



# Forecasting Citi Bike Demand

Predicting the rental demand of  
NYC's popular bike sharing system

# Goal

## Forecast

Daily demand with **365-day horizon** per bike station

## Compare

**Facebook Prophet model**  
and **WaveNet model**

## Visualize

**Forecasted results**

## Applications & Use Cases

- Inventory management
- Station decommissioning
- New station installations

# Citi Bike Data

## Source

- Transactional data on AWS S3
- Pulled rides from 2015-2019
- Total of ~80 million rides

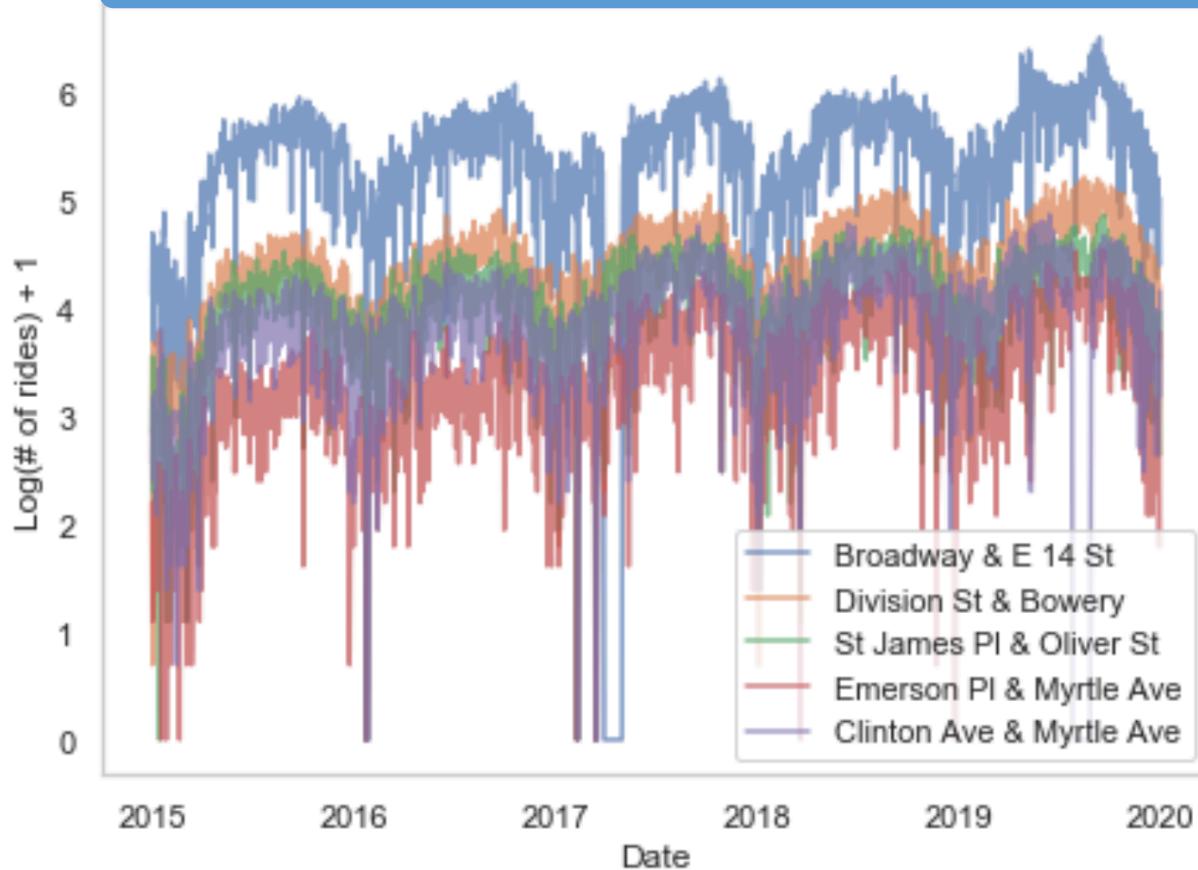
## Preprocess

- Excluded new stations or those missing significant data
- Rolling-median data imputation
- ~200 Citi Bike stations

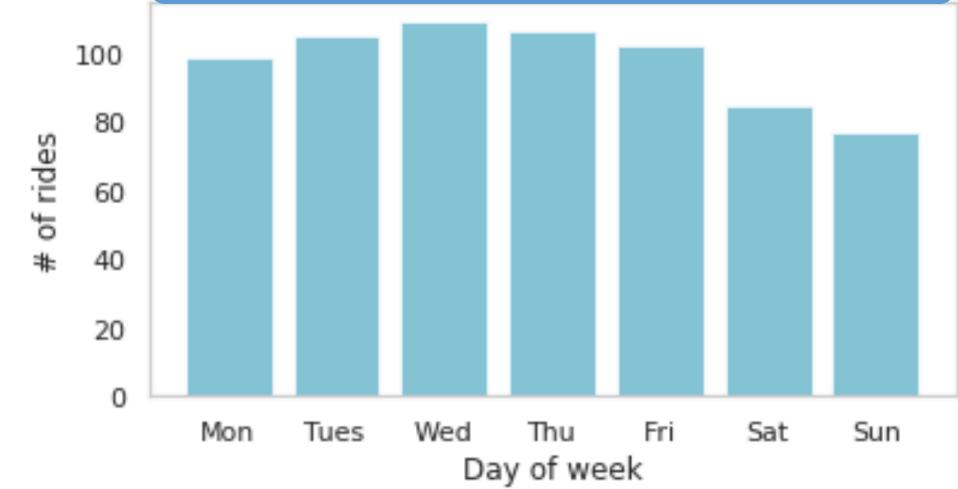


# Exploratory Analysis

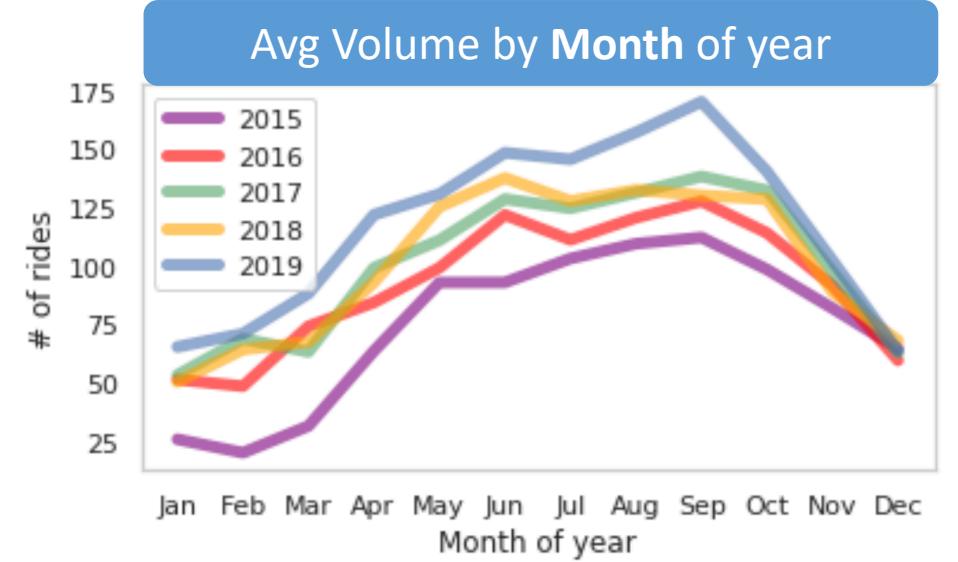
Randomly picked stations daily (log) ride counts



Avg Volume by Day of week



Avg Volume by Month of year



# Facebook Prophet



## Seasonalities

- Day of week
- Month of year
- US holidays
- Major NYC events

## Training

Fine-tuned parameters on  
a single selected station

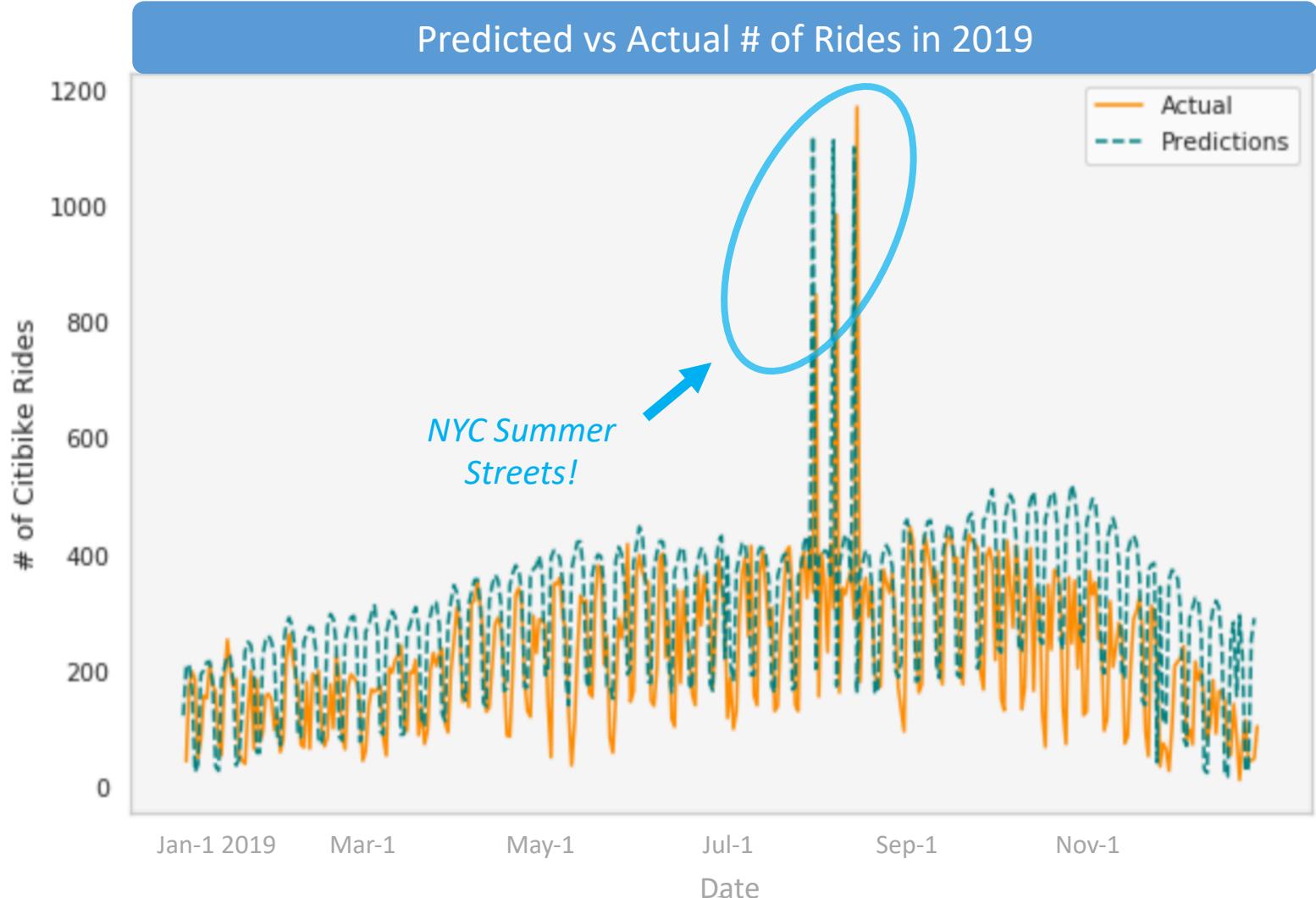
## Cross Validation

Expanding time window for training and validation

# Prophet Forecast: East 24<sup>th</sup> Street & Park Ave

## Evaluation

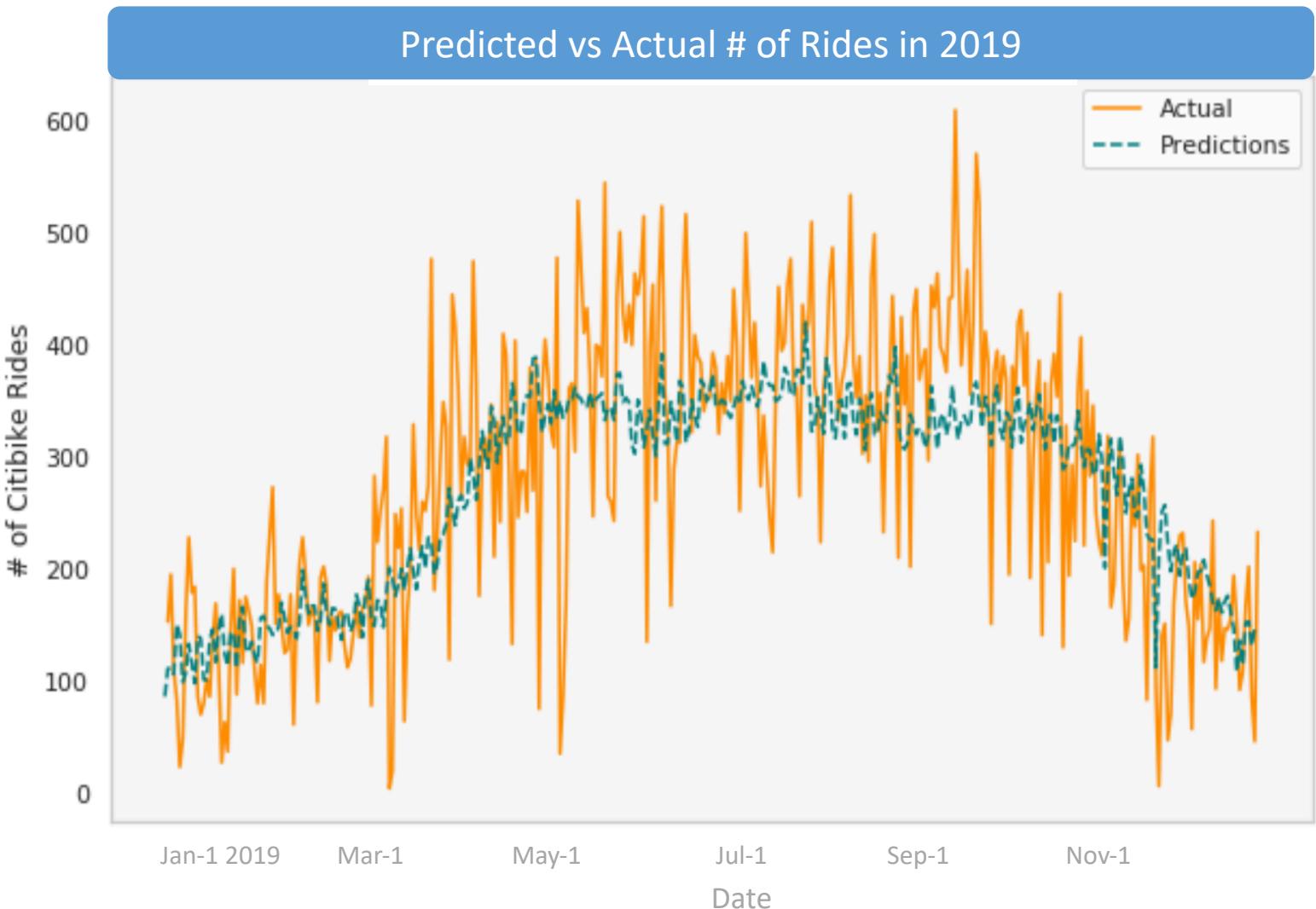
- MAPE: 53.3
- MAE: 78.7



# Prophet Forecast: Broadway & West 60<sup>th</sup> St

## Evaluation

- MAPE: 53.2
- MAE: 68.8



# WaveNet



colab

## Architecture

- 16 dilated causal conv blocks
- 32 filters per block
- Relu activation functions
- Increasing dilation

## Approach

- Walk-forward validation
- Loss metric of MAE

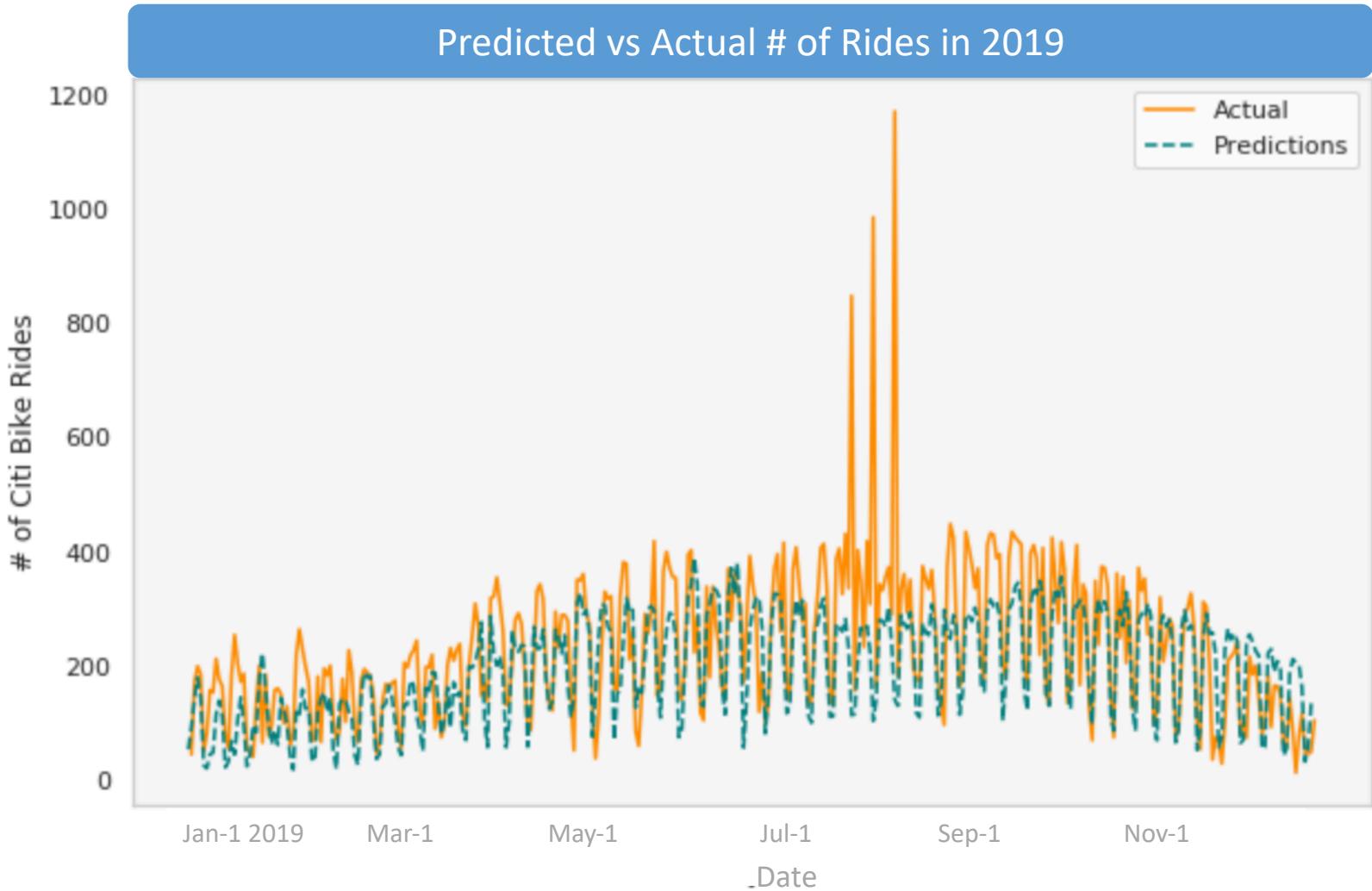
## Training

- Trained on GPU through Google Colab
- Inclusion of exogenous features

# WaveNet Forecast: East 24<sup>th</sup> Street & Park Ave

## Evaluation

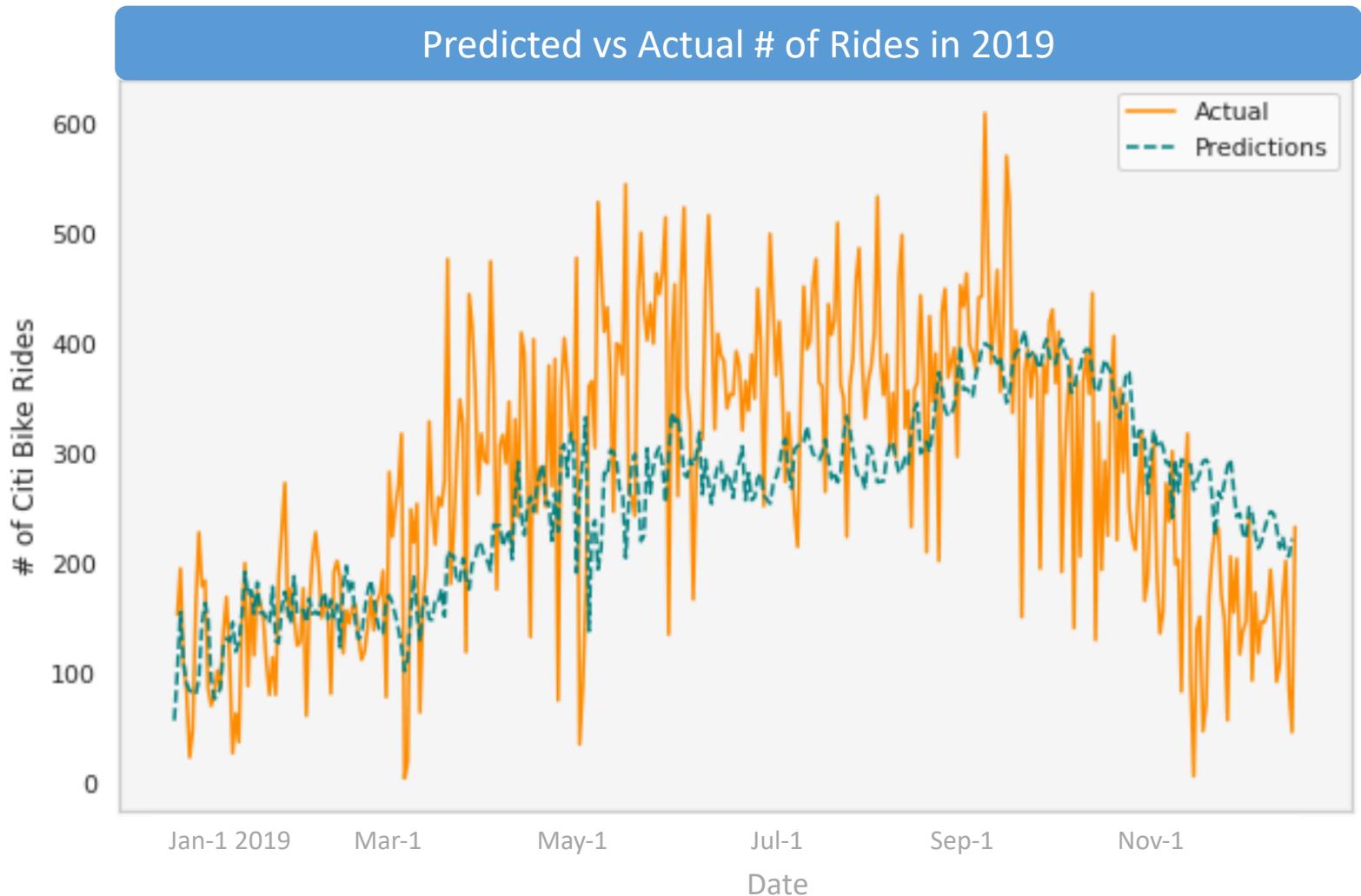
- MAPE: 51.5
- MAE: 89.8



# WaveNet Forecast: Broadway & West 60<sup>th</sup> St

## Evaluation

- MAPE: 61.1
- MAE: 87.5



# Results Across All Stations (2019)

		Forecasting models	
Average Scores		Prophet	WaveNet
Evaluation metrics	MAPE	37.0	43.6
	MAE	31.7	38.2

## Citi Bike Demand Forecaster

E 24 St & Park Ave S

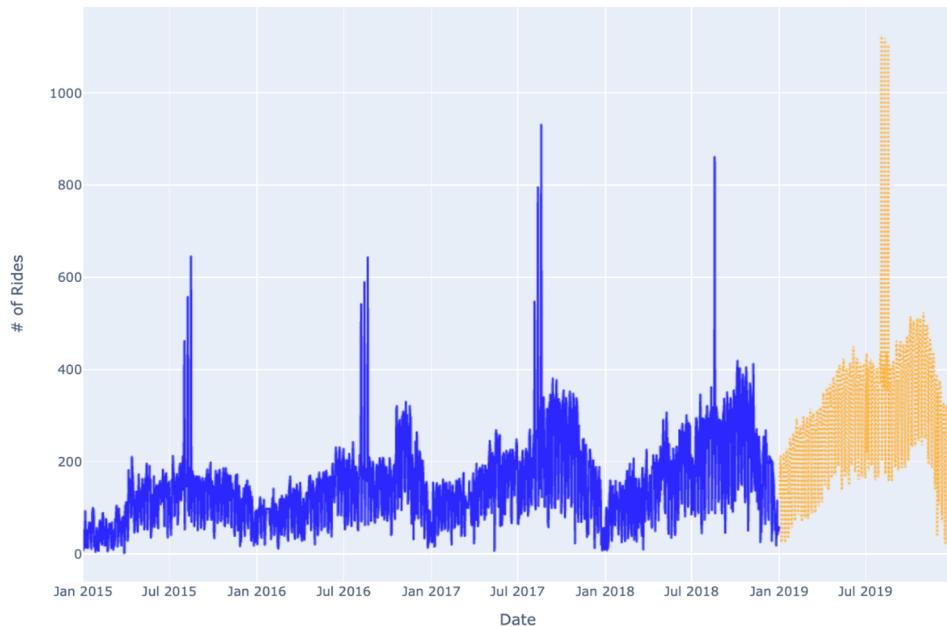
x

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Citi Bike stations in NYC - Hover over them!



Forecasted demand for E 24 St & Park Ave S (2019):



Predicted using Facebook Prophet model --- Powered by Dash: A web application framework for Python





Happy riding!