Bikeshare DC Capstone Presentation

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DC Dockless Bikeshare Pilot

- September 2017 - August 2018 (Data through April 2018)
- 400 dockless vehicles per operator
- Must share trip data with DC Department of Transportation (DDOT)
- As a Capstone team we worked with DDOT to use pilot data for our project

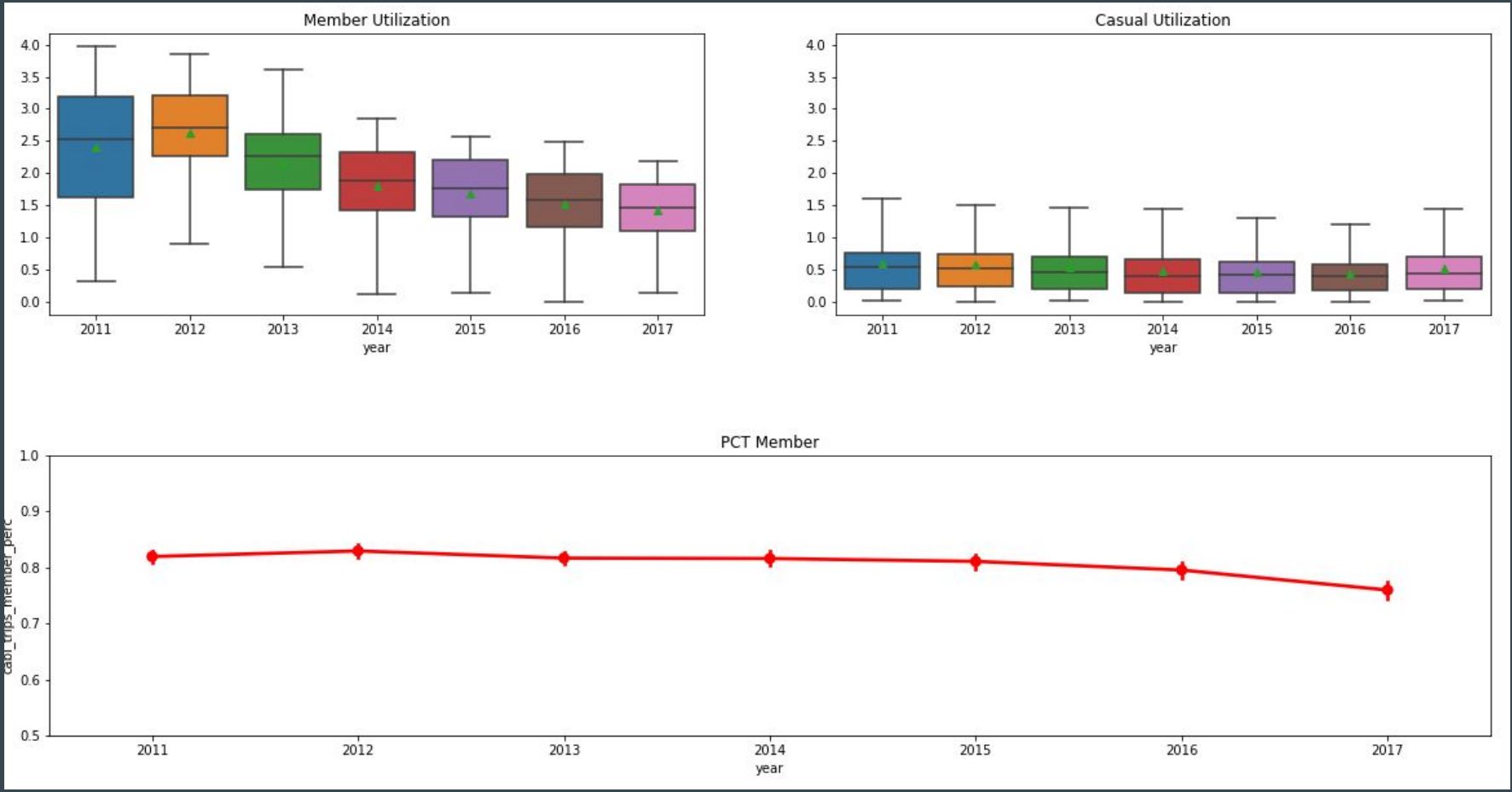
Overview of DC Bikeshare Operators

Capital Bikeshare has 3 times as many bikes as all dockless operators combined and twice the utilization rate over the first 8 months of the dockless pilot

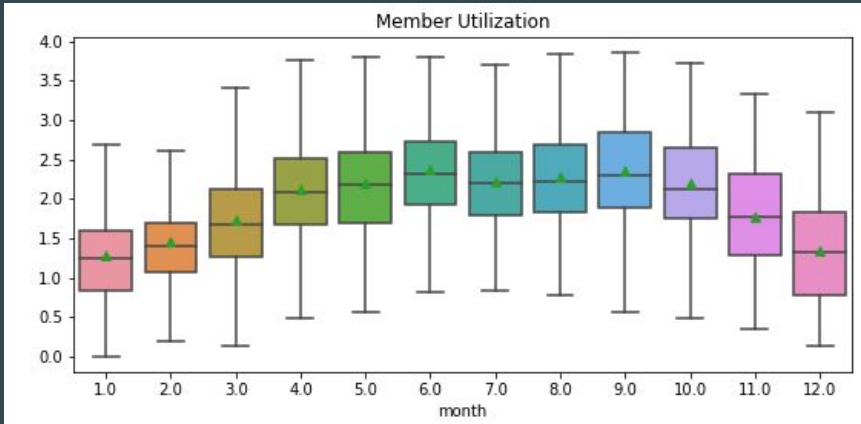
Operator	Operating Area	Bike Cost	Fleet During Pilot	Trips During Pilot
CaBi	DC Metro Area	$1,000	4,500	~1.7 Million
Lime	59 US cities	$300	400	~ 137,000 (41%)
Mobike	Over 200 int'l cities	$300	400	~ 83,000 (25%)
Ofo	Over 250 int'l cities	$50	400	~ 59,000 (18%)
Jump	4 US cities	$1,000	100	~ 31,500 (9.5%)
Spin	30 US cities	$300	200	~ 25,800 (8%)

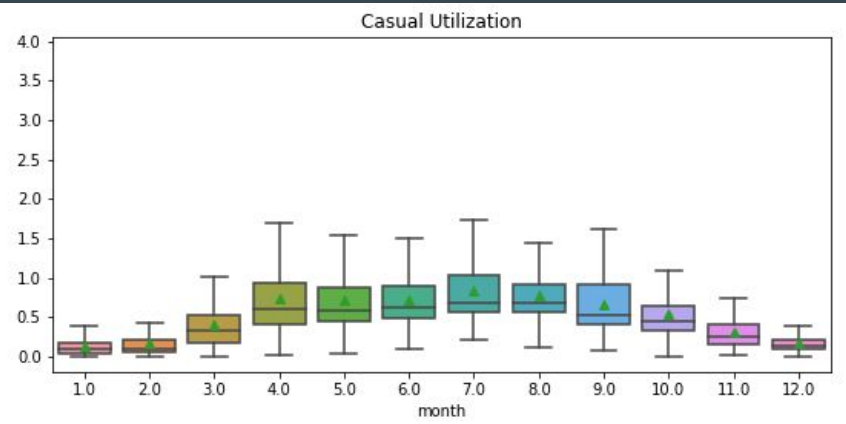
Hypothesis:
Dockless Pilot is impacting Capital Bikeshare Demand for DC to DC trips

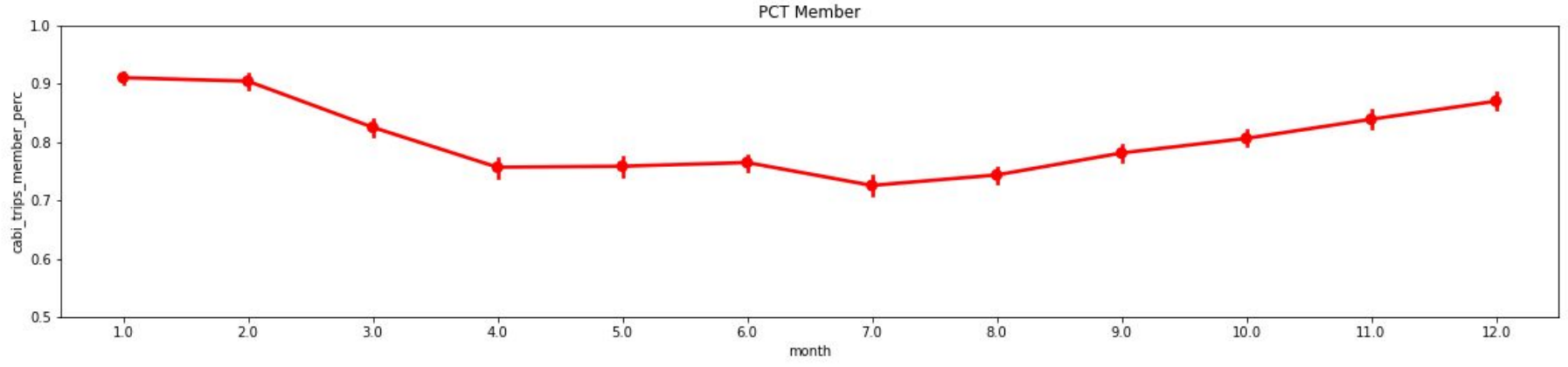
80% of CaBi Trips by members, single trips surge in ‘16, ‘17



CaBi Casual Usage Highest in Summer Months





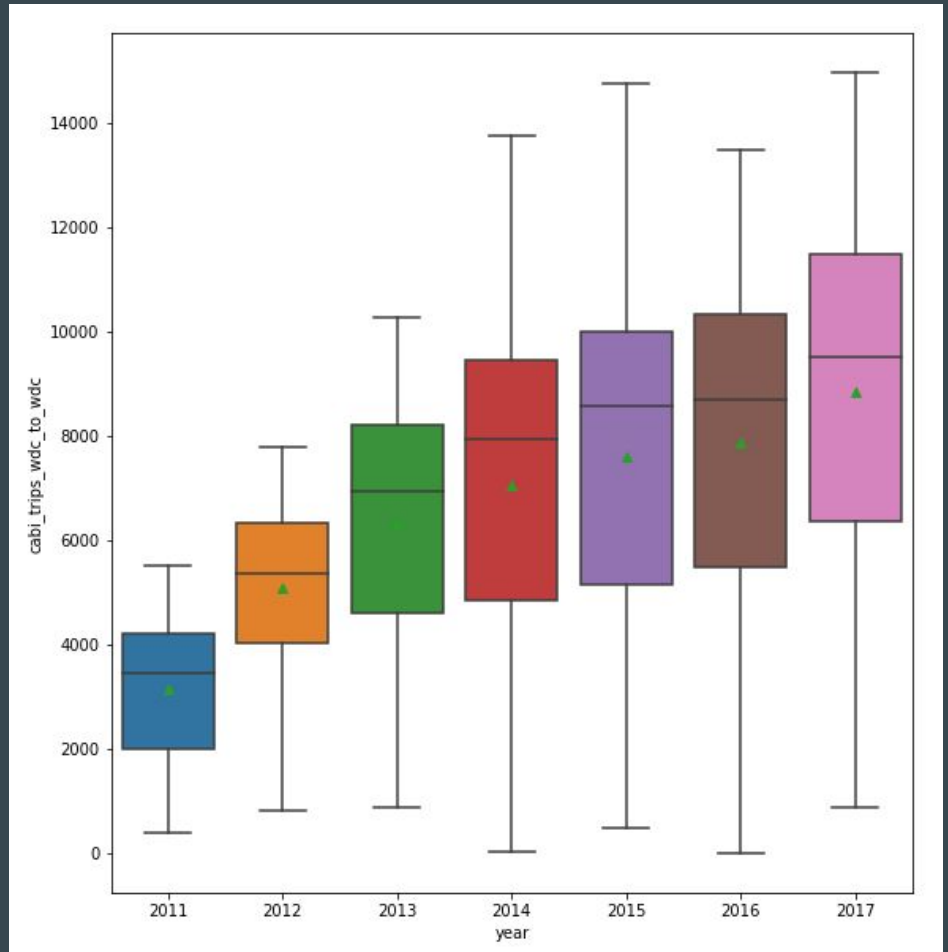


Machine Learning Data Selection

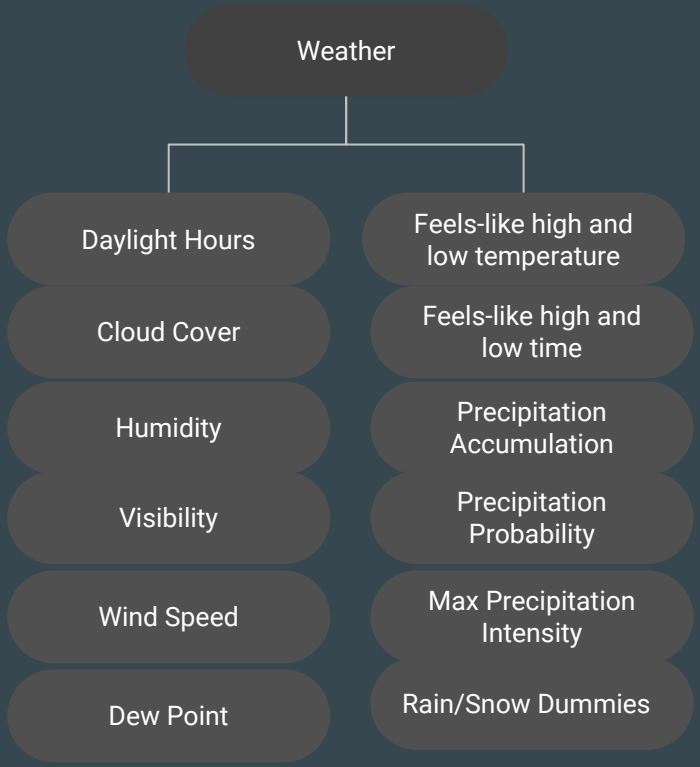
We predicted CaBi demand at the daily level in order to include as many features (ie, Weather, US Holidays) as possible in our model.

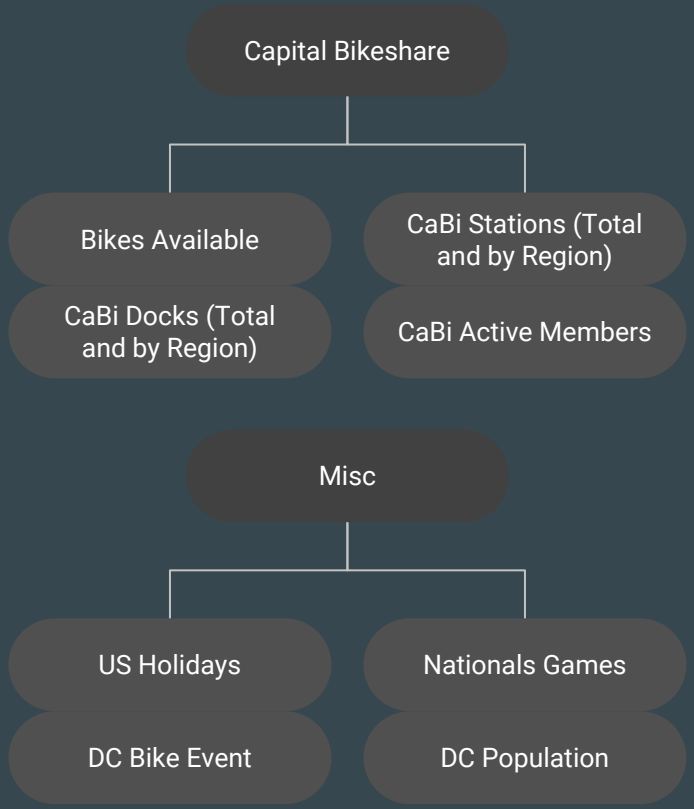
CaBi DC to DC daily average trips per year shows that 2011 and 2012 weren't representative due to rapid growth in the system, so we did not include them in our training data.

Train Set: 1/1/2013 - 9/8/2017
Test Set: 9/9/2017 - 4/30/2018 (Pilot)



Final Features Selected by Machine Learning Model





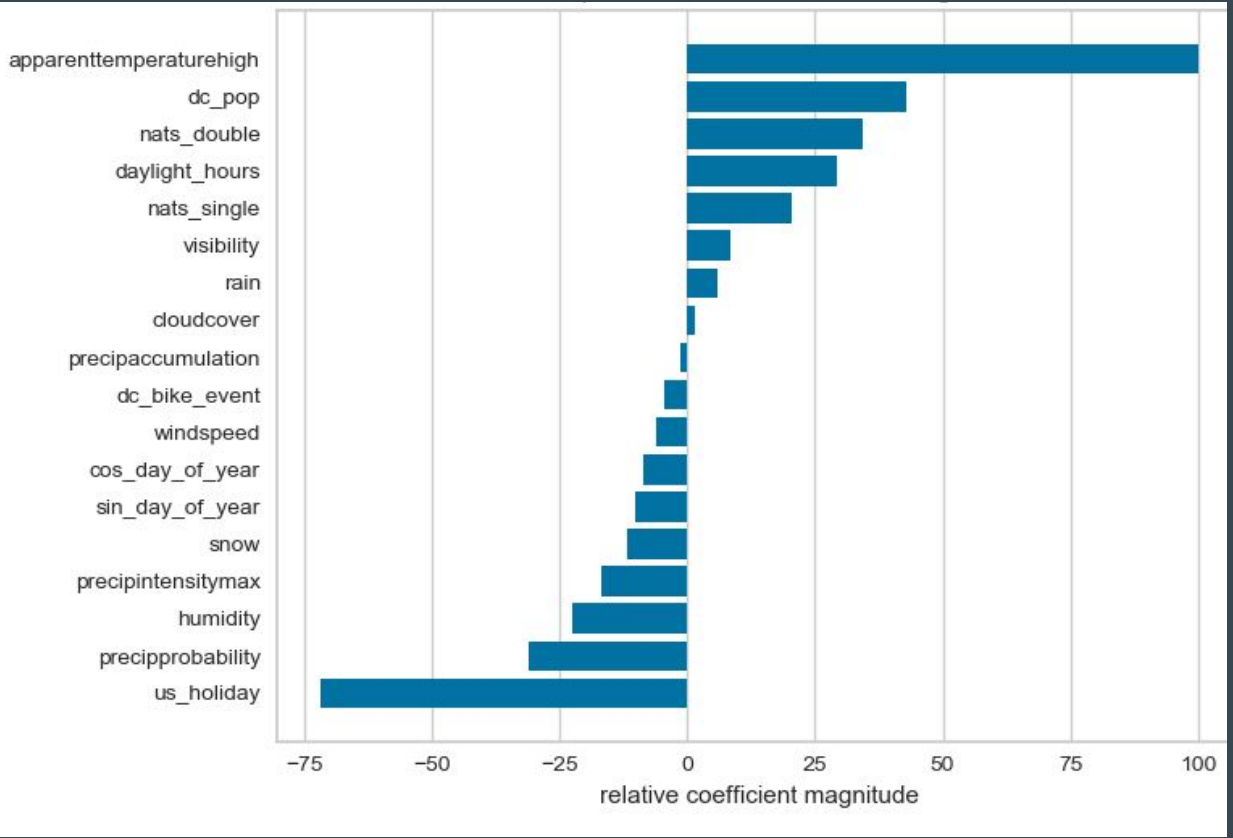
Feature Importance

Temperature High has the most positive impact respectively on CaBi demand.

Since 80% of CaBi demand is member driven, US Holidays have a negative impact on demand.

Rain has a weak positive impact because it's often coupled with warm weather and evenly distributed throughout the year.

However, chance of precipitation has a strong negative impact.

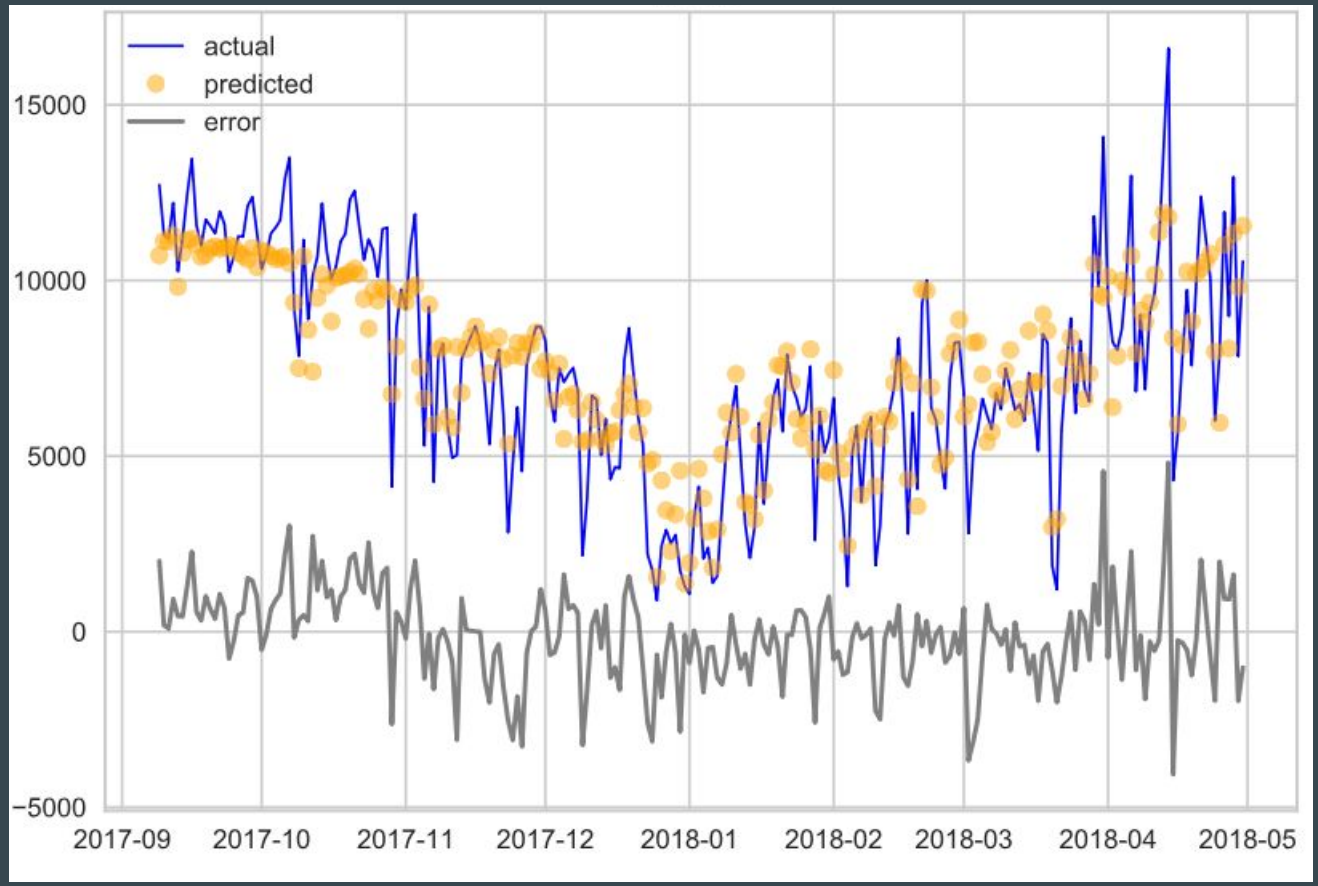


Actual vs. Predicted Total CaBi Rides

With 0.87 and 0.82 R^2 scores for the train and test data, our model is considered highly predictive by Data Science standards.

In the pilot (test) period, we consistently overpredicted CaBi demand as demonstrated by the shown negative error.

Overestimating means factors outside are model, like dockless demand, could be contributing to lower than expected CaBi demand.

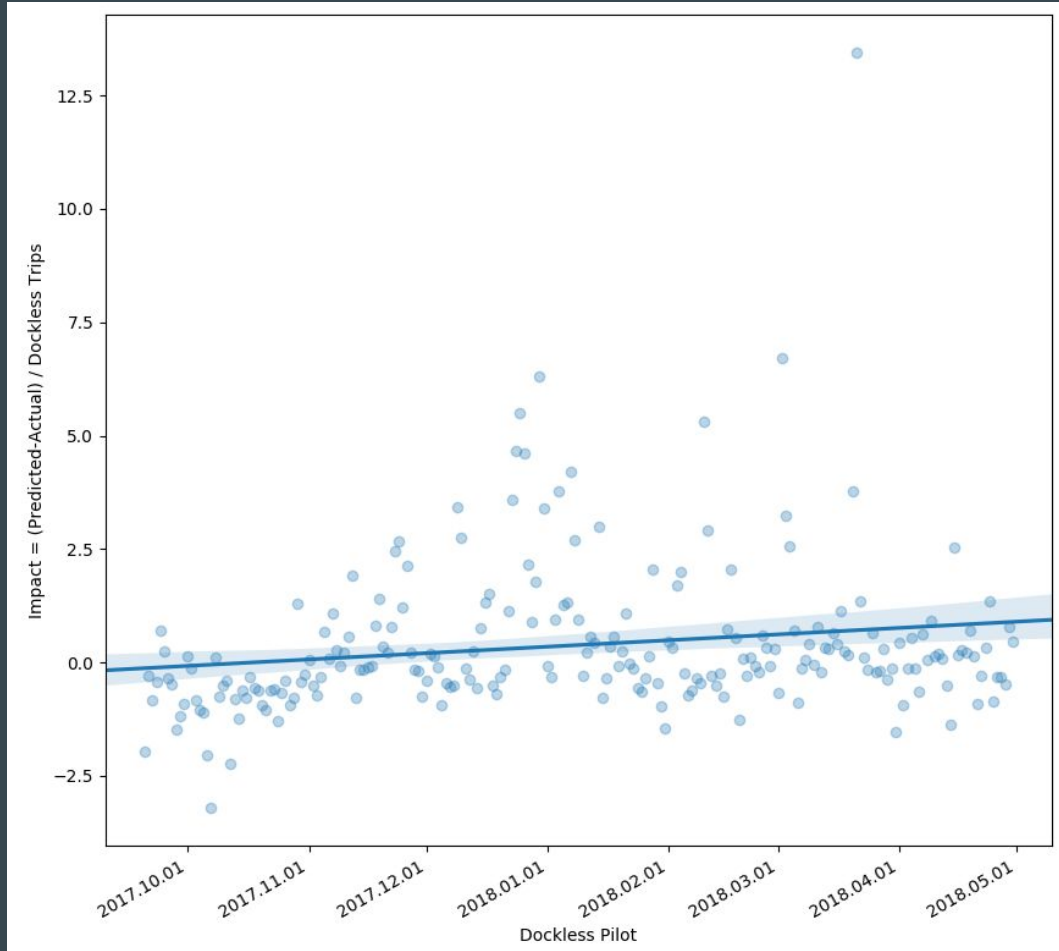


Dockless Impact = (CaBi Predicted - CaBi Actual) / Dockless

Here we determine if the delta between CaBi Predicted and Actual is reasonable by dividing the delta by daily dockless trips taken.

The regression line through these points, at about 0.5, means that on a given day the resulting delta from our model is equivalent to 50% of dockless trips.

The positive outliers can be attributed to phenomena that our model does not control for, like “the winter holiday season” and unexpected weather events, such as the snow storm in late March that shut down CaBi completely.



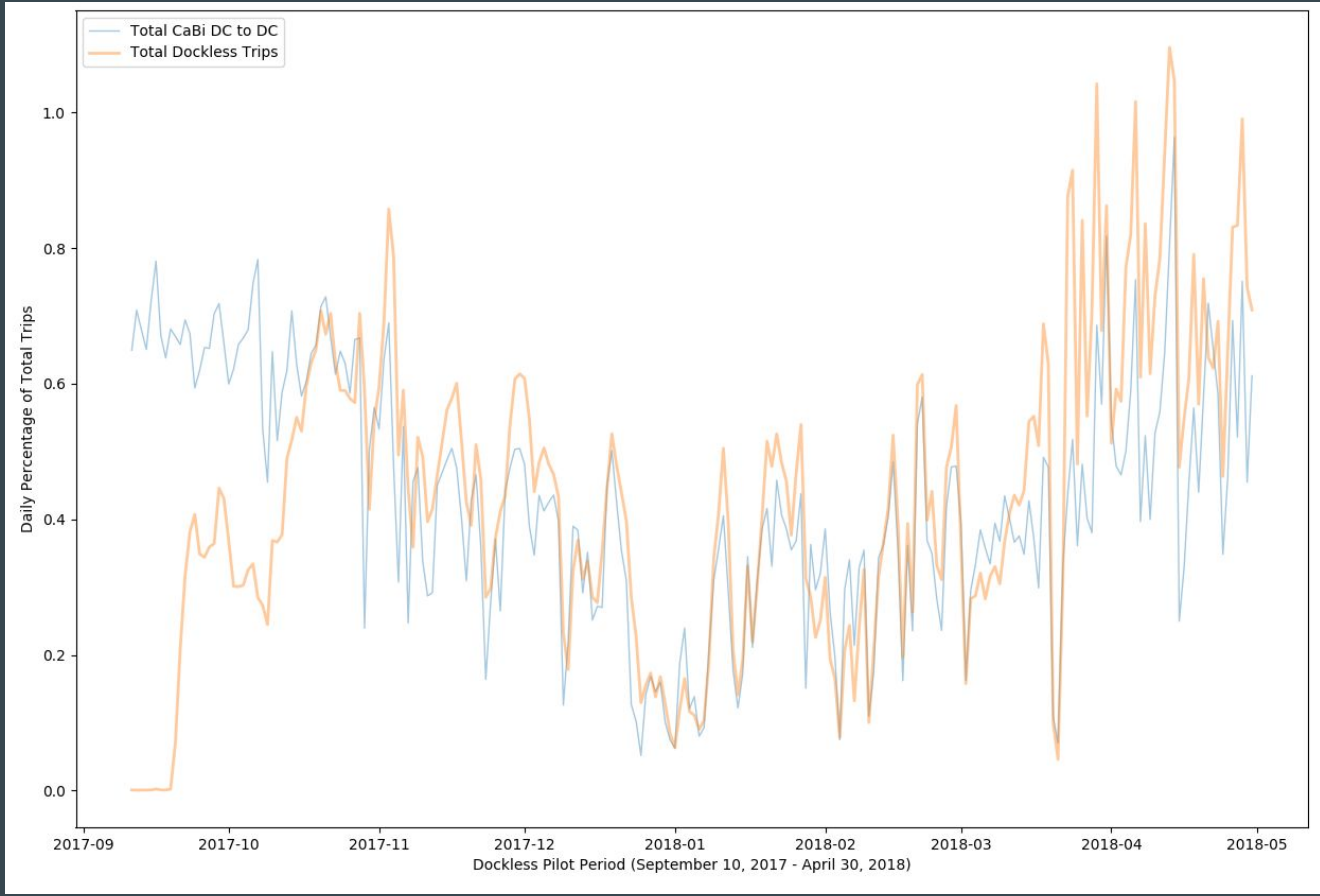
Scaling CaBi and Dockless Trips Shows Similar Demand

Scaling CaBi and Dockless trips to a daily percent of total pilot period trips, allows patterns to emerge.

After dockless ramps up in Sep and Oct, we see several dockless demand spikes due likely to the dockless “novelty effect”.

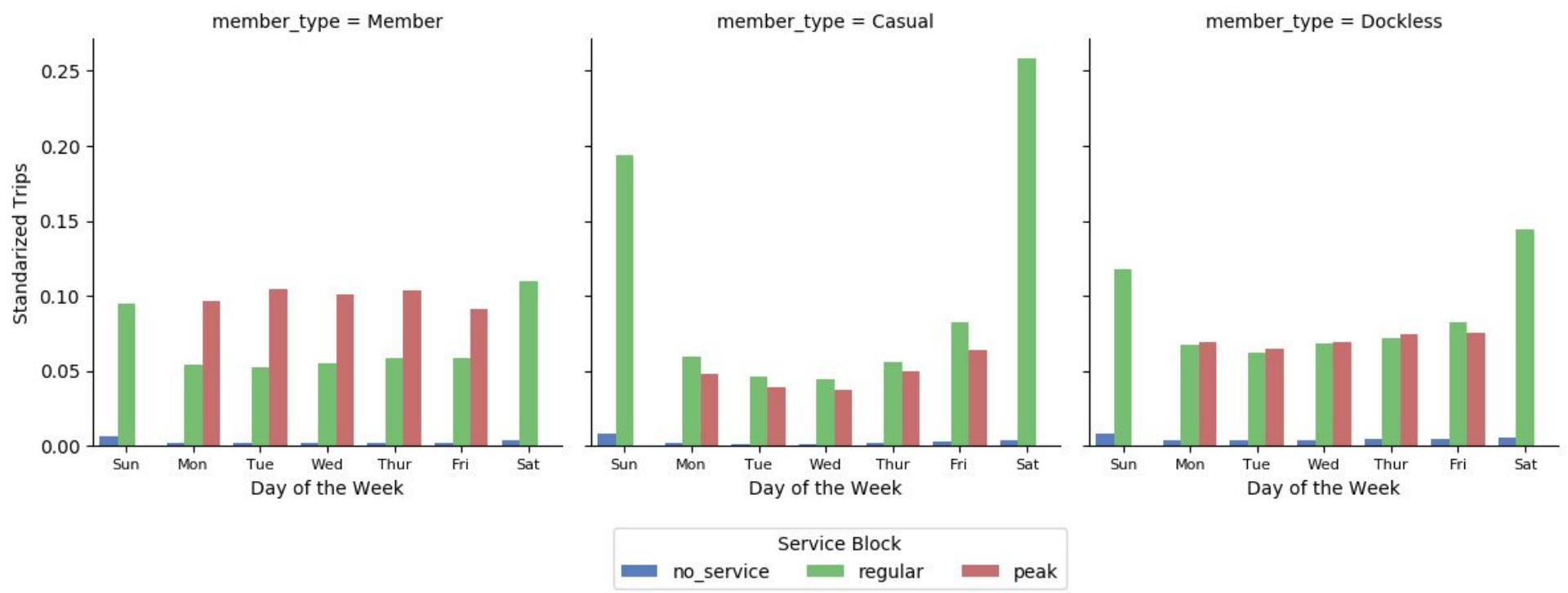
Over the winter months, trips move in lock step.

Moving into spring, we see more spikey dockless trips centered around casual weekend use.



Trips by Metro Operating Status Proves Casual Use for Dockless

- CaBi member rides are mostly taken during peak Metro hours.
- CaBi casual rides are mostly on weekends and regular Metro services hours.
- Dockless rides are a hybrid of the two, but lean toward the CaBi casual ridership patterns.

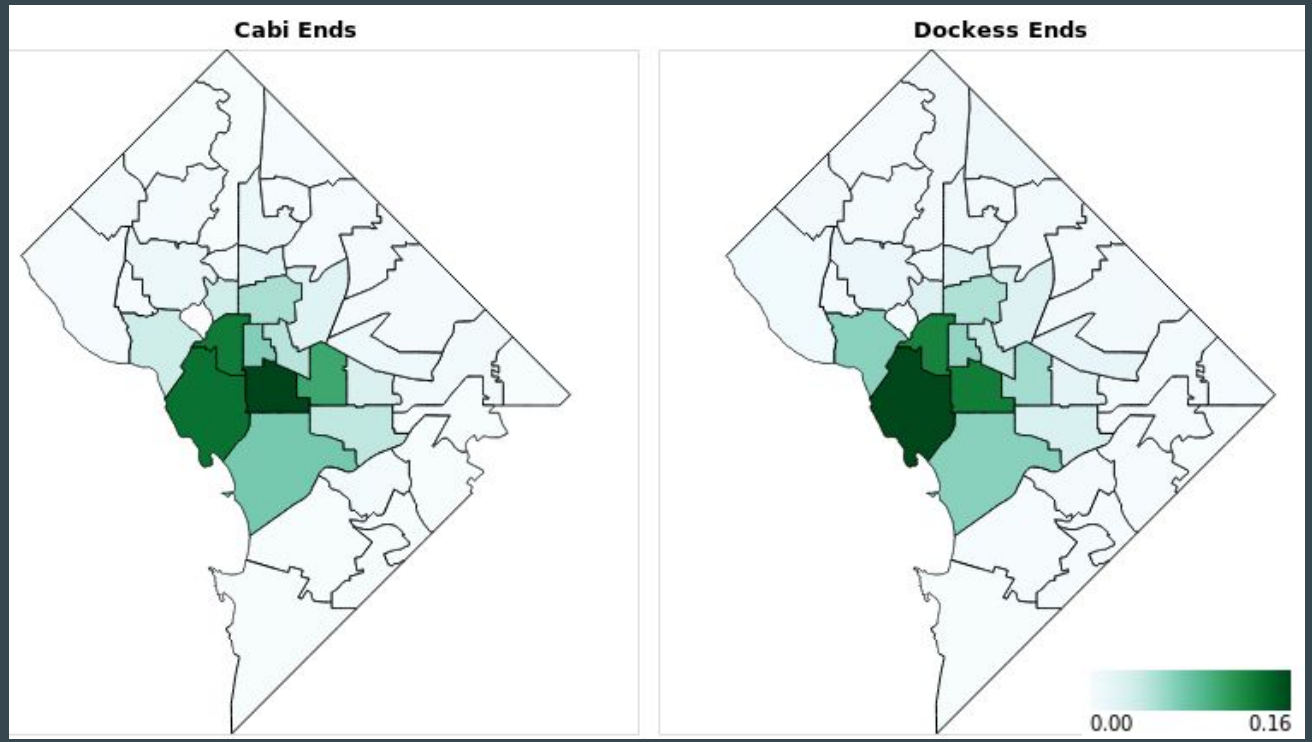


CaBi Trips Ends Centered on Downtown, Dockless on Nat'l Mall

CaBi and Dockless trip ends largely cover the same Advisory Neighborhood Commission geo-districts

CaBi trips is centered on downtown and the eastern half of the National Mall, while dockless trips are centers on the western half of the mall.

This distinct further proves that dockless behavior is more "casual" in nature than CaBi.



Fleet Replacement Statistics (Sept - Apr)

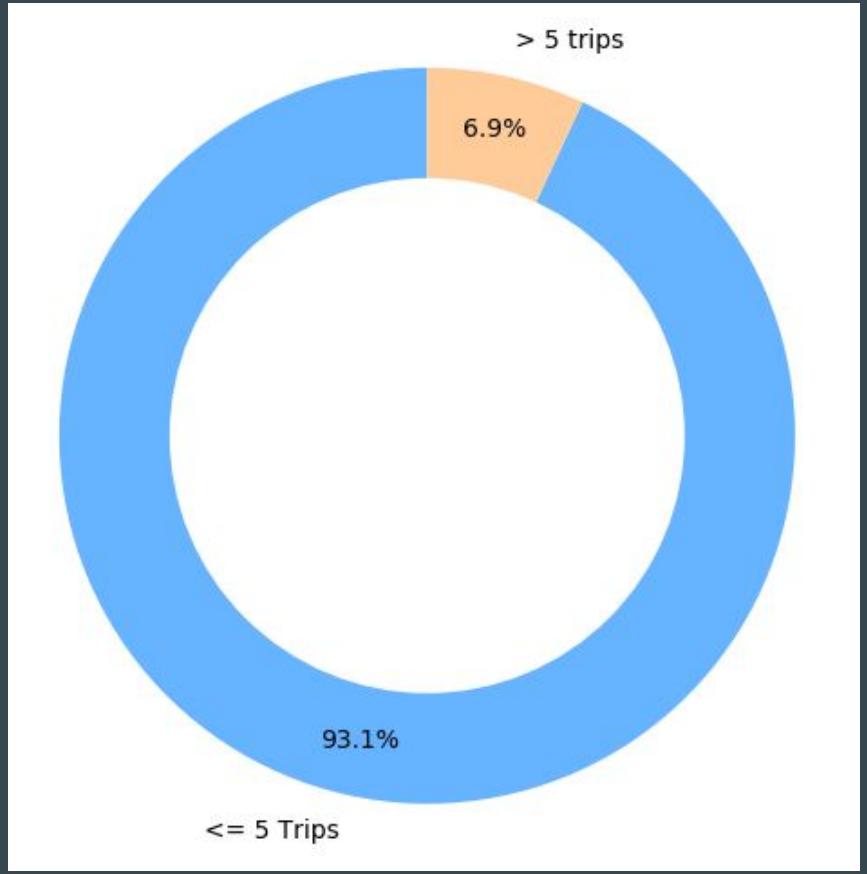
- On average, dockless operators are replacing entire fleets over 3 times in an 8 month span, with bikes lasting just over 2 months.
- CaBi has only replaced 10% of its fleet over an 8 year period, with bikes lasting 4.5 years on average

Age Stat	Min	Avg	Max	CaBi*
Total Bikes	211	1,786	2,649	4,925
Replace Rate	1.51	3.44	6.62	1.09
Bike Age	52 Days	70 Days	95 Days	1,614 Days

* CaBi Stats for entire CaBi History (2010-2018)

One-Off Ridership Dominates DC Dockless Pilot

93.1 % of all dockless trips were taken by users that took 5 trips or less over the 8 month pilot period.



Barriers to Entry - Many Price Models and Apps Required

Each dockless operator has its own pricing model and app that must be used to reserve a bike. The cumbersome prospect of navigating these issues when compared to CaBi may be preventing dockless users from riding with more regularity

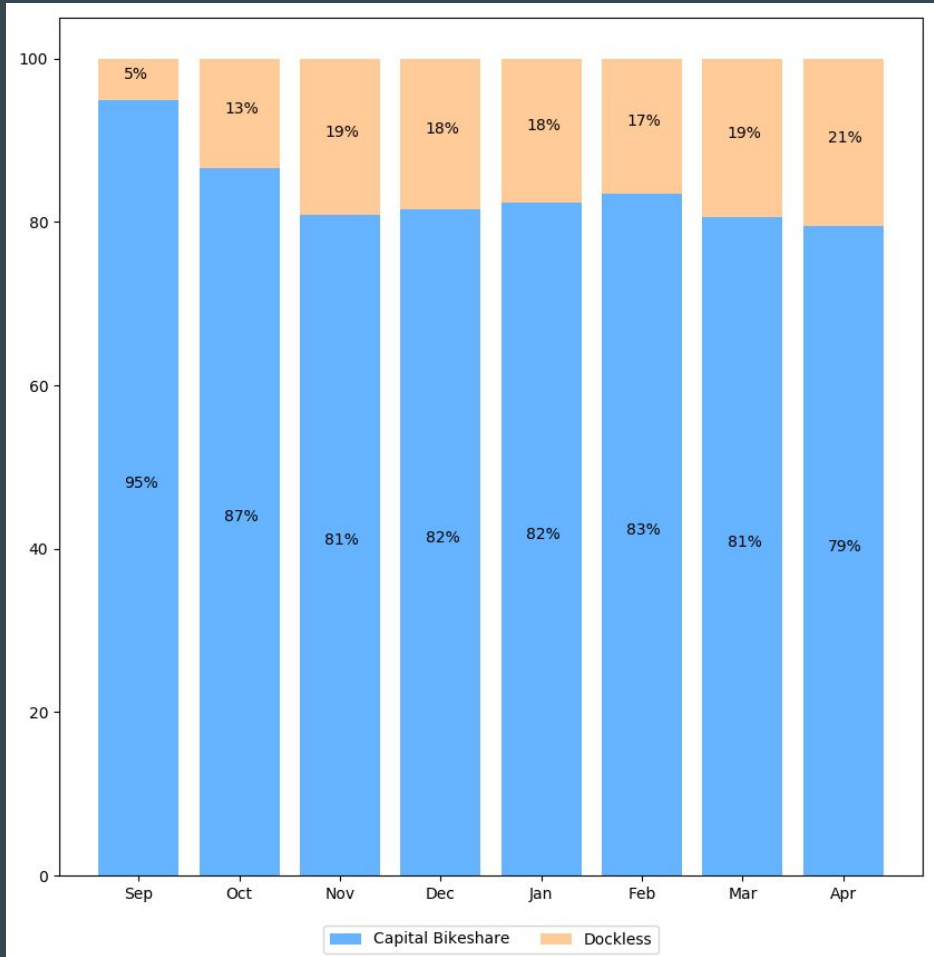
Operator	**Trip Cost**
Capital Bikeshare	$2 for Single Trip (1st 30 min)
Jump	$2 for first 30 min then $0.07 per min
Lime	$1 per 30 min (Scooters $1 per ride plus $0.15 per min)
Mobike	$1 per 30 min
Ofo	$1 per 60 min
Spin	$1 per 30 min

CaBi Market Share Holds Strong at 80%

After the dockless ramp up in the Fall, CaBi market share holds at about 80% through April

Dockless does look to have gained some ground in March and April as the weather turned and dockless scooters were introduced.

Lime does not differentiate between bikes and scooters in its data, so they were included here.

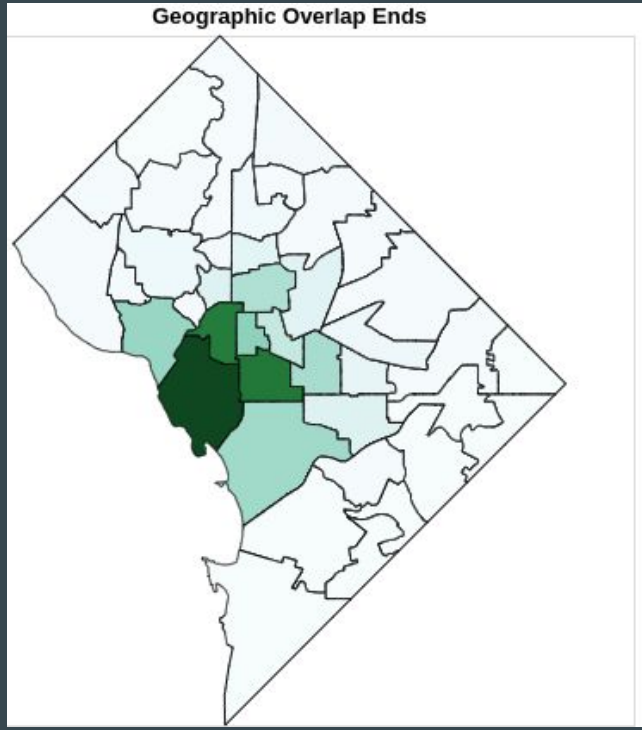


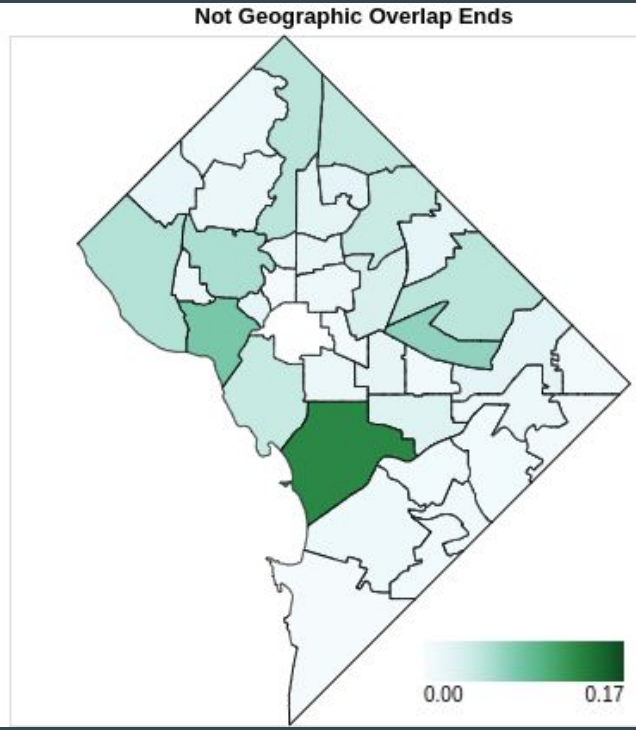
Penetration into Wards 3, 4 and 5 for Unique Service Areas

90% of dockless trips end within a quarter mile of a CaBi station

For the remaining 10% of dockless trips (on the right), the service area shifts to Wards 3, 4 and 5.

Neither map show significant penetration into Wards 7 and 8





Conclusion

The Dockless Pilot trending toward impactful on Capital Bikeshare Demand, but inconclusive due to several factors:

- Dockless Reliability (Fleets constantly replaced)
- Dockless Availability (4,500 CaBi vs 1,500 Dockless)
- Number of Dockless Operators
- Pilot to date not inclusive of summer months (Casual use in summer)
- Not enough time for current CaBi Memberships to expire