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TREND ANALYSIS AND CORRELATION OF TOURIST, RESTAURANT AND HOTEL VISITS IN KUNINGAN REGENCY

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Abstract *— This study conducts an in-depth analysis of the tourism sector in Kuningan Regency, focusing specifically on hotel stays, tourist arrivals, and restaurant visits. Utilizing forecasting models and correlation analyses, the research aims to uncover trends and interdependencies within the sector. The primary objective is to identify actionable insights that can inform data-driven decision-making. The study employs the FBProphet algorithm for forecasting future trends and conducts Kendall correlation analysis to examine relationships among key variables. Data collected spans a time series of 84 months, from January 2016 to December 2022. FBProphet accurately predicts trends in hotel stays, while variations exist in predictions for tourist arrivals and restaurant visits. Mean values for hotel stays, tourist arrivals, and restaurant visits are 21,098.67, 135,647.33, and 130,660.83, respectively. Kendall correlation analysis reveals a moderate positive correlation (0.214, p-value = 0.004) between tourist arrivals and restaurant visits, a strong positive correlation (0.324, p-value = 1.291e-05) between tourist arrivals and hotel stays, and a weaker positive correlation (0.176, p-value = 0.019) between restaurant visits and hotel stays. These findings underscore the intricate dynamics of Kuningan Regency's tourism sector, providing stakeholders with critical insights for strategic planning. The research contributes significantly to sustainable growth initiatives by guiding stakeholders in leveraging the interconnected elements of tourism and making well-informed decisions.*

Keywords: *correlation, Kuningan Regency, sustainable development, trend analysis, tourism.*

Abstrak *— Studi ini melakukan analisis mendalam terhadap sektor pariwisata di Kabupaten Kuningan, dengan fokus khusus pada menginap di hotel, kedatangan wisatawan, dan kunjungan ke restoran. Dengan memanfaatkan model peramalan dan analisis korelasi, penelitian bertujuan untuk mengungkap tren dan ketergantungan dalam sektor tersebut. Tujuan utama adalah mengidentifikasi wawasan yang dapat diimplementasikan untuk mendukung pengambilan keputusan berbasis data. Studi ini menggunakan algoritma FBProphet untuk meramalkan tren masa depan dan melakukan analisis korelasi Kendall untuk menguji hubungan antara variabel kunci. Data yang dikumpulkan mencakup rentang waktu selama 84 bulan, dari Januari 2016 hingga Desember 2022. FBProphet dengan tepat memprediksi tren menginap di hotel, sementara variasi terjadi dalam prediksi kedatangan wisatawan dan kunjungan ke restoran. Nilai rata-rata untuk menginap di hotel, kedatangan wisatawan, dan kunjungan ke restoran adalah masing-masing 21.098,67, 135.647,33, dan 130.660,83. Analisis korelasi Kendall mengungkapkan korelasi positif sedang (0,214, nilai p = 0,004) antara kedatangan wisatawan dan kunjungan ke restoran, korelasi positif kuat (0,324, nilai p = 1,291e-05) antara kedatangan wisatawan dan menginap di hotel, serta korelasi positif yang lebih lemah (0,176, nilai p = 0,019) antara kunjungan ke restoran dan menginap di hotel. Temuan ini menggarisbawahi dinamika kompleks dari sektor pariwisata Kabupaten Kuningan, memberikan wawasan kritis bagi para pemangku kepentingan dalam perencanaan strategis. Penelitian ini memberikan kontribusi signifikan untuk inisiatif pertumbuhan yang berkelanjutan dengan membimbing para pemangku kepentingan dalam memanfaatkan elemen-elemen terkait dari pariwisata dan membuat keputusan yang terinformasi dengan baik.*

***Kata Kunci**: korelasi, Kabupaten Kuningan, pembangunan berkelanjutan, analisis trend, pariwisata.*

INTRODUCTION

Tourism is a vital sector for economic growth and development in various regions across the world (Naseem, 2021)(Citra, Walewangko, & Maramis, 2023). In Indonesia, the tourism industry has been recognized as a major contributor to the national economy, promoting local culture, creating job opportunities, and attracting foreign investment (Utami, Dhewanto, & Lestari, 2023) (Pawalluri, 2023)(Citra, Walewangko, & Maramis, 2023). Kabupaten Kuningan, located in West Java, Indonesia, exemplifies this potential, boasting diverse cultural heritage, natural attractions, and unique culinary experiences (Amanullah, Ramadhani, & Hadil, 2023). However, despite these advantages, Kabupaten Kuningan faces significant challenges in fully realizing its tourism potential.

Recent studies indicate that while tourism in Kabupaten Kuningan has grown, it has not reached its full potential due to issues such as inadequate infrastructure, limited marketing, and the need for sustainable practices (Wahyuningsih & Djuwita, 2021)(Tshania, 2022).

Understanding these challenges and exploring potential solutions is crucial for sustainable tourism development and maximizing the positive impact on the local community and economy (Syifa & Fahmi, 2021) (Wattimena, Idris, & Puturuhu, 2023). One of the key factors in devising effective strategies is the ability to analyze and interpret trends and correlations within the tourism sector (Kawuwung, Kumenaung, & Tolosang, 2023) (Karali, Das, & Roy, 2024) (Karali et al., 2024) (Wu, Wang, Tao, & Zeng, 2023) (Nababan, 2023).

In this paper, we aim to conduct a comprehensive trend analysis and correlation study of tourist arrivals, restaurant visits, and hotel stays in Kabupaten Kuningan. By employing advanced analytical techniques, including the Prophet algorithm for trend analysis and statistical methods for correlation analysis, we seek to gain insights into the dynamics of these three crucial components of the tourism industry (Taylor et al., 2023) (Bouhaddour, Saadi, Bouabdallaoui, Guerouate, & Sbihi, 2023). The relevance of this research is highlighted by the current global emphasis on sustainable tourism development. As the world recovers from the COVID-19 pandemic, there is a renewed focus on creating resilient and sustainable tourism sectors. This findings of this study will provide valuable information to policymakers, investors, and local businesses, enabling them to develop targeted strategies to boost tourism growth and address specific challenges in Kabupaten Kuningan. Moreover, the correlation analysis will help identify potential interdependencies between tourist arrivals, restaurant visits, and hotel stays, which may guide the formulation of targeted strategies to boost tourism growth and address specific challenges faced by the region(Liu, Feng, Chin, Sun, & Wang, 2023) (Toharudin et al., 2023).

As we delve into the intricacies of the tourism sector in Kabupaten Kuningan, this paper acknowledge the importance of sustainable practices and responsible tourism. Striking a balance between attracting visitors and preserving the region's natural and cultural heritage will be essential to ensure long term prosperity and benefit for both the community and the environment (Zhao, Du, & Sun, 2022). By contributing to the body of knowledge on tourism trends and correlations in Kabupaten Kuningan, this research aims to assist in the formulation of evidence-based policies, marketing strategies, and investment decisions that will pave the way for a thriving and sustainable tourism sector in the region (Liu et al., 2023).

This research makes a significant contribution to the understanding and enhancement of the tourism sector in Kabupaten Kuningan. Through a comprehensive analysis employing advanced techniques such as the Prophet algorithm for trend analysis and statistical methods for correlation analysis, the study aims to unravel the dynamics of tourist arrivals, restaurant visits, and hotel stays. Anticipated findings are expected to illuminate the evolving patterns of tourism activities over time, providing vital information for policymakers, investors, and local businesses.

MATERIALS AND METHODS

This study adopts an observational research design to analyze trends and correlations between tourist arrivals, restaurant visits, and hotel stays in Kuningan Regency, West Java, Indonesia. The research steps carried out are explained in Figure 1. Data for this study were sourced from relevant authorities, including the Kuningan Regency Tourism Office, leading hotels, and popular restaurants in the area. Data that has been collected is based on time series data collected over a period of 84 months, shows in Table 1, from January 2016 to December 2022. The comprehensive data provides a robust foundation for analyzing trends and correlations within the tourism sector over an extended period. The use of time series data allows for the examination of variations and patterns over time, offering valuable insights into the dynamics of the tourism sector in the region.

PILAR Nusa Mandiri: Journal of Computing and Information System
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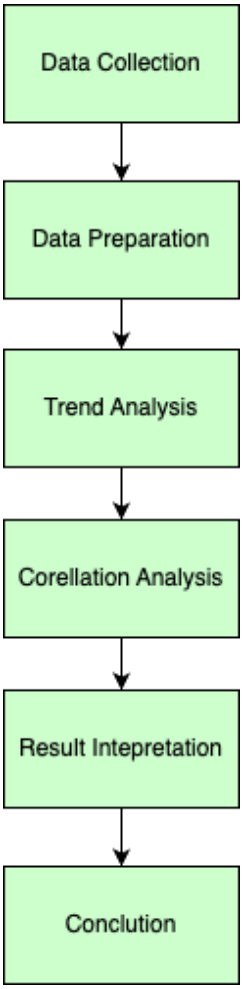


Source: (Research Results, 2023)

Figure 1. Research Diagram

In Data Preparation Phase, the collected data were organized in a tabular format, with time (month) as the independent variable and the respective variable's count as the dependent variable. The secondary data collected include the number of monthly tourist arrivals, restaurant visits, and hotel stays. Additionally, information on special events or festivals that might impact tourist numbers was also obtained.

Table 1. Hotel Stays Dataset

Number	Total Tourists	Unit	Month	Year
1	15621	People	January	2016
2	15431	People	February	2016
3	16938	People	March	2016
4	21879	People	April	2016
5	22660	People	May	2016

Source: (Research Results, 2023)

The date columns were converted to the appropriate format for analysis. The datasets consist of three main variables: “Hotel Stays" shows in Table 1, “Tourist Arrivals" shows in Table 2, and "Restaurant Visits” shows in Table 3.

Table 2. Tourist Arrivals Dataset

Number	Total Tourists	Unit	Month	Year
1	282584	People	January	2016
2	82926	People	February	2016
3	88883	People	March	2016
4	89750	People	April	2016
5	115147	People	May	2016

Source: (Research Results, 2023)

Each dataset contains monthly data points from January 2016 to December 2022, resulting in a total of 84 observations for each variable. The data were organized in a tabular format, with time (month) as the independent variable and the respective variable's count as the dependent variable. Table 3 shows an example of the intended table format.

Table 3. Restaurant Visits Dataset

Number	Total Tourists	Unit	Month	Year
1	61243	People	January	2016
2	51917	People	February	2016
3	52066	People	March	2016
4	63346	People	April	2016
5	86686	People	May	2016

Source: (Research Results, 2023)

In Trend Analysis Phase, The FBProphet algorithm was used to analyze trends in hotel stays, tourist arrivals, and restaurant visits. The algorithm models trend components (linear and logistic growth), seasonal components (weekly, monthly, and yearly patterns), and holiday effects. FBProphet is effective in capturing seasonality and trend patterns in time series data. It is particularly suitable for forecasting in tourism, where trends and seasonal effects are prominent.

In the realm of time series forecasting, the justification for adopting the Facebook Prophet algorithm is well-supported by recent research findings. Previous research from (Chuwang & Chen, 2022), focusing on "Forecasting Daily and Weekly Passenger Demand for Urban Rail Transit Stations," demonstrates the algorithm's success in enhancing computational forecasting accuracy when compared to traditional time series models. Notably, the Facebook Prophet model outperforms the Box–Jenkins model for daily time series, emphasizing its efficacy in real-world applications, particularly in transportation planning.

This trend is further substantiated by previous research from (Menculini et al., 2021), titled "Comparing Prophet and Deep Learning to ARIMA in Forecasting Wholesale Food Prices." Here, the study compares various forecasting techniques, including ARIMA and Prophet, and establishes that Prophet surpasses ARIMA in certain time series scenarios. This validates the algorithm's applicability in situations where computational efficiency and ease of use are paramount, making it

a justified choice for scenarios requiring swift and reliable predictions.

In Previous research from (Man, Chen, & Ma, 2023), "Research and Application of Time Series Prediction Model Based on Prophet Algorithm," the authors employ the Facebook Prophet algorithm for time series prediction, achieving favorable results. The successful application in forecasting research further supports the algorithm's suitability for time series prediction tasks.

The Prophet algorithm, developed by Taylor and Letham (2017) (Taylor et al., 2023), is a robust method for time series forecasting that can effectively capture trends and seasonality. The algorithm utilizes a non-linear model, combining trend components (linear and logistic growth), seasonal components (weekly, monthly, and yearly patterns), and holiday effects (special events or holidays)(Bouhaddour, Saadi, Bouabdallaoui, Guerouate, & Sbihi, 2023).

The Prophet algorithm was implemented using Python and the "fbprophet" library. Data preparation involved converting the date column (ds) to the appropriate format and renaming the target variable column (e.g., TA, RV, HS) as 'y'. The model was trained on the historical data to learn the patterns and generate future predictions. The trend analysis results were visualized using line plots to display the observed data and the predicted trends. Additionally, the Mean Absolute Percentage Error (MAPE) and Root Mean Squared Error (RMSE) were calculated to evaluate the accuracy of the model's predictions (Farizal, Rachman, & Rasyid, 2014).

In Correlation Analysis Phase, Kendall correlation was used to analyze the relationships between tourist arrivals, restaurant visits, and hotel stays. Kendall correlation coefficients (τ) were calculated for each pair of variables. Kendall correlation is a non-parametric measure that assesses the monotonic relationship between two variables (Mallick et al., 2021).

Kendall correlation is suitable for non-linear relationships and does not assume normality, making it ideal for tourism data, which can have complex interdependencies. It is robust to outliers and provides a clear measure of association between variables. Pearson correlation assumes linearity and normality, which may not hold for the data. Spearman correlation, while similar to Kendall, can be less robust in the presence of ties in the data.

It is particularly suitable for time series data as it does not assume linearity. Kendall correlation coefficients (τ) were calculated for each pair of variables: TA vs. RV, TA vs. HS, and RV vs. HS. The Kendall correlation was calculated using the following Formula 1:

$$T = \frac{(\text{Number of concordant pairs} - \text{Number of discordant pairs})}{(\text{Number of concordant pairs} + \text{Number of discordant pairs})} \quad (1)$$

Where concordant pairs are pairs of data points that have the same order (both increase or decrease together), and discordant pairs are pairs with opposite order.

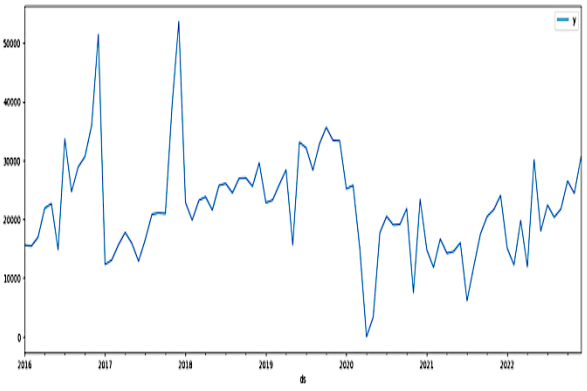
The combination of trend analysis using the Prophet algorithm and correlation analysis using Kendall correlation provides a comprehensive understanding of the dynamics and relationships within the tourism sector of Kuningan Regency. The results will contribute to informed decision-making for stakeholders in the tourism and hospitality industry, aiding in the formulation of effective strategies and policies for sustainable development.

The results from trend and correlation analyses were interpreted to understand the dynamics and interdependencies within the tourism sector. This step is crucial for deriving meaningful insights that can inform decision-making and strategy development for stakeholders in the tourism industry.

A summary of findings, their significance, and recommendations for future research and policy-making were provided. Summarizing the research outcomes helps in consolidating the insights gained and suggesting actionable steps for improving the tourism sector.

RESULTS AND DISCUSSION

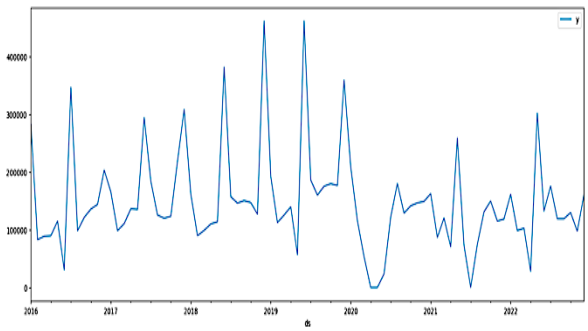
The examination of three distinct yet interconnected aspects of Kuningan Regency's tourism sector - hotel stays, tourist arrivals, and restaurant visits - provides a comprehensive understanding of the sector's dynamics. Visual representations in Figure 1, Figure 2, and Figure 3 depict similar patterns of fluctuations, offering valuable insights into their mutual influences.



Source: (Research Results, 2023)
Figure 2. Hotel Stays Trends (January 2016 - 2022)

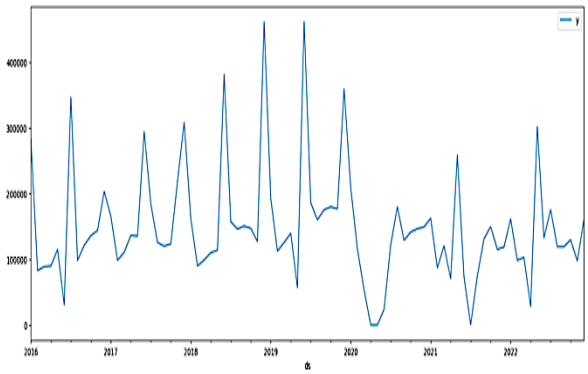
PILAR Nusa Mandiri: Journal of Computing and Information System
Vol. 20, No. 2 September 2024 | DOI: 10.33480/pilar.v20i2.4618

Figure 2 illustrates the trends in hotel stays over the study period. Peaks and valleys are observable, mirroring the rise and fall of tourism activity. Notably, spikes in hotel stays during festive seasons underline the impact of cultural celebrations and holidays on the local tourism sector. Conversely, precipitous declines, such as those in September and October, might be attributed to external factors that deter tourists during certain months. The cyclic behavior hints at potential seasonality in tourist preferences.



Source: (Research Results, 2023)
Figure 3. Tourist Arrivals Trends (January 2016 - 2022)

In Figure 3, the trends in tourist arrivals are visually presented. The graph echoes the undulating pattern seen in the hotel stays chart. Peaks correlate with periods of heightened tourist arrivals, often coinciding with holidays and cultural events. The troughs, in contrast, suggest lulls in tourism activity during certain months. The consistent fluctuations emphasize the interconnectedness of various factors influencing tourist behavior.

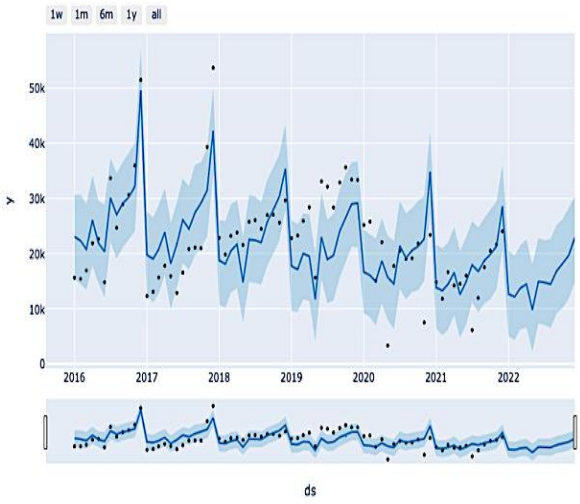


Source: (Research Results, 2023)
Figure 4. Restaurant Visits Trends (January 2016 - 2022)

Figure 4 elucidates the trends in restaurant visits, which closely mirror the trends observed in the two prior charts. The surge in restaurant visits during peak tourism months complements the increased inflow of tourists. Notably, the sudden drops in restaurant visits during certain months reflect the impact of external conditions on tourism and dining patterns. The synchronized ups and downs emphasize the interdependence of tourism components.

These three charts collectively illuminate the intricate relationships between hotel stays, tourist arrivals, and restaurant visits. The synchronization of patterns across the graphs suggests the presence of mutual influences. An upswing in one aspect appears to stimulate corresponding increases in the others, underscoring the multi-dimensional nature of the local tourism ecosystem.

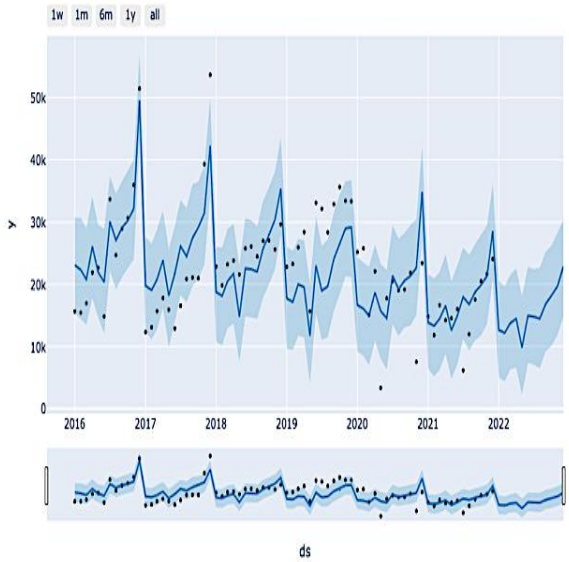
Trend Analysis using the Prophet Algorithm



Source: (Research Results, 2023)
Figure 5. Comparison between Actual and Predicted Hotel Stays

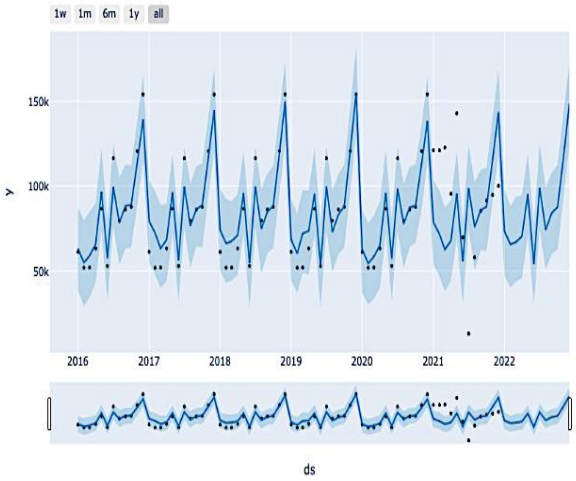
Chart in Figure 5 show the segments spanning of Comparison between Actual a Predicted Hotel Stays from January 2016 to December 2021, the black dots representing actual data points align with the blue lines depicting predictions. This alignment signifies the model's competence in capturing the trends and nuances of the actual data. The instances where the actual data occasionally diverges from the predictions indicate moments of variance, highlighting the inherent complexities of forecasting.

Chart in Figure 6 present an intricate analysis of the tourism trends spanning from January 2016 to December 2022. Notably, they are divided into two distinct segments: the period from January 2016 to December 2021, which showcases the comparison between actual and predicted data, and the subsequent period from January 2022 to December 2022, which solely features predictions.



Source: (Research Results, 2023)

Figure 6. Comparison between Actual and Predicted Tourist Arrivals



Source: (Research Results, 2023)

Figure 7. Comparison between Actual and Predicted Restaurant Visits

Chart in Figure 7 show comparison between actual and predicted restaurant visits from January 2022 to December 2022, the sole presence of blue lines signifies the forecasted data. This segment provides an invaluable insight into the model's predictive capacity. As the blue lines mirror the patterns observed in the earlier segment, it is evident that the model extrapolates the trends effectively into the future.

The examination of three distinct yet interconnected aspects of Kuningan Regency's tourism sector - hotel stays, tourist arrivals, and restaurant visits - provides a comprehensive understanding of the sector's dynamics. Visual representations in Figure 4, Figure 5, and Figure 6 depict similar patterns of fluctuations, offering valuable insights into their mutual influences.

The evaluation of the forecasting models using Root Mean Squared Error (RMSE) and Mean Value of the Test Dataset provides valuable insights into the accuracy and performance of the predictions for hotel stays, tourist arrivals, and restaurant visits in Kuningan Regency. The results are presented as follows:

Hotel Stays
Root Mean Squared Error between actual and predicted values 7851.916707201143
Mean Value of Test Dataset: 21098.666666666668

The RMSE for hotel stays indicates an average prediction error of approximately 7851.92 units. Comparing this value with the mean value of the test dataset (21098.67), it is evident that the prediction errors, on average, are relatively low in comparison to the magnitude of the actual data. This suggests that the model's predictions for hotel stays are generally close to the actual values.

Tourist Arrivals
Root Mean Squared Error between actual and predicted values 81191.00584402222
Mean Value of Test Dataset: 135647.33333333334

The RMSE for tourist arrivals is notably higher at approximately 81191.01 units. The comparison with the mean value of the test dataset (135647.33) highlights a more substantial prediction error in relation to the magnitude of the actual data. This indicates that the model's predictions for tourist arrivals exhibit a larger degree of variance from the actual values.

Restaurant Visit
Root Mean Squared Error between actual and predicted values 52176.62176198155
Mean Value of Test Dataset: 130660.83333333333

The RMSE for restaurant visits stands at around 52176.62 units. When juxtaposed with the mean value of the test dataset (130660.83), it is apparent that the prediction errors are of moderate magnitude compared to the actual data. This suggests a relatively reasonable alignment between the model's predictions and the actual values for restaurant visits.

Kendall Correlation Analysis

This section presents the results of the correlation analysis conducted on the dataset comprising tourist arrivals, restaurant visits, and hotel stays in Kuningan Regency, West Java,

Indonesia. The analysis aimed to uncover the relationships between these variables and provide insights into the dynamics of the local tourism sector. The Kendall Correlation coefficients were computed to examine the relationships between the variables. The following correlations were observed:

Kendall Correlation between Tourist Arrivals and Restaurant Visits: 0.21466119664336922
P-value: 0.004459416880003619

The Kendall Correlation coefficient of approximately 0.214 suggests a moderate positive correlation between tourist arrivals and restaurant visits. This implies that there is a tendency for these two variables to increase together, albeit not strongly. The p-value of 0.004 indicates that this correlation is statistically significant at a conventional significance level (e.g., 0.05), suggesting that the observed correlation is unlikely to have occurred by random chance alone.

Kendall Correlation between Tourist Arrivals and Hotel Stays: 0.32400634369584325
P-value: 1.291473540231477e-05

The Kendall Correlation coefficient of around 0.324 indicates a moderate to strong positive correlation between tourist arrivals and hotel stays. This suggests that an increase in tourist arrivals is associated with a corresponding increase in hotel stays. The very low p-value (1.291e-05) underscores the statistical significance of this correlation, reinforcing the notion that the observed relationship is unlikely to be a result of random chance.

Kendall Correlation between Restaurant Visits and Hotel Stays: 0.17574207265602299
P-value: 0.01985605429218218

The Kendall Correlation coefficient of approximately 0.176 signifies a relatively weak positive correlation between restaurant visits and hotel stays. While there is a tendency for these variables to increase together, the correlation is not as pronounced as in the previous cases. The p-value of 0.019 indicates that the observed correlation is statistically significant at a typical significance level. The interpretation of these Kendall Correlation results provides valuable insights into the relationships between the three variables. The strength and direction of these correlations can inform stakeholders in the tourism industry about the potential interdependencies among tourist arrivals, restaurant visits, and hotel stays.

The statistically significant correlations highlight the existence of meaningful relationships among these variables, implying that changes in one variable can influence changes in another. These insights can guide strategic decision-making, such as resource allocation, marketing strategies, and event planning, to maximize the positive outcomes within Kuningan Regency's tourism sector.

Research Limitation

The RMSE values indicate varying levels of prediction accuracy across different tourism components, with tourist arrivals showing higher prediction errors. This suggests potential limitations in the model's ability to capture all influencing factors. The analysis is based on historical data, and the evolving nature of tourism trends means that future patterns may differ. Ongoing data collection and model refinement are necessary to maintain relevance. The study does not explicitly account for external factors such as economic conditions, global events (e.g., pandemics), or changes in local policies that may impact tourism dynamics.

CONCLUSION

In culmination, the comprehensive analysis of Kuningan Regency's tourism sector, grounded in empirical data and key metrics, provides illuminating insights into the dynamics of hotel stays, tourist arrivals, and restaurant visits. The application of forecasting models and correlation analyses facilitated a nuanced understanding of the sector's trends and relationships.

The forecasting models, employing the FBProphet algorithm, yielded distinct outcomes for each facet of tourism. The predicted Root Mean Squared Error (RMSE) for hotel stays, at approximately 7851.92, signified a relatively precise alignment with the actual data. In contrast, tourist arrivals demonstrated a higher RMSE of 81191.01, indicative of more substantial prediction discrepancies. Restaurant visits followed a middle ground with an RMSE of 52176.62, demonstrating a moderate accuracy. The mean values of the test datasets presented further context. Hotel stays displayed an average of 21098.67, tourist arrivals showcased 135647.33, and restaurant visits revealed 130660.83, setting the stage for evaluating the predictive performance of the models against the actual data.

Moreover, the Kendall Correlation analysis underscored critical relationships among the variables. A moderate positive correlation of 0.214 existed between tourist arrivals and restaurant visits, with a statistically significant p-value of 0.004. A more robust positive correlation of 0.324

between tourist arrivals and hotel stays was accompanied by a highly significant p-value of 1.291e-05. Restaurant visits exhibited a weaker positive correlation of 0.176 with hotel stays, statistically significant at a p-value of 0.019.

Suggestions for future research, investigate the factors influencing predictive accuracy variations and explore the inclusion of additional variables to improve model performance. Extend the analysis to include the impact of external factors such as economic conditions, global events, or policy changes on tourism dynamics. Conduct more granular analyses at the regional or sub-sector level to uncover localized trends and correlations that may be masked in the broader dataset. Explore the use of advanced methods such as machine learning and deep learning for forecasting and analyzing complex patterns in tourism data.

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