**Critical Thinking #6: Final Research Paper**

Rachel Jenkins

Colorado State University Global

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Dr. Osama Morad

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**Abstract**

This study investigates seasonal trends and the impact of holidays on customer traffic in the restaurant industry, with a focus on Japanese restaurants. Given that 30% of restaurants close within the first year due to economic challenges and staff management issues, leveraging data analytics is crucial to maintaining a competitive edge (Price, 2021). This study aims to address the gap in literature by focusing on these fluctuations and providing actionable insights for restaurant managers. The ability to predict busy periods allows for better staffing, inventory management and market strategies, ultimately leading to increased customer satisfaction and sustainability. By leveraging historical data and advanced statistical methods, this research seeks to offer a strong framework that can be adapted to diverse types of restaurants and regions.

By employing ARIMA modeling with Fourier terms and ANOVA, the research aims to develop predictive models to forecast visitor numbers and analyze holiday effects. Historical data spanning a year and a half was used to identify patterns and build models that can inform strategic decisions in staffing, inventory management, and marketing. The ARIMA model successfully captured seasonal trends, showing a significant increase in visitor numbers between June and July. However, the statistical significance of these trends was not confirmed due to large standard errors. Additionally, ANOVA results indicated no statistically significant difference in visitor numbers between holidays and non-holidays. Despite these mixed results, the findings offer valuable insights for restaurant managers seeking to optimize operations and improve profitability through data-driven decision-making. The study highlights the potential for predictive analytics to enhance business performance, although further research is needed to refine these models and confirm their applicability across different restaurant types and regions.

**Seasonal Trends and Holiday Effects in the Restaurant Industry**

In the restaurant industry, understanding and adapting to seasonal trends is crucial in optimizing operations and maximizing profitability. Seasonal variations can significantly impact customer traffic, menu preferences, and overall revenue. By leveraging data using predictive models and big data analytics, restaurants can achieve more accurate sales forecasts, potentially improving prediction accuracy by 25-50% compared to human estimates alone (Tenzo, 2017). This enhanced foresight allows for informed scheduling strategies, inventory management, and marketing strategies, especially for small and medium-sized businesses that often struggle to compete with larger chains (Chernova et al., 2023).

Incorporating seasonal elements such as holidays, weather patterns, and local events into time series forecasting models can provide actionable insights that drive informed decision-making. For local restaurants, this approach can transform raw data into strategic advantages, enabling them to anticipate demand fluctuations and adjust their offerings accordingly. This research project aims to explore how seasonal trend analysis can be applied to the restaurant industry to enhance business performance, focusing on data-driven methods to identify and leverage these trends effectively.

The restaurant industry faces significant challenges related to seasonal fluctuations in customer demand. These variations can lead to periods of low sales and high operational costs, impacting the overall profitability of restaurants, especially small and medium-sized establishments. The specific problem this research project will address is the lack of effective strategies to manage and capitalize on these seasonal trends to maintain steady business performance throughout the year.

The purpose of this study is to identify and analyze seasonal trends in the restaurant industry, focusing on differences in seasonality and holiday events that impact customer visitation frequency and revenue. By developing advanced predictive models tailored to individual restaurants, this research aims to provide actionable insights that can help businesses adjust their strategies and operations (Polonsky & Waller, 2019). The goal is to create a framework that enables restaurants to forecast demand more accurately which can inform staffing and inventory ordering strategies, as well as develop targeted marketing campaigns. Implementing these strategies during slow seasons can boost revenue and profitability.

**Objectives**

The objective of this research project is to develop an accurate predictive model that incorporates seasonal trends into the forecasting capabilities. By analyzing historical data that includes factors related to seasonal patterns, the model aims to identify the variables that lead to fluctuations in customer traffic. While this model will be tailored to the specific needs of the restaurant of interest, it will also be designed to integrate factors that are relevant to other restaurants. Ultimately, the model should be adaptable to accurately represent the unique characteristics of various restaurants. This comprehensive model will address seasonal trends and provide actionable insights to inform menu adjustments, staffing requirements, and marketing strategies, thus maximizing the competitive potential of local restaurants through data-driven decision-making.

**Overview of Study**

This study aims to develop a comprehensive understanding of how seasonal trends impact the restaurant industry, focusing on both general seasonal patterns and specific holiday effects. By analyzing historical data from various restaurants, I will identify key variables that influence customer traffic. The study will develop advanced predictive models to forecast demand, helping restaurants make informed decisions about staffing, inventory, and marketing strategies. This research will not only provide insights into how restaurants can leverage data to forecast demand and potential revenue, but also offer practical solutions for businesses to improve performance throughout the year.

**Research Questions and Hypotheses**

The goal of this research is to identify patterns and trends in restaurant visitor numbers to improve decision-making processes for restaurant management. To achieve this, I have formulated the following research questions and corresponding hypotheses.

The first research question and set of hypotheses is as follows:

1. Is there trend or seasonality in the number of visitors to restaurants?

H0: There is no statistically significant trend or seasonality in the number of visitors over time.

Ha: There is a statistically significant trend or seasonality in the number of visitors over time.

This research question examines how the number of visitors to different restaurants changes over time. Understanding business fluctuations is crucial to reducing food waste and labor costs, as well as offering seasonal menu items to increase revenue and profits (Posch et al., 2021). If the null hypothesis (H0) is rejected, the alternative hypothesis (Ha) is supported, indicating a seasonal effect on the number of visitors of the restaurants in the study.

Seasonality can have a significant impact on restaurant operations. For example, at certain times of year like summer or holiday season, a restaurant might see increased visitor numbers due to vacations or family gatherings more common during these times (Posch et al., 2021). Alternatively, off-peak seasons may experience a decline in visitors. Understanding and modeling these trends allows restaurant managers to plan better, ensuring they have adequate staff and inventory to meet demand without overstocking or understaffing during slower periods.

The second research question is as follows:

1. Is there a statistically significant difference in the number of visitors to restaurants during holiday events?

H0: There is no statistically significant difference in the average number of visitors on a non-holiday day versus a day with a holiday event.

Ha: There is a statistically significant difference in the average number of visitors on a non-holiday day versus a day with a holiday event.

This question examines how the number of visitors at a restaurant changes during holidays. Understanding how holidays impact foot traffic is important for similar reasons as seasonality. Staffing and ordering procedures may need to be adjusted to account for an influx or decrease in business during these events. By rejecting the null hypothesis (H0), I can confirm that there is a statistically significant difference in visitors during holidays.

Holidays can significantly alter the usual patterns of restaurant visits. For example, holidays such as Christmas, Thanksgiving, and New Year’s Even often result in higher-than-average visitor numbers as people dine out to celebrate. On the other hand, some holidays might see a decrease in regular visitors if people prefer to stay home or travel. Analyzing these patterns can help restaurants prepare for these fluctuations, ensuring they can capitalize on high-traffic days and manage resources efficiently during low-traffic periods.

**Literature Review**

Seasonality affects many industries, including agriculture, higher education, and restaurant hospitality. Understanding how seasonal trends impact operational processes is essential for businesses to optimize their strategies. By collecting and analyzing data on trends over time, businesses can leverage these insights for data-drive decision-making, leading to improved productivity, efficient resource management, enhanced customer satisfaction, and increased business value (Bera, 2021). This literature review aims to identify current industry knowledge and address gaps to provide insights into the restaurant industry, particularly how these insights can be applied to specific businesses.

Horner and Swarbrooke (2020) highlight that restaurants experience on- and off-peak seasons depending on their location. “School holidays will usually be the peak time of demand for tour operations, charter airlines, and visitor attractions. However, for city-centre hotels and scheduled airlines, school holidays are their off-peak season because that is when business people usually take their holidays with their families (Horner & Swarbrooke, 2020).” These findings indicate that sales and visitor trends are seasonally related to peak seasons, which fluctuate throughout the year and may correlate with holidays. Consequently, some restaurants experience significant fluctuations in visitor numbers, while others may see varied relationships between holidays and sales. Understanding these patterns can help restaurants tailor their operations, marketing strategies, and staffing levels to optimize performance throughout the year.

To create accurate predictive models of seasonal trends, time series forecasting methods such as the ARIMA model are commonly used. According to Boomija et al. (2018), the ARIMA model combines auto-regression, integration, and moving average processes to produce accurate predictions. “Auto-regression uses the dependent relationship between an observation and some number of lagged observations. Integration uses differences in the data to make the time series stationary. Moving average uses the dependency between an observation and residual error (Boomija et al., 2018).” These components work together to depict seasonal trends effectively. The ARIMA model’s flexibility and accuracy make it a valuable tool for forecasting in various sectors, including the restaurant industry.

However, the accuracy of the ARIMA model depends on the quality of its inputs. Including additional variables that influence seasonal trends can enhance the model’s accuracy, but it is crucial to balance the number of variables to avoid overfitting. Suhartono and Subanar (2005) emphasize that “the more complex model does not always yield a better result than a simpler one. Additionally, we also find the possibility to do further research, especially the use of a hybrid model by combining some forecasting methods to get better forecast (Suhartono & Subanar, 2005).” Simple models can capture general trends, and adding too many variables may not significantly improve predictive accuracy. Combining different forecasting methods might be the key to achieving accurate models without overfitting.

Applying Fourier terms in time series forecasting, particularly within ARIMA models, offers a valuable method for capturing seasonal patterns, especially when dealing with limited data. Traditional time series modeling depends on having two full periodic cycles. The Fourier theorem plays a significant role in this context. It provides a framework for estimating periodic signals via Fourier series. According to the theorem, “The Fourier theorem states that (loosely speaking) when representing a well-behaved periodic function this way, by adjusting the weights a(n) and b(n), the series can be made to converge to the function. So, a finite Fourier sum might be an effective way to approximate periodic signals (seasonal components of time series) — we are only looking for an approximation, not full convergence, so we use a finite sum. (Andrei, 2023)” Incorporating Fourier terms into ARIMA models allows for the effective application of seasonal components within time series forecasting. This will be especially applicable, as the dataset for this research project only spans a year and a half.

For my research project, I intend to use historical data from Japanese restaurants to develop a predictive model that employs time series forecasting to analyze seasonal volume trends. Holidays will be included as a predictor variable, as they can significantly influence restaurant business volume depending on the location. Bera (2021) notes that operational analytics can identify performance bottlenecks and suggest alternatives to reduce costs and increase efficiency, thus improving productivity. “Operational analytics improves firms’ performance significantly, enabling businesses to understand and interpret results from data, get actionable intelligence for efficient resource utilization, and improve customer satisfaction (Bera, 2021).” Based on the literature review, I believe that a simple ARIMA model incorporating historical data and a holiday binary variable will produce accurate results without overfitting.

This research aims to fill a gap in industry knowledge regarding the influence of holidays on restaurant seasonality. By demonstrating that time series models based on historical data and holiday events can produce accurate predictions, this study will contribute valuable insights to the restaurant industry. Additionally, the findings could be extrapolated to specific restaurants, offering an expansive application of the research.

Understanding and forecasting seasonal trends allows restaurants to better manage their resources, ensuring they are appropriately staffed and stocked during peak times while avoiding excess during off-peak periods. This not only optimizes operational efficiency but also enhances customer satisfaction by maintaining consistent service quality. The ability to predict busy periods can inform marketing strategies, helping restaurants to attract more visitors during traditionally slow periods with targeted promotions and unique offers.

By focusing on the connection between holidays and seasonal trends, this research will provide a distinct understanding of how external factors influence restaurant performance. This knowledge can help restaurant managers make more informed decisions, leading to more adaptable and strategic business strategies. The incorporation of holidays as a variable in predictive models represents an innovative approach that acknowledges the complexity of seasonal operations.

**Research Design**

**Methodology**

This study uses a quantitative approach to examine seasonal trends and the impact of holidays on customer traffic in Japanese restaurants. The main goal is to develop predictive models and identify significant patterns using historical data. The methodology involves quantitative analysis, predictive modeling, and statistical testing. The project relies on numerical data to identify patterns and test hypotheses about seasonal variations and holiday effects on restaurant visitors. Advanced predictive models, specifically the ARIMA model using Fourier terms, will be used to forecast future visitor numbers by analyzing trends and seasonal patterns. Lastly, statistical testing compares the visitor number on holidays versus non-holidays, determining if there are significant differences attributable to holidays.

**Research Methods**

The research methods for this research project include data collection, data analysis, and the tools used for these processes. Data collection involves identifying the appropriate data that will answer the research questions. The data I collected contains visitor data for over 800 restaurants over the course of a year and a half. This data serves as the basis for analysis and provides the necessary variables to investigate seasonal trends and holiday impacts. The data was then cleaned and preprocessed to ensure accuracy. Data cleaning involved addressing outliers and anomalies that could skew the results. Outliers were identified using statistical methods such as the Interquartile Range (IQR) and were either removed or adjusted to fit within a reasonable range. Additionally, missing values were handled using imputation techniques to maintain the integrity of the dataset. The data analysis used is time series analysis and ANOVA to create seasonal predictive models and determine if there are statistically significant differences in the number of visitors on holidays. The tool used for this project is R Studio.

The two analysis methods I plan to use are time series forecasting with ARIMA methods and Fourier terms and ANOVA. Time series forecasting will develop a predictive model of the number of visitors based on seasonal trends over time. The predictive model can be used to forecast the number of visitors depending on the time of year. Time series analysis involves decomposing the data into components such as trend, seasonality, and noise to understand underlying patterns. To decompose the data, traditionally two full periods need to be present in the dataset. With the relatively short duration captured in this data, I applied Fourier terms to decompose this data into digestible seasonal sections for the model (Andrei, 2023). This method is particularly useful for identifying patterns and making future predictions based on historical data (*Time,* n.d.). By applying time series forecasting using ARIMA methods and Fourier terms, I aim to provide restaurant managers with actionable insights that can help them anticipate busy and slow periods, allowing for more efficient planning and resource allocation.

ANOVA is a statistical method that compares the mean values of two groups—in this case, holidays, and non-holidays. ANOVA will identify if there is a significant difference in mean visitors between holidays and non-holidays. This method is particularly effective for determining whether observed differences in means are statistically significant considering the variance within each group (Kim, 2017). By applying ANOVA, I can assess whether holidays have a meaningful impact on visitor numbers, providing restaurant managers with evidence-based guidance for staffing and inventory decisions during these periods.

To build the time series forecasting model and perform ANOVA, I plan to use R. R is a versatile, open-source programming language with extensive libraries for statistical analysis and data visualization. By utilizing the extensive libraries in R, I can ensure the accuracy and readability of the results while also gaining insights into the usability and presentation of my findings.

**Limitations**

Several limitations need to be addressed in this study. First, the accuracy of the predictive models depends on the quality, quantity, and completeness of the historical data. Incomplete, inaccurate, or insufficient data may build unreliable predictive models. Another major limitation of this study is the relatively short duration of the dataset, which spans only a year and a half. Longer data periods could provide a more comprehensive view of seasonal trends and improve the accuracy of predictive models. Additionally, the data is specific to Japanese restaurants, which may limit the generalizability of the findings to other types of restaurants or regions. Not only does this include regional seasonality changes, but also cultural differences associated with holidays. Lastly, other factors that are not included in the focus of these models may reflect inaccuracies in the predictive ability of the forecasting model. External factors like economic conditions, unexpected events like the pandemic or extreme weather, or changes in consumer behavior may all impact business, but are not accounted for in this study. Including such variables could enhance the predictive power of the models and provide more nuanced insights.

Considering these limitations, the scope of this study is appropriate to answer business questions. Building a time series forecast based on visitor numbers and calendar date should capture trends in seasonality. ANOVA testing should determine if there are statistically significant differences in visitors on holidays, and subsequent statistical testing can determine the direction and strength of these differences. As mentioned prior, simple modeling can provide more accurate predictions than one with many variables. A model that is too complex is in danger of overfitting data, and thus would lead to an inability for the model to be generalized to other restaurants. While it would be interesting to understand how external factors impact the restaurant business, those relationships are outside the scope of this assignment and can be appropriately analyzed in other research projects.

**Ethical Considerations**

Several ethical considerations must be addressed during this project. The data contains information about restaurant operations, which may be proprietary. Therefore, the data needs to be anonymized to protect sensitive information. The data provided for this dataset has been anonymized, using restaurant IDs to differentiate restaurants rather than identifying features like the restaurant name. Additionally, the dataset was obtained under an agreement that it would be used for academic purposes only, prohibiting its use for competitive purposes. This ensures that the data is managed responsibly and ethically (Franks, 2019).

Given these ethical considerations and limitations, coupled with the project objectives, research questions and hypotheses, methodology and methods, the subsequent section of this paper focuses on the findings of the study. I will present the findings from the analysis, including detailed insights into the seasonal trends and holiday effects observed in the restaurant data. In examining the results of the time series forecasting and ANOVA, I will identify significant patterns and trends that can inform practical strategies for management and demonstrate the applicability of data-driven decision-making to optimize restaurant operations. By understanding these patterns, restaurant managers can make more informed decisions to optimize their operations. The ARIMA model with Fourier terms and the ANOVA results provide a sound foundation for predicting visitor numbers and planning accordingly. These research findings can be applied to other restaurant’s business models, improving operational efficiency, enhancing business performance, and increasing business value throughout the seasonal fluctuations of the year. The following sections will delve into the detailed results and discuss their implications for restaurant management.

**Research Findings**

After conducting the time series analysis and ANOVA on the data, I observed mixed results. The time series model, constructed using the ARIMA methodology with Fourier terms, successfully captured seasonal effects. However, the statistical significance of the model was not proven due to the large standard errors in the results, indicating that other variables should be introduced to future models to fully capture the variability in visitor numbers. Similarly, the Analysis of Variance (ANOVA) did not reveal a statistically significant difference between the mean number of visitors on holidays versus non-holidays.

To begin, I set up my working directory, loaded the necessary libraries, and imported the datasets. The initial steps involved cleaning and exploring the data. I combined the datasets, interpolated missing values based on surrounding data points, and removed outliers that could cause abnormalities in the forecasting model. I then aggregated the data based on date, and then by month. The daily data was used for the ANOVA test and the monthly data was used to model the time series forecasting with ARIMA methods and Fourier terms.

Figures 1 and 3 below exhibit the summarized results of the aggregated and monthly data, respectively. The dataset spans from January 1, 2016 to April 22, 2017. The range of total daily visitors for all restaurants ranged from 1,033 to 23,982. The dataset includes 31 holidays and 447 non-holidays. Figure 2 provides a histogram visualizing the frequency of non-holidays and holidays.

The monthly data values differ as they represent aggregates of each day’s visitors within the month. The monthly dataset spans from January 2016 to April 2017, using the 1st of each month as a placeholder date. Monthly visitor numbers ranged from 152,924 to 497,617. As the ANOVA test was conducted on the daily aggregate data, the holiday variable was excluded from the monthly dataset. Figure 4 below shows the number of visitors over each month. There is a distinct jump in monthly visitors between the months of June and July of 2016.

**Figure 1**

*Descriptive Statistics for Daily Data*

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Description automatically generated*

*Note.* The range of visit dates is from 01/01/2016 to 04/22/2017. The total number of daily visitors for all restaurants ranges from 1033 to 23982. The number of holidays is 31 while the number of non-holidays is 447.

**Figure 2**

*Histogram of the Frequency of Non-Holidays and Holidays*

*A graph of a number of holidays

Description automatically generated*

*Note.* There are disproportionately less holidays in the dataset than holidays with only 31 holidays in a dataset of 478 days.

**Figure 3**

*Descriptive Statistics for Monthly Data*

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Description automatically generated*

*Note.* The range of months is from 01/2016 to 04/2017. The range of monthly visitors for all restaurants is 152924 to 497617. The holiday variable was removed as it is not a part of the forecasting model that uses this subset of monthly data.

**Figure 4**

*Line Graph Showing the Number of Monthly Visitors Over Time*

*A graph of a restaurant

Description automatically generated*

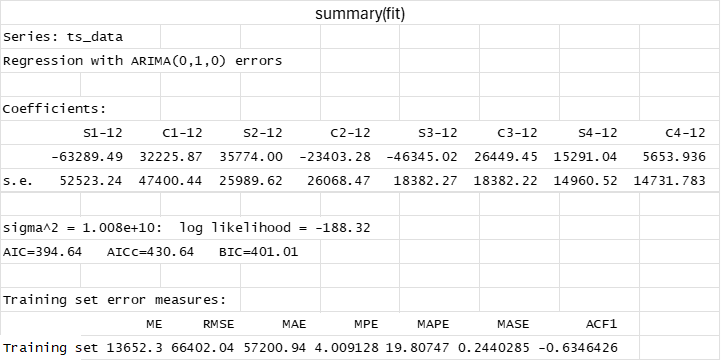
*Note.* There is a generous uptick in number of visitors between the months of June and July of 2016.

As mentioned in the literature review, I used ARIMA modeling with Fourier terms to construct a time series forecasting model (*R,* n.d.). This approach effectively captures the seasonality in monthly visitors over time given a relatively small amount of historical data. The model used no autoregressive terms, first-order differencing, and no moving average terms. The output statistics of this model are presented in Figure 5 below.

The coefficients S1-12 and C1-12 represent the first seasonal and cyclical terms with a 12-month period, respectively. Similarly, S2-12 and C2-12 represent additional seasonal and cyclical terms. These values suggest that the model is capturing seasonality in the data. However, the relatively large standard errors indicate that these seasonal effects are not statistically significant. This is supported by the ACF1 value of -0.6346, which implies that the model does not capture all patterns in the data. The visualization shown in Figure 6 displays the predicted values. Visually, the model appears to follow the general trend observed in the historical data, predicting a similar spike in business between June and July of 2017. This seasonal trend aligns with general customer behavior patterns where dining out increases during warmer weather and timing of summer vacations. While visually the model appears to be able to accurately predict future numbers of monthly visitors, I cannot statistically disprove the null hypothesis. This means that there is no evidence of seasonality captured by this model.

**Figure 5**

*Output Statistics for the ARIMA Forecasting Model with Fourier Terms*

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*Note.* The fit statistics and training set error values show seasonality but not statistical significance with an ACF1 value of -0.635.

**Figure 6**

*ARIMA Model with Fourier Terms Forecast Graph*

*A graph showing a number of visitors

Description automatically generated*

*Note.* The forecasted visitor numbers begin around the same values of the historical data and predict a similar spike in business between June and July of 2017. The rest of the prediction is smooth and trends downward while the historical data appears overall stagnant after the summer uptick.

To investigate whether there is a statistically significant difference in visitor numbers between holidays and non-holidays, I conducted an Analysis of Variance (ANOVA). The results, summarized in Figure 7 below, indicate that there is no statistically significant difference in the average number of visitors on holidays compared to non-holidays. The sum of squares for the residuals exceeds the sum of squares for the holiday variable, suggesting that more variation is due to variables not accounted for in this ANOVA. Additionally, the p-value of 0.143 exceeds the commonly accepted significance level of 0.05, implying that holidays do not have a statistically significant impact on the number of visitors to restaurants in Japan according to this historical dataset. Thus, I failed to reject the null hypothesis, concluding that there is no statistically significant difference in the average number of visitors between holidays and non-holidays. These results suggest that holidays may not be as influential on customer traffic as previously thought, challenging common assumptions, and highlighting the importance of data-driven decision-making.

**Figure 7**

*ANOVA Results*

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*Note.* The p-value of 0.143 is greater than the accepted 0.05 p-value, indicating that there is no statistically significant difference in means on holidays versus non-holidays.

**Conclusion**

In summary, this research project applied ARIMA modeling with Fourier terms and ANOVA to analyze a dataset of historical data from Japanese restaurants spanning a year and a half. The ARIMA model with Fourier terms effectively captured seasonal patterns in monthly visitor numbers, although the statistical significance of these seasonal effects was challenged by relatively large standard errors. The model’s predictions followed the historical data trends and identified a notable spike in visitor numbers between June and July of 2017. However, it is uncertain whether the spike is attributed to seasonality and if it should be included in subsequent predictive models. The ANOVA results revealed no statistically significant difference in average visitor numbers between holidays and non-holidays, with a p-value of 0.143 suggesting that holidays do not substantially impact restaurant business based on the analyzed dataset. These findings indicate that while seasonal trends are present, holidays do not significantly influence visitor numbers in this context.

Although this study was unable to create a statistically significant predictive model or prove holiday effects on visitor numbers, these findings still have practical implications for restaurant managers. By leveraging data analytics, managers can better understand and predict customer traffic patterns, leading to more efficient resource allocation, improving customer satisfaction. The importance of data-driven decision-making cannot be overstated, especially in an industry where 30% of restaurants close within the first year due to economic challenges and staff management issues. Implementing predictive models can provide a competitive advantage, enabling restaurants to anticipate busy periods and prepare accordingly. This proactive approach can mitigate the risks associated with fluctuated customer traffic and contribute to long-term business success.

**Recommendations**

Based on the findings of this research project, several recommendations can be made to improve the accuracy and relevance of predictive models for restaurant visitor numbers. Extending the data collection period is crucial, as it allows for capturing seasonal trends with greater accuracy and provides a more comprehensive view of seasonal variations, ultimately contributing to a more comprehensive model. However, with relevance to new restaurants, historical data may be limited to the first year of operation, given that the restaurant was able to sustain itself for that length of time. Incorporating data with additional variables, such as weather conditions, could significantly improve forecasting accuracy, especially on a dataset limited by the amount of historical data. External factors can provide a more nuanced understanding of visitor patterns and improve model performance. If more detailed data is available, integrating these variables into the forecasting process could result in more precise and actionable insights. Lastly, each restaurant could perform its own predictive modeling and ANOVA analyses. Given that each restaurant has its own unique characteristics and operational dynamics, a more localized approach would better account for specific nuances and provide more accurate insights tailored to their individual needs.

While the study presents valuable insights, it also highlights the need for further research to improve the models and confirm their applicability across different restaurant types and regions. Future studies should consider incorporating additional variables such as weather conditions and economic indicators to enhance the predictive power of the models. The restaurant industry, particularly among small and medium-sized businesses, has significant gaps in current analytical knowledge. By performing more comprehensive analyses on restaurant data, there is an opportunity to expand our understanding of seasonality, navigate these challenges and maintain a competitive edge.

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