Maverik Revenue Forecast

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Project Objective

Build a predictive model that Maverik can use to predict sales upon opening a new store.

Sales KPIs are as follows:

- Inside Sales (Merchandise)
- Food Sales
- Diesel Sales
- Unleaded Sales

Project Scope

- Build a time-series model to predict sales across 4 different KPIs
- The model(s) must be rolling (able to ingest actuals to revise forecasts)

Business Problems & Risks

- Four separate predictions are needed
- Limited knowledge of specific domain / industry
- Forecast must be rolling
- Rolling forecast models are computationally demanding
- Variations in seasonality + sales volume across stores

Results

Six-Month RMSE Comparison

	Our Model	**Benchmarks***
Inside Sales (Merch)	1065.6	3283.1
Food Sales	390.2	1081.7
Diesel Sales	1119.0	4398.0
Unleaded Sales	892.7	5845.4

*Maverik would have experienced an average **73%** reduction in prediction error for store ID 24535, based on these assumptions.*

- Inside Sales: **67.5%**
- Food Sales: **63.9%**
- Diesel Sales: **74.6%**
- Unleaded Sales: **84.7%**

*Average RMSE score from 37 stores

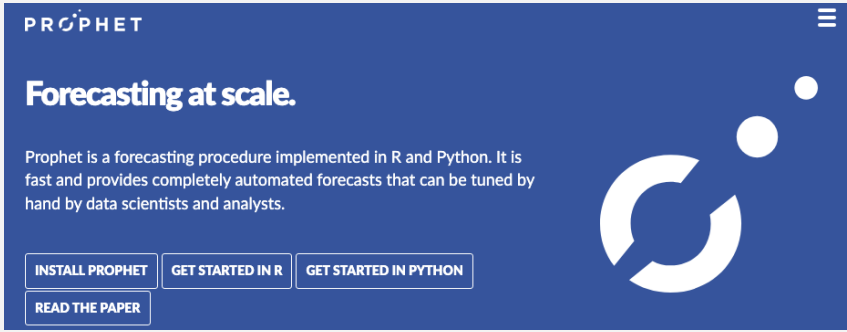
Prophet Model

What is Prophet?

- Open-source forecasting tool designed to work with time series data.
- Effective for datasets with strong seasonal effects and extensive historical data.

Processing Time & Computational Requirements

- Computational Resources: The model was run on a 16GB Mac laptop
- Processing Time: 1240 minutes (20 hours and 40 minutes)
- With more powerful CPU & greater RAM, we could run this model for all stores.



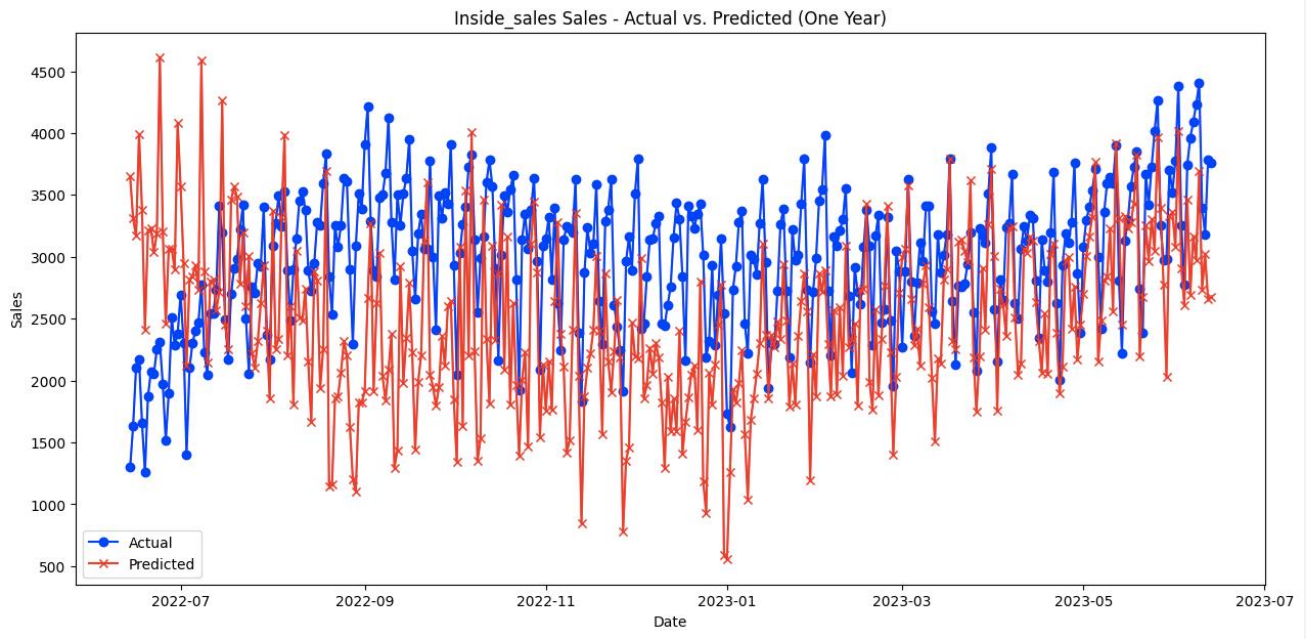
Model Benefits

Strengthens prediction accuracy

Improves supply chain management

More accurate initial ROI estimates

Model Performance: Actuals vs Predictions



Inside Sales (Merch) Results

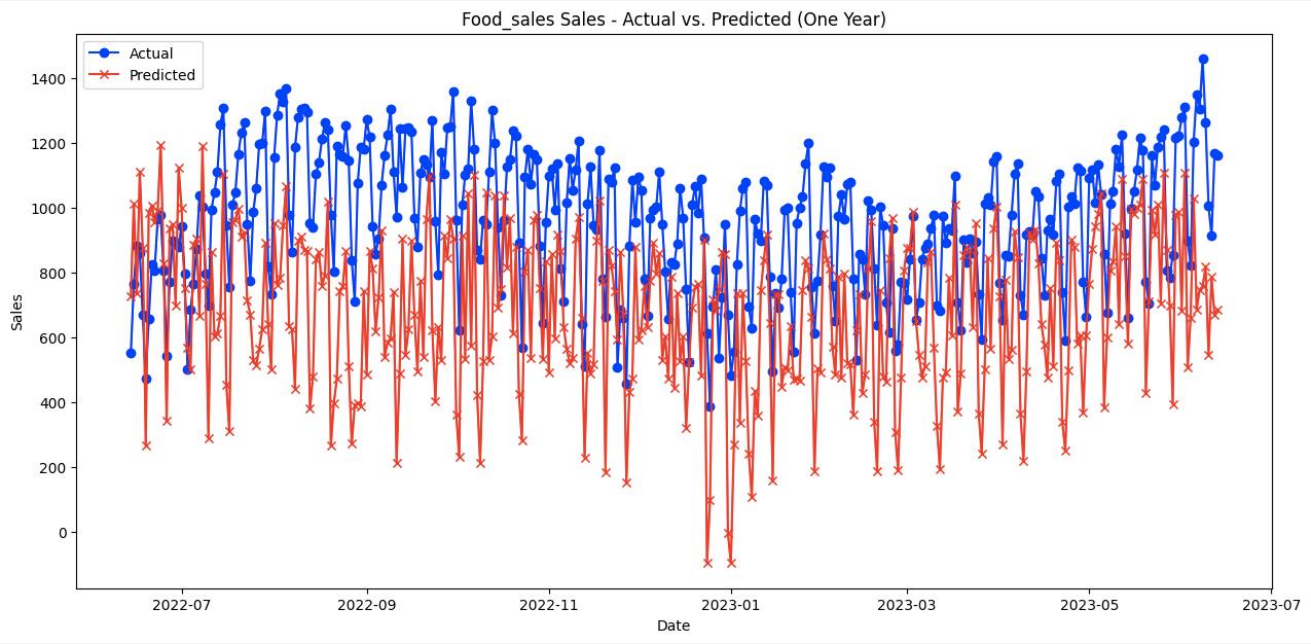
two_week - RMSE: 1447.6, MAPE: 75.9

three_week - RMSE: 1300.3, MAPE: 63.9

six_month - RMSE: 1065.6, MAPE: 32.6

one_year - RMSE: 907.6, MAPE: 25.8

Model Performance: Actuals vs Predictions



Food Sales Results

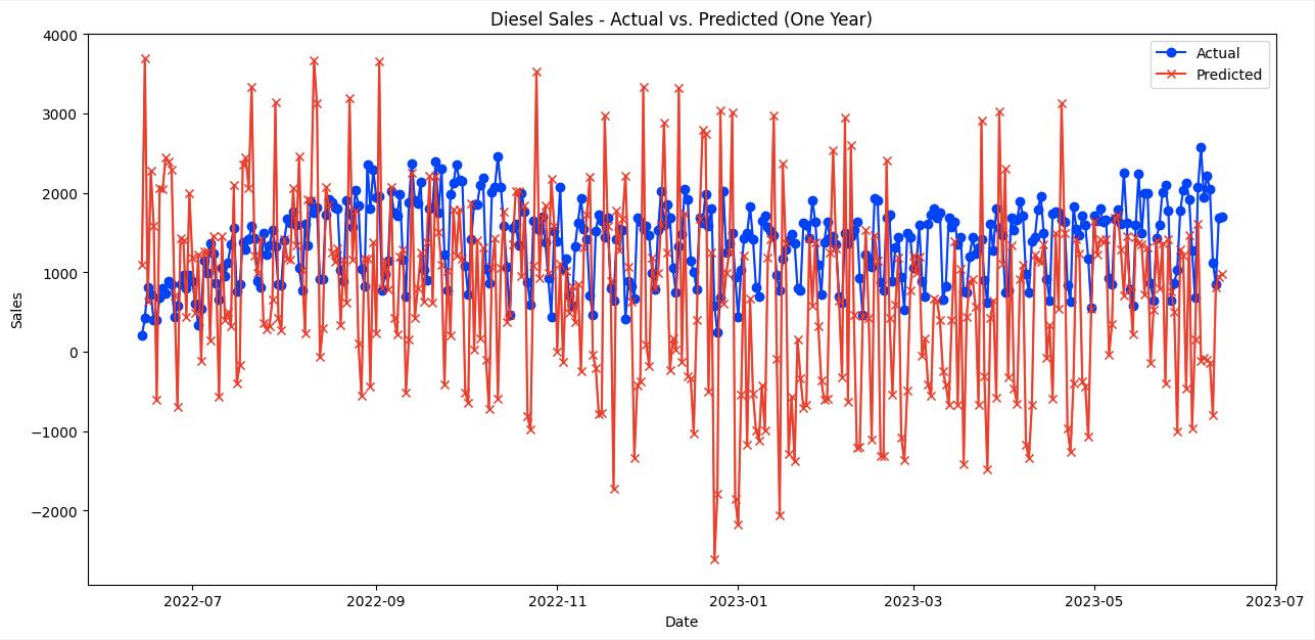
two_week - RMSE: 190.5, MAPE: 24.5

three_week - RMSE: 178.2, MAPE: 22.0

six_month - RMSE: 390.2, MAPE: 32.5

one_year - RMSE: 360.2, MAPE: 31.8

Model Performance: Actuals vs Predictions



Diesel Sales Results

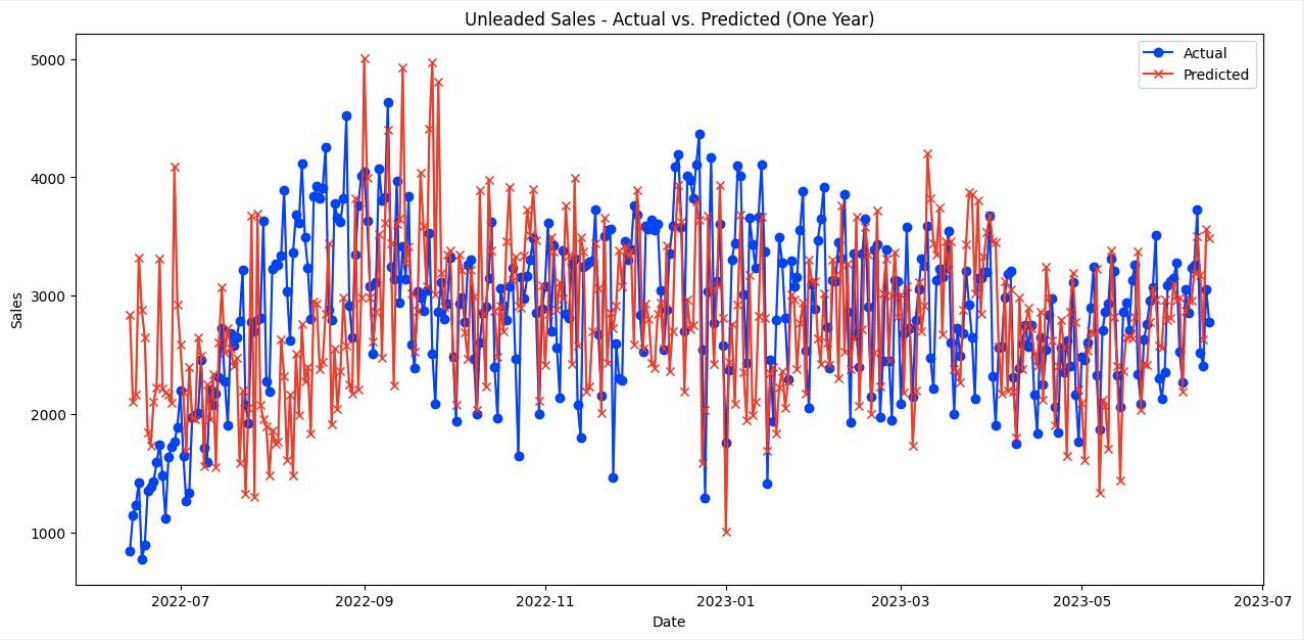
two_week - RMSE: 1399.3, MAPE: 222.1

three_week - RMSE: 1203.8, MAPE: 178.4

six_month - RMSE: 1119.0, MAPE: 83.6

one_year - RMSE: 1298.1, MAPE: 93.2

Model Performance: Actuals vs Predictions



Unleaded Sales Results

two_week - RMSE: 1228.1, MAPE: 95.3

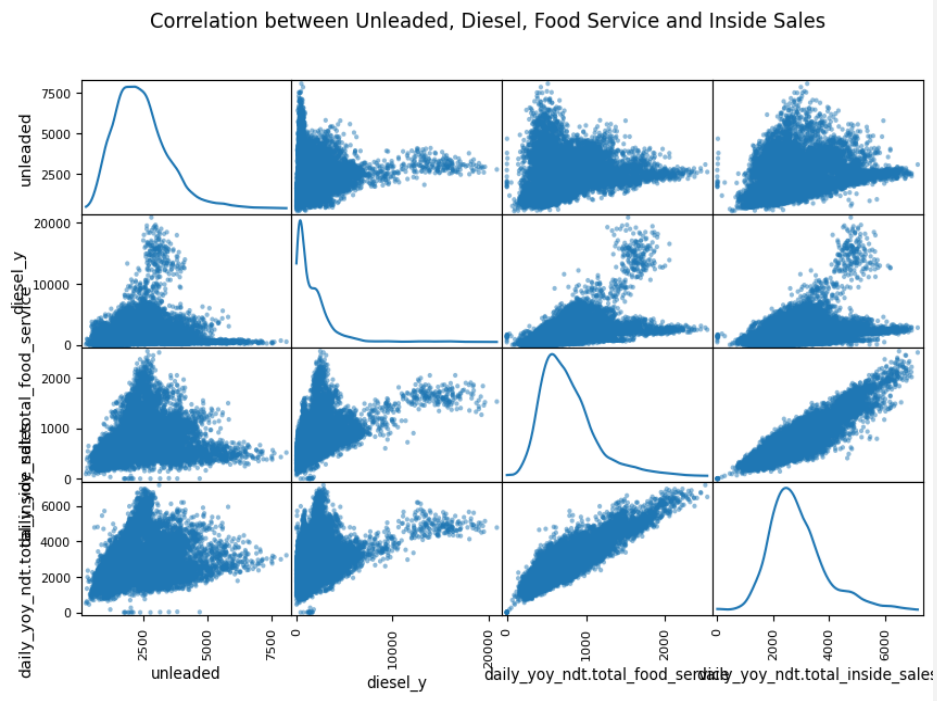
three_week - RMSE: 1184.4, MAPE: 80.9

six_month - RMSE: 892.7, MAPE: 29.7

one_year - RMSE: 766.9, MAPE: 23.7

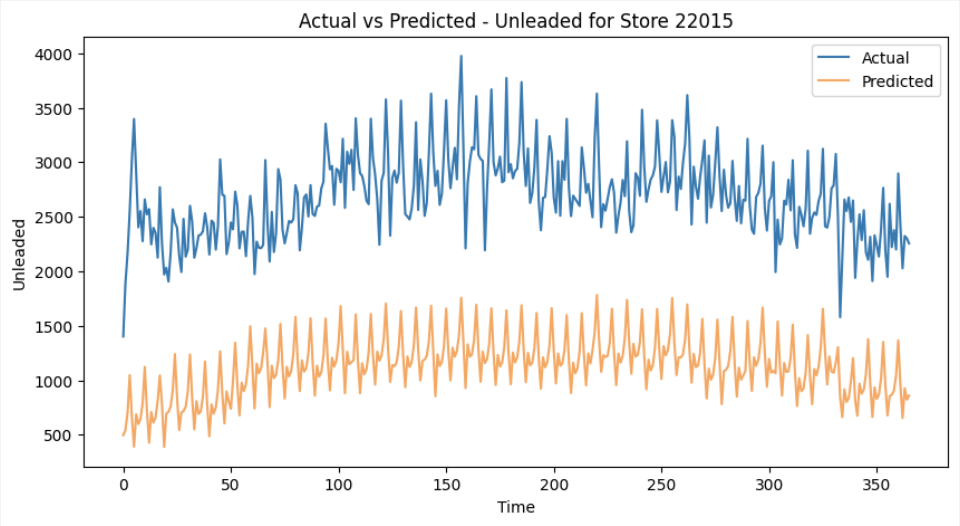
Additional Findings & Adjustments

- Strong weekly seasonality
- Holiday vs non-holiday
- Low sales during store opening month
- Features with no variability were dropped
- Custom seasonalities were added
- Store 21980 was removed due to unusually high diesel sales



Adding National Unleaded Prices

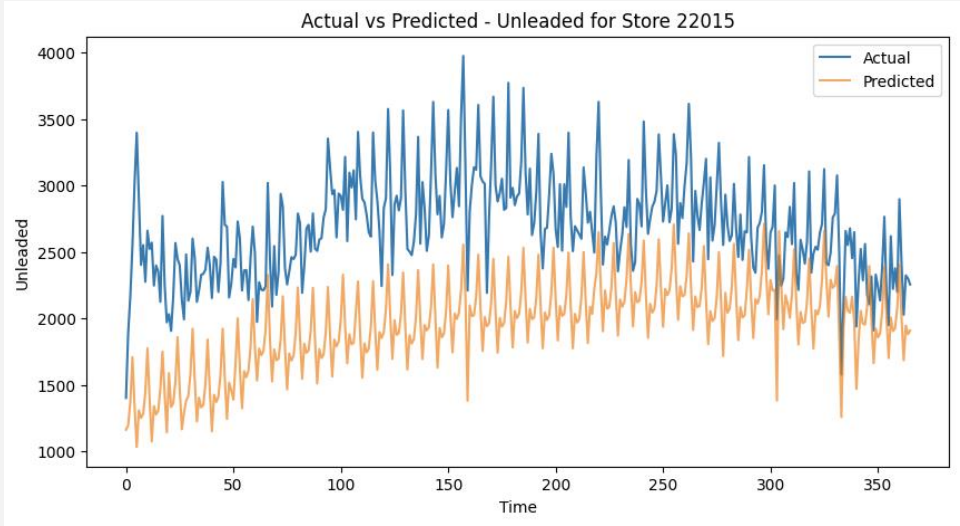
Before



RMSE: 1586.38

MAE: 1564.76

After



RMSE: 799.86

MAE: 740.77

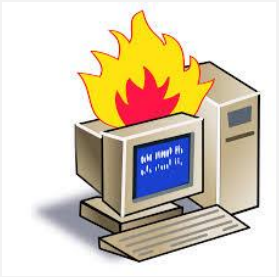
Conclusion

Developed a rolling forecast model using Prophet

73% average error reduction using this model for store 24535

Seasonal strengths and adaptability

Included historical national Diesel and Unleaded prices and greatly reduced RMSE and MAPE



Computationally intensive process for one store

THANK YOU

Appendix

Prophet Model Rolling Forecast Overview

Prophet Model with Rolling Forecast

- *Initial Setup*: Historical data is trained up to opening date
- *Daily Training*: Four Prophet models created and updated daily for each sales metric
- *Daily Forecasts*: Daily forecasts for the next 365 days.
- *Data Storage*: Actuals and predictions are stored in dictionaries to produce performance metrics

Feature Selection

Features dropped

- Front_door_count
- Godfather_s_pizza
- Diesel_x
- Non_24_hour
- Self_check_out
- Car_wash
- Ev_charging

Features included

- National historical unleaded and diesel prices
- Populations (x1_mile_pop, x1_2_mile_pop, x7_min_pop)
- Number of RV & high-flow lanes, layouts, stack types
- Men’s urinal count, women’s sink count
- Serves pizza, cinnabon, etc
- Store age
- Store openings

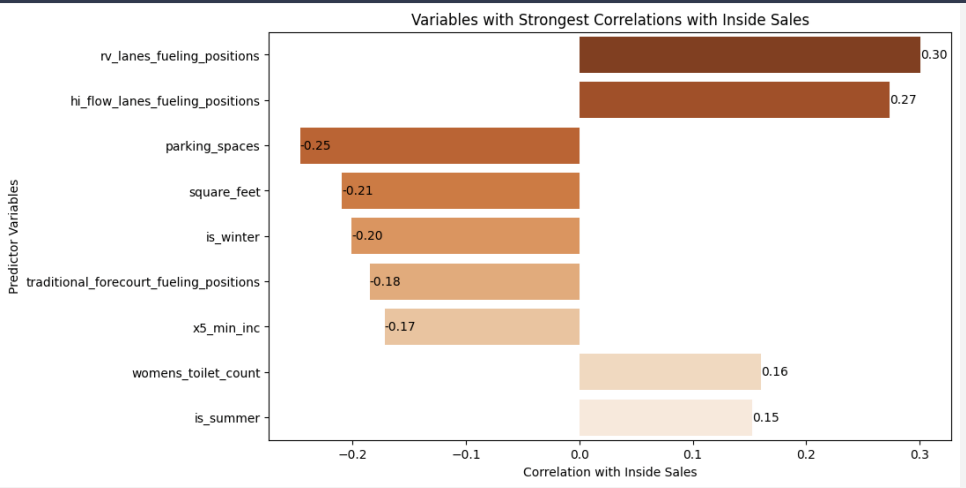
Custom seasonalities

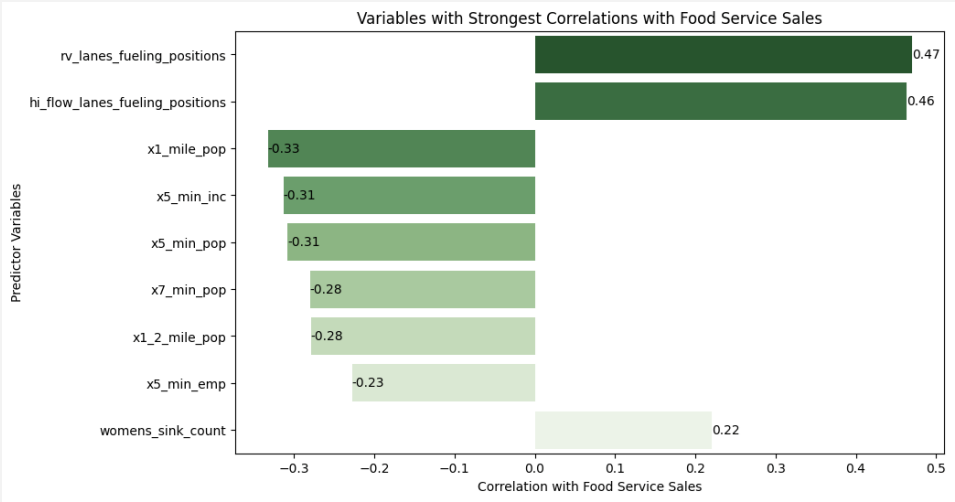
- Seasons
- Day of the week
- Holidays

Store 21980

- Removed as an outlier due to exceptionally high diesel sales

Correlations





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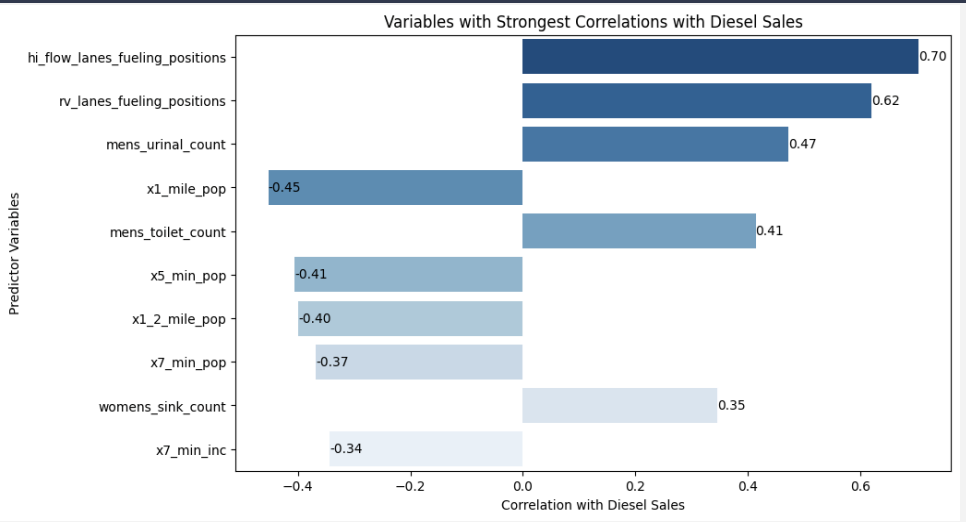

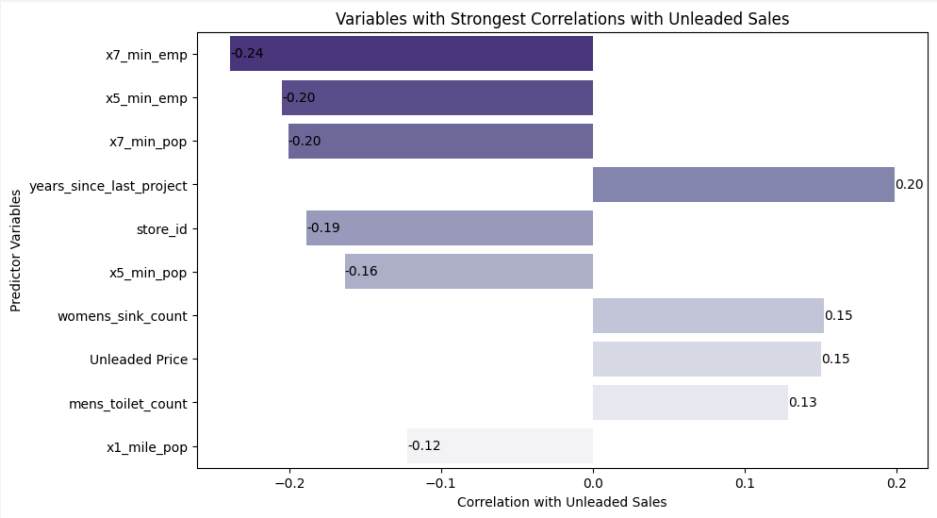

Seasonal Decomposition - Unleaded