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AI-core-AI4-RB04

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Predictive Analytics for Tortillas

# Introduction

Problem

One of the challenges businesses always face in the restaurant industry is the inability to predict the number of guests each day. Without a reliable way of predicting how many people will walk through the door, restaurants often deal with inefficiencies Overstaffing leads to unnecessary labor costs, while understaffing can lead to long wait times, poor service, and dissatisfied customers. Also, incorrect estimates of guest counts can lead to excessive food preparation, resulting in wasted inventory and increased costs.

Idea

Understanding the significance of tackling this problem, predictive analytics can be utilized to forecast daily guest numbers. By considering various factors such as historical visitor data, weather conditions, local events like PSV matches, Effenaar concerts, train delays, etc., a reliable model can be developed to predict future demand accurately.

Solution

The proposed solution involves developing a custom predictive analytics model tailored to meet the restaurant's needs. Through thorough data analysis, important trends and patterns will be identified. These insights will guide the creation of a predictive model capable of accurately forecasting daily guest numbers.

By implementing this predictive model, informed decisions can be made regarding staffing levels and inventory management. Staffing schedules can be adjusted based on expected demand, ensuring there are enough staff members during busy times. Additionally, inventory levels can be managed more efficiently to match predicted guest counts, reducing waste and costs.

Ultimately, using predictive analytics in restaurant operations promises to improve efficiency, enhance customer satisfaction, and drive long-term success in a competitive industry. By anticipating changes in demand and organizing resources accordingly, the restaurant can improve its operations and provide exceptional experiences to its customers.

# Why AI-powered tech is revolutionizing the restaurant industry | Nation's Restaurant News

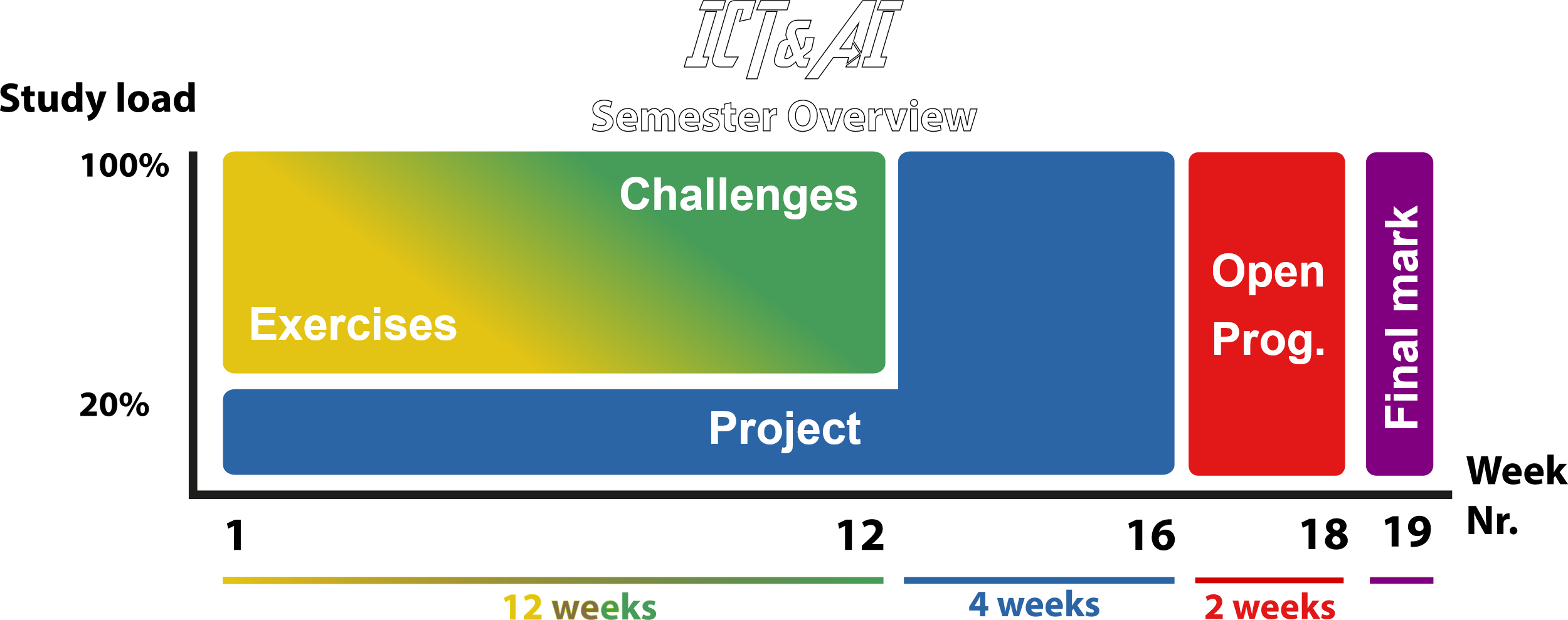
# Plan overview

Stakeholders

As a member of the "Tortillas" restaurant team, my primary stakeholder is the boss/owner Randy van den Broek, who will oversee the project's progress. The boss/owner will also work with others who have the necessary data or information for the project. Additionally, teachers' input and feedback will be important for improving the project.

Timeline

The project will span until week 16 and will be divided into three distinct phases: A, B, and C, with a midterm evaluation included. Each phase will have specific objectives and deliverables, ensuring steady progress towards project completion within the designated timeframe.



Resources

To gather information about the restaurant, the boss/owner will provide relevant data and insights. Additionally, external sources such as the internet, events like Effenaar or PSV matches, will be utilized for datasets and calendar information. Efforts will also be made to explore available APIs, such as those provided by NS, to access relevant data efficiently.



# Domain understanding

To improve our ability to predict restaurant guest numbers, brief research will be reviewed. This will help us determine if similar efforts have been successful and if such predictions are feasible for our restaurant and project.

Main question

How do you accurately predict the number of guests a restaurant will receive?

Sub questions:

1. What are the key factors influencing restaurant guest numbers?
2. Are there existing models or frameworks in the industry for predicting restaurant guest numbers?
3. How can the accuracy of the prediction models be evaluated and improved over time?

After looking at some research to see if other projects like ours have worked, we'll tackle the main question: How do we guess how many guests a restaurant will have? Then, we'll break it down into smaller questions like what things affect how many people come to a restaurant, if there are already ways to guess this, and how we can make our guesses better over time.

Result

**What are the key factors influencing restaurant guest numbers?**

Understanding why people choose to dine at restaurants is important for improving restaurant operations. This analysis examines two primary categories of factors: internal factors, which pertain to aspects within the restaurant, and external factors, which are influenced by elements outside the restaurant's control. By exploring these factors, restaurants can gain insights into customer behavior and improve their overall performance.

|  |  |
| --- | --- |
| **Internal Factors** | **External Factors** |
| Price | Location |
| Staff Quality | Events |
| Reviews | Weather/Season |
| Decoration/Ambiance | Holidays |

Improving internal factors within a restaurant is relatively straightforward, as there is a wealth of resources available online offering tips and guidance on enhancing various aspects of the dining experience. For instance, like [this](https://medium.com/@willisftw/elevating-the-brand-experience-the-10-essential-touchpoints-for-restaurants-ced177e77807) article provide valuable insights into optimizing key elements such as ambiance, service quality, and customer interactions. By leveraging these resources and implementing recommended strategies, restaurants can effectively elevate their brand experience and attract more guests.

<Discuss further external factors with Randy>

**Are there any existing models or frameworks in the industry for predicting restaurant guest numbers?**

There are tools like [5Out](https://www.5out.io/post/leveraging-predictive-analytics-tools-for-success-in-the-restaurant-industry#:~:text=Restaurant%20predictive%20analytics%20is%20a,informed%20predictions%20about%20future%20trends.), that are utilized in the restaurant industry to make informed predictions about future trends. Additionally, platforms such as [Kobas](https://www.kobas.co.uk/blog/ai-restaurants-guest-experiences/) and [Lineup AI](https://lineup.ai/how-to-create-restaurant-sales-forecast/#:~:text=Collect%20and%20analyze%20historical%20sales,point%20for%20your%20sales%20forecast.) provide insights into leveraging AI for enhancing guest experiences and creating restaurant sales forecasts respectively. The Kobas article explores how AI can be used to elevate guest experiences in restaurants, while Lineup AI offers guidance on collecting and analyzing historical sales data to create accurate sales forecasts.

A student from Oregon State University conducted a machine learning project aimed at predicting dinner guest counts for a local restaurant in Corvallis, Oregon. The project sought to address the challenge faced by restaurant management in accurately estimating customer numbers for staffing and inventory management purposes. Leveraging a decomposable time series model, the student aimed to provide a more reliable method for forecasting guest counts, ultimately leading to more efficient staffing decisions and potential cost savings for the restaurant. Ongoing efforts are focused on refining the algorithm by incorporating additional data sources, such as weather conditions and local events, to further enhance prediction accuracy (Lusardi, 2020).

A study demonstrates the utilization of various features for training a dataset aimed at predicting customer arrivals in restaurants. These features include weather conditions such as temperature, humidity, precipitation, and wind speed, as well as temporal factors like day of the week, month, and season. Additionally, the study incorporates information on holidays and special events, which can significantly influence restaurant traffic. By analyzing these diverse features, the model aims to accurately forecast customer arrivals, enabling restaurants to optimize staffing levels and operational efficiency (Tanizaki, Kozuma, & Shimmura, 2021).

In conclusion, as evidenced by the examples provided, there are notable advancements in leveraging predictive analytics tools and machine learning algorithms within the restaurant industry. These developments offer promising opportunities to enhance operational efficiency and guest experiences. Given the demonstrated potential of these technologies, further exploration and implementation in restaurant management practices are warranted.

**How can the accuracy of the prediction models be evaluated and improved over time?**

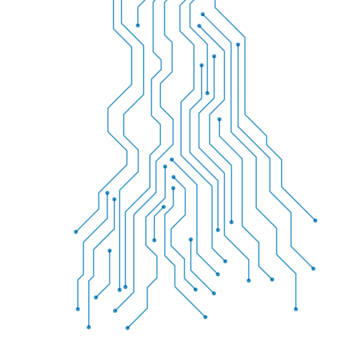
According to the AI methodology, the process involves iterating and improving the model over time. This iterative approach allows for continuous refinement and enhancement based on feedback from model evaluations. [This methodology](https://fhict.instructure.com/courses/13770/pages/ai-project-methodology?module_item_id=1071124) ensures that every project follows a structured process, facilitating clear understanding and effective execution of tasks.

Expanding on feature engineering involves enriching the dataset by adding more features to make it wider. This process goes beyond simply collecting more data points; it entails identifying and incorporating relevant variables or attributes that can provide valuable insights into the underlying patterns of the data.

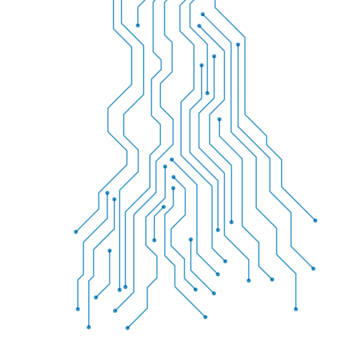
One approach is to explore new variables that may influence the outcome of interest. This could involve gathering additional data sources that are related to the problem domain. For example, in the context of predicting restaurant guest numbers, new features might include demographic information about the local population, nearby points of interest, or social media activity related to dining trends.

By expanding the dataset with new features and creatively engineering existing ones, we can enhance the model's ability to capture complex relationships within the data, ultimately leading to more accurate predictions.

Furthermore, seeking guidance from machine learning teachers and actively engaging in practical exercises can provide valuable insights into refining prediction models. By adjusting settings like hyperparameters, which control how algorithms learn, students can iteratively enhance model performance and gain deeper understanding of machine learning concepts.







# Conclusion

In summary, predicting restaurant guest numbers offers significant benefits for improving efficiency and customer satisfaction. By using predictive analytics tools and machine learning, restaurants can better anticipate demand and make informed decisions about staffing and inventory. Exploring key factors affecting guest numbers and discovering existing models highlight the potential of data-driven approaches in restaurant management. Continued efforts to refine prediction models, expand feature engineering, and collaborate with machine learning instructors are essential for improving accuracy and ensuring long-term success in this field. With a proactive approach to data-driven solutions, restaurants can thrive in the competitive hospitality industry.

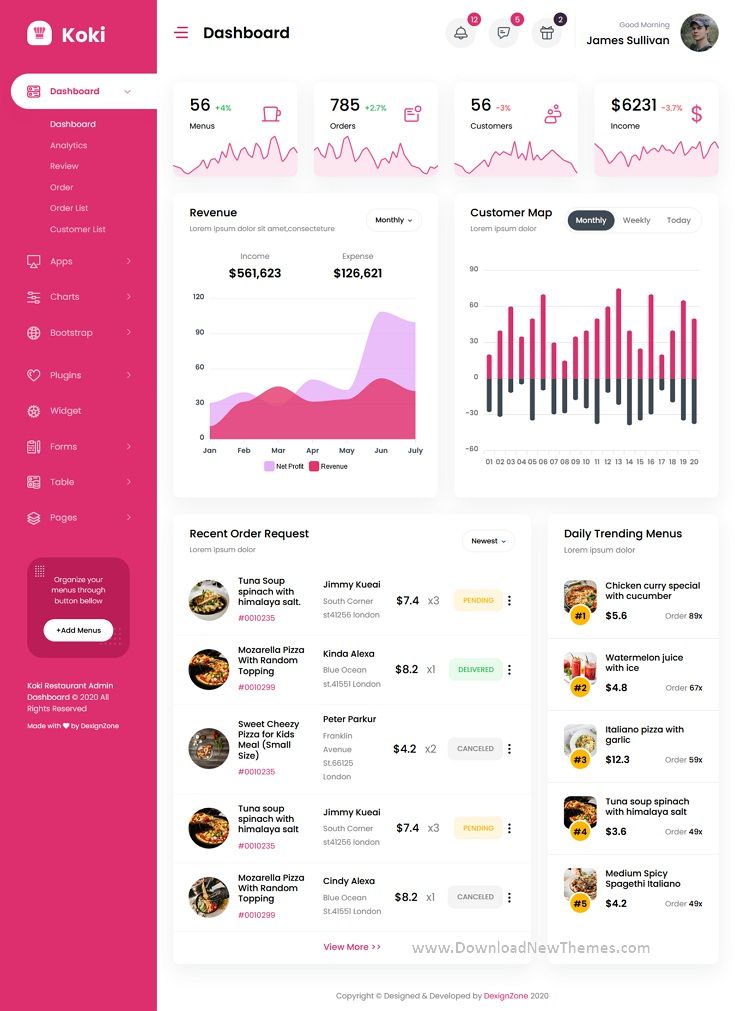
Product

The product of this project could be a user-friendly software application or platform customized specifically for restaurant owners and managers. This application would integrate predictive analytics models and machine learning algorithms to accurately forecast daily guest numbers. It would offer a comprehensive dashboard displaying predicted guest counts, along with insights into key factors influencing these predictions, such as weather conditions, local events, and historical data.

Features of the product could include:

* Prediction Dashboard: A user-friendly interface providing real-time predictions for daily guest numbers based on the developed predictive models.
* Historical Data Analysis: Tools for analyzing historical guest count data to identify trends and patterns, helping restaurant owners make informed decisions.
* Integration with External Data Sources: Integration with external data sources such as weather APIs, event calendars, and local news feeds to enhance prediction accuracy.

Overall, the product aims to empower restaurant owners and managers with actionable insights and tools to optimize operations, improve customer experiences, and drive Tortillas success in the competitive restaurant industry.



**References**

Lusardi, A. (2020, December 23). *Machine Learning Can Now Predict How Many Customers to Expect in Your Restaurant Tonight.* Opgehaald van Linkedin: https://www.linkedin.com/pulse/machine-learning-can-now-predict-how-many-customers-expect-lusardi/

Tanizaki, T., Kozuma, S., & Shimmura, T. (2021, August 31). *Forecasting the Number of Customers Visiting Restaurants Using Machine Learning and Statistical Method*. Opgehaald van Springer link: https://link.springer.com/chapter/10.1007/978-3-030-85906-0\_21

**Version**

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| --- | --- |
| **When?** | **What?** |
| 20-02-2024 | Introduction + Domain understanding |
| 20-03-2024 | Results + First version |