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AI Model & Data Visualizations: A Study on Small Pizza Restaurants

Harshitha Sheshala[1] and Ethan Eldridge[#]

[1]Folsom High School, USA
[#]Advisor

ABSTRACT

In recent years, data visualizations gained prominence in businesses. Modern visualizations differ from the past because these are created on computers; when equipped with Artificial Intelligence (AI) models, they provide quantitative predictions used to make informed business decisions. Many large corporations rely on these tools, but there is a significant gap within small businesses as they are unable to leverage this powerful tool because of three limiting factors: time, money, and accessibility. Additionally, data visualization is an emerging field with the current body of research focusing on the advantages and disadvantages of data visualization and its incorporation into large corporations, presenting a gap in the literature regarding small businesses. Therefore, the purpose of this study is to create an AI model utilizing data visualizations to help Pizza Restaurant X in the Sacramento area. This tool can be generalized to small pizza restaurants as the fundamental code will remain the same with only some data changing. Further, this research study will contribute to the current body of research by informing how small businesses can incorporate visualizations to make supply chain decisions.

Literature Review

Representing information visually is a familiar concept to the world. From the hieroglyphics that were used by our ancestors to communicate, to the maps that were used to navigate the world, visual representations are integral to the comprehension of information (Ioannidis, 2017). Visuals improve learning by finding patterns, discovering trends, and breaking down complex information into simple yet understandable formats (Bobek and Tversky, 2016). Businesses' constant intake of information through computer systems makes it challenging to examine the data and make decisions accordingly in which visuals can assist in learning. In the past couple of years, to simplify and resolve this problem, developers created data visualizations. Data visualization is defined as the “graphical representation” of numerical data in terms of graphs, charts, etc. (Tableau). The earliest data visualization concept predates even the creation of computers in 1981. These were used in maps to represent mathematical statistics and to keep track of data (Friendly, 2008).

As technology becomes increasingly integrated into businesses, the volume of data significantly rises. Big data is a term in businesses describing “large, hard-to-manage volumes of data” that “inundate businesses,” but the data can be harnessed to gain insights into the organizational structure of the business, customers’ perspectives, and helps track the growth of the company (SAS Insights). Businesses typically collect customer orders, survey data, ingredient lists, profit and loss, and inventory. At any level of business, the foremost goal is to enhance customer satisfaction and optimize profits, in which data plays a key role. The University of Pennsylvania, College of Liberal Arts and Professional Studies (2022) explains that data is essential to attain deeper insights into the business because it indicates the structure of a business, the flaws it encounters, and customers' views towards the company. Therefore, analyzing data enhances decision-making skills to optimize profits and improve customer experience. Researchers from Plymouth Business School and Montpellier Business find that analyzing data and predictive analytics – the task of forecasting outcomes – helps organizations “reduce costs, make products faster, and create new products or services

to meet customers' changing needs" (p. 2). Additionally, the researchers surveyed manufacturing companies located in India finding that analyzing data is directly correlated with improved decision-making among operation managers, thus boosting revenue (Dubey et al., 2020). Therefore, data is critical in the world of business.

Data Visualizations

A popular method to comprehend data is data visualization. Tableau, a company that creates data visualizations, defines data visualizations as "graphical representations" such as charts, graphs, and maps to present the data in a visual form. Visualizations are important for identifying trends, finding outliers, and general patterns among the data (Tableau; Kandel & Sharma, 2023). With visualizations, there is a greater understanding of the data presented that is not easily understood when presented on an Excel sheet. As the Harvard Data Science Review explains, visually looking at data expedites recognizing the outliers, trends, boundaries, and clusters; this information will be used to make decisions dependent on the data which is not viable when looking at statistical data (Unwin, 2020). Popular companies such as Google, Spotify, and Microsoft, companies with vastly different purposes and business models utilize visualizations (Kandel & Sharma, 2023) to maintain customer satisfaction, drive business decisions, and give greater insights into how to optimally operate the business. Additional advantages include communication with employees and stakeholders, faster "identification of outliers and anomalies", and identification of the cause of the relationships (Yellowfin, 2023). Business decisions are five times faster and three times more likely to execute the goals efficiently, states the consulting company Bain and Company. Overall, data visualizations provide a holistic view and when done correctly, the pictures identify correlations and trends enabling businesses to make informed decisions. The Results section of the research paper will provide examples of data visualizations from the study.

AI Analytics

A field that combines business analytics and current technology is known as AI Analytics. Anodot, an American data analytics company defines it as the use of machine learning techniques to discover insights by automating most of the work to improve the speed and scale of the data. Harnessing AI Analytics provides quantitative predictions using historical data enabling informed business decisions.

Popular companies such as Spotify, Google, and Amazon harness the power of data visualizations and AI Analytics to leverage their business. One such example is Domino's, the pizza company, that studies customer behavior and then uses it to give out coupons, and discounts to gain more customers, sequentially increasing profits and customer satisfaction. Additionally, data visualizations help Domino's gauge information about their business in tandem with their competition allowing them to make decisions by strategizing the best way to improve. Another example is the versatile company, Target, which combines data visualizations preliminarily to understand the data and then AI to predict the probability of a customer buying a certain product and recommends products so customers can buy leading to increased sales (Kandel & Sharma, 2023). Combining AI Analytics and data visualizations is powerful because it identifies patterns helping employers use more accurate predictions from the AI model, which from previous studies demonstrates that these tools provide insightful analysis and improve decision-making abilities in businesses.

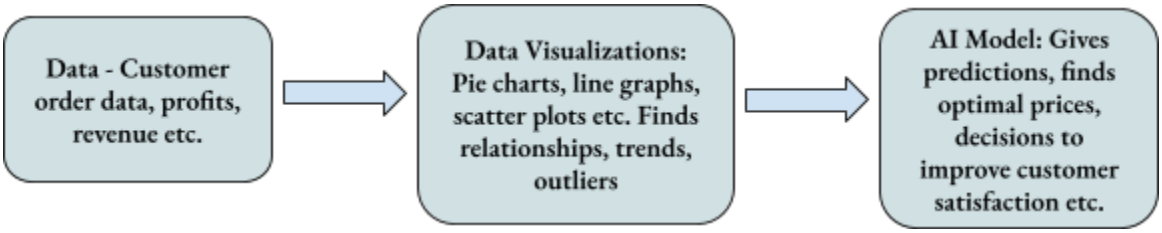

Figure 1. Illustration of Steps. Shows the steps businesses take in analyzing data.

Existing Gap in the Literature

An existing gap in the current literature is attributed to small or local businesses. Most of the research, seen in the previous sections, utilizes the analysis of large businesses such as Target, Google, Spotify, Airbnb, etc.; however, there is no research conducted on small businesses that are defined as businesses that do not hold franchises. They lack a lot of resources that many large companies have. Some of the resources include (but are not limited to) employees with expertise in the field, time to dedicate to analysis, and money to be able to invest in these technologies. Most of the time, local businesses focus on catering to their customers' needs so they are unable to dedicate a lot of time to learning how to use these tools.

The current tools available, such as Microsoft Power BI, Tableau, Salesforce Einstein, Zoho Analytics, Google Charts, and Quick Book are powerful tools that are very effective and used by many companies around the world. However, these tools typically require experience in statistics or taking various online courses to accurately use them, making them not accessible for everyone. According to Business, a digital media company that provides marketing services explains that having inaccurate visualizations is harmful because it gives misleading information which will then be used to make important business decisions, which will ultimately hurt instead of helping the company (Shah, 2023).

An additional factor preventing businesses from employing these data visualization technologies is money. DigitalOcean, a company established to research medium and small-sized businesses, surveyed 1670 small to medium-sized businesses in 2023 and found that 72% of the small businesses mention cost as a significant contributor to implementing infrastructure (Digital Ocean). As cost is a significant contributor and most of the visualization platforms cost at least $15/month, not all small businesses can utilize these tools. Overall, the time, money, and complexity of the tools prevent small businesses from utilizing these tools. Amazon Web Services Editorial Team (2023) finds that only 35% of small and medium-sized businesses (SMB) use cloud-based analytics which is the idea of collecting and analyzing the data the businesses have, which further reinforces the point that small businesses do not utilize data visualizations which is in the category of cloud-based analytics. To address the gap and increase the simplicity of the tools for better access, the following question was developed: To what extent can an AI model tool with data visualization capabilities help address the issues of time, money, and accessibility in small pizza restaurants to help them gain insights and make supply chain decisions?

Summary

An artificial intelligence model with visualization capabilities is a powerful tool that enables businesses to gain a better understanding of the business and make supply chain decisions. Supply chain decisions are defined as inventory management and understanding sales such as most and least popular items. Currently, there are not any tools that consider the three limiting factors – time, money, and accessibility – hindering the implementation of data visualization and AI models in small businesses. Additionally, there is a limited amount of research correlating small businesses and data visualizations, so this paper provides an overview of the power of visualizations at any level of business and sparks future research about this topic. As local businesses have a large scope; to narrow it down, the study is conducted on pizza restaurants. To make the research project realistic in a limited amount of time, the model will be created for Pizza Restaurant X. While the model is created for a specific pizza restaurant, the fundamental code will be the same with only labels and data in sheets changed, so the model can still be applied to most pizza restaurants.

Methodology

Overview

The objective of businesses is to maximize profits and improve customer satisfaction. Therefore, the goal of this research project is to provide visualizations and predictions for small pizza restaurants that enable them to gain insights into their business, consequently making supply chain decisions such as managing how many ingredients to buy. Making supply chain decisions ensures that the pizza restaurant has enough supplies to fulfill customers' orders while learning about preferences enables businesses to promote the pizzas. To achieve this goal, the create method was utilized to address the limiting factors of time, money, and accessibility. Additionally, quantitative data is utilized to create visualizations. To successfully develop the model, the widely used framework of the Artificial Intelligence Project cycle was adapted.

Defense of Method

To address the gap of a lack of tools in the current market that considers time, money, and accessibility, a create approach with the use of quantitative data was adopted. Data visualizations are graphs and visuals that convey statistics; thus, quantitative data is a prerequisite to complete the task.

The researcher utilized the AI Project Cycle to address the gap (See *Figure 2*). The AI Project Cycle is a "comprehensive approach" that tracks the development of the AI model from "conception" to "production." The proposed approach acknowledges the endless possibilities for innovation with emerging technologies but ensures that social values and stakeholders' interests are not neglected. To ensure safety, the AI Project Cycle identifies risks, followed by acquiring and exploring data, designing, and developing the model, and ending with evaluation (Silva & Alahakoon, 2022). This is the preferred approach by the researcher for two reasons: it is the traditional method used for the development of any AI technologies; following this methodology ensures there are not any negative ethical implications that can pose harm to the stakeholders. The final step of evaluation of the success of the tool will not be taken as the research question is only concerned with the development of the tool rather than implementation.

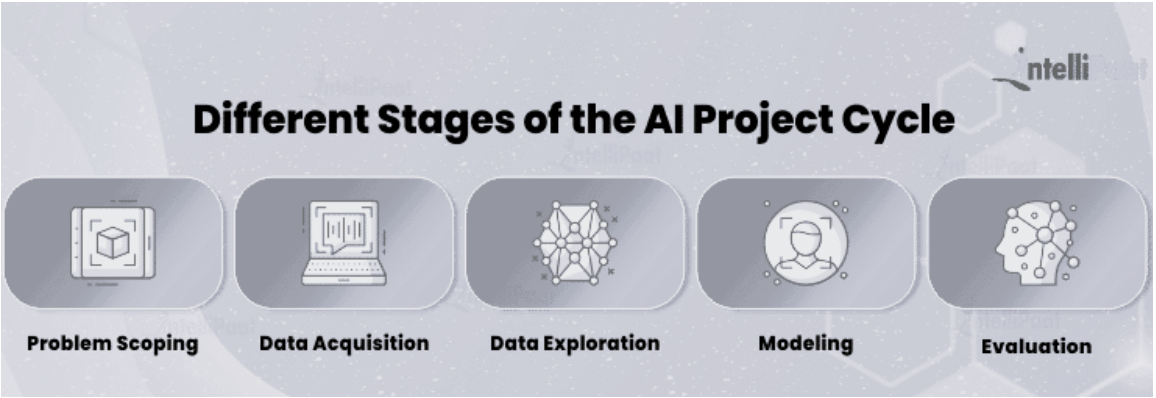

Figure 2. AI Project Cycle. The steps the researcher took consequentially to answer the research question.

Problem Scoping

Problem scoping requires narrowing down the topic, which was identified in the Literature Review. The gap was established to help small businesses by creating a visualization tool to help improve profits while considering time, money, and accessibility. Ethics were considered as the first main concern of replacing employees. While this can apply to large businesses, small businesses generally do not employ data analysts, so this tool will be an addition to the business rather than a replacement. Additionally, the researcher did not receive personal identifying information to protect customers' privacy. Further, the researcher will not reveal the datasets to ensure the privacy of the business

is maintained with an agreement signed that fully discloses the research project (See *Appendix A*). With all these considerations and the identification of the problem, the first step was successfully implemented.

Data Acquisition

The initial plan was to gain access to data like the number of customers per day, orders, and financial information; however, an important aspect was overlooked by the researcher, which is that small businesses will not disclose all this information. By the California Consumer Privacy Act established in 2018, small businesses are obliged to protect customers' sensitive information and give the option to opt out of these data-sharing services (State of California Department of Justice, 2024). To prevent complications and the possibility of having inaccurate information, the researcher and the business excluded customers' private information. Secondly, the researcher partnered with a local pizza restaurant in the state of California without any chain restaurants, fulfilling the definition of small business. As the data that was collected looked at the ingredients bought, the pizzas ordered, and the quantities to create the pizza, the researcher tackled supply chain information because this data can inform about the most and least popular items, customers preferences as well as the number of ingredients to be bought. Through this step, the researcher successfully acquired the data.

Data Exploration

After completing the first two initial steps. the researcher explored the data. The goal of this step is to learn what the data means, the value and significance of each piece, and the specific aspects to be tackled. To fulfill this step, the researcher began by curating all the data into one Google Sheet. The data is later downloaded into comma separated values or CSV file format and that is uploaded onto Google Colab to provide the visualizations.

The data provided gave information about how many pizzas and what type of pizzas were sold. The researcher decided to visualize customers' preferences and popular pizzas which will ultimately help make inventory decisions. Further, the researcher observed that cheese was consistently bought each week and is used for all pizzas, meaning visualizations as well as predictions can be created on this contributing to the supply chain decisions.

Modeling

The modeling step in the AI Project Cycle is the development of the tool itself.

Tools

The tool used in the creation of the AI model is Google Colaboratory which is a free online software to code Python. Python was the coding language used to create this model because it is easy to use, has many libraries with capabilities of data analysis and can use machine learning algorithms for forecasting.

The second tool is Google Sheets where all the data is stored. It is downloaded into a CSV format to upload the data onto the Google Colab interface and get the respective visualizations.

Libraries

Data analysis and visualizations require the importing of external libraries as Google Colab itself cannot support capabilities such as comprehending the data, graphing, and providing predictions (See *Figure 3*). Therefore, the five models imported are pandas for data manipulation (Nvidia), os to navigate the computer files (Python, 2019), matplotlib to plot line graphs and scatter plots (matplotlib), stats models for predictions, and sci-kit learn to measure the accuracy of the predictions (Pedregosa et al., 2011).

```
#@title Run this to import libraries and your data! { display-mode: "form" }
import pandas as pd   # Great for tables (google spreadsheets, microsoft excel, csv).
import os # Good for navigating your computer's files
import numpy as np
import matplotlib.pyplot as plt
from statsmodels.tsa.arima.model import ARIMA
from statsmodels.tsa.seasonal import seasonal_decompose
from sklearn.metrics import mean_squared_error

# Our dataset is hosted on Google Cloud. Here's how we can grab it:
!wget -q --show-progress "https://docs.google.com/spreadsheets/d/14EQvx51aKEh8OZwcFWwg1tNbkP2pHkK5akghl7DB-4c/edit?usp=sharing"

# Quiet deprecation warnings
import warnings
warnings.filterwarnings("ignore")
```

Figure 3. Libraries Import. This is the code for importing the libraries to create visualizations and predictions.

Data Visualization

For data visualizations, there were three types of visuals created. While there are several possibilities of graphs that can be created with the given information, the end goal was kept in mind which is to gain insights into the structure of business as well as forecast some aspects to make supply chain decisions. The data available to the researcher are the types of pizzas ordered such as veggie, chicken, or halal, the pizza sizes within each pizza type, as well as the amount of cheese ordered. The visualizations were coded (See *Appendix B*) primarily using the Matplotlib library. For all the visuals, the Results section will explain the interpretation of each of the graphs.

The first graph is a line chart to show the total pizzas ordered per week. An overall trend line to understand the way the business performs weekly helps the business track its growth, which also has the potential to help the restaurant make marketing decisions.

The second is a pie chart that demonstrates the distribution of pizza types in doordash orders as well as in-store orders (See *Appendix D*). The researcher chose to find the distribution of orders by looking at the most and least popular items. Understanding this will ensure that the menu is kept "relevant and appealing" by ensuring that the popular item stays, while deciding to what extent the least popular item can be modified, consequently increasing sales (Marketing Food Online, 2023). In addition, finding the most popular items will give insights into the ingredients that need to be ordered in the following week, providing supply chain decisions. Secondly, pie charts were also used to find the distribution of the size of each type of pizza to understand customer preferences for the pizza and the size of it.

Lastly, a bar chart was created that represents the distribution of pizza type over the twelve weeks of data available.

Forecasting

Forecasting, part of Artificial Intelligence analytics, provides predictions for the given data. As the data is concerned with time, any machine learning algorithms that have time-series analysis can be used to predict. Thus, the "auto-regressive integrated moving average" model, ARIMA for short, was used (Banerjee, 2020). This is a common model that uses statistical concepts of moving average, finding seasonal data which is to see if there's a particular interval where there is tremendous growth. The ARIMA model forecasted the number of pizzas and the amount of cheese for the next four weeks (See *Appendix C*).

In addition, the accuracy of the predictions was tested using the mean absolute error (MAE) which shows the difference between the actual value and the predicted value. Finding accuracy is an important step, as it demonstrates the validity of the predictions and to what extent the predictions can be trusted. It also suggests the flaws in the model and ways to improve the model to increase accuracy (See *Appendix C*).

Results

Using Google Colab, the researcher created visualizations and provided predictions for the pizza restaurant to gain insights. The business is provided with a five-step guide on how to access these visualizations (See *Appendix F*).

The visualizations were created with twelve weeks of data. The final dataset is created using Google Sheets with embedded equations that automatically add values to the columns with the total values (See *Figure 4*). For example, when the business inputs the number of veggie pizzas by size sold, the columns with the veggie_total as well as a total number of veggie pizzas are added. The final dataset contains thirty-six columns containing the date, the size distribution for the three pizza types with doordash orders, and the total number of pizzas.

veggie_family	veggie_large	veggie_medium	veggie_small	veggie_total

Figure 4. Dataset labels. The final dataset cannot be shown to protect the privacy of the business and to not breach the agreement between the researcher and the business.

Final Visualizations

The following two images show the number of pizzas sold over the twelve weeks (See *Figure 5 and Figure 6*). As the dataset gets updated weekly, the number of data points increase, contributing to greater insights into how the business is doing. An example of an insight can be that, at the end of December, there is a rise in pizzas sold. This can be because it is during the holidays, so the restaurant can expect a greater number of orders during that time the following year.

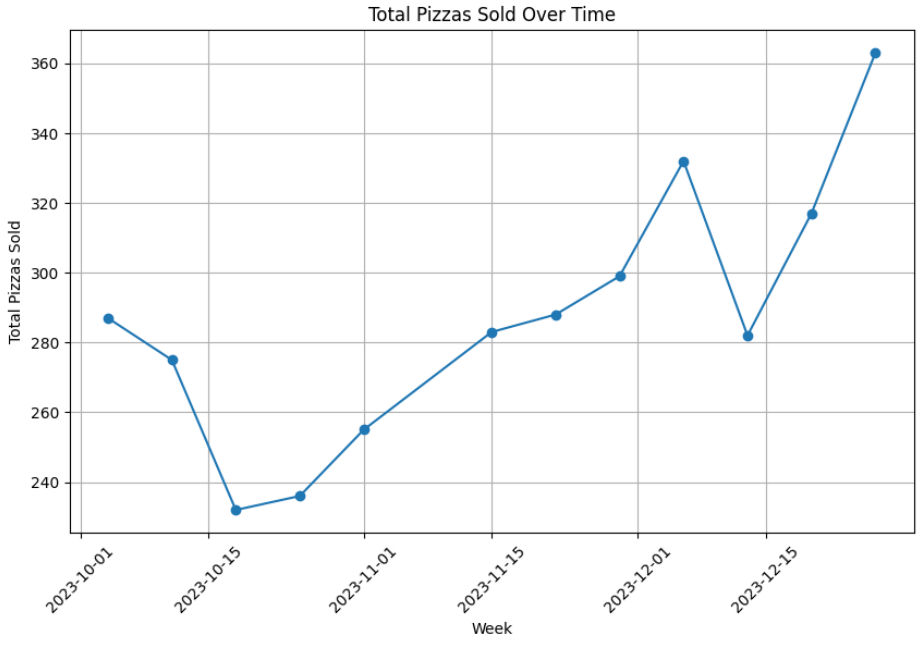

Figure 5. Line chart#1. A line chart that shows the number of pizzas sold per week over the course of 12 weeks.

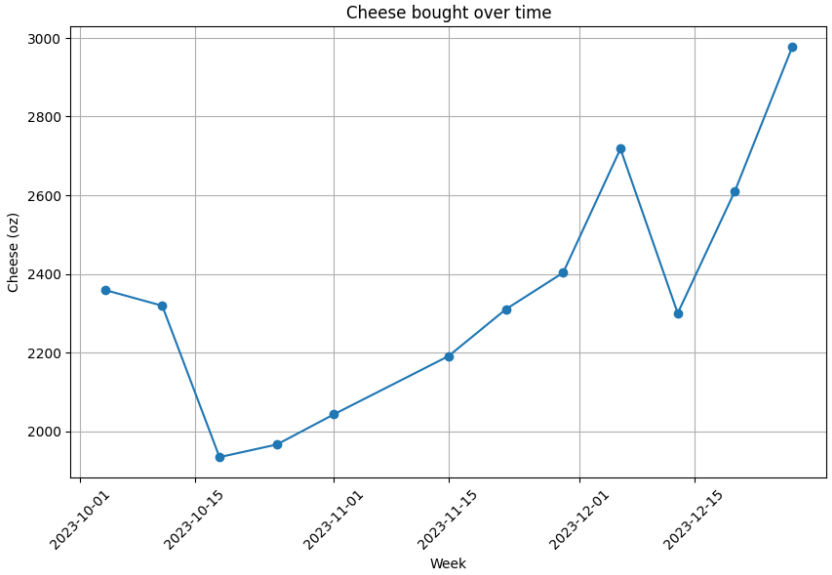

Figure 6. Line chart#2. A line chart that shows the amount of cheese in ounces bought.

The following two images (See *Figure 7 and Figure 8*) show pie charts looking at the distribution of types of pizzas as well as the size of pizzas per week. The pie charts enable supply chain decisions by allowing businesses to understand the most popular items and buy inventory accordingly. For example, the visualizations find veggies to be the most popular, the business can ensure that the number of vegetables bought is sufficient for the following week. This ensures there is enough inventory and fulfill orders allowing customer satisfaction. Additionally, the pizza size breakdown enables businesses to understand how much quantity of flour they need to buy and the customer's preferences for the type of pizza and the size. Similarly, the bar charts provide a similar interpretation but demonstrate an overtime trend.

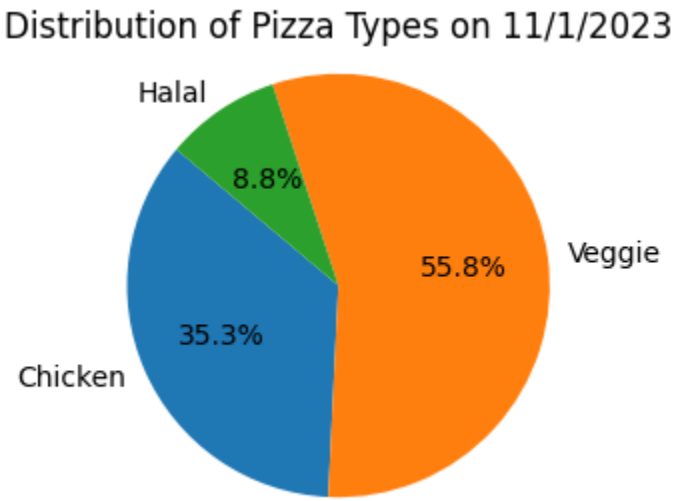

Figure 7. Pie chart #1. A pie chart represents the distribution of pizza types for the week of 11/1/2023. These pie charts can be created for each week where when the code cell is run, the code prompts for the date, and inputting the date provides the visualizations.

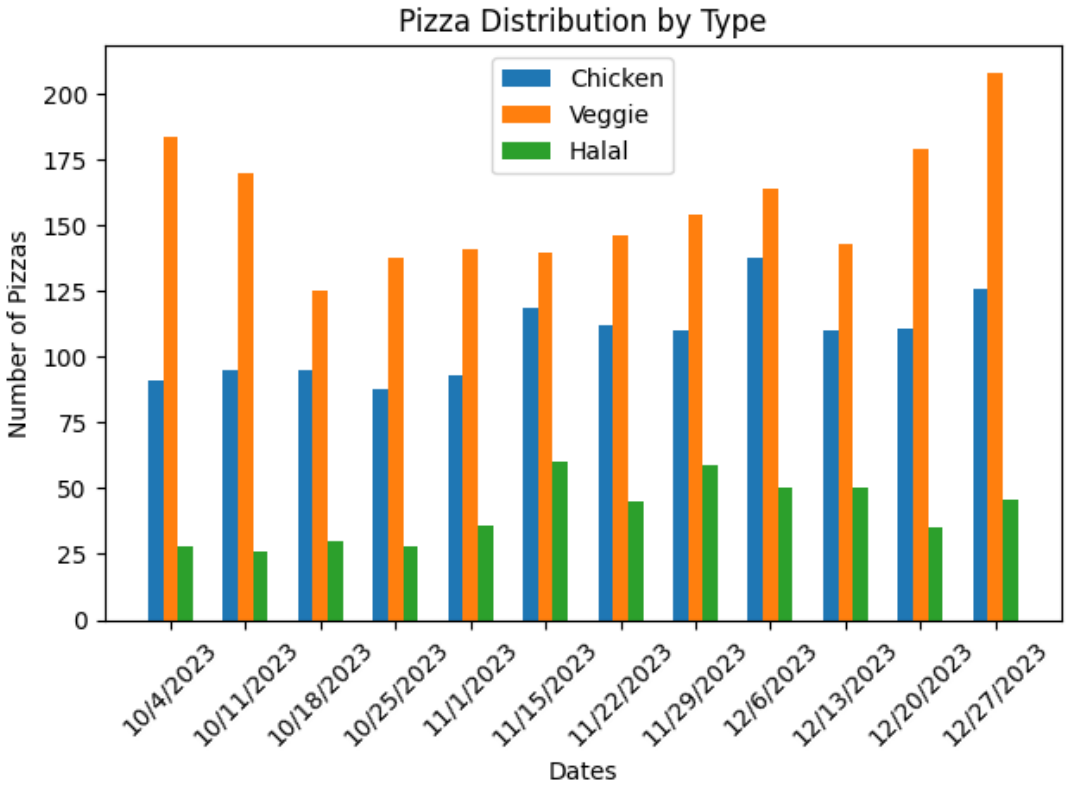

Figure 8. Bar chart for pizza distribution over time. Distribution of pizza types over the 12 weeks.

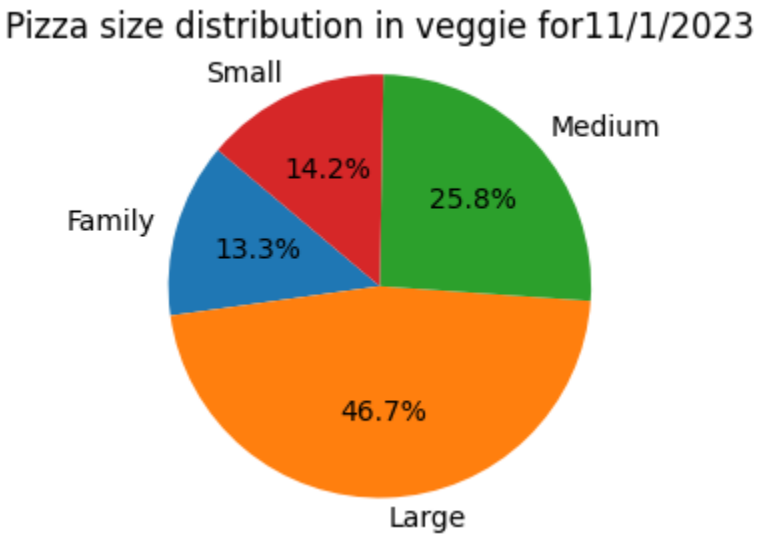

Figure 9. Pie chart for pizza size distribution. These pie charts can be created for all three types of pizzas for all the weeks.

Final Predictions

The ARIMA model provides the forecast in graphical format as well as gives the predictions with a number for the next four weeks (See *Figure 10 and Figure 11*). The total pizzas sold predictions will enable businesses to get an expectation of how many orders will be placed and buy the ingredients for the following week. For example, for the week of 2024-01-01, the business can expect 360 orders, which is a little lower than the previous week. Depending on the amount of inventory the business has that week, the ingredients can be bought accordingly.

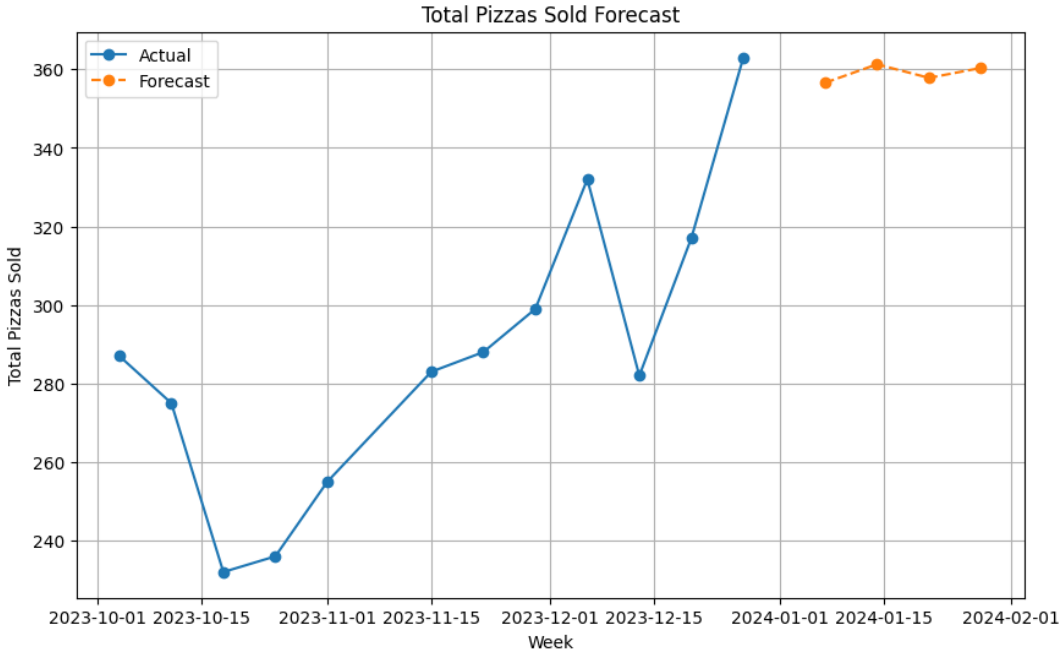

Figure 10. Total pizzas sold forecast.

```
Forecasted total pizzas sold for the next 4 weeks:
4
Week 2024-01-01 00:00:00: 356.57
Week 2024-01-08 00:00:00: 361.29
Week 2024-01-15 00:00:00: 357.83
Week 2024-01-22 00:00:00: 360.37
```

Figure 11. Total pizzas forecast.

The second prediction is for cheese that will be ordered (See *Figure 12*). The model uses the information from the last twelve weeks to show how much cheese can be expected to be used and then converts from Ounces to the number of boxes the restaurant must order for next week. This prediction does not consider the inventory already there in the restaurant, so to truly find how much should be ordered, the formula is:

$$AI\ Model\ prediction - Current\ Inventory = Cheese\ orders$$

```
Week of 2024-01-03 00:00:00: buy 6.00 boxes
Week of 2024-01-10 00:00:00: buy 6.00 boxes
Week of 2024-01-17 00:00:00: buy 6.00 boxes
Week of 2024-01-24 00:00:00: buy 6.00 boxes
```

Figure 12. Cheese predictions.

Evaluation

To evaluate the accuracy of the predictions, the accuracy score was tested for the prediction of total pizzas sold. While there are three accuracy scores given, the most important one is the mean absolute error or MAE (See *Figure 13*). The 36 demonstrates that the prediction is 36 units from the true value. For example, if the number of pizzas bought is 200, the MAE says that the prediction is 236 or 164. The optimal predictions should have an MAE of around ten which can be achieved by having more data as models become the most accurate when given more historical information. Overall, the predictions are reasonable and with more data, the accuracy can significantly increase.

```
Mean Absolute Error (MAE): 36.83126387339232
Mean Squared Error (MSE): 2141.1355915628096
Root Mean Squared Error (RMSE): 46.27240637315948
```

Figure 13. Accuracy score. The mean absolute error shows that the model is 36 units away from actual value.

Discussion

The gap identified in this research paper is a lack of a tool that provides data visualizations and predictions for small businesses with the factors of time, money, and accessibility. Throughout the paper, the researcher demonstrates the process to create a tool that addresses the three limiting factors and how the tool adds tremendous value to a business and gives purpose to the data that is collected by the business. The researcher was unable to create a tool for all small businesses which is not feasible as the structure and desired visuals has a lot of variations and depends on each type of business. However, the researcher successfully created a tool for small pizza restaurants addressing the three factors. While the tool was created based on one pizza restaurant, the tool can be generalized as the fundamental code remains the same with the different pizza restaurants simply changing the numbers in the dataset or the labels.

The gap is addressed as this is a free tool addressing the problem of money and thus removing the barrier. Secondly, this is an accessible tool as with three easy steps, the business will be able to receive the visualizations (See *Appendix E*). Utilizing these tools requires no additional understanding of coding and will receive the visualizations immediately. Lastly, time is saved for the businesses by having a tool that can create the visualizations within two minutes after the uploading of data, which is significantly less compared to other tools such as Tableau. However, it is important to note that Tableau and other tools are significantly more powerful, so a business can opt to choose these tools if desired. In the context of smaller businesses that are looking to learn a basic overview of the status of their business, this is an effective tool.

Beyond the implication of this tool, this research paper initiates a conversation in the research community. Data visualization is a relatively new field with research mostly focusing on advantages and disadvantages or

comparative analyses for large corporations rather than implications on small businesses. As a result, this research paper has the potential to shift the focus to data visualizations and AI analytics from large businesses to small businesses which is neglected in the current scholarly conversation. Understanding the effects of these visualizations and the role they play in small businesses can change the landscape for these businesses enabling them to improve customer satisfaction, maximize profits, and expand their business with the insights and forecasts.

Conclusion

In conclusion, this tool leverages Python data analysis and machine learning capabilities to create a tool that provides visualizations and forecasts the amount of pizza that will be sold in the following four weeks, consequently the amount of cheese that should be bought. These insights inform the business about the structure of the business such as the most popular items which is essential in knowing customers preferences to alter the other recipes to increase profit and optimize customer satisfaction. In addition, these insights help businesses make supply chain decisions like how many ingredients should be bought in the following week. Overall, this tool, while equipped with its own limitations, has a significant impact on the existing gap by conducting a study that looks into effects on small pizza restaurants and a tool that is able to address the factors of time, money, and accessibility.

Limitations

It is worth nothing that the research contains a few limitations that can cause discrepancies. Firstly, the data in the final data set might not be 100% accurate. Three different datasets of ingredients list, customer orders, and the recipe had to be manually input into the final dataset. This has room for human error when it comes to counting, adding up all the values, and inputting the values in the dataset. Consequently, the data might be different affecting the visualizations and models which directly take the numbers from the datasets. However, as the predictions are created each time the code is run, if the dataset is updated with accurate data, the predictions will become more accurate and change accordingly.

Secondly, the business must use their own datasets and aggregate the data to fit into the format of the dataset which increases the time spent. While this is an inconvenience, it is the optimal way to gain insights. Inputting data into the final dataset takes approximately fifteen minutes from the researcher's experience.

Lastly, a limitation that is harder to address is the businesses do not have experience in coding, so if any bug arises with the code, they will not be able to fix it without help from someone with Python experience. With the code programmed by the researcher, the code should work in all cases, but occasionally bugs do arise with code being accidentally changed or documentation of code changing. The most effective way to address this limitation is to create a website or an app, so the code cannot be changed, and the developer can always update it on the backend. The next step in this research project would be to make it more user friendly by creating a website which would also address this limitation.

Future Research

As mentioned in the limitations section of the paper, a future possibility is to create an app or website that can make this tool user-friendly. Giving more interactive experience with guidelines on the website itself will make the process more efficient and effective. In addition, the tool is currently catered for Pizza Restaurant X in Sacramento Area, so creating a guide for how the tool can be adapted by other pizza restaurants allows more pizza restaurants to access the tool. It is important to note that the code will remain the same, with only the data changing as well as some labels in the code. In *Figure 14,* if the label of the dataset is hawaiian_total instead of veggie_total, in pizza_types, the veggie_total is replaced with hawaiian_total, demonstrating the quick and efficient way to generalize the tool.

```
#Store orders
date_input = input("Please enter the date: ")
# Extract total counts for each pizza type for the specific date (10/4/2023)
pizza_types = ['chicken_total', 'veggie_total', 'halal_total']
pizza_counts = [vis_data.loc[date_input, pizza_type] for pizza_type in pizza_types]

labels = ['Chicken', 'Veggie', 'Halal']
# Plot the pie chart
plt.figure(figsize=(3, 3))
plt.pie(pizza_counts, labels=labels, autopct='%1.1f%%', startangle=140)
plt.title('Distribution of Pizza Types on ' + date_input)
plt.axis('equal')  # Equal aspect ratio ensures that pie is drawn as a circle
plt.show()
```

Figure 14. Labels.

Aside from the tool itself, the research can be furthered by conducting a longitudinal study on the effects of data visualizations and forecasting on insights and supply chain decisions for small pizza restaurants. The study would enhance understanding of the implications and to what extent these tools are advantageous along with limitations, which addresses smaller businesses in which there is a lack of research in. Additionally, there can be research conducted on the tool created looking at how this tool can further expand to marketing decisions on top of supply chain decisions

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