Info Challenge 2022
Veo E-Scooter Sidewalk Usage

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Outline

Context

Project objectives

Data & methodology

Spatial analysis

Regression analysis

Discussion of findings

Data limitations and further directions

Practical solutions

Context

The VeoRide e-scooters became available on UMD campus in Fall 2019, and gained popularity among students since its launch. The affordable service fees and **availability in many locations** on campus are likely main drivers for the Veoride e-scooter service popularity.

However, the UMD Department of Transportation Services raised concerns lately for **pedestrian safety** risks associated with the use of sidewalks by VeoRide e-scooter riders. This alludes to a growing issue of **competition for space intended for pedestrians** such as sidewalks given the rise of micro-mobility services like VeoRide in recent years.

With VeoRide going dockless in 2020, a problem of **scooter cluttering** also emerged, hindering pedestrian movement in areas highly frequented by them.
It also made the process of charging and rebalancing the scooter supply more challenging for VeoRide.

Project Objectives

In this project, we examined the dataset provided by DOTS that contains Veoride scooter trips aggregated per street segment in September and November 2021.

Using ArcGIS and Python packages like geopandas, we identified the campus areas with the highest scooter traffic levels in those two months.

Data

trips_intersected_only_20220302T163907Z_001 - Sept trips intersected only

id	name	count	percentage	geometryId
a30f7d5c1d3857b4deaa96527b…		401.00	1.10	a30f7d5c1d3857b4deaa96527b…
68c39a5dc69f7264d9f5853cc99…		58.00	0.20	68c39a5dc69f7264d9f5853cc99…
4bddca8d46f66baca3e5bf95a19…		4.00	0.00	4bddca8d46f66baca3e5bf95a19…
23f8e1dfdef8ca4e971c428b93b…		403.00	1.10	23f8e1dfdef8ca4e971c428b93b…
a86653e49a21dae941ed18c163…		58.00	0.20	a86653e49a21dae941ed18c163…
569bffaa212009e6aa91eed5cb8…		405.00	1.10	569bffaa212009e6aa91eed5cb8…

Data

Figure 1:
trip counts in
September

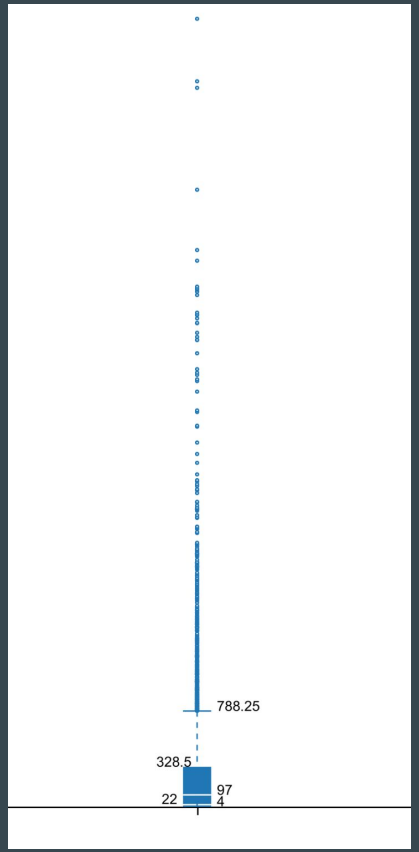
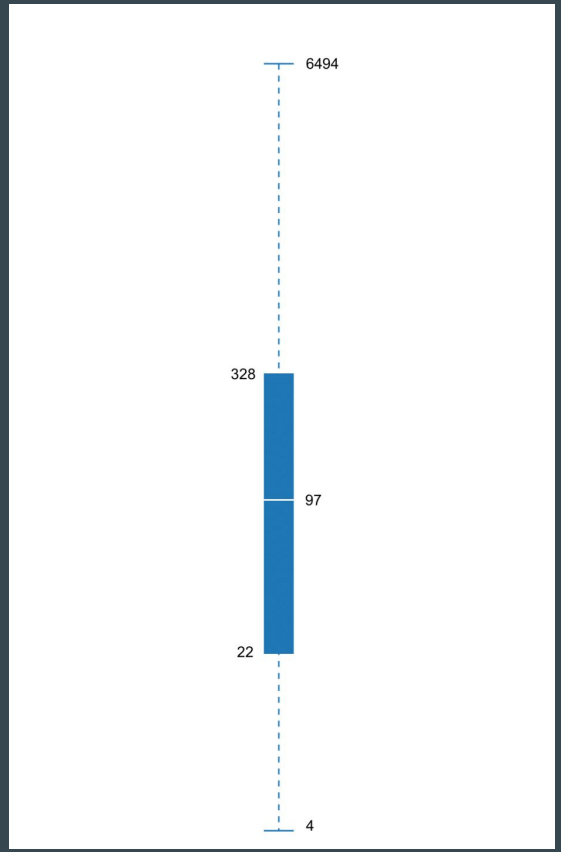


Figure 2:
trip counts in
September
(normalized)



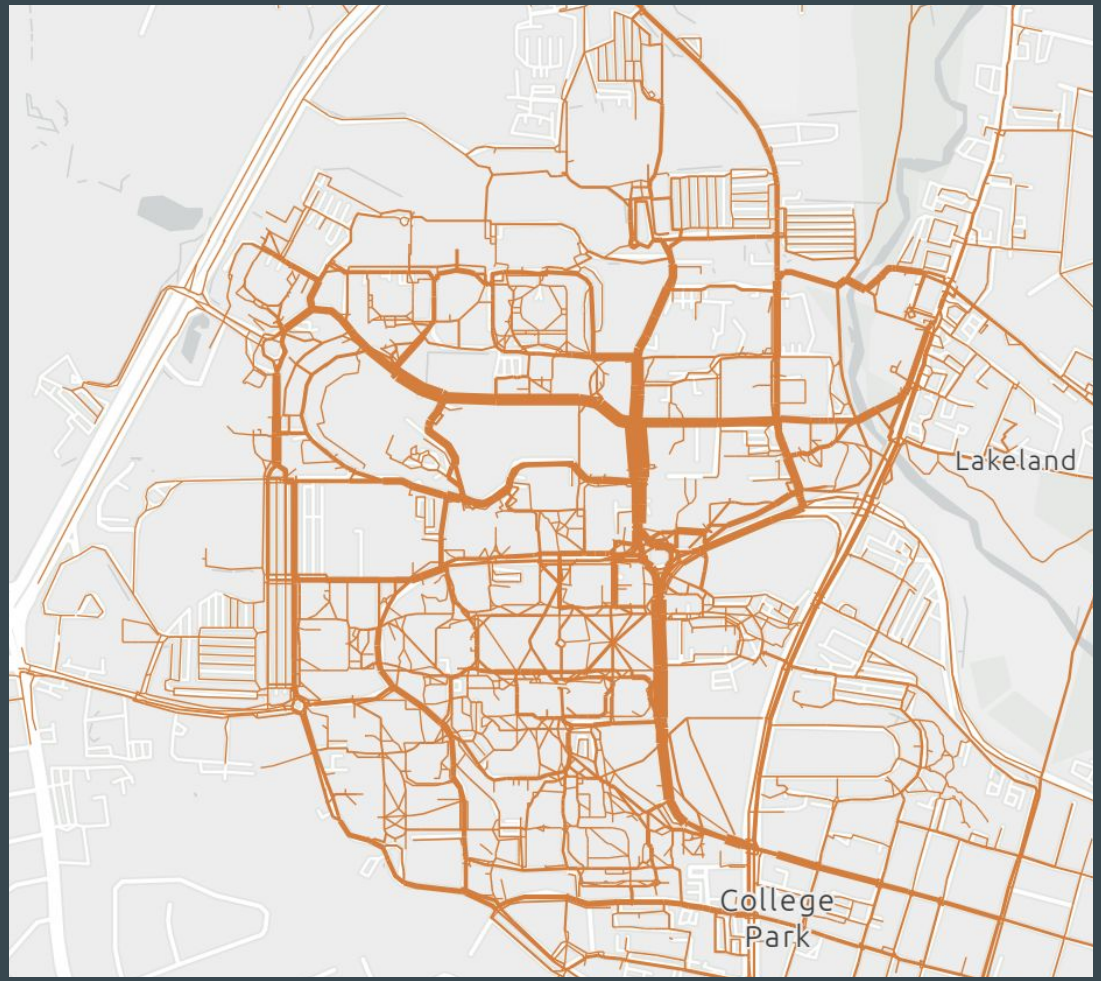
Methodology

1. Data cleaning and processing in Python using pandas, geopandas, and shapely packages
2. Use ArcGIS Desktop to subset trips made on sidewalks only and calculate sidewalk width
3. Use ArcGIS Online for map visualizations
4. Use Random Forest regression for predicting VeoRide scooter user behavior

E-Scooter Trips

September

Roads & sidewalks



September trips (roads & sidewalks)

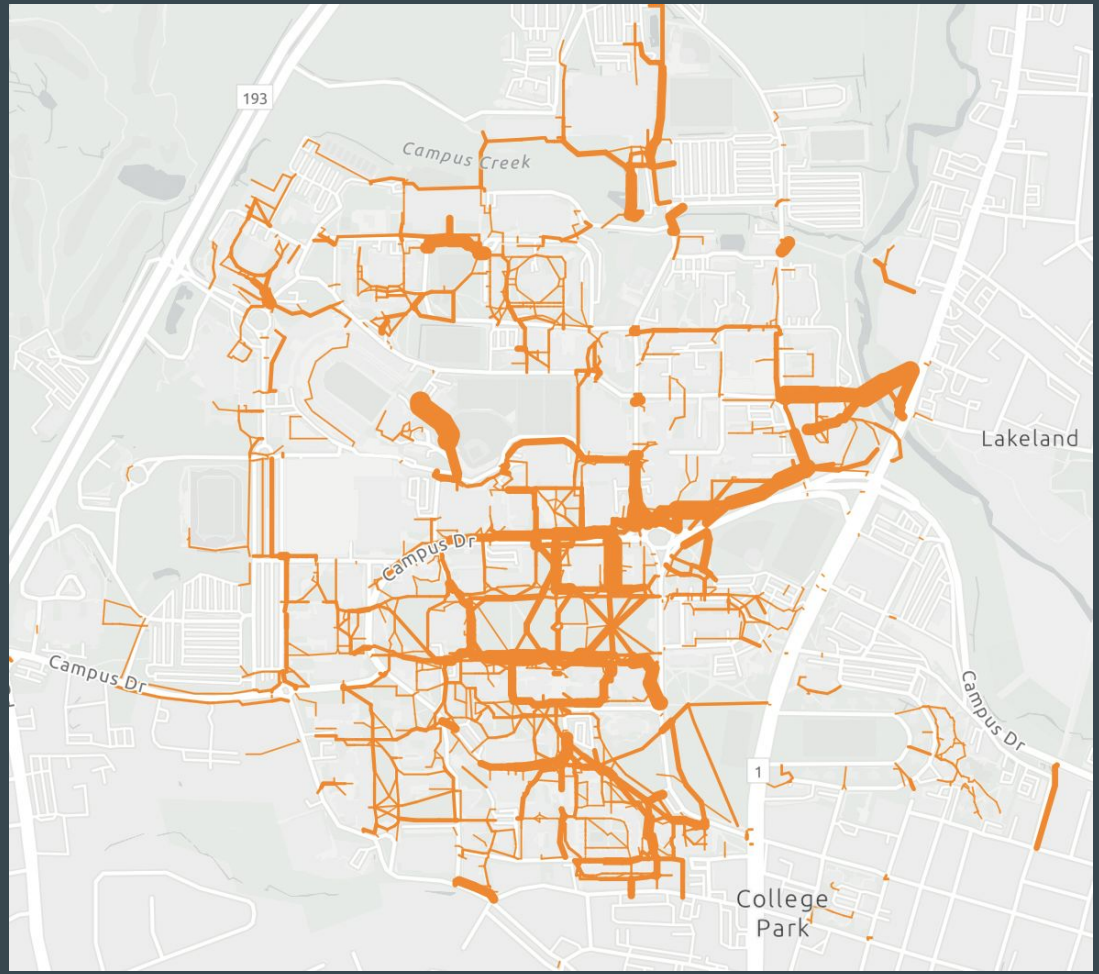
count

- > 6,494
- 5,000
- 3,000
- 1,500
- < 4

E-Scooter Trips

September

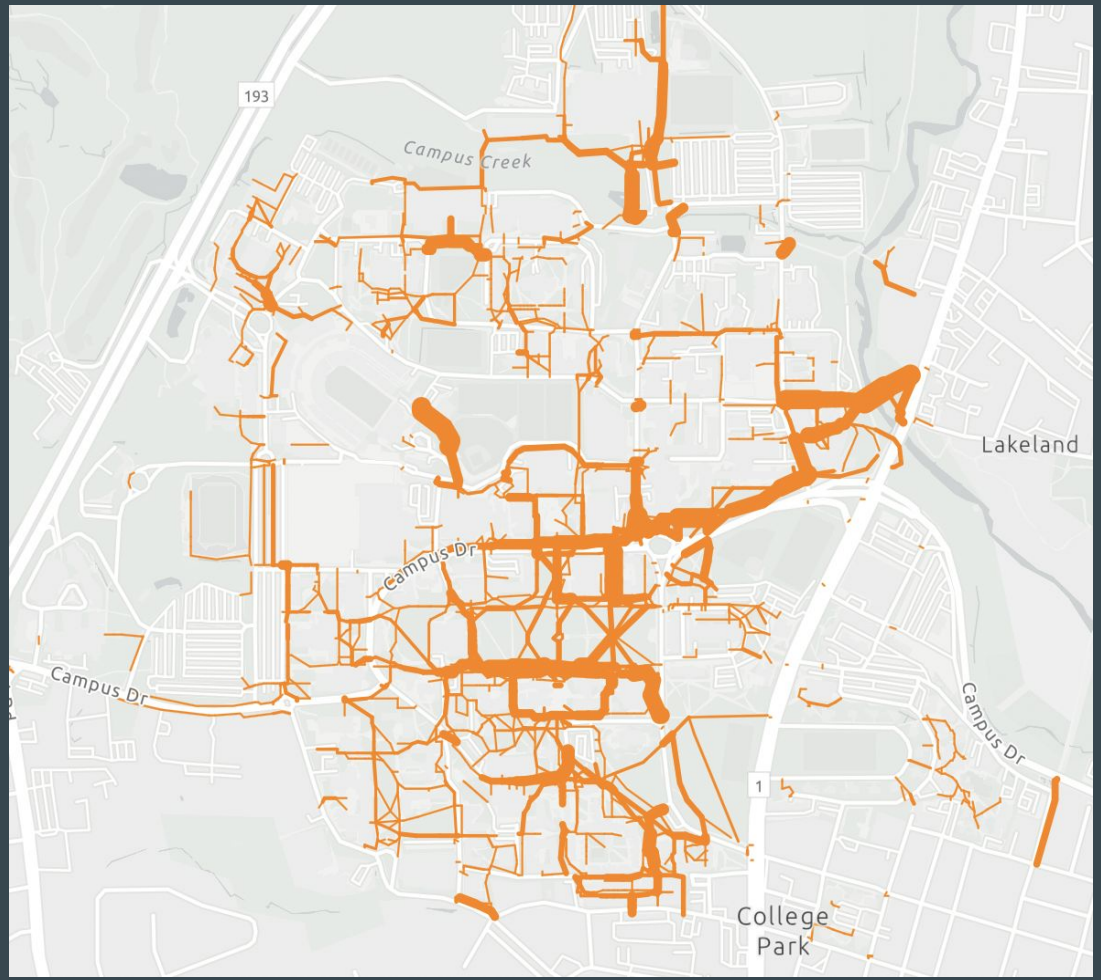
Sidewalks only



E-Scooter Trips

November

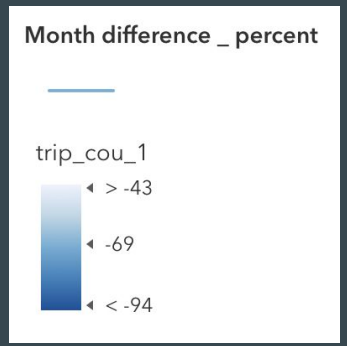
Sidewalks only

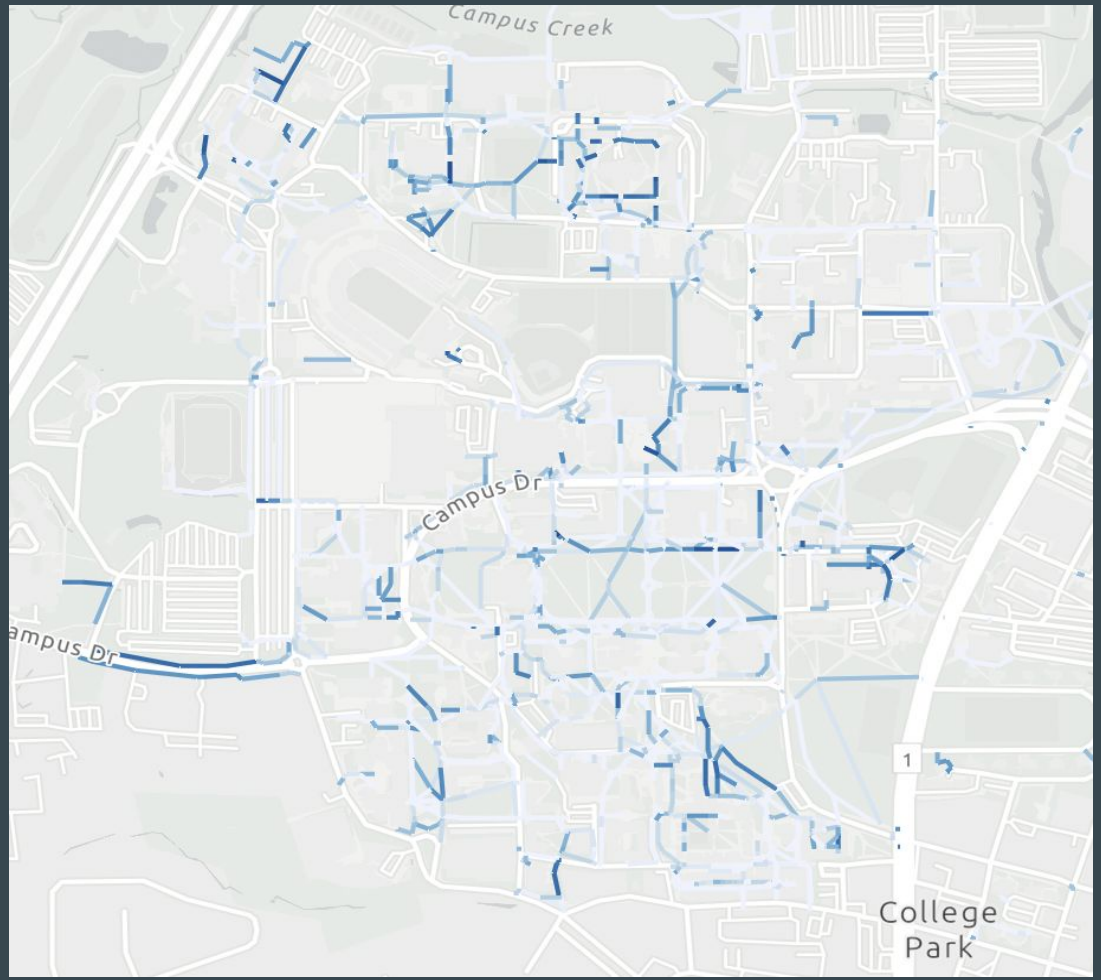


E-Scooter Trips

Difference between Sept and Nov

Sidewalks only



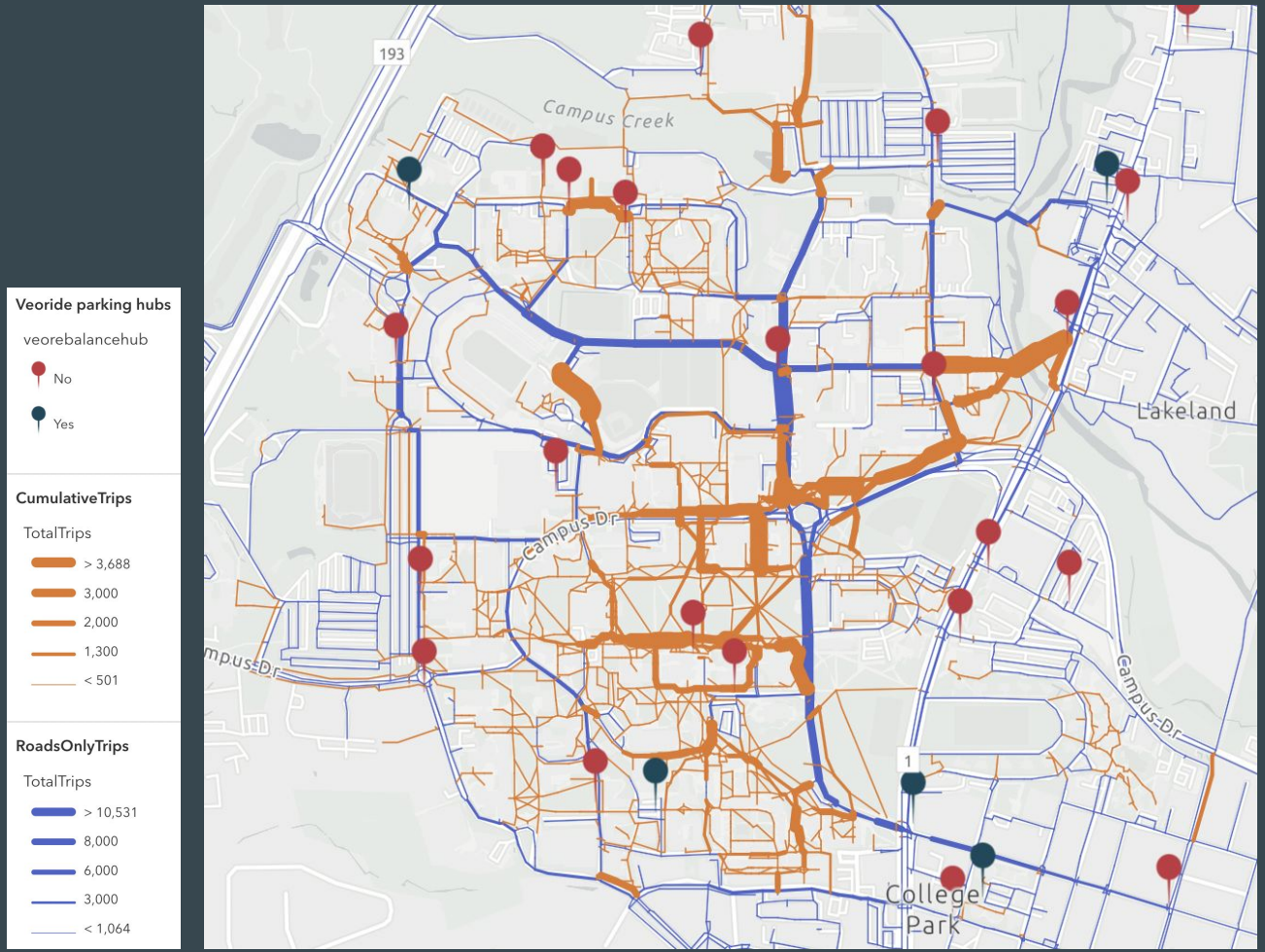


Sidewalk Trips vs Road Trips

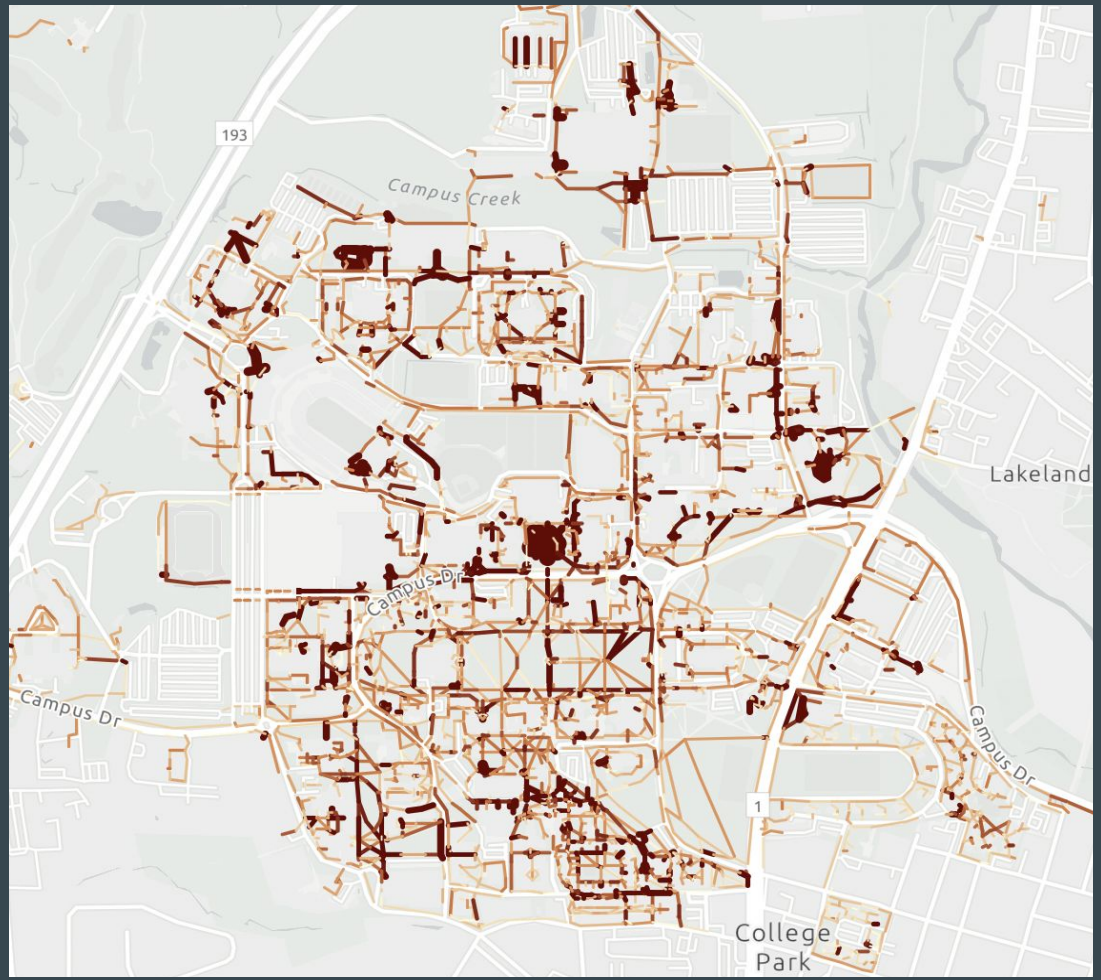
Both months

Roads and sidewalks displayed separately

Veoride parking hubs included



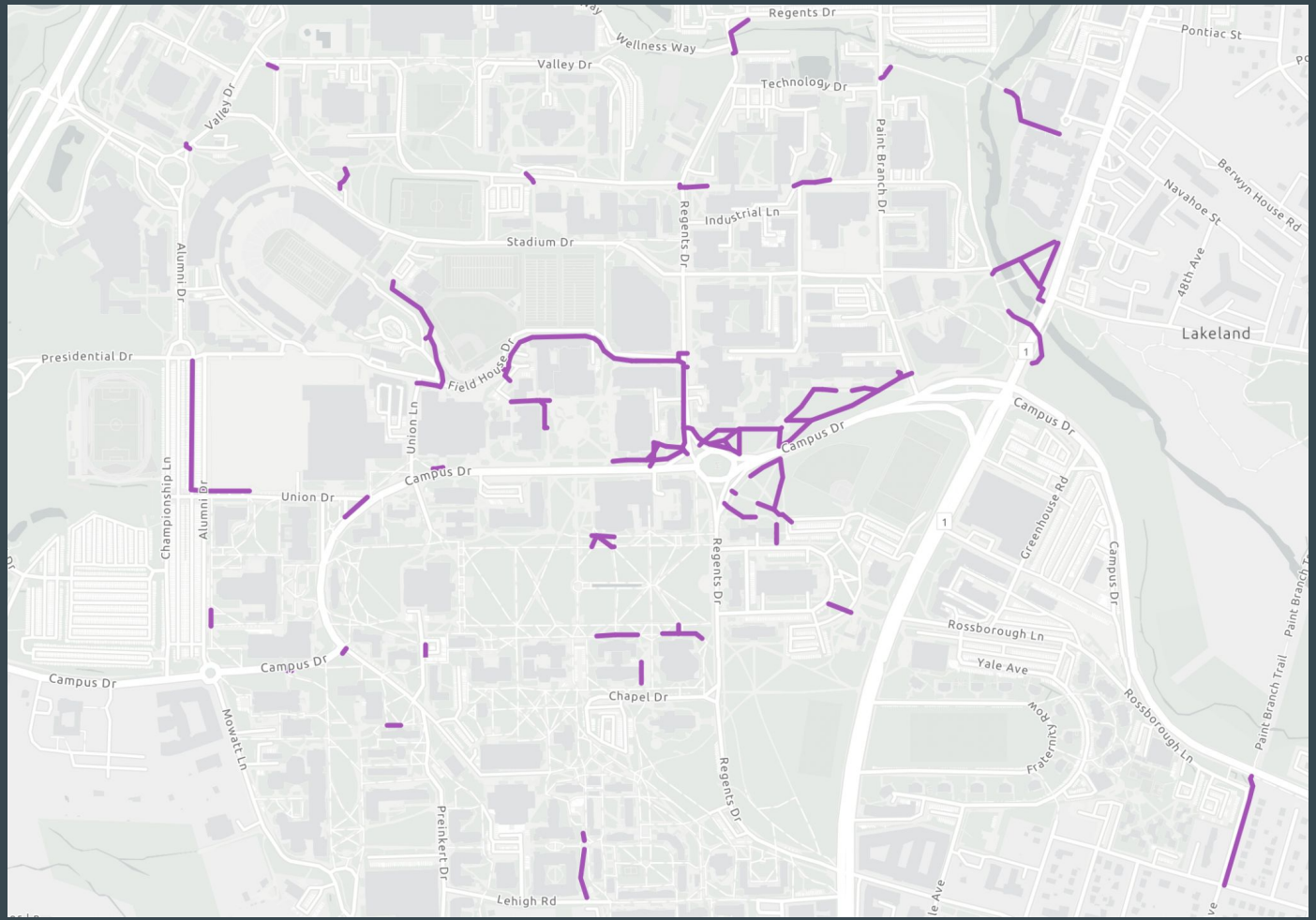
Sidewalks Width



Safety Risk Sidewalks

Sidewalk width less than 4 feet

Scooter activity in top 25 percentile



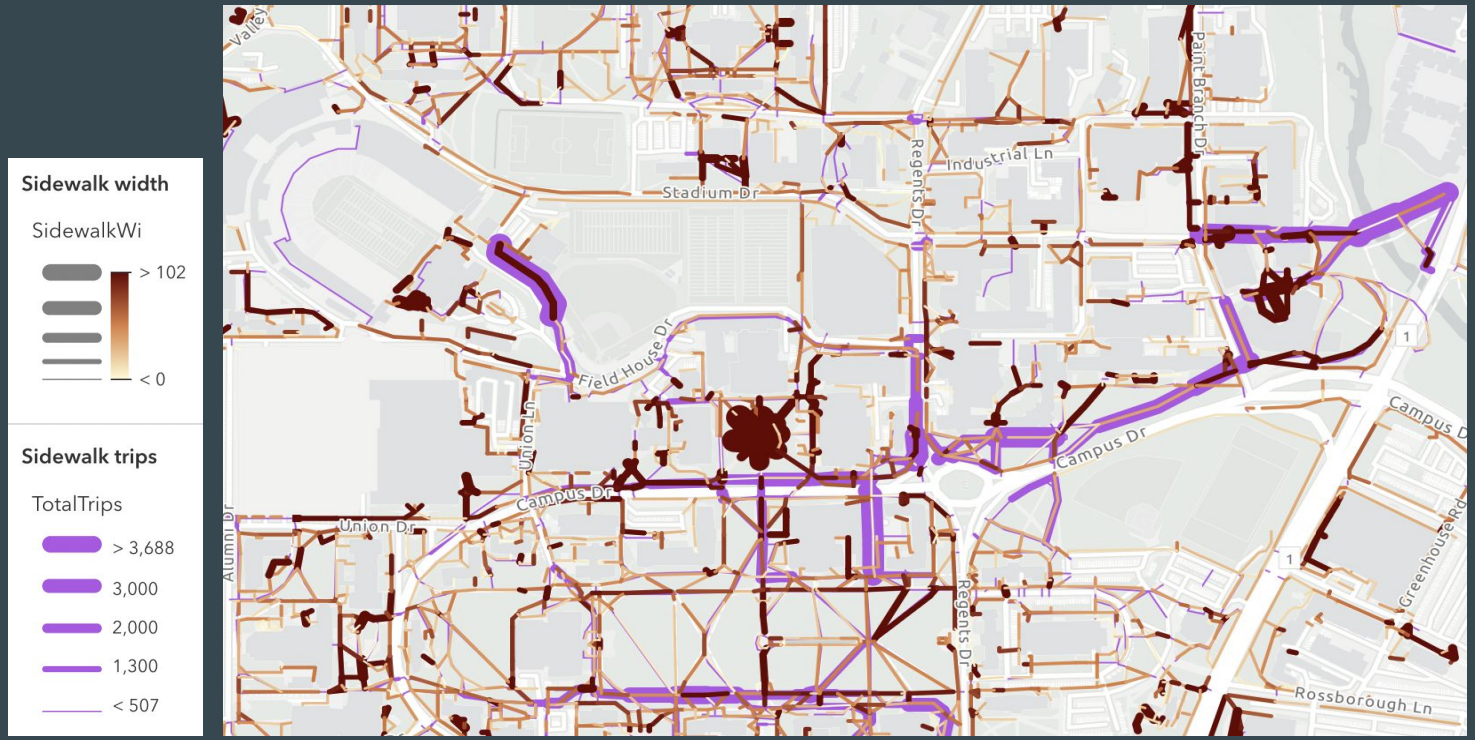
Regression Analysis

Using Random Forest Regressor, we tried to predict the behavior of scooter riders and understand what factors influence people to ride on the sidewalks.

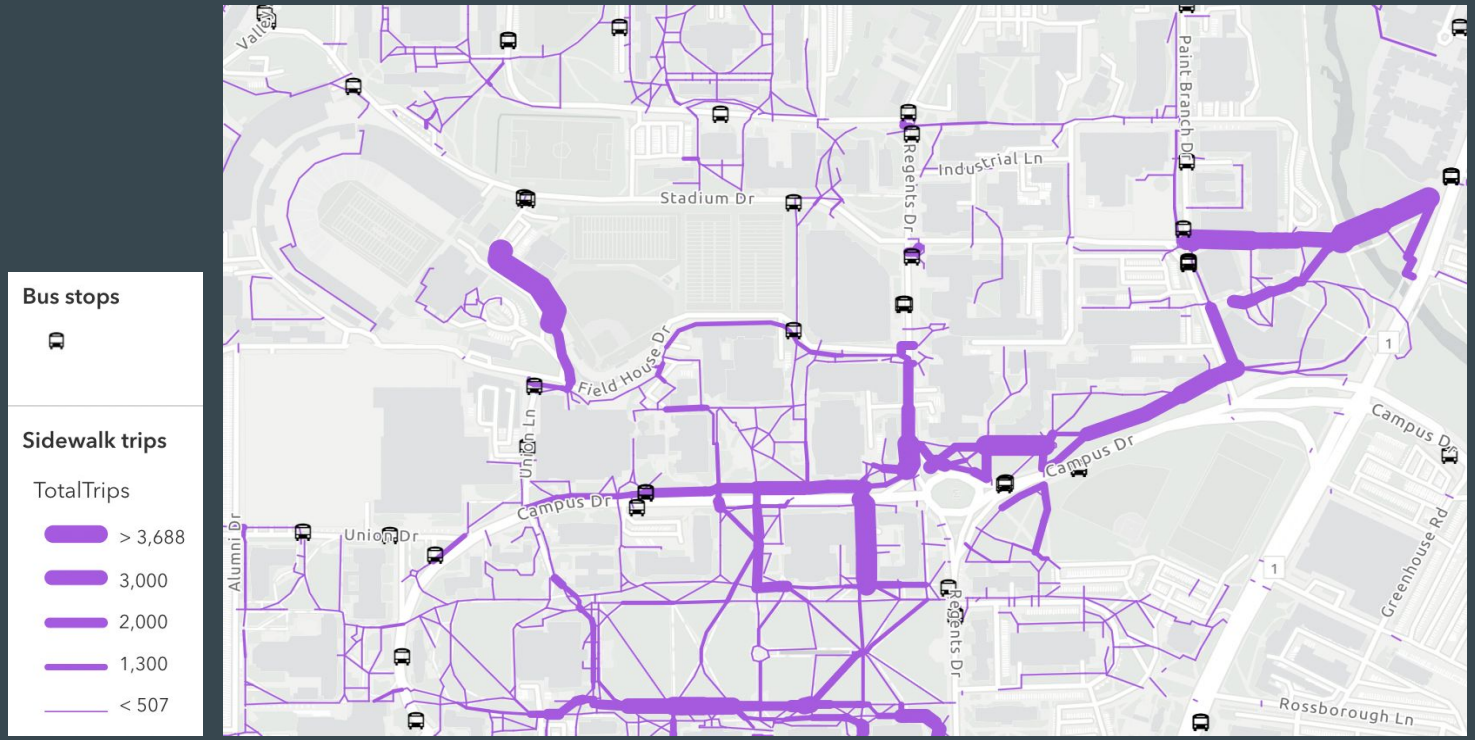
Input variables for this model include:

- Width of the segment
- Distance to nearest bus stop
- Distance to nearest parking lot
- Number of segments connected to a given segment

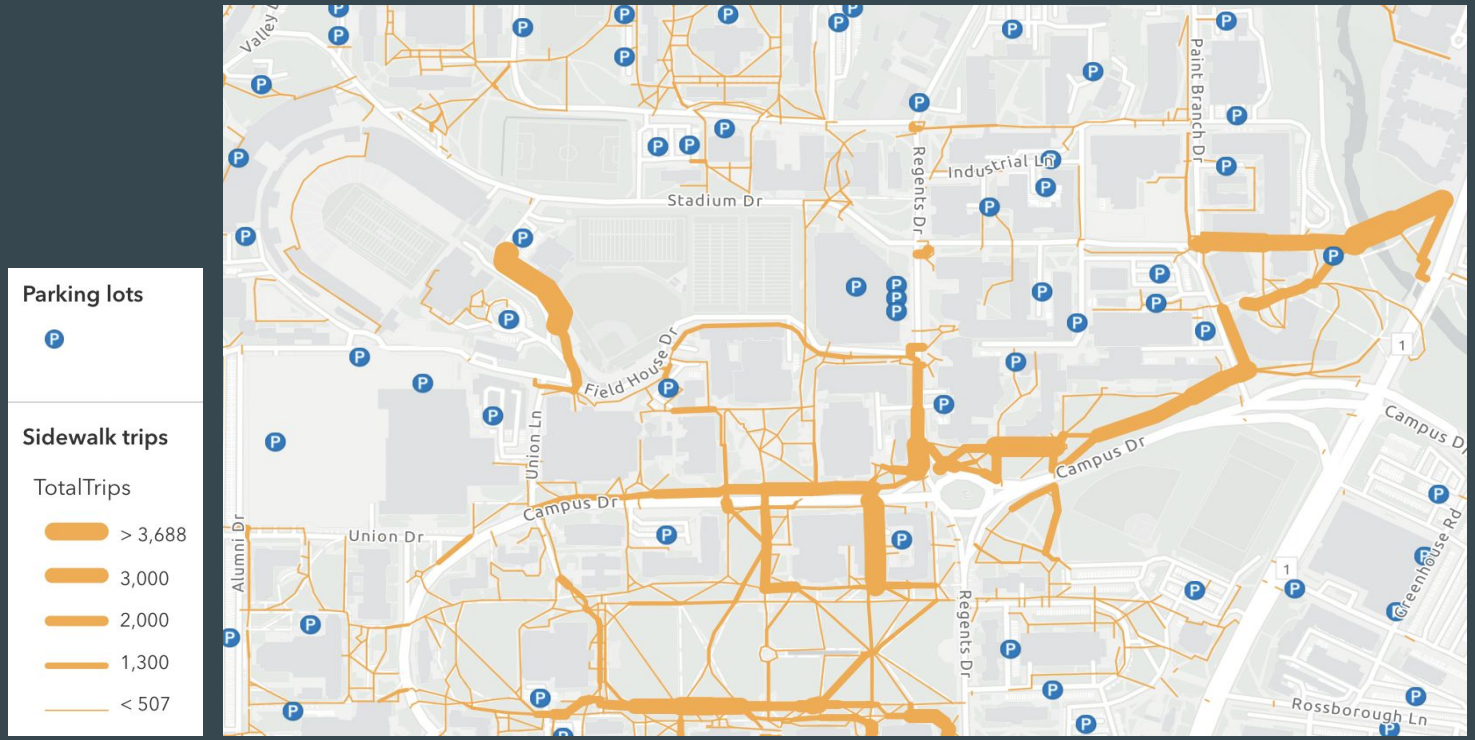
Width of the Segment



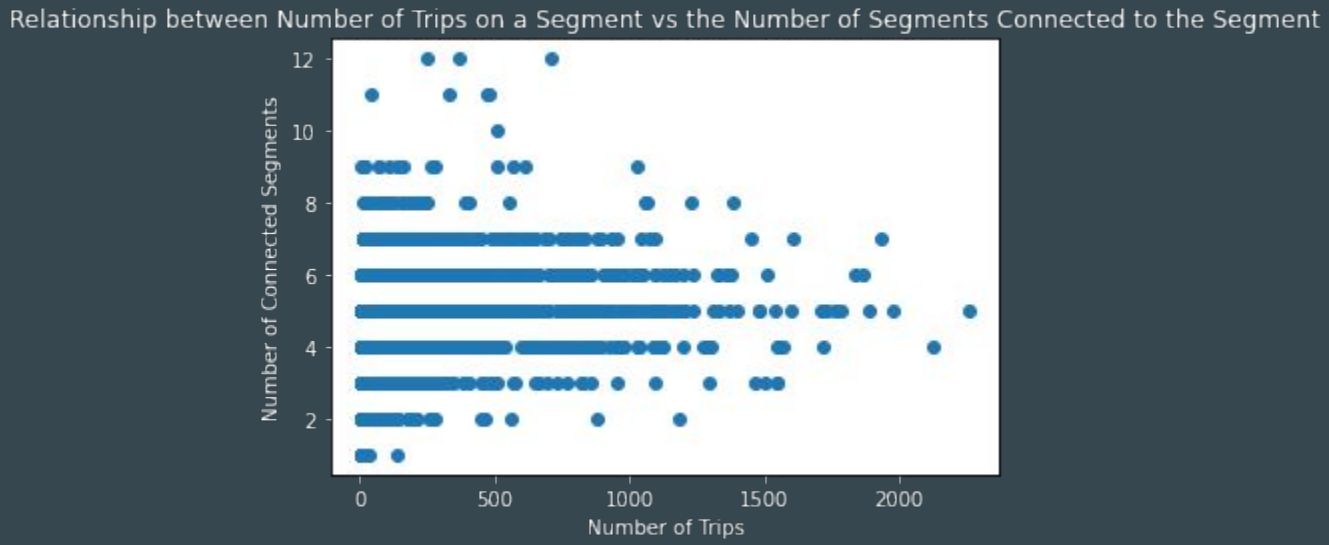
Distance to the Nearest Bus Stop



Distance to the Nearest Parking Lot



Number of Segments Connected to a Given Segment



Data Limitations

No data for individual trips - The trip data was aggregated at the month level and per street segment which prevented us from doing granular analysis including where trips started and ended or building individual trip trajectories, for example.

Lack of temporal data - No hourly or daily trip data was provided making it impossible to perform time series analysis.

Practical Solutions

Optimize scooter hub locations

Enforce speed limits in safety risk areas on campus

Use a geofenced system for proper parking

Run the short-term pilot program with speed limits and no scooter zones in safety risk areas

Incentive programs: Free rides and discounted trip fares for following on-campus regulations

Software & external datasets used

ArcGIS, geopandas, shapely

UMD map API

Scooter hubs data

Bus stations data

Parking lots data

Bike rack data