# FLIGHT FARE FORECASTING SYSTEM USING STACKED PREDICTION MODEL IN A WEB INTERFACE

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## ABSTRACT

This project involves a web application that predicts airline ticket prices using advanced ensemble machine learning techniques that incorporate features such as departure date, airline, and origin/destination locations. Using historical records of air travel, the application first cleans, pre-processes, and engineers features in order to evaluate trends and relationships among various air travel variables. After developing models based on these relationships, the application uses a stacked predictive model, as opposed to single analytical model.

The stacked model combines two base prediction models (Random Forest Regressor and XGBoost Regressor) into a single output generated from the meta-model (Linear Regression). The system was evaluated by comparing Mean Squared Error (MSE) and R-squared (R2) against each of the two base models. The analysis of the feature importance identified two statistically significant variables in predicting air ticket price: airline carrier and number of stops.

The system provides a user-friendly web interface for submitting travel requests (origin and destination locations as well as the travel date) to obtain an immediate projected price for airline tickets, which

can be used to make informed decisions and take advantage of the increasingly common practice of dynamic pricing.

Keywords: Dynamic Pricing, Forecasting Airfare, Machine Learning, Stacked Models, Ensemble Learning, Random Forest Regressor, XGBoost Regressor, Web Based Application.

## INTRODUCTION

Air travel has become one of the most popular modes of transportation due to its speed and convenience. However, one of the major challenges faced by travelers is the unpredictable nature of flight ticket prices. Airline fares change frequently based on multiple dynamic factors, making it difficult for users to book tickets at the most affordable price.

With the rise of data science and machine learning, predictive analytics has become a powerful tool for forecasting prices in various industries. Flight fare prediction is one such application where historical data is analyzed to estimate future prices. This helps users identify the best time to book flights and reduce travel expenses.

The proposed system, **Flight Fare Forecasting System using Stacked Prediction Model**, aims to provide accurate fare predictions using advanced machine learning techniques. A stacked ensemble model is used to combine multiple algorithms, improving prediction accuracy compared to individual models.

The system is deployed on a **web-based interface**, allowing users to easily input travel details and receive instant fare predictions. This makes the system accessible to a wide range of users without requiring technical knowledge.

## EXISTING SYSTEM

Existing flight fare prediction systems are mostly based on simple regression models or rule-based pricing tools. Some airline websites provide fare estimates, but they do not clearly explain how prices are calculated or predicted.

Many travel platforms show historical price trends but lack accurate forecasting capabilities. These systems usually rely on single machine learning models, which may not capture complex patterns in flight pricing data.

### Disadvantages

- Low prediction accuracy due to single model usage

- Limited ability to handle complex pricing patterns
- No ensemble learning techniques used
- Lack of transparency in fare estimation
- Poor generalization across different routes
- No user-friendly predictive web interface in many systems

## PROPOSED SYSTEM

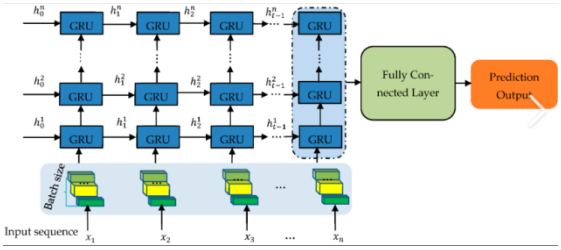
The proposed system, **Flight Fare Forecasting System using Stacked Prediction Model in a Web Interface**, is designed to provide an intelligent, accurate, and user-friendly solution for predicting airline ticket prices. The system addresses the limitations of traditional fare estimation methods by using advanced **ensemble machine learning techniques**, specifically stacking, combined with a modern web-based interface for real-time access.

The core objective of this system is to analyze historical flight data and identify hidden patterns in pricing behavior. Airline ticket prices are influenced by several factors such as booking time, seasonality, demand fluctuations, airline reputation, route distance, number of stops, and travel class. The proposed system integrates all these features into a unified predictive framework to generate reliable fare forecasts.

## Advantages

- Higher accuracy using ensemble learning
- Reduced prediction error
- Real-time web-based access
- Handles complex pricing patterns
- Scalable and adaptable system

## SYSTEM ARCHITECTURE




## TECHNOLOGIES USED

- Python
- Scikit-learn
- XGBoost
- Pandas, NumPy

- Flask / Streamlit (Web Interface)
- HTML, CSS, JavaScript

## APPLICATIONS

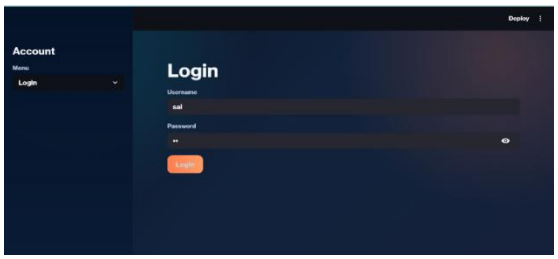
- Travel booking platforms
- Airline pricing analytics
- Budget travel planning
- Tourism agencies
- Smart recommendation systems

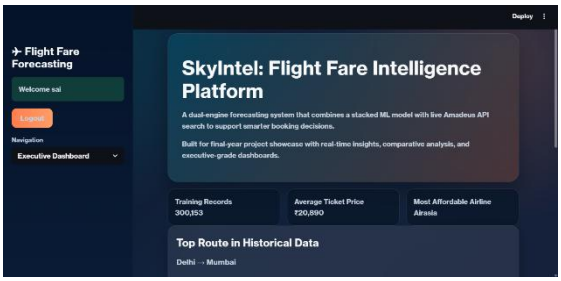
## CHALLENGES & RISKS

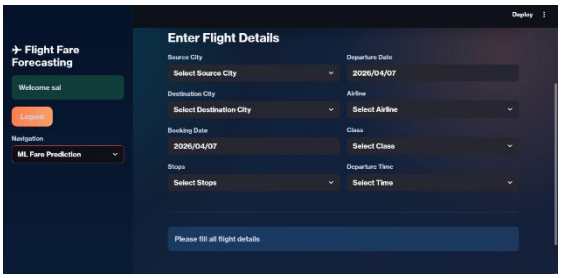
- Highly dynamic airline pricing
- Data inconsistency across sources
- Seasonal variation effects
- Overfitting in complex models
- Need for continuous model updates

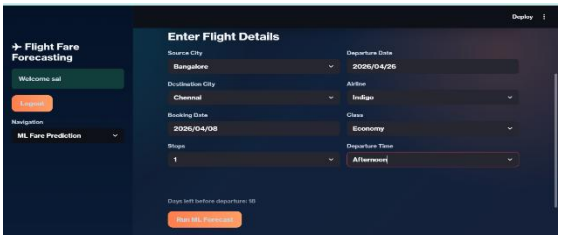
## RESULTS

The proposed stacked prediction model demonstrated strong performance in forecasting flight ticket prices. The model achieved a Mean Absolute Error (MAE) of 2440 and a Root Mean Squared Error (RMSE) of 4370, indicating low prediction error. Additionally, the model obtained an $R^2$ score of 0.96, which reflects a high level of accuracy and a strong correlation between predicted and actual values. Compared to individual models such as Random Forest and XGBoost, the stacked approach showed superior performance, improved accuracy, and better generalization capability across different flight data scenarios. These results confirm the effectiveness of ensemble learning in handling complex pricing patterns and enhancing prediction reliability.



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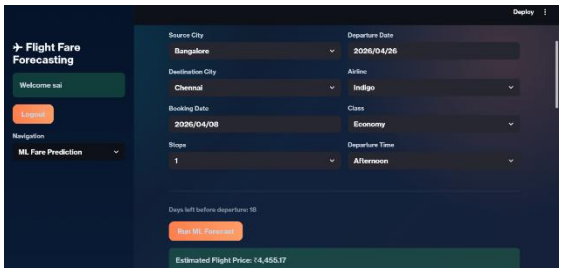


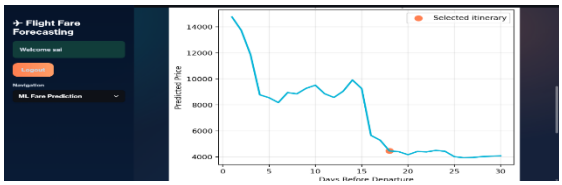


## CONCLUSION

The Flight Fare Forecasting System using Stacked Prediction Model provides an efficient and intelligent solution for predicting airline ticket prices. By combining multiple machine learning models through stacking, the system significantly improves prediction accuracy compared to traditional single-model approaches.

The integration of a web-based interface makes the system accessible and easy to use for all types of users. Travelers can quickly input their journey details and receive reliable fare estimates, helping them make informed booking decisions.

The system demonstrates how ensemble learning techniques can be effectively applied to real-world problems such as dynamic pricing prediction. It reduces uncertainty in flight booking and helps users save money by identifying optimal booking times.

Although the system performs well, further improvements can be made by incorporating real-time airline APIs, deep learning models, and more granular pricing features. Overall, this system represents a powerful application of machine learning in the travel industry.

## FUTURE ENHANCEMENTS

- Integration with real-time airline APIs
- Deep learning-based forecasting models
- Mobile application version
- Personalized travel recommendations
- Dynamic pricing alerts and notifications
- Global route expansion

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