



Capital Bikeshare Fleet Modeling

A toolkit for station agnostic fleet rebalancing operations

Introduction: The Business Case

Capital Bikeshare

Capital Bikeshare is the largest provider of rented bikes in DC.

Recently purchased by Lyft.

Context

Traditional docked bikes must be left at one of around 600 stations throughout the region.

“Dockless” bikes introduced in July 2020.

Problem

Maximize availability of bikes and parking without depending on dock-based models.

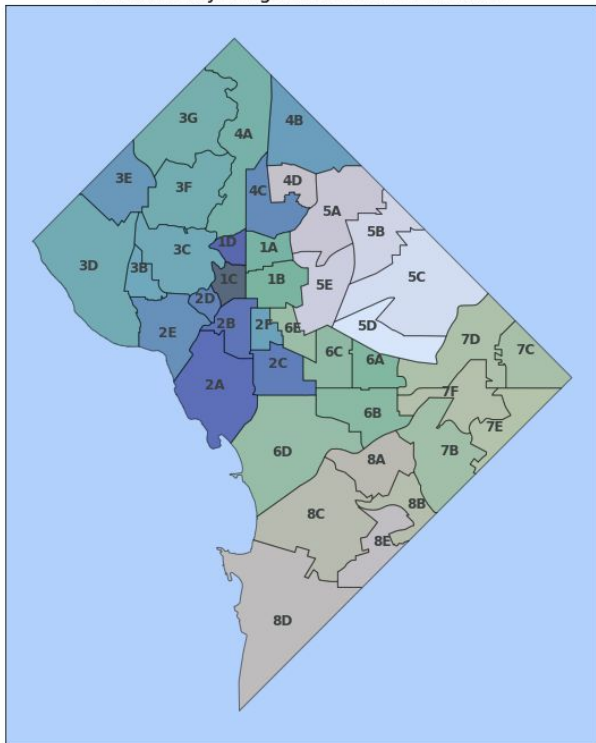
We propose models by ANC instead.

The Problem

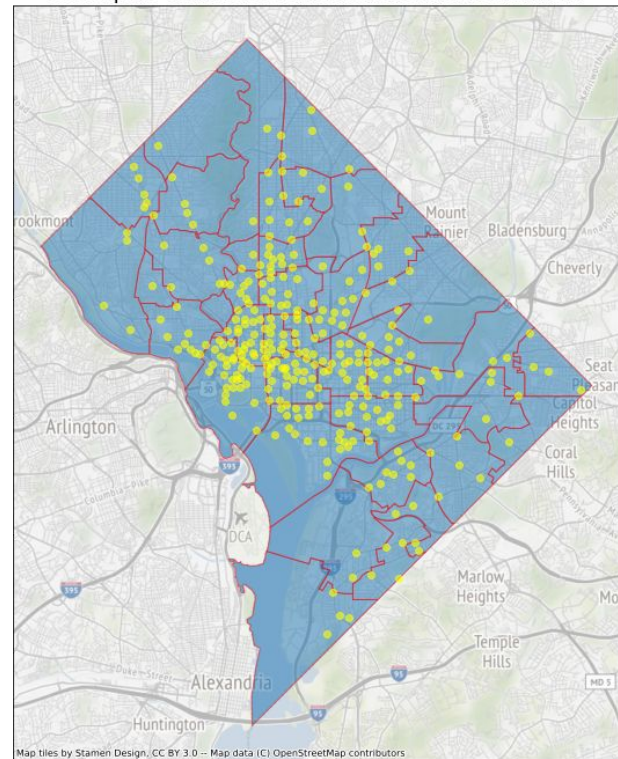


Geography Approach: Areas Instead of Stations

DC Advisory Neighborhood Commissions



DC Capital Bikeshare stations with ANC boundaries



Trips Approach: 2020 Is Not A “Normal” Year

Daily Capital Bikeshare Ride Counts, 2018-2020
Green and Red Lines are 15 Day Moving Averages

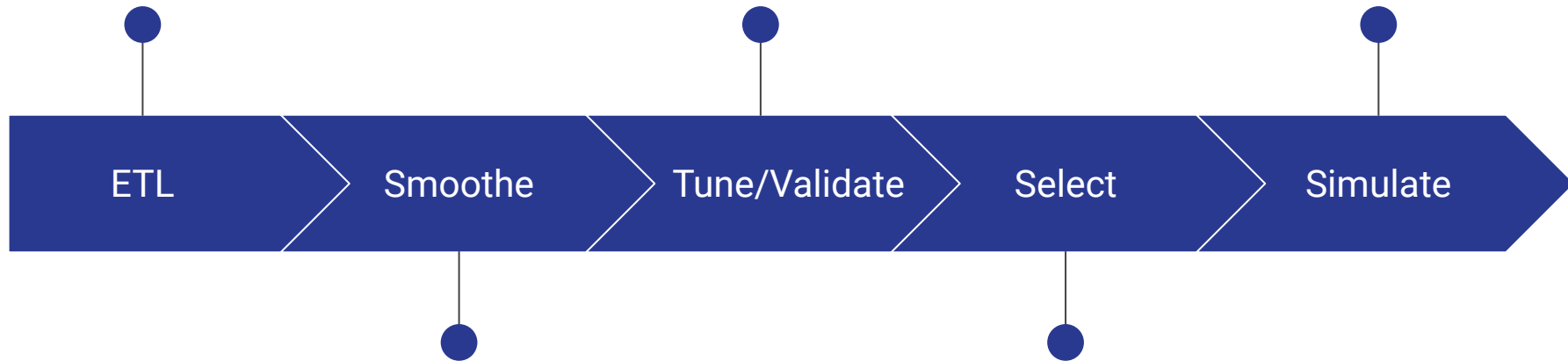


Data Science Process

Trip start/end points
assigned to an ANC,
loaded into postgis by
time

Find best components
for each model.
Validate over different
time periods.

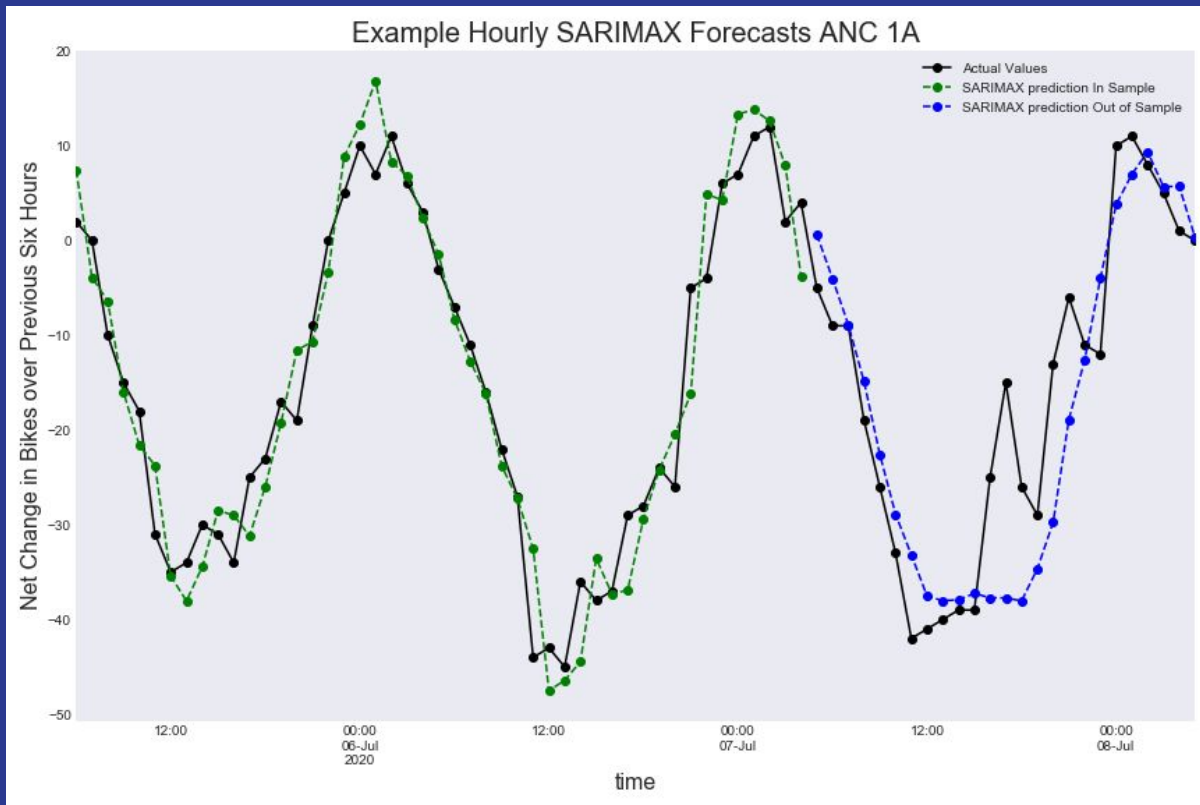
Simulate business
application to be
tested on August data
soon to be released.



Select the right
frequency for each
model.

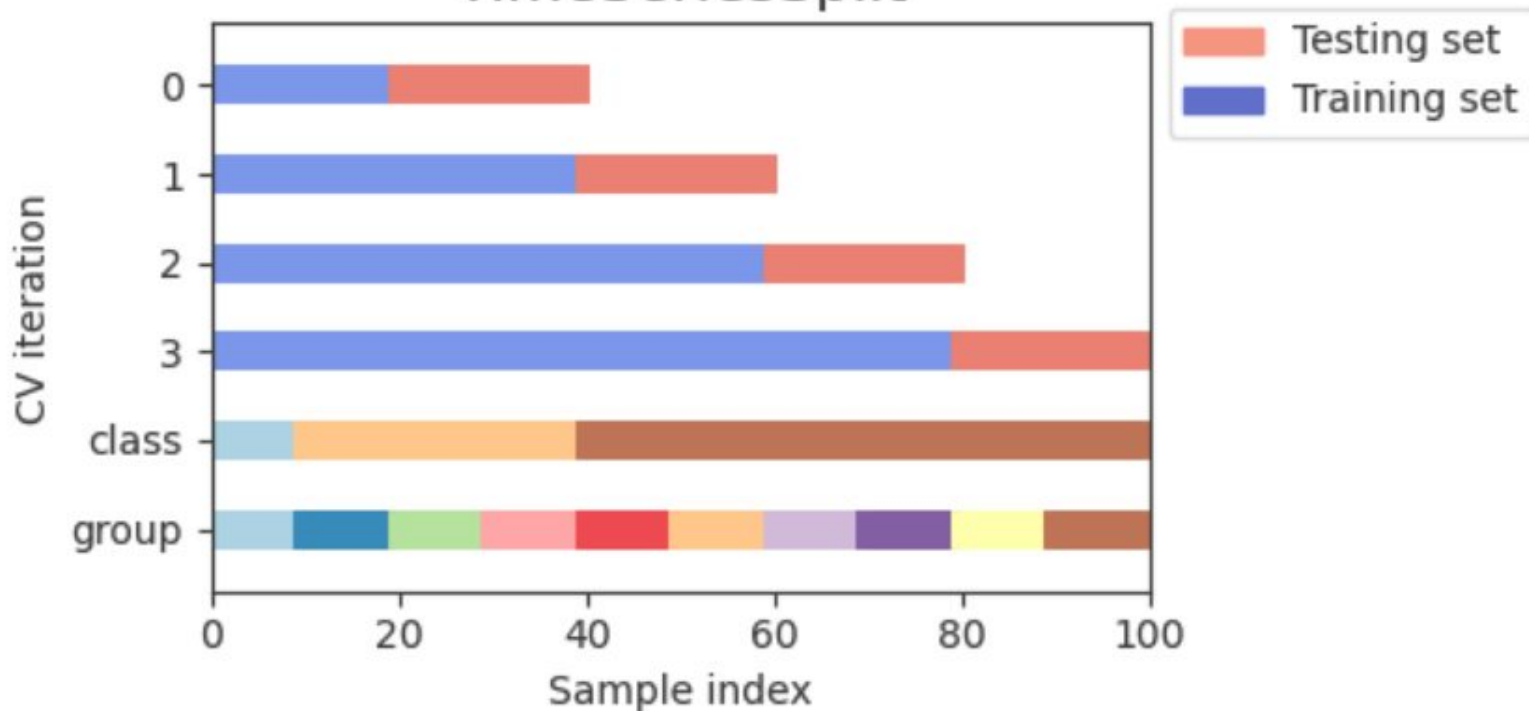
Compare model
performance. Select
best models for each
task.

Model: Daily SARIMA



Evaluation

TimeSeriesSplit



Future Improvements

- APIs make live predictions possible
- Time series predictions as an input feature in a larger model
- Clustering Gives More Actionable Results

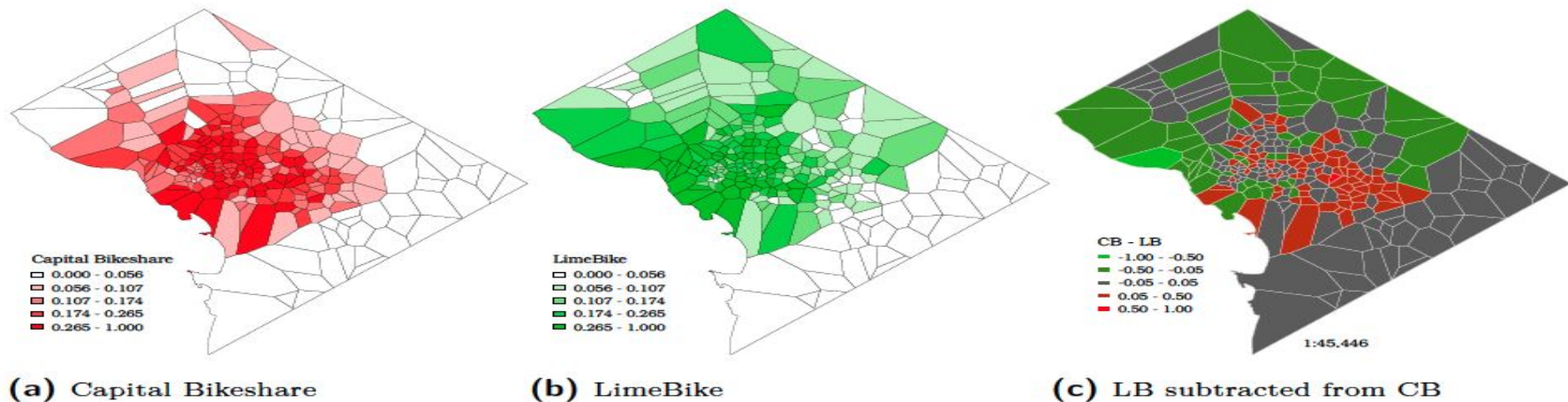


Figure 3 Normalized trip starts assigned to Capital Bikeshare station-based Voronoi polygons.

Sources

- Voronoi Polygons on previous slide are from Grant McKenzie's "Docked vs. Dockless Bike-sharing: Contrasting Spatiotemporal Patterns" (GIScience 2018)
- Analysis based on monthly trip data obtained from Capital Bikeshare (<https://s3.amazonaws.com/capitalbikeshare-data/index.html>)
- API address for real time info on available ebikes not at a dock: (https://gbfs.capitalbikeshare.com/gbfs/en/free_bike_status.json)
- API address for real time info on available bikes/ebikes at all CaBi docks (https://gbfs.capitalbikeshare.com/gbfs/en/station_status.json)
- TimeSeriesSplit Graphic from (https://scikit-learn.org/stable/auto_examples/model_selection/plot_cv_indices.html)
- Empty Dock Image from (<https://www.popville.com/2014/09/problems-with-capital-bikeshare-for-commuting>)

Thank You!

Contact

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