

PREDICTIVE ANALYTICS OF TOURISM IN INDIA: A DATA MINING APPROACH TO VISITOR FORECASTING

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Abstract:

The tourism sector contributes extensively to regional and national economic progress, therefore reliable visitor prediction has become important for planning, infrastructure utilization, and policy formulation. This study examines the use of predictive analytics and machine learning approaches to estimate tourist inflow patterns by analyzing quantitative tourism datasets collected from Kaggle and global tourism databases. The study utilizes historical tourism data including worldwide tourist arrivals, travel receipts, GDP, inflation, unemployment, and seasonal trends from 1999 to 2023. Prior to building the predictive models, the gathered dataset processed through several preprocessing techniques such as data normalization, handling of missing entries, and feature refinement. Three machine learning algorithms—Decision Tree, Random Forest, and Support Vector Machine (SVM)—were applied and evaluated using performance measures including Mean Absolute Error (MAE), Root Mean Square Error (RMSE), and Accuracy Score. The quantitative findings showed that the Random Forest algorithm delivered the best forecasting performance with an accuracy rate of 93.4%, exceeding the results obtained from the Decision Tree and SVM models. The outcomes reveal that advanced machine learning and ensemble-based techniques can substantially enhance tourism prediction by identifying hidden and complex visitor behavior patterns. The study contributes to smart tourism research by providing a scalable predictive framework that supports tourism policy planning, resource allocation, and destination management.

Keywords: Predictive Analytics, Tourism Forecasting, Data Mining, Visitor Prediction, Machine Learning.

1. Introduction

Travel is one of the fastest-growing industries globally and contributes significantly to service generation, foreign exchange earnings, and economic growth (Song, Qiu, & Park, 2019). Governments and tourism organizations require accurate visitor forecasting systems to improve destination planning, infrastructure development, marketing strategies, and resource allocation.

Traditional forecasting approaches such as moving averages, regression analysis, and ARIMA models are effective for linear datasets but often fail to capture the complex and non-linear patterns present in modern tourism data (Goh & Law, 2011). The emergence of machine learning and big data has transformed tourism forecasting by enabling the analysis of structured and unstructured datasets from multiple digital platforms (Lee & Wong, 2016).

This research proposes a predictive analytics framework using data mining algorithms to forecast tourism demand. The study uses quantitative datasets collected from Kaggle and World Bank tourism repositories containing tourist arrivals, economic indicators, and tourism expenditure statistics.

The Main Objectives of this Study are:

1. To analyze tourism datasets using quantitative data analysis techniques.
2. To implement machine learning for visitor predicting.
3. To compare predictive performance of Decision Tree, Random Forest, and SVM algorithms.
4. To identify major factors influencing tourist arrivals.

2. Literature Review

Studies have examined tourism demand predicting using both conventional statistical techniques and advanced machine learning approaches. Traditional forecasting methods, including ARIMA, exponential smoothing, and regression models, have demonstrated reasonable results for time-series prediction; though, they face challenges when dealing with complex and high-dimensional tourism datasets.

Recent research highlights the growing significance of machine learning techniques in tourism predicting because they are accomplished of identifying complicated relations among multiple variables (Claveria, Monte, & Torra, 2015).

Researchers also combined big data sources such as social media analytics, online travel searches, weather data, and mobile location information into tourism prediction models (Aburumman & Al-Qudah, 2020). Ensemble learning approaches have consistently demonstrated better forecasting performance compared to individual models. The increasing availability of open tourism datasets from Kaggle and international organizations has enabled the development of scalable predictive frameworks for tourism analytics.

3. Dataset Description: 3.1 Dataset Source

The quantitative dataset used in this research is considered from Kaggle datasets related specifically to Indian tourism statistics and Ministry of Tourism reports (Tourism Ministry, Government of India, 2024). The dataset contains annual and monthly tourism indicators for India from 2010 to 2024.

The study focuses exclusively on Indian tourism trends including domestic tourist visits, global tourist arrivals, tourism revenue, state-wise tourism growth, and seasonal tourism patterns.

Indian Tourism Dataset Variables

Variable	Description
Foreign Tourist Arrivals (FTA)	International people arriving in India
Domestic Tourist Visits (DTV)	Domestic people visits across Indian states
Tourism Revenue	Income generated from tourism
Hotel Occupancy Rate	Accommodation utilization statistics
GDP Contribution	Tourism contribution to Indian GDP
Seasonal Index	Seasonal tourism variation
Air Passenger Traffic	Domestic and international passenger movement
Online Search Trends	Tourism-related Google search activity

Dataset Size

Attribute	Value
Total Records	8,750
Number of Features	8
States Covered	28 States and 8 UTs
Time Duration	2010–2024

4. Research Methodology

4.1 Data Collection

Tourism-related information was taken from open Kaggle repositories along with tourism statistics available through international databases. Historical tourism arrival data, economic indicators, and tourism expenditure records were merged into a unified dataset.

4.2 Data Preprocessing

The following preprocessing techniques were applied:

- Removal of duplicate records
- Handling missing values using KNN imputation
- Data normalization using Min-Max Scaling
- Feature selection using correlation analysis
- Time-series decomposition for trend analysis

4.3 Machine Learning Models

Three machine-learning algorithms were implemented:

Decision Tree

This algorithm identify tourism demand categories through structured rule-based branching mechanisms.

Random Forest

This integrates several decision trees to increase prediction reliability while minimizing overfitting issues.

Support Vector Machine (SVM)

This models determine optimal boundaries for classification and forecast of tourism trends.

5. Quantitative Data Analysis

5.1 Exploratory Data Analysis

The quantitative analysis of Indian tourism data revealed strong growth patterns in domestic tourism after 2021, while foreign tourist arrivals showed gradual recovery after the COVID-19 pandemic.

Analysis

Variable Pair	Correlation
Domestic Tourist Visits vs Tourism Revenue	0.91
Foreign Tourist Arrivals vs Tourism Revenue	0.87
Air Passenger Traffic vs Tourist Arrivals	0.82
Seasonal Index vs Tourist Arrivals	0.69
Inflation vs Tourist Arrivals	-0.34

The analysis indicates that domestic tourism and air passenger traffic significantly influence tourism revenue generation in India.

The findings suggest that an increase in tourist arrivals is strongly associated with higher tourism revenue and GDP growth, whereas factors such as inflation and unemployment have an adverse impact on the expansion of the tourism sector.

5.2 India Tourism Growth Analysis

Year	Foreign Tourist Arrivals (Millions)	Domestic Tourist Visits (Millions)	Tourism Revenue (₹ Crore)
2019	10.9	2321	211000
2020	2.7	610	50200
2021	5.1	980	89400
2022	8.5	1730	165000
2023	11.2	2500	245000
2024	12.4	2780	276500

The analysis clearly demonstrates the severe impact of COVID-19 on Indian tourism during 2020. However, domestic tourism recovered rapidly after 2021 due to increased local travel and government tourism promotion campaigns such as Dekho Apna Desh.

The analysis clearly shows the impression of the COVID-19 pandemic on travel demand during 2020, followed by gradual recovery in subsequent years.

5.3 Model Training and Testing

The dataset was divided into:

- Training Data: 80%
- Testing Data: 20%

Evaluation metrics used:

- Accuracy
- MAE
- RMSE

6. Experimental Results

6.1 Model Performance Comparison

Algorithm	Accuracy (%)	MAE	RMSE
Decision Tree	85.2	11.7	16.4
SVM	90.3	8.9	12.3
Random Forest	94.1	6.4	9.1

The Random Forest model achieved the highest prediction accuracy of 94.1% for forecasting Indian tourism demand, which is consistent with the findings from previous tourism forecasting studies using ensemble-learning methods (Claveria, Monte, & Torra, 2015).

The Random Forest model achieved the best predictive performance with the highest accuracy and lowest error values.

6.2 Feature Importance Analysis

The Random Forest model identified the following major factors influencing Indian tourism demand:

Feature	Importance Score
Domestic Tourist Visits	0.33
Tourism Revenue	0.24
Air Passenger Traffic	0.17
Seasonal Index	0.11
Foreign Tourist Arrivals	0.09
Inflation	0.06

The findings indicate that domestic tourism plays the most significant role in the growth of the Indian tourism industry.

The results indicate that tourism receipts and GDP are the strongest predictors of visitor arrivals.

7. Discussion

The statistical results sanction that machine learning approaches are highly capable of estimating Indian tourism demand when large datasets are utilized. The Random Forest model achieved the best performance because of its ability to manage complex tourism trends and seasonal variations.

The analysis highlights that domestic tourism is the primary driver of India's tourism economy. Air passenger traffic and tourism revenue also strongly influence visitor forecasting accuracy.

The recovery trend after COVID-19 indicates increasing resilience in the Indian tourism industry due to digital tourism campaigns, improved transportation infrastructure, and growth in domestic travel (UNWTO, 2023).

The proposed predictive analytics framework can support:

- Tourism policy planning in India
- Smart tourism initiatives
- State-wise tourism forecasting
- Infrastructure development
- Revenue optimization
- Tourism demand management

8. Conclusion

This research presented a quantitative analysis-based predictive analytics framework for Indian tourism forecasting using machine learning algorithms. The study utilized Indian tourism datasets obtained from Kaggle and tourism statistical repositories to assess the performance of all three models.

The results of the study showed that the Random Forest attained the highest prediction accuracy of 94.1%, proving to be the most effectual technique for forecasting tourism demand in India.

The study also identified domestic tourist visits, tourism revenue, and air passenger traffic as the most influential factors affecting Indian tourism growth.

Research also confirms that predictive analytics techniques can improve the precision of tourism forecasting and assist evidence-based decision-making within the Indian tourism industry.

Future work may include:

- Deep learning-based forecasting models
- Real-time tourism analytics
- Integration of IoT and smart city data
- Social media sentiment analysis
- AI-driven tourism recommendation systems

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