessibility.

With this transformation, understanding customer satisfaction has become essential for travel companies, as it directly influences customer retention, business growth, and competitive advantage. Travelers often evaluate services based on factors such as waiting time, pricing, app usability, and overall travel experience before deciding whether to continue using a particular service. Additionally, demographic factors especially age play a crucial role in travel mode preference, as different generations exhibit varying levels of comfort with digital platforms.

This research focuses on analyzing customer satisfaction levels across different travel modes and predicting whether customers are likely to recommend a service. Using machine learning techniques, we aim to:

1. Examine how travel mode preference varies across different age groups.
2. Identify key factors affecting customer satisfaction and recommendation likelihood.
3. Predict customer recommendations using machine learning models.

The dataset used in this study was collected from multiple sources, including customer surveys, online booking platforms, and feedback systems. Various data preprocessing techniques were applied to clean and prepare the data before analysis. The study employs predictive models such as Logistic Regression and Decision Trees to evaluate customer satisfaction trends and identify patterns in travel mode preferences.

By leveraging data-driven insights, businesses can optimize their service offerings to improve customer experiences and build stronger customer relationships. The integration of artificial intelligence (AI) and machine learning (ML) in predictive analytics enables travel service providers to better understand user needs, enhance service efficiency, and stay ahead in an increasingly competitive market.

DATA COLLECTION

The dataset for this study was obtained from multiple sources, including:

1. Online Travel Booking Platforms: User reviews, booking details, and ratings collected from travel service websites.
2. Customer Surveys: Direct feedback obtained from travelers about their experiences, preferences, and satisfaction levels.
3. Transport Service Feedback Systems: Data collected from various service providers' feedback mechanisms, where customers rate aspects such as waiting time, pricing, and service quality.

The dataset includes the following attributes:

- Name (anonymous for privacy)
- Age (categorized into different groups for analysis)
- Travel Mode (classified as Online or Offline)
- Travel Frequency (how often the customer uses the service)
- Number of Complaints (customer-reported issues)
- Waiting Time (average waiting time for a ride or service)
- Price Sensitivity (how much pricing affects the customer's choice)
- App Usability (for online services, ease of use of booking platforms)
- Customer Satisfaction (measured on a scale, used as the primary factor for prediction)

Additionally, a separate dataset consisting of new customer details was used for predictive analysis to determine future satisfaction trends.

DATA PREPROCESSING

Before performing analysis, the collected data was refined using the following preprocessing techniques:

1. Data Cleaning
   - Removed duplicate entries to avoid biased results.
   - Handled missing values in numerical fields using mean imputation and categorical fields using mode imputation.
2. Feature Engineering
   - Categorization of Age Groups into:
     - 18-22 (Young Adults)
     - 23-34 (Early Career Professionals)
     - 35-50 (Middle-aged Professionals)
     - 50+ (Senior Citizens)
   - Transformed the Customer Satisfaction variable into a binary classification model:
     - 1 (Yes) if satisfaction score ≥ 3 (Likely to Recommend)
     - 0 (No) if satisfaction score < 3 (Unlikely to Recommend)
3. Data Splitting
   - Divided the dataset into 80% training data and 20% testing data to ensure an optimal balance for machine learning training and evaluation.
4. Normalization and Encoding
   - Numerical features were standardized to bring all variables to a uniform scale.
   - Categorical features such as travel mode were converted into numerical form using one-hot encoding.

ANALYSIS

The analysis involved training machine learning models to assess customer satisfaction and identify travel mode preferences among different age groups.

1. Model Training
   - A Logistic Regression model was employed to predict whether a customer would recommend the service based on satisfaction scores.
   - Additional models like Decision Trees were tested for improved accuracy.
2. Customer Satisfaction Prediction
   - Predictions were generated for new customers based on past data trends.
   - The model assigned a probability score for recommendation, with high-confidence predictions indicating strong satisfaction.
3. Travel Mode Preference Analysis
   - Offline vs. Online Satisfaction: The number of satisfied and unsatisfied customers for each mode was compared.
   - Age-Wise Travel Mode Trends:

- Younger customers (18-22) preferred online travel due to ease of app-based bookings.
- Older customers (50+) relied more on offline services for familiarity and accessibility.

4. Influence of Key Factors on Satisfaction

- Waiting Time: Longer waiting times negatively impacted satisfaction levels, especially in online ride-hailing services.
- Price Sensitivity: Customers with high price sensitivity preferred offline modes due to stable fares.
- App Usability: A well-designed app experience played a crucial role in retaining online customers.

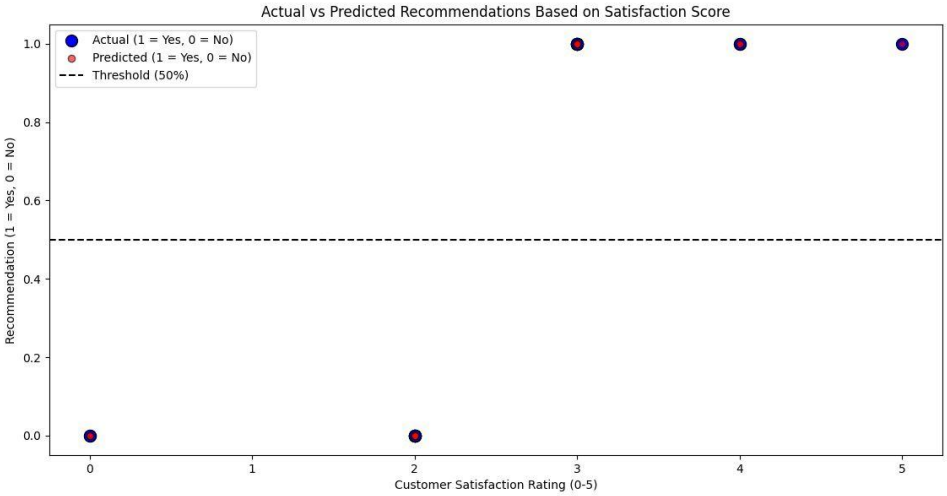
OUTPUT

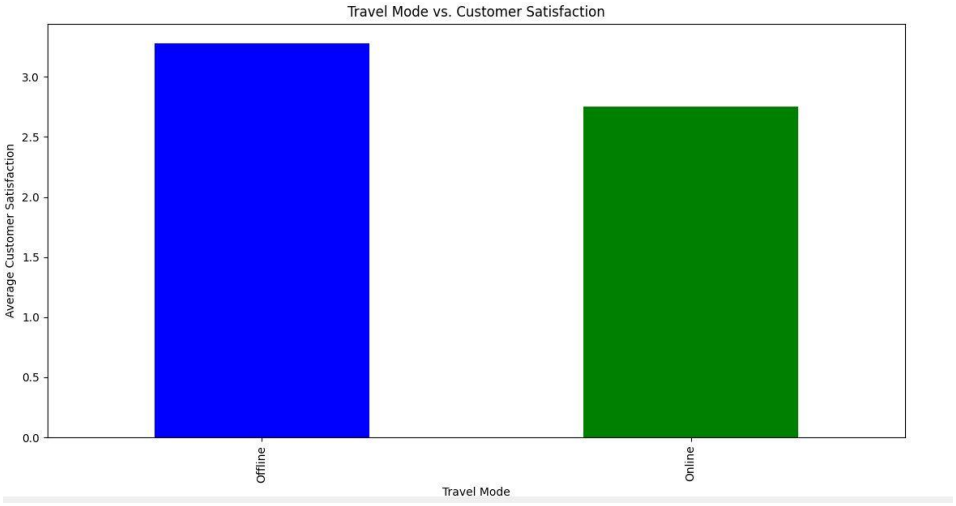
```
========== RESTART: D:\DII\finalresearchcoding.py ==========
Learned Formula: Recommendation Probability = -0.137 + (0.306 × Customer Satisfaction)


Overall Customer Preferences Based on Travel Mode:

Travel Mode  Satisfied Customers (Actual)  Not Satisfied Customers (Actual)  Satisfied Customers (Predicted)  Not Satisfied Customers (Predicted)
    Offline                           20                                 5                                2                                   2
     Online                           42                                18                                1                                   0

Preferred Travel Mode Based on Actual Data: Online
Preferred Travel Mode Based on Predicted Data: Offline
```





II. CONCLUSION

This study highlights the importance of customer satisfaction in the travel industry and how it influences travel mode preferences across different age groups. By analyzing data from surveys, online booking platforms, and customer feedback systems, we identified key factors such as travel frequency, waiting time, price sensitivity, and app usability that impact customer recommendations. The findings indicate that younger individuals tend to prefer **online travel modes** due to their convenience, real-time tracking, and seamless digital transactions, whereas **offline travel modes** remain essential for long-distance and public transportation needs, particularly among older travelers.