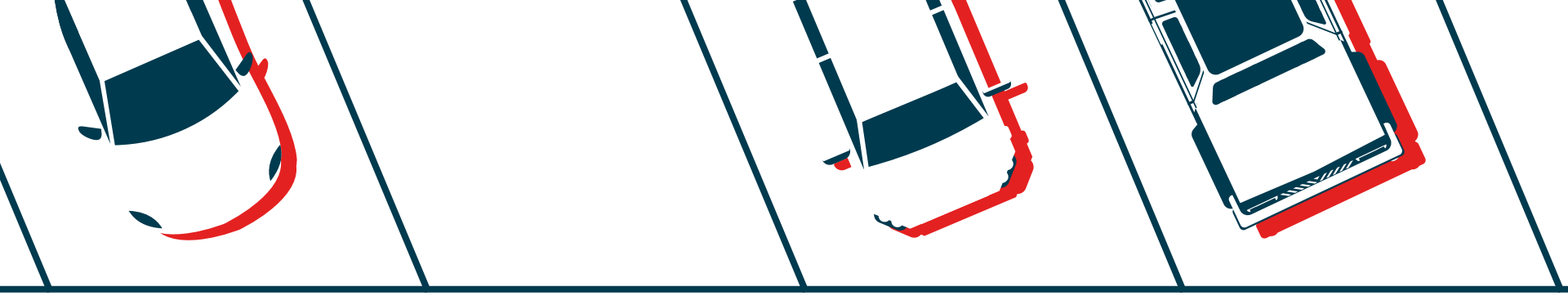

# Birmingham Parking Evaluation

Olivia Marcinkus, Ruthie Montella, Giulia Neves Monteiro

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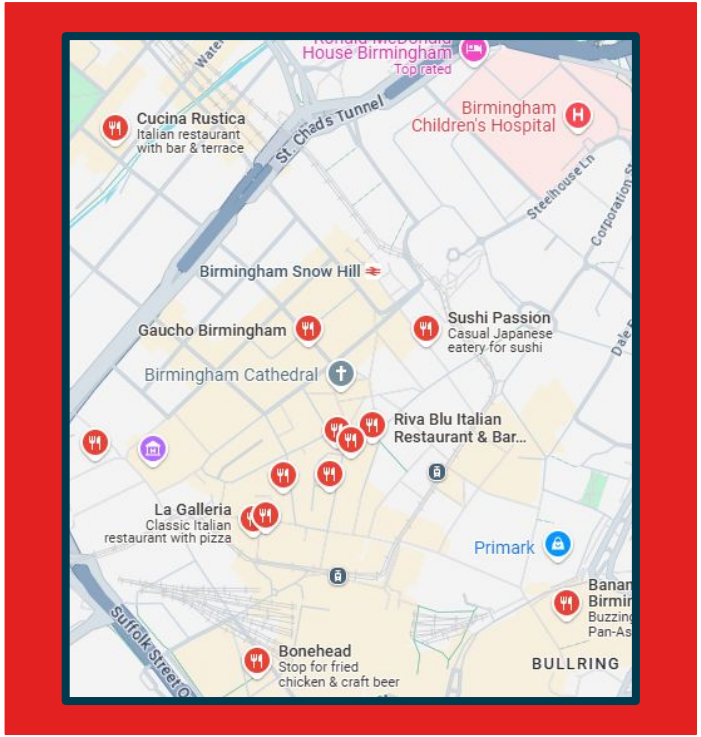
# Birmingham Parking Dataset



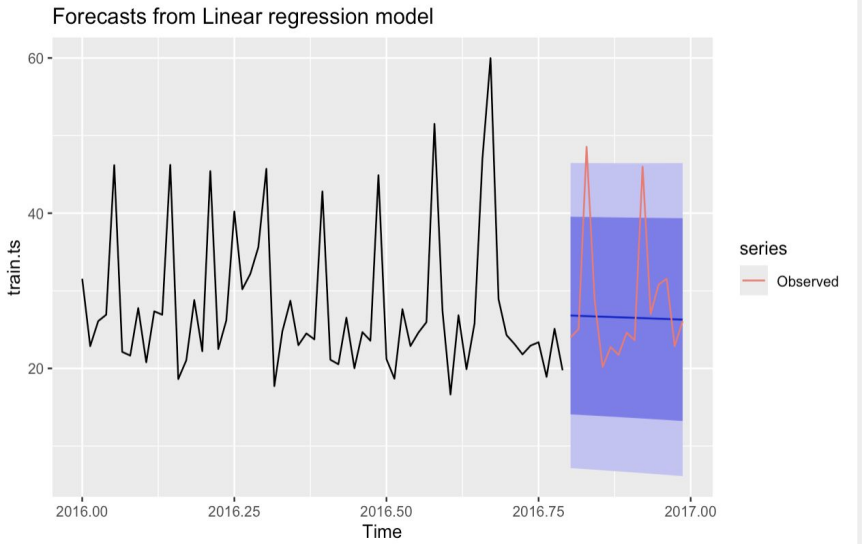

- Data ranging from Oct. 4th, 2016 - Dec. 19th, 2016

- GOAL: Benefit consumers and proprietors
  - Consumers to see forecasted prediction of best time to find parking
  - Proprietors may find a way to fill empty lots during slower periods of time

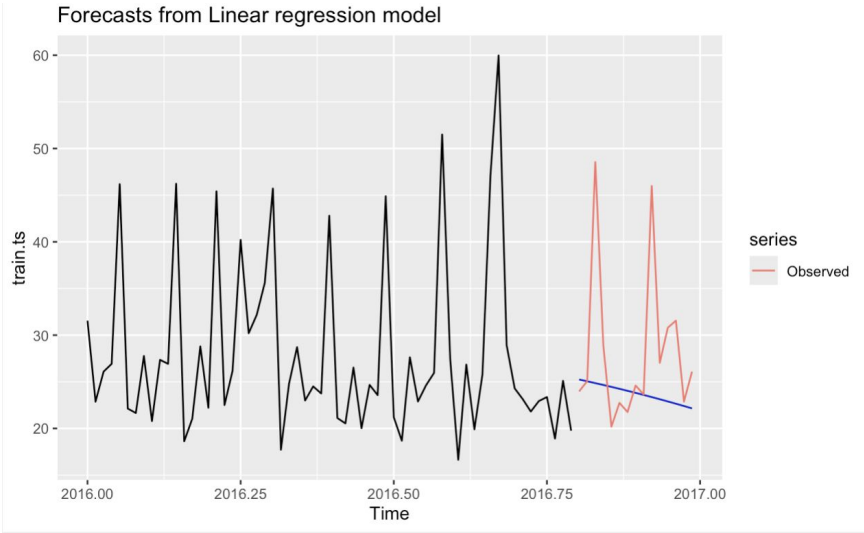
- Aggregated data from one parking structure into daily average for best model results

# Linear and Quadratic Regression Models

## Linear Regression:




## Quadratic Regression:




# Linear and Quadratic Regression Accuracy Scores

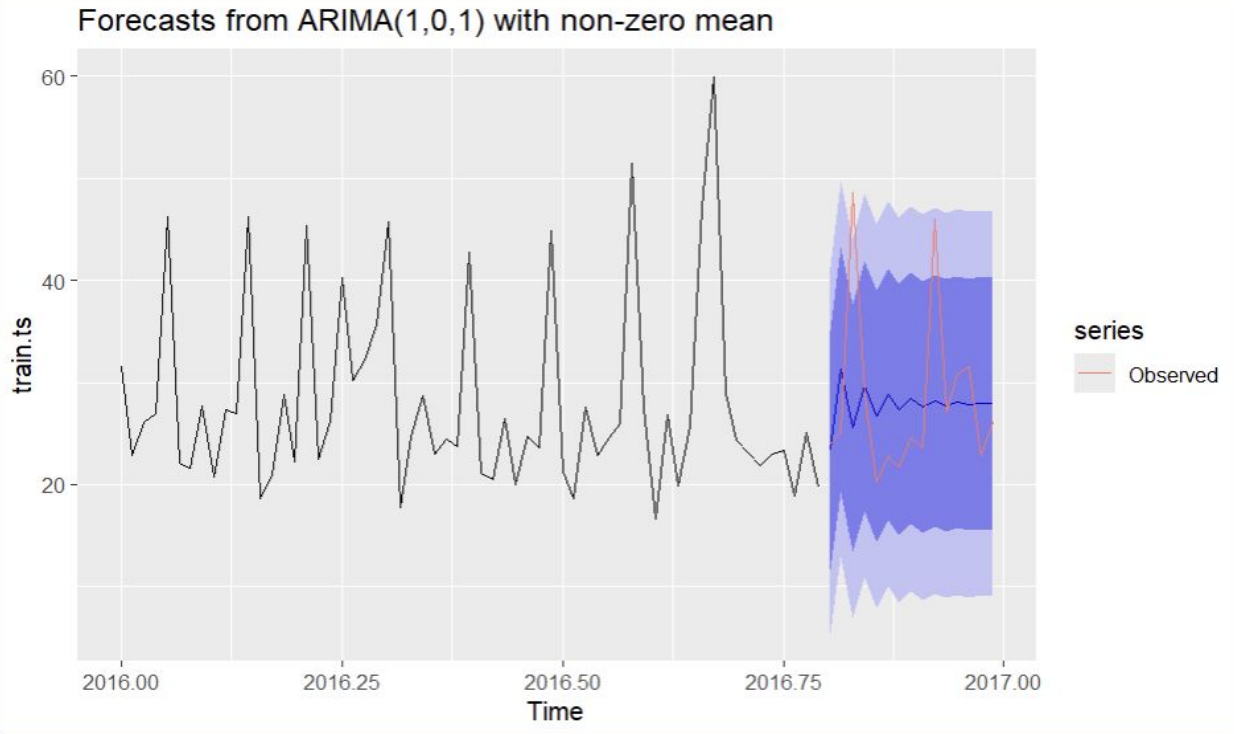
## Linear Regression:

| | ME | RMSE | MAE | MAPE |
|---|---|---|---|---|
| **Test Set** | 1.69568 | 8.257515 | 5.456044 | 16.90603 |

## Quadratic Regression:

| | ME | RMSE | MAE | MAPE |
|---|---|---|---|---|
| **Test Set** | 4.477765 | 9.277543 | 5.718846 | 16.32828 |

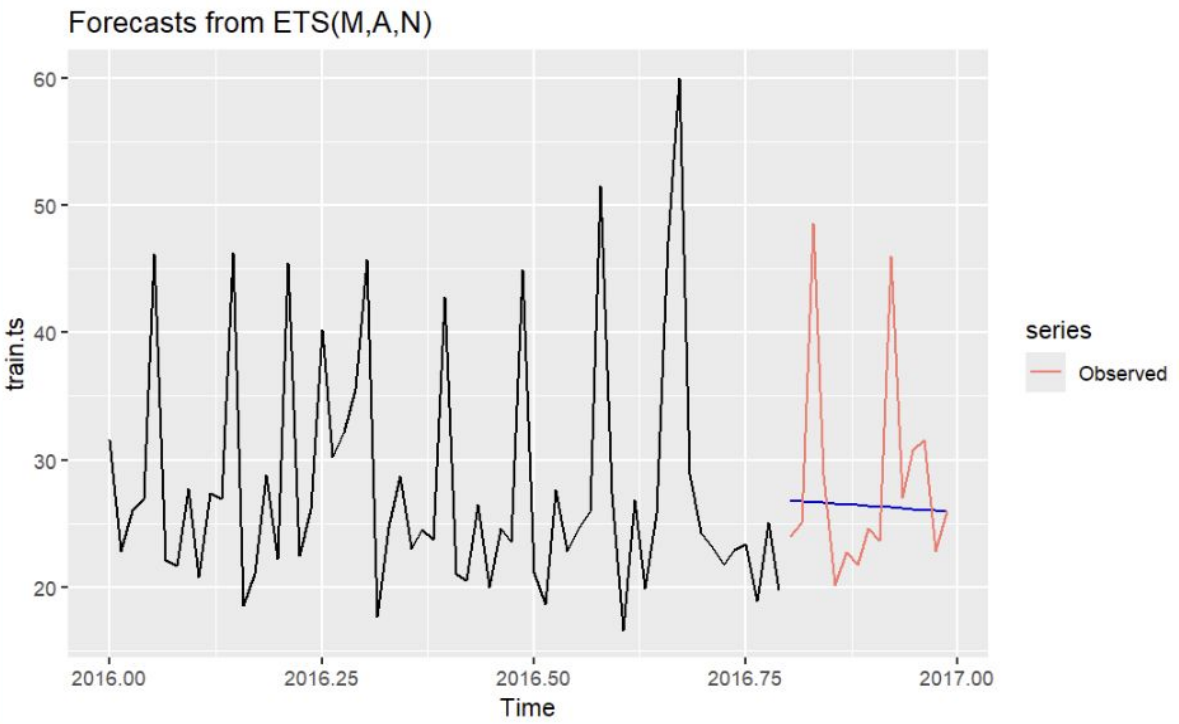
# ARIMA Model


Forecasts from ARIMA(1,0,1) with non-zero mean
60
40
20
train.ts
2016.00
2016.25
2016.50
2016.75
2017.00
Time
series
Observed

# ARIMA Accuracy Scores

| | ME | RMSE | MAE | MAPE |
|---|---|---|---|---|
| **Test set** | 0.4814617 | 8.474017 | 5.899766 | 19.0532 |

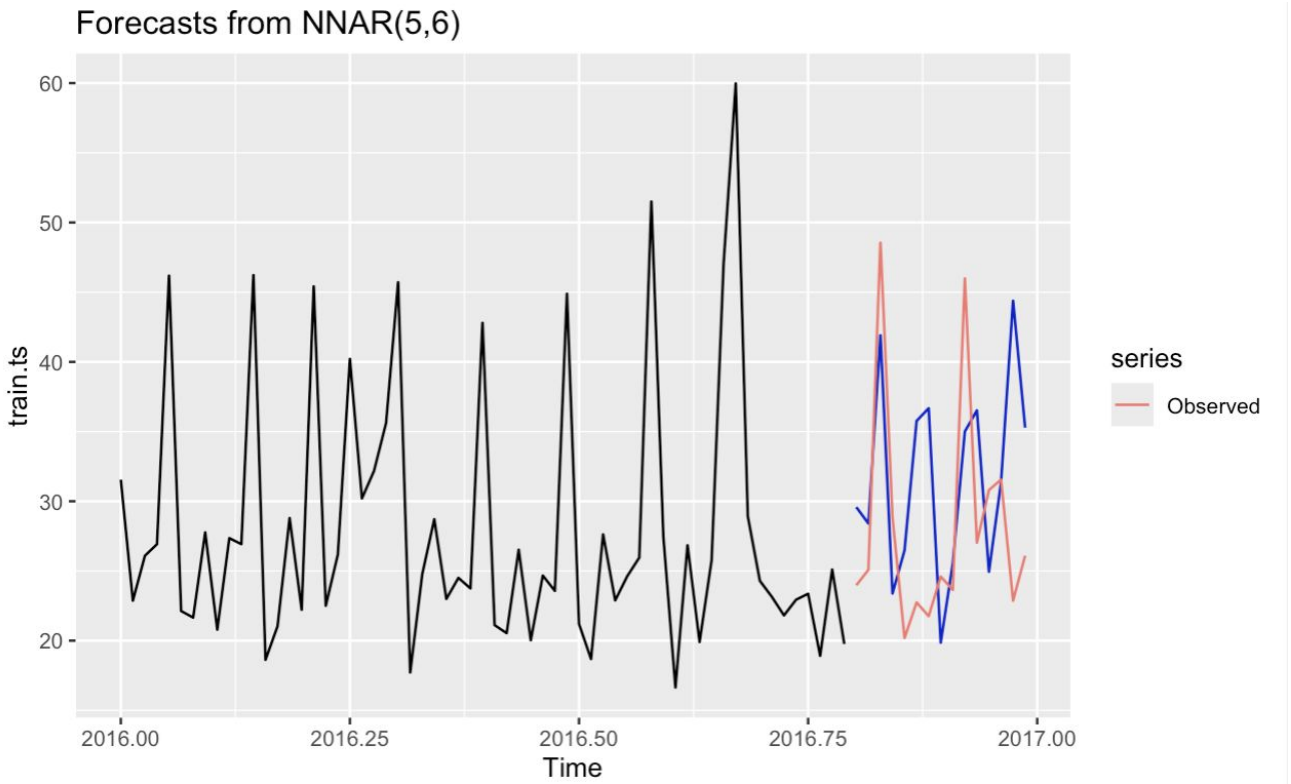
# Holt-Winters Model



# Holt-Winters Accuracy Scores

| | ME | RMSE | MAE | MAPE |
|---|---|---|---|---|
| **Test set** | 1.8429612 | 8.290404 | 5.458908 | 16.83531 |

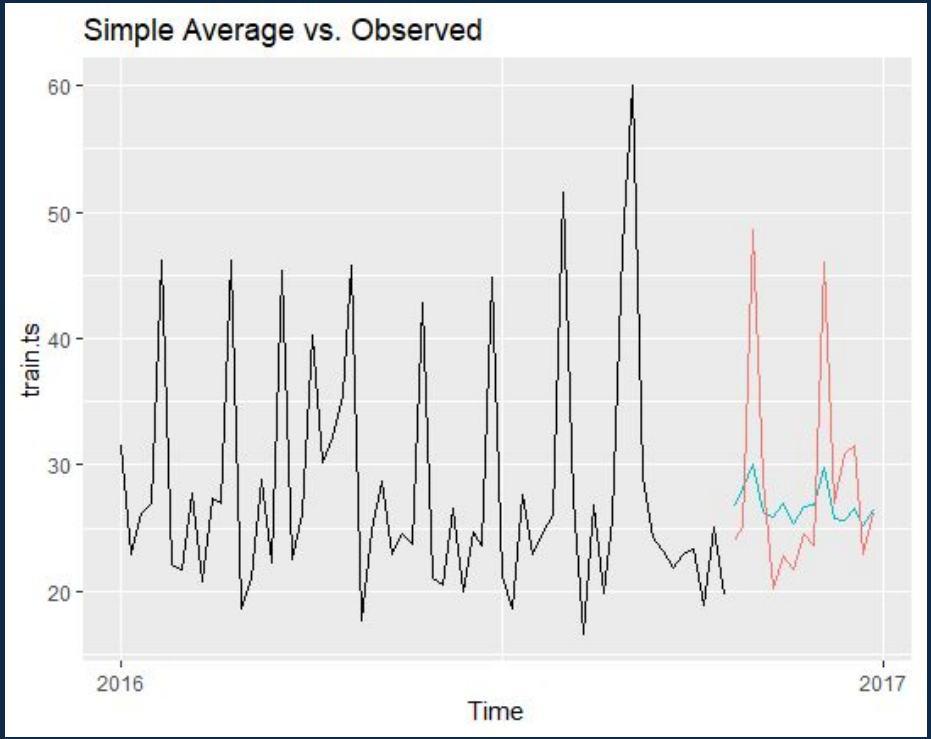
# Neural Network Model



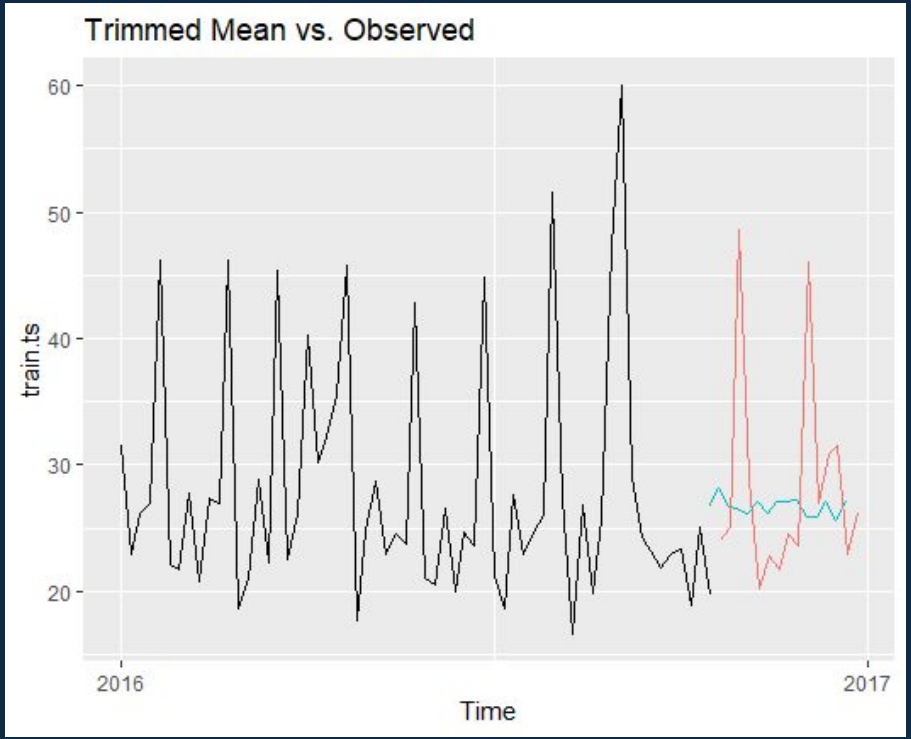

# Neural Network Accuracy Scores

| | ME | RMSE | MAE | MAPE |
|---|---|---|---|---|
| **Test set** | -0.239792493 | 4.457212 | 3.814515 | 14.773320 |

# Aggregating Multiple Forecasts




MAPE: 16.02




MAPE: 18.25

# Accuracy Scores

| Models | MAPE |
|---|---|
| NN | 14.77 |
| Simple Avg | 16.02 |
| LM Quad | 16.33 |
| Holt-Winters | 16.84 |
| LM | 16.91 |
| Trimmed Avg | 18.25 |
| ARIMA | 19.05 |
| ETS | 19.23 |

# Final Thoughts:

- Neural Network performed best in accordance with accuracy scores
- More data (monthly or annual) would drastically improve prediction accuracy
- Attempted other models
  - STL: no performance on this data