

LEVERAGING STREET VIEW IMAGERY AND COMPUTER VISION IN PLANNING RESEARCH AND PRACTICE

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BIKE LANE DETECTION

Bike Lane Detection

- Trained a model that predicts the presence of bike lane based on two street view images and an aerial image.

```
1/1 [=====] - 0s 64ms/step
```

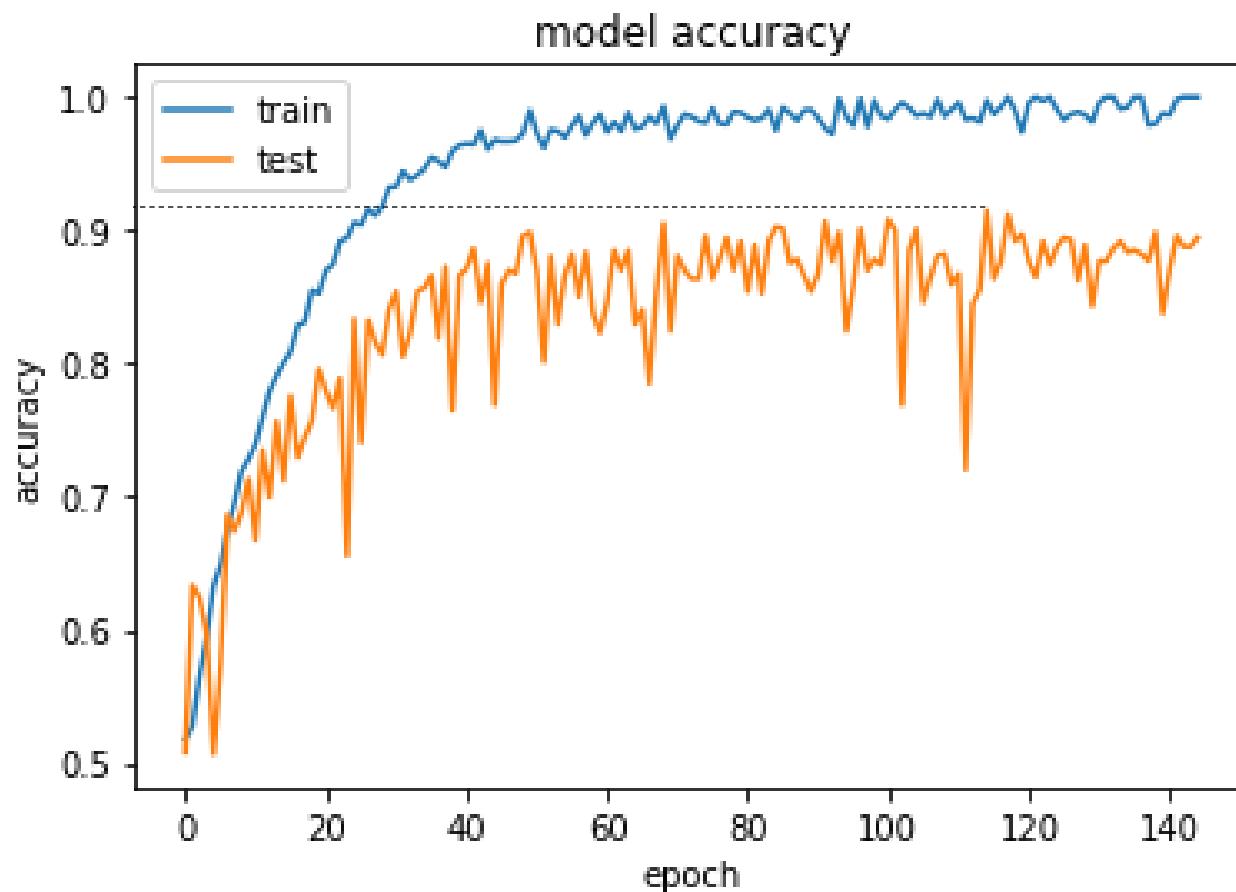
```
True Label: No bike
```

```
Pred Label: No bike
```



Bike Lane Detection

- The model achieved the accuracy of 92%.



UNREGULATED ON-STREET PARKING DETECTION

Unregulated Street Parking



Unregulated Street Parking



Unregulated Street Parking?



Unregulated Street Parking?



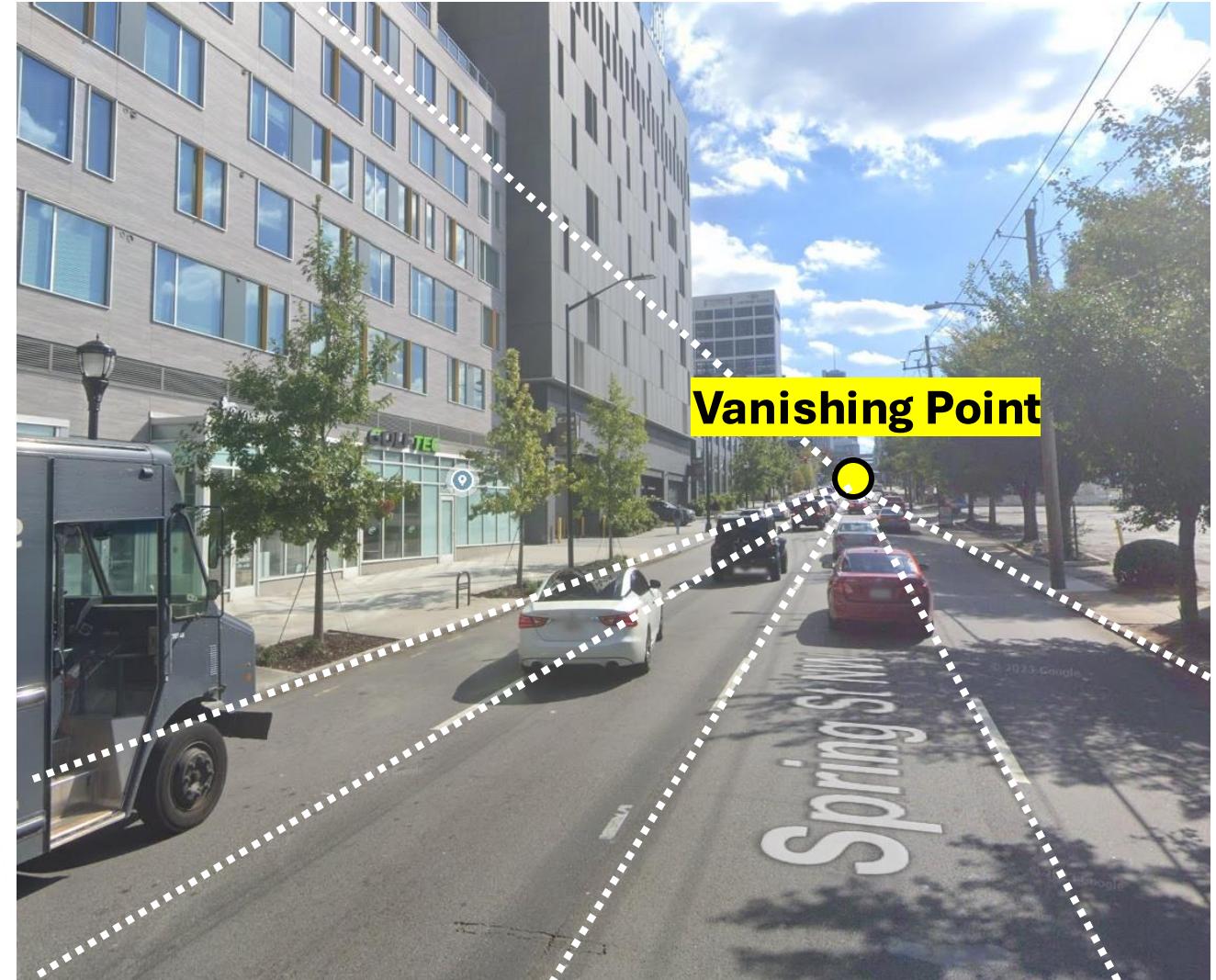
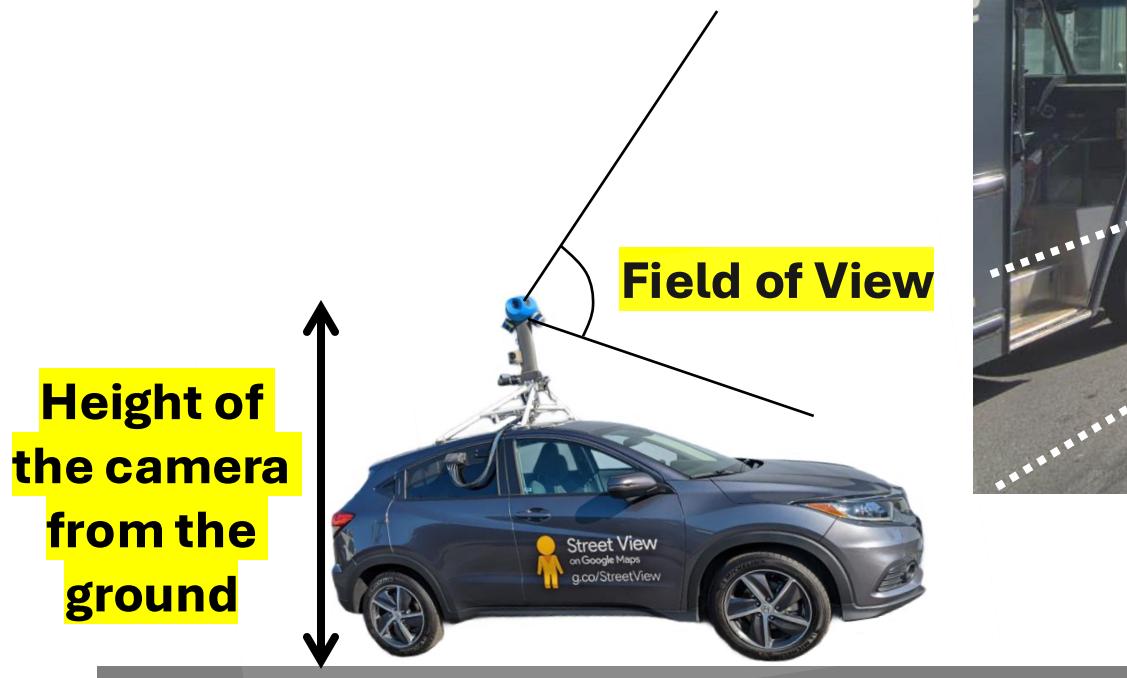
Idea:

If a car on a road (but not near an intersection) is stationary, it is likely that the car is parked on the street.

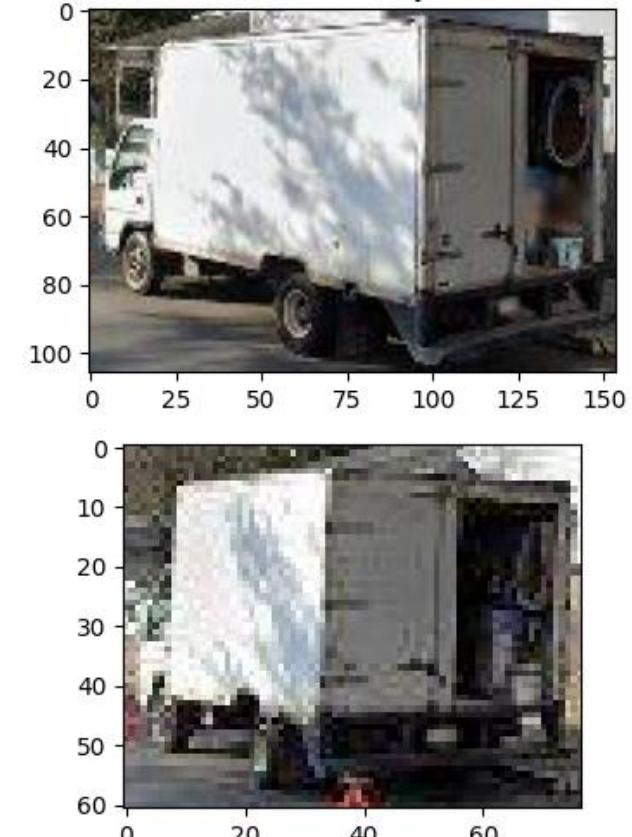
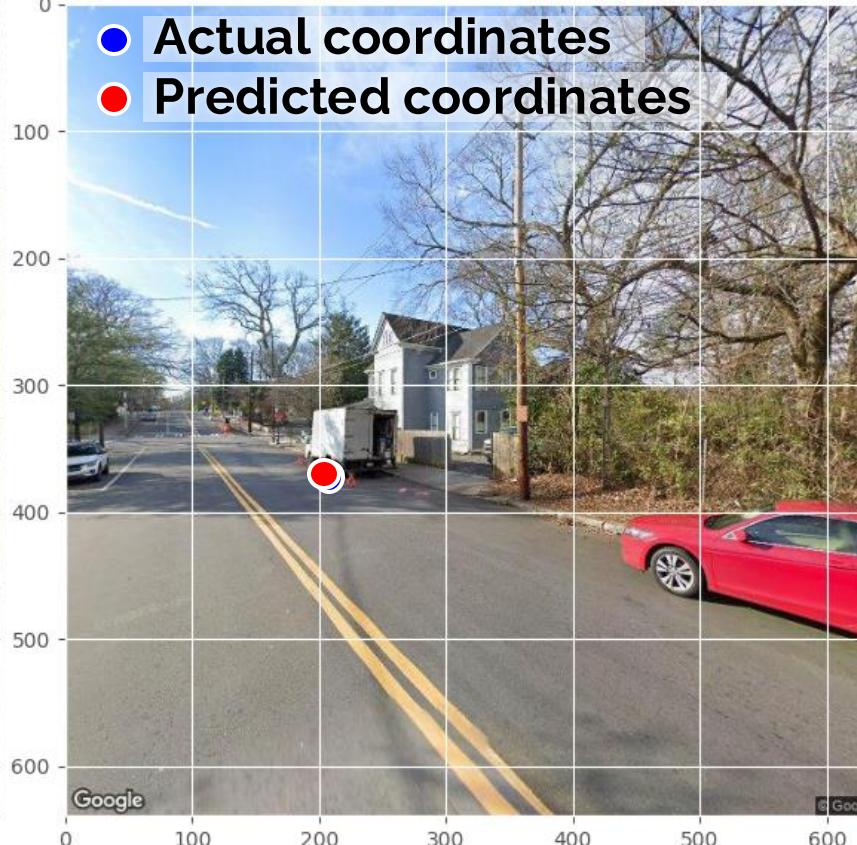
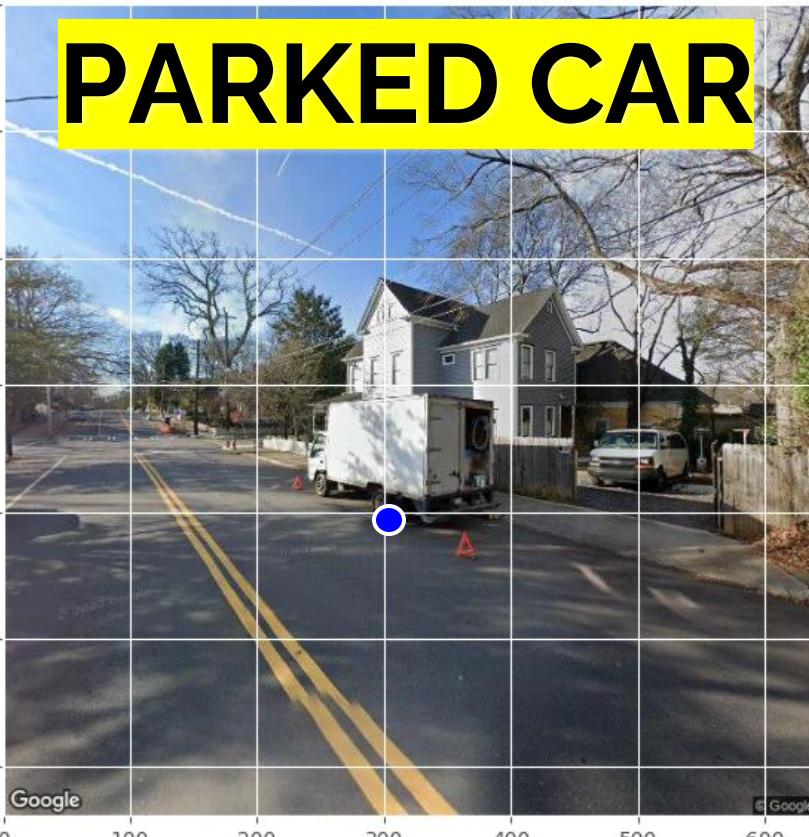
Unregulated Street Parking



Key Parameters

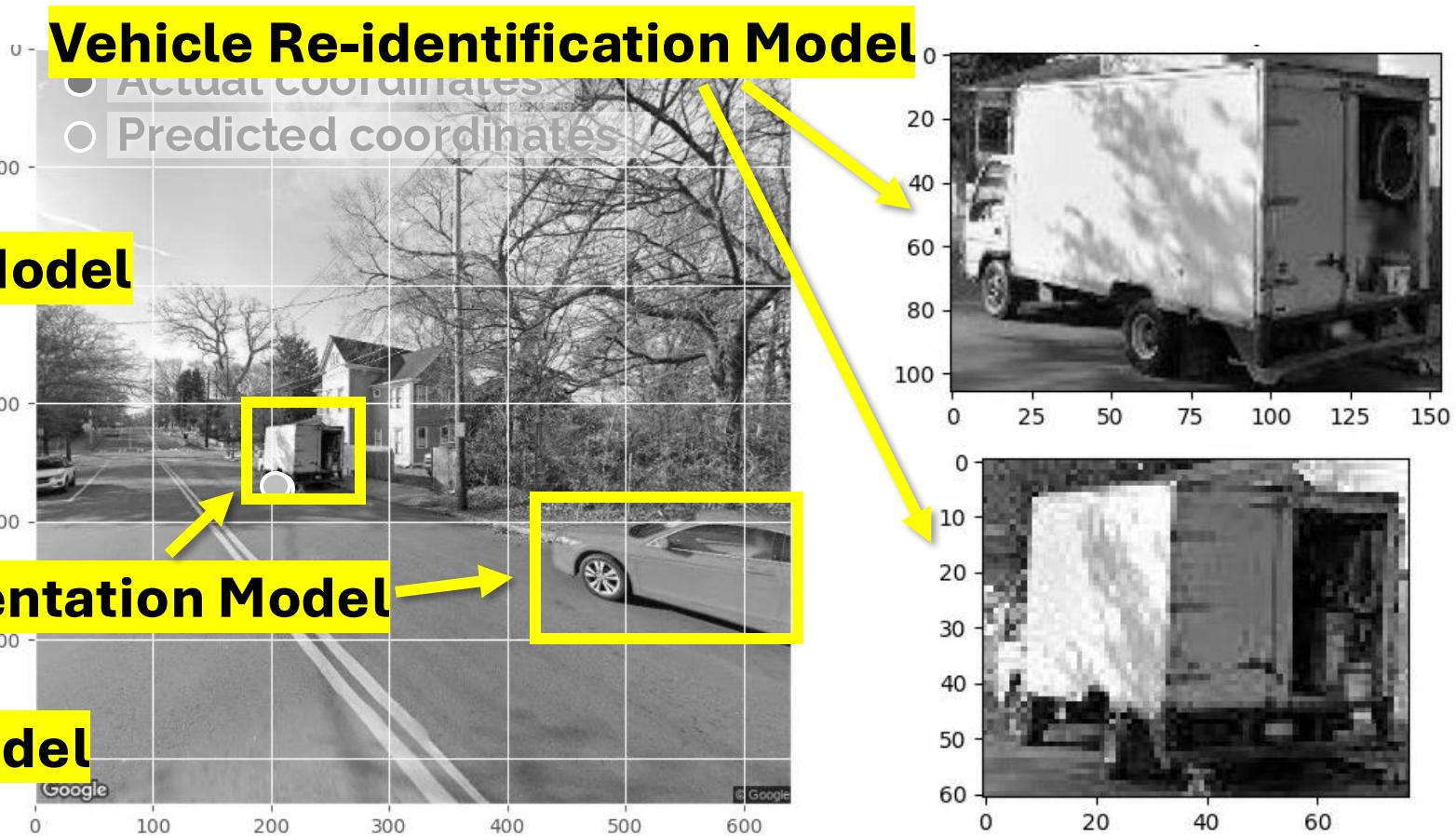
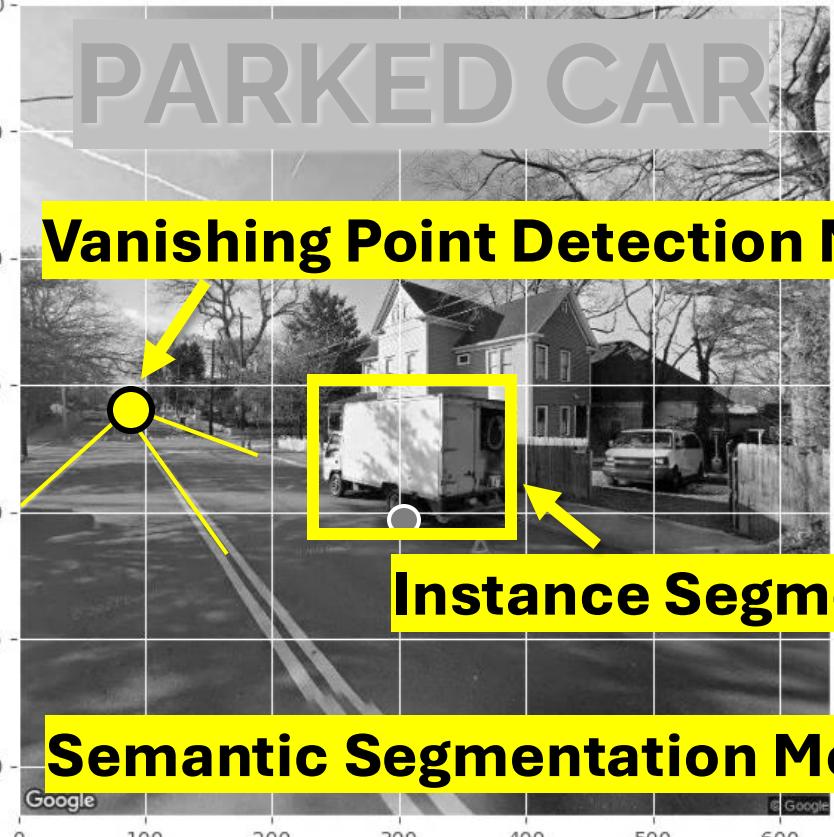






DEVIATION FROM PREDICTED COORDINATES:
0.42 meters

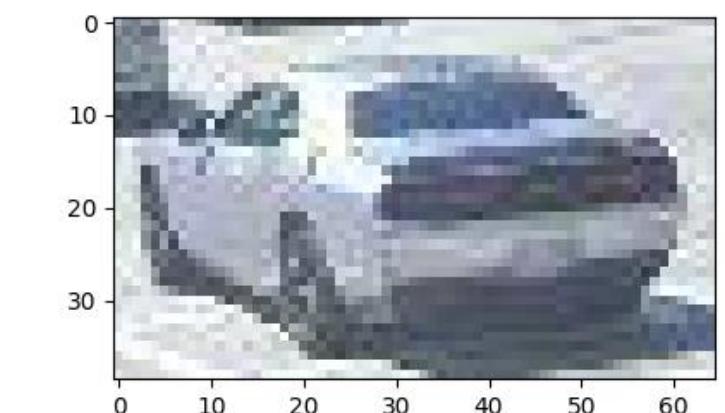
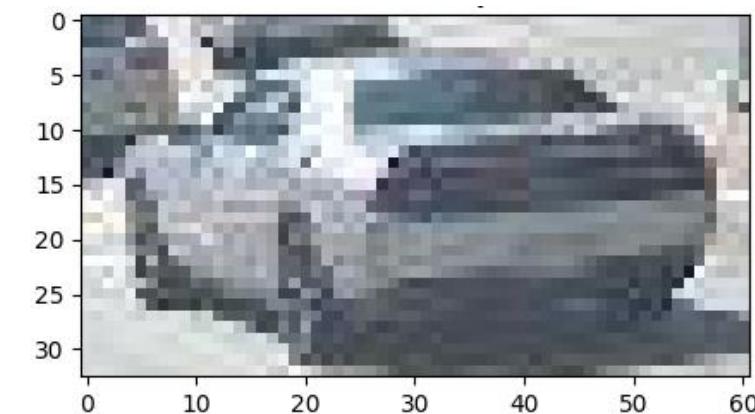
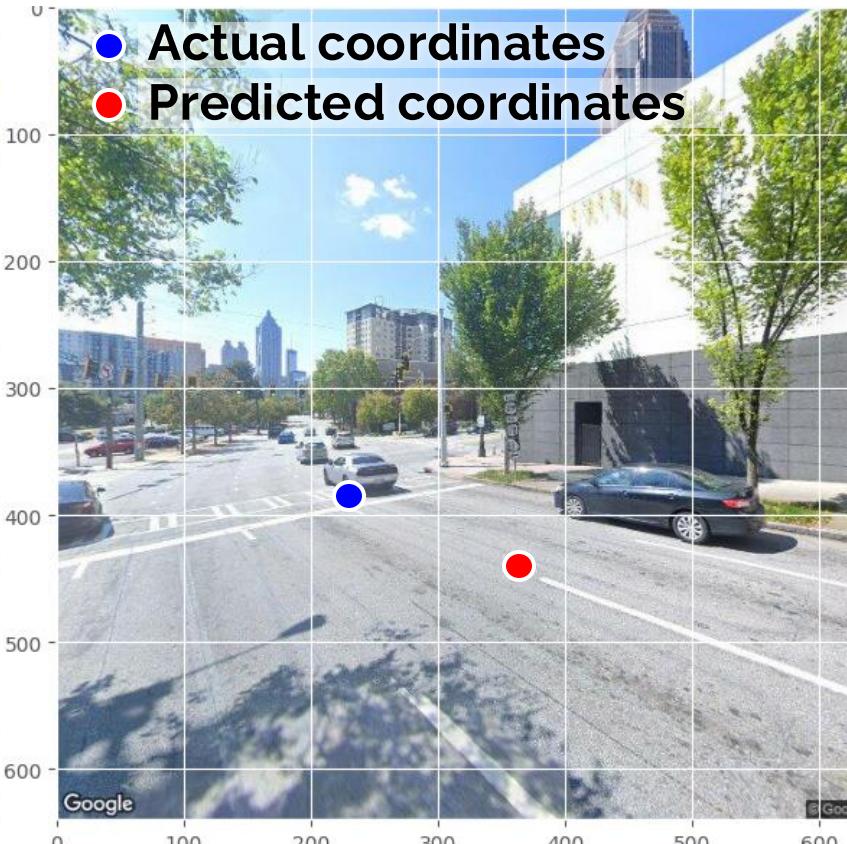
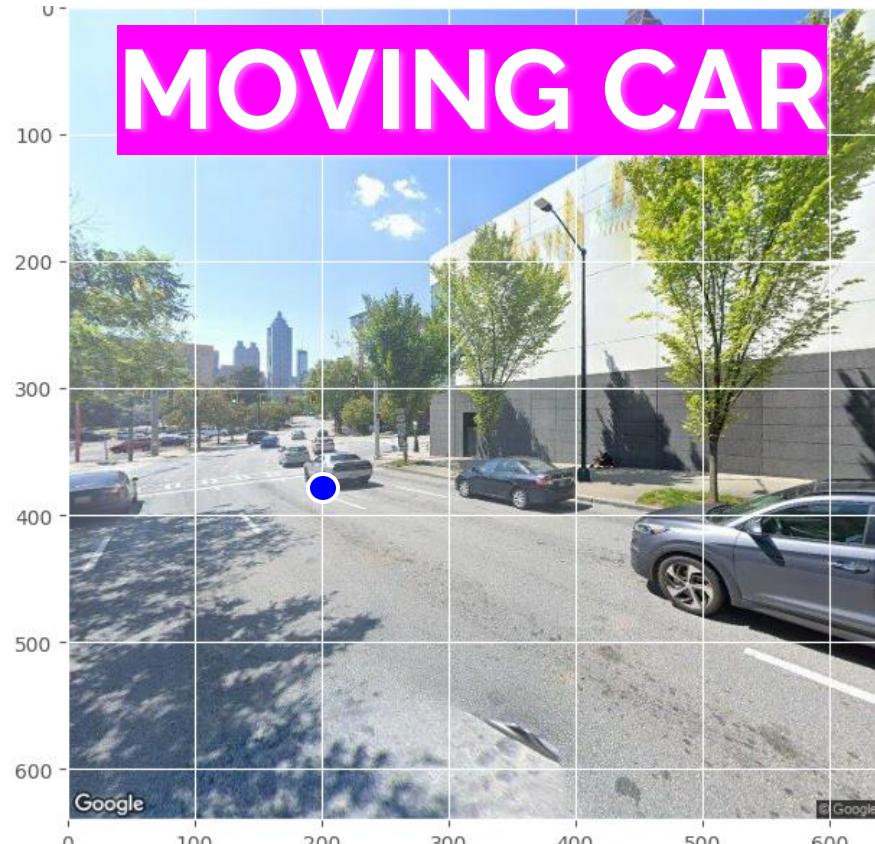
COSINE SIMILARITY:
0.74



DEVIATION FROM PREDICTED COORDINATES:
0.42 meters

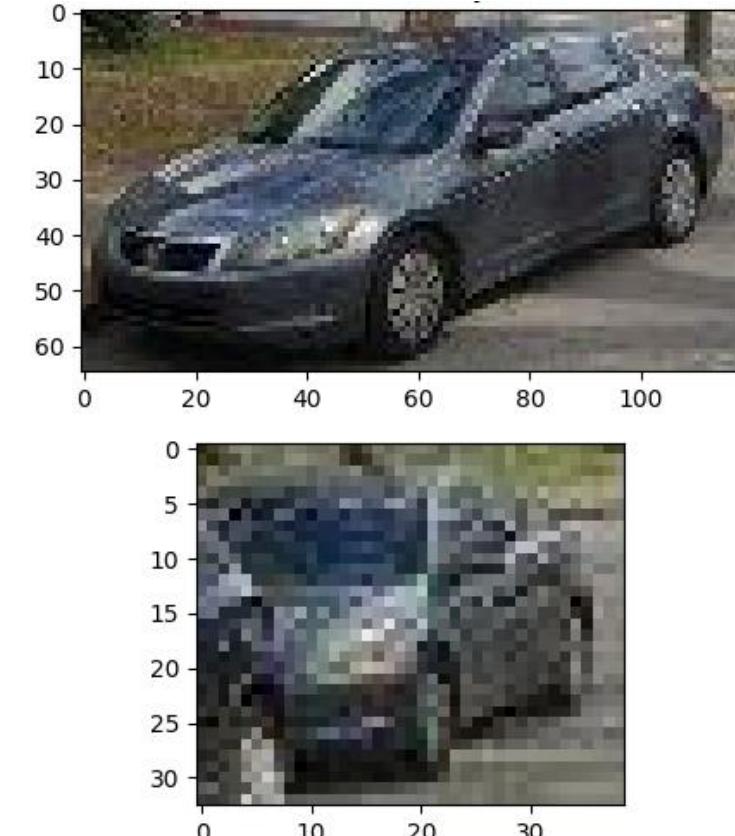
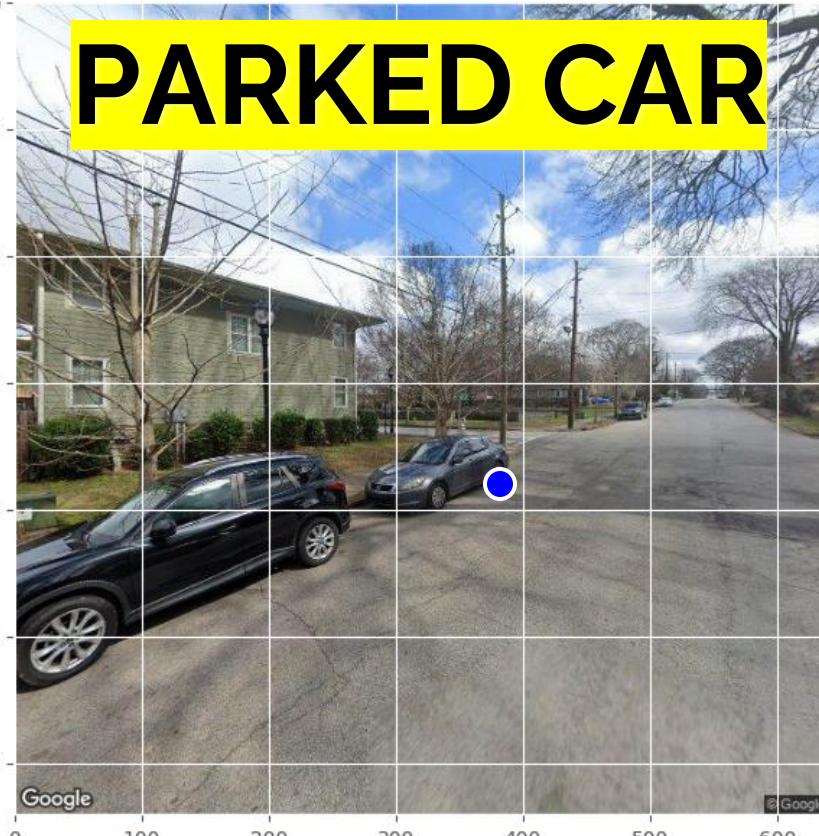
COSINE SIMILARITY:
0.74

MOVING CAR



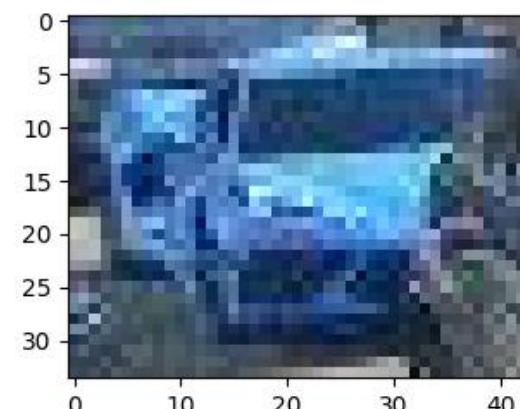
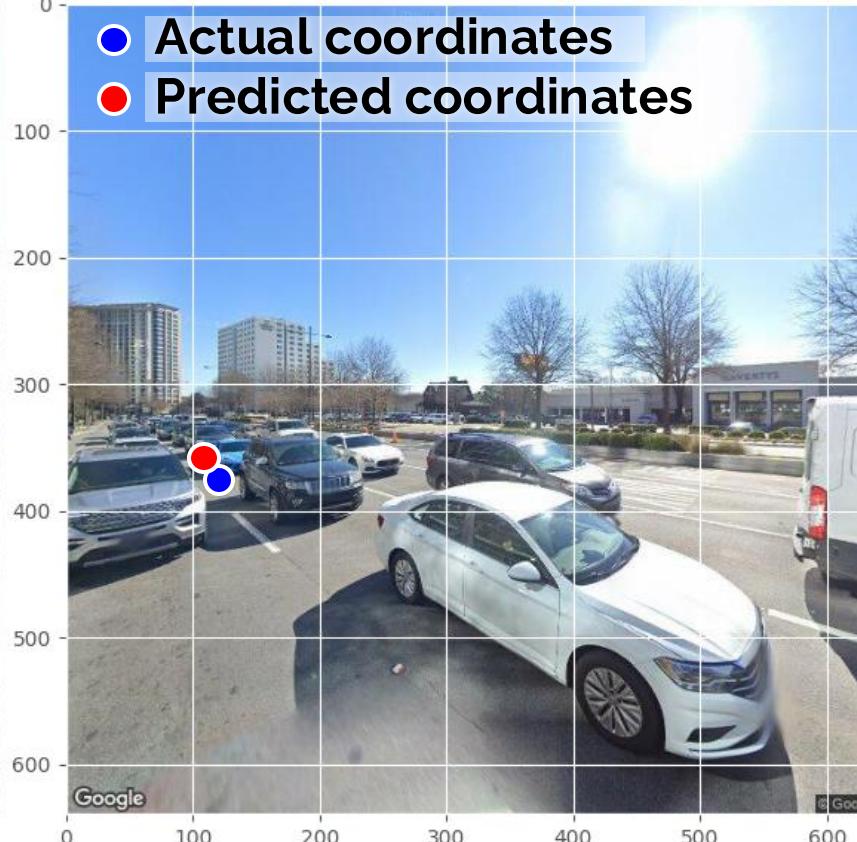
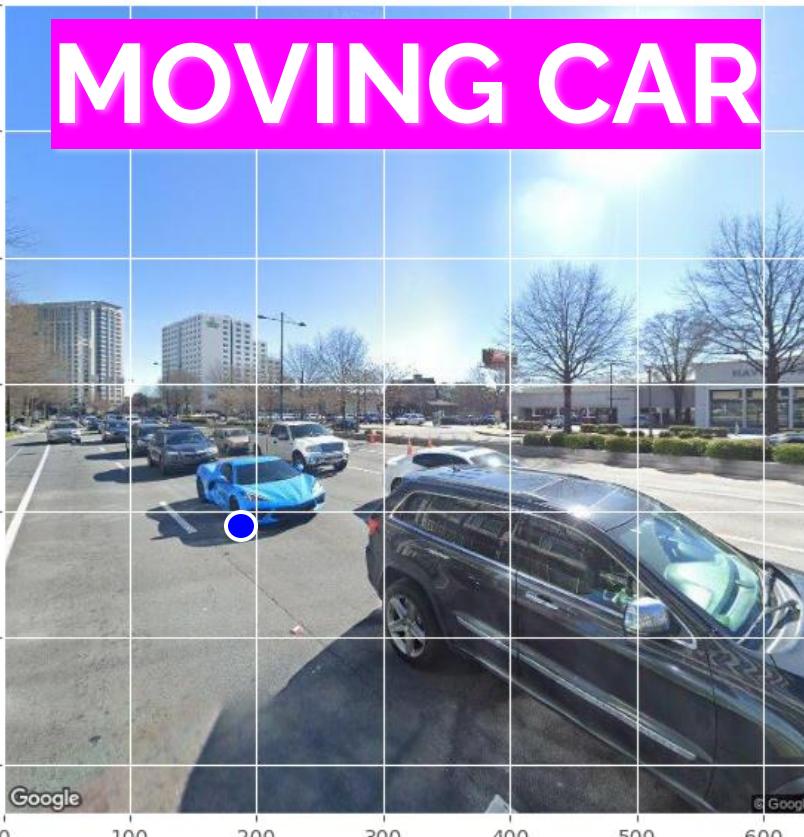
DEVIATION FROM PREDICTED COORDINATES:
7.78 meters

COSINE SIMILARITY:
0.56



DEVIATION FROM PREDICTED COORDINATES:
0.57 meters

COSINE SIMILARITY:
0.63



DEVIATION FROM PREDICTED COORDINATES:
4.02 meters

COSINE SIMILARITY:
0.64

STREETSCAPE AND CUSTOMER SATISFACTION

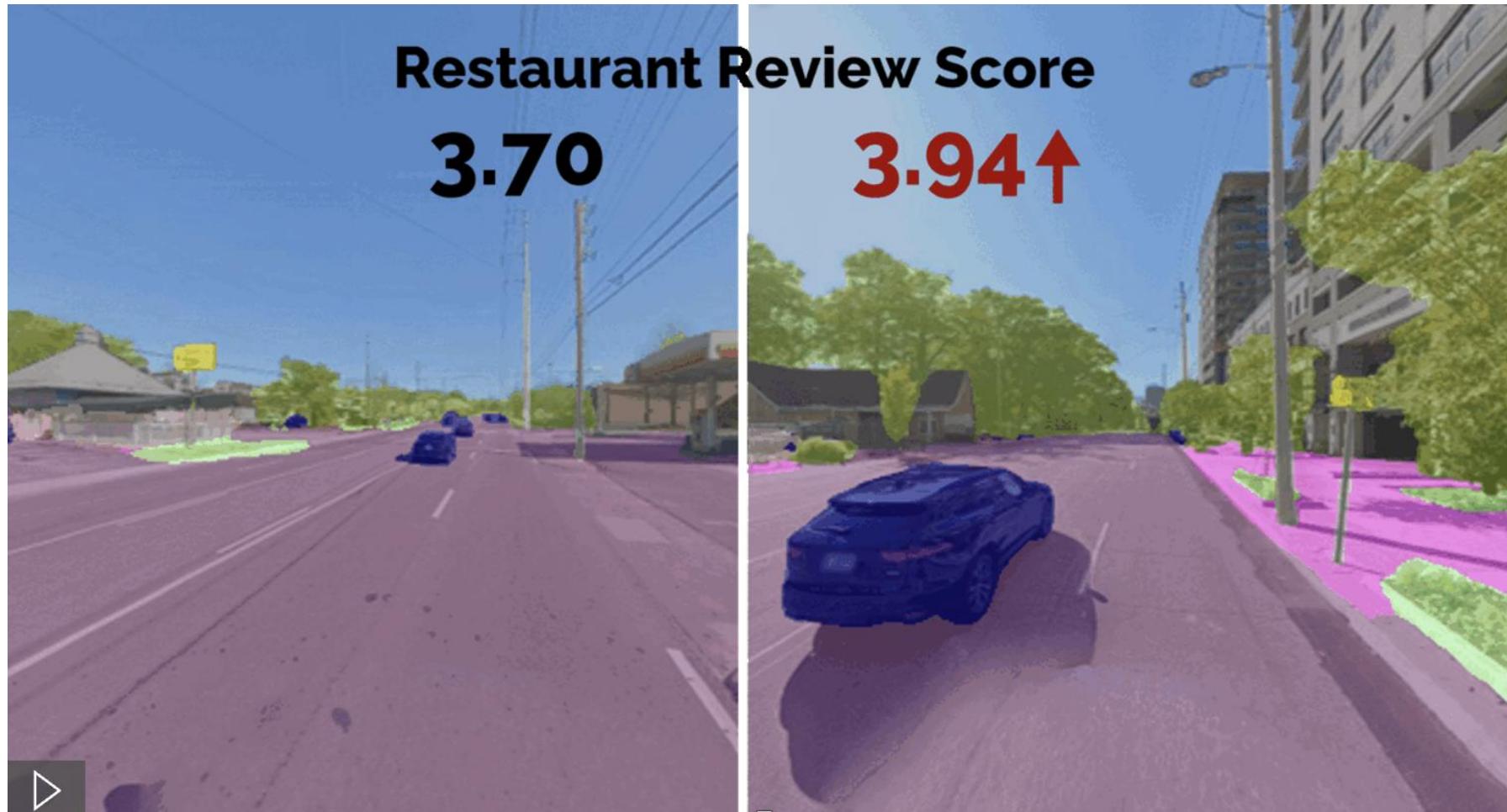
Streetscape and Customer Satisfaction

- Research question: “Can *walkable streetscapes* make *local businesses more attractive*? ”



Streetscape and Customer Satisfaction

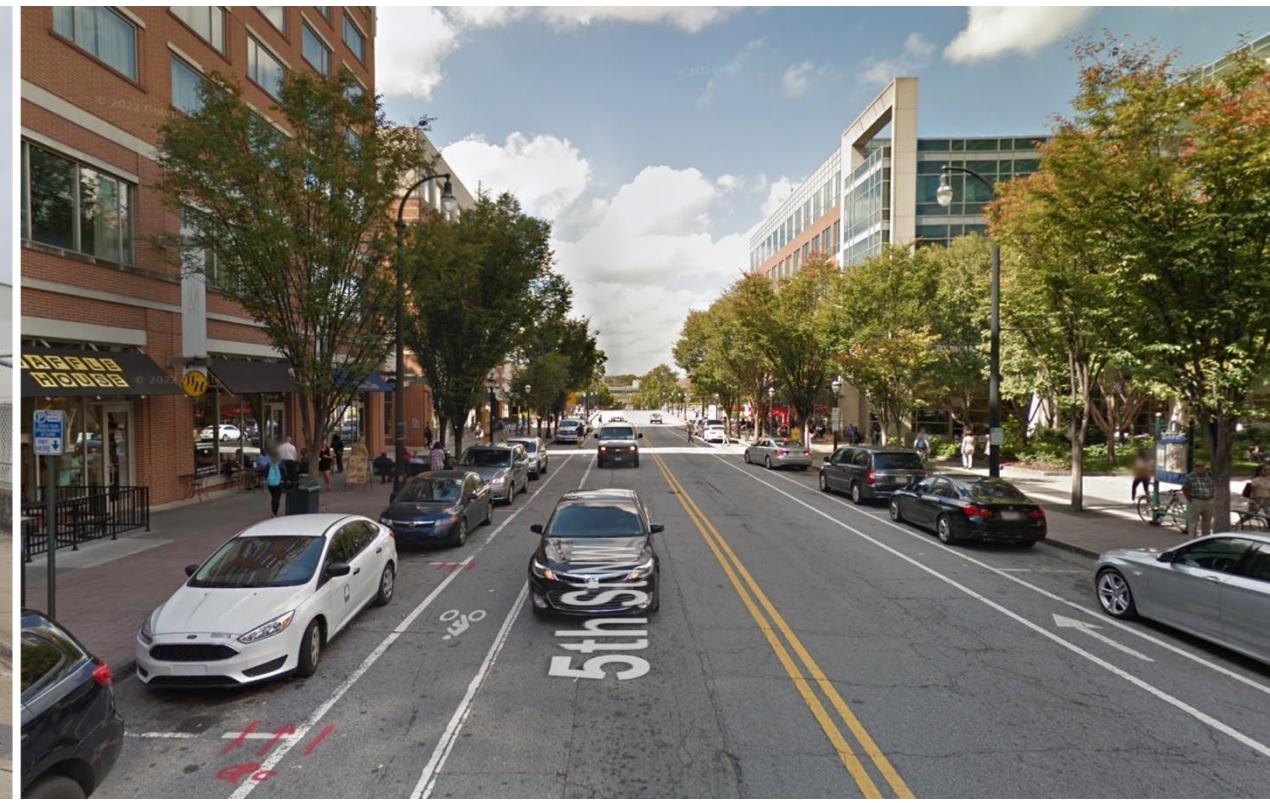
- Findings: ***Greenness***, ***building-to-street ratio***, and ***sidewalk buffer*** have a positive impact on customer satisfaction of nearby restaurants.



PERCEPTION OF STREETSCAPE AND BIKE LANES

Perception of Streetscape and Bike Lanes

- Research question: “Do bike lanes in low-income neighborhoods—which are often perceived as less safe—yield the same results as those in safer, more affluent neighborhoods?”

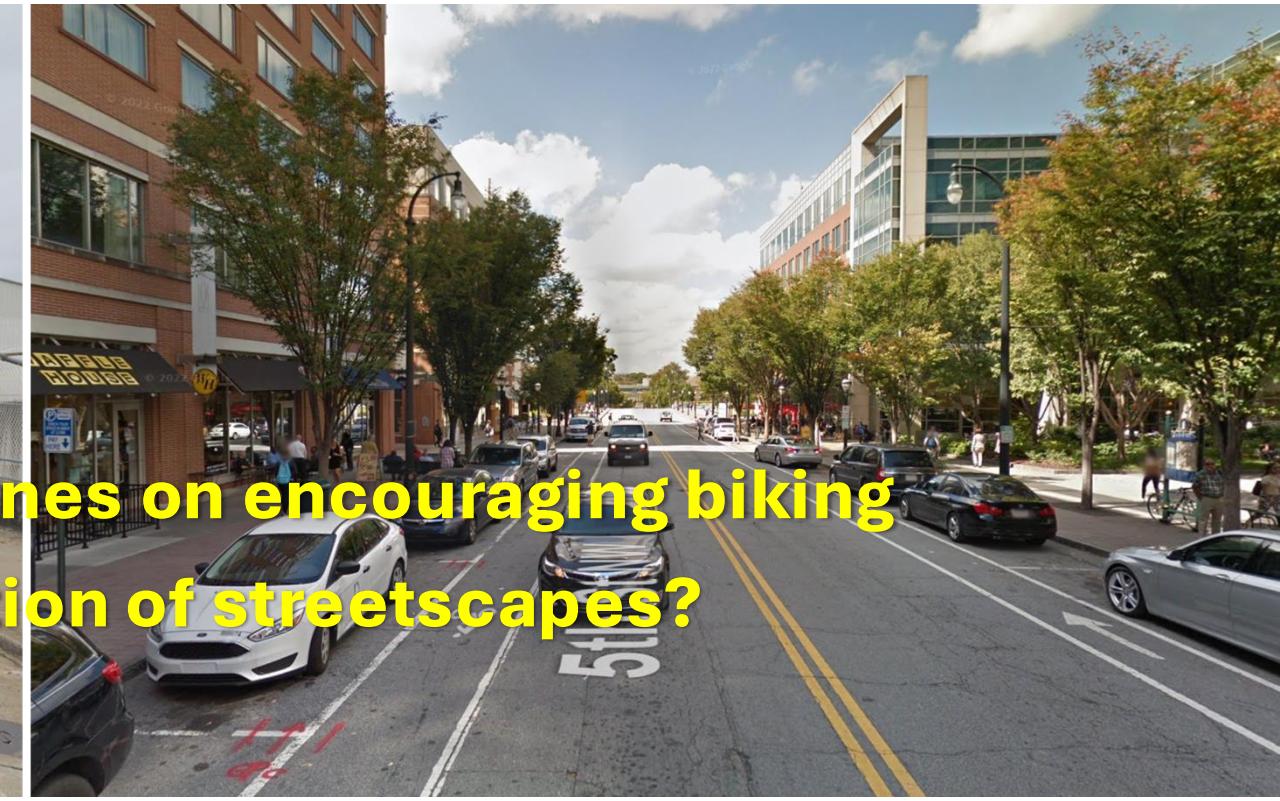


Perception of Streetscape and Bike Lanes

- Research question: “Do bike lanes in low-income neighborhoods—which are often perceived as less safe—yield the same results as those in safer, more affluent neighborhoods?”



Does the impact of bike lanes on encouraging biking differ by the perception of streetscapes?



Perceived Safety

Which place looks safer?



How Do We Teach “Perceptions” to a Computer?



SUBJECTIVE

*“This place looks
dangerous.”*

INTERSUBJECTIVE

***“Most people would agree that
this place looks dangerous.”***

OBJECTIVE

Dataset: Place Pulse 2.0

- Online crowdsourced survey dataset on the perceptual attributes of street view images.

Which place looks **safer** ?



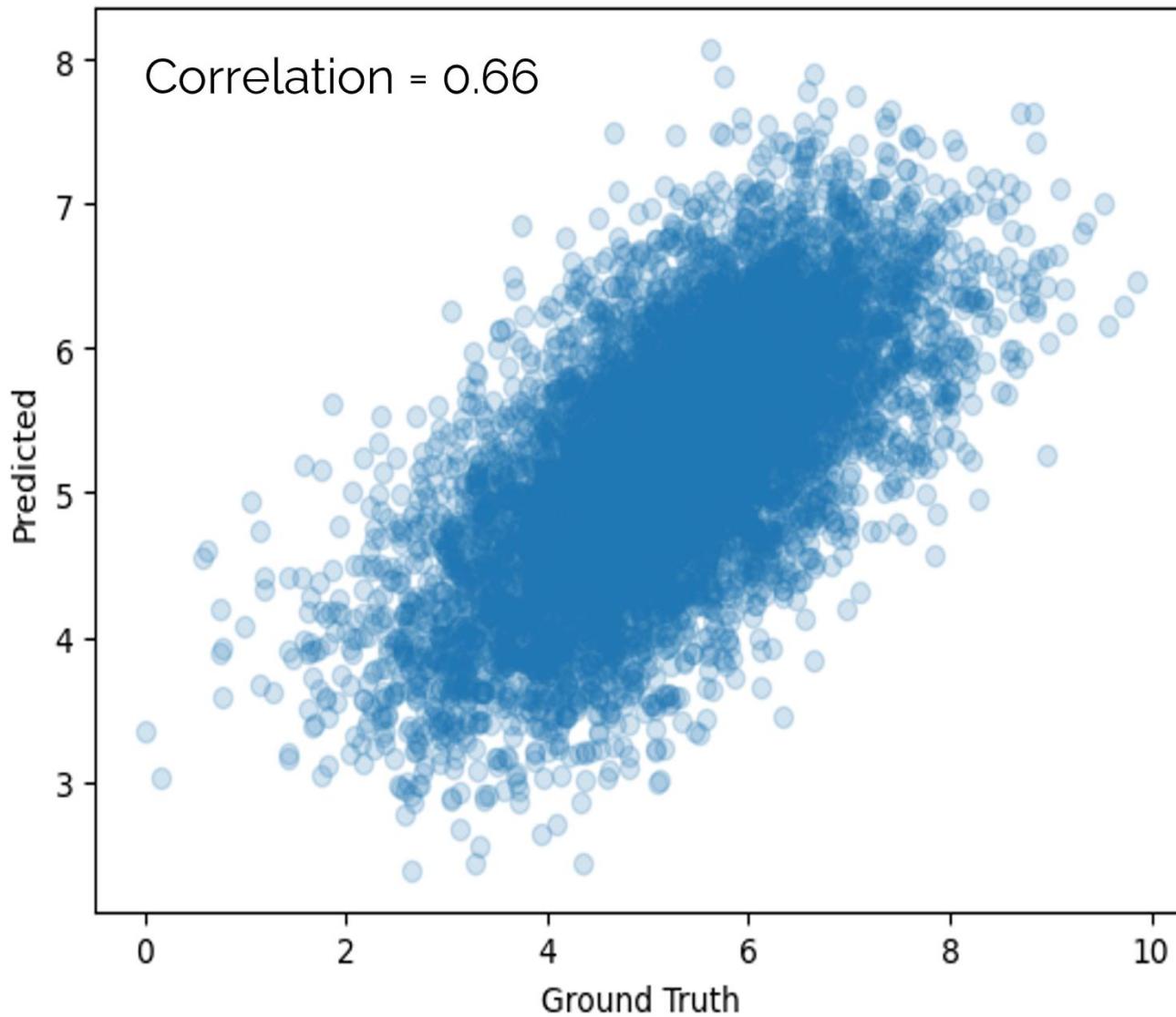
For this question: 477,898 clicks collected Goal: 500,000 clicks

[SEE REAL-TIME RANKINGS](#)

RANK	CITY	CLICKS	TREND	RANK	CITY	CLICKS	TREND
1	Washington DC	8298		54	Gaborone	6111	
2	Toronto	28619		55	Rio De Janeiro	32480	
3	Minneapolis	7162		56	Belo Horizonte	17103	

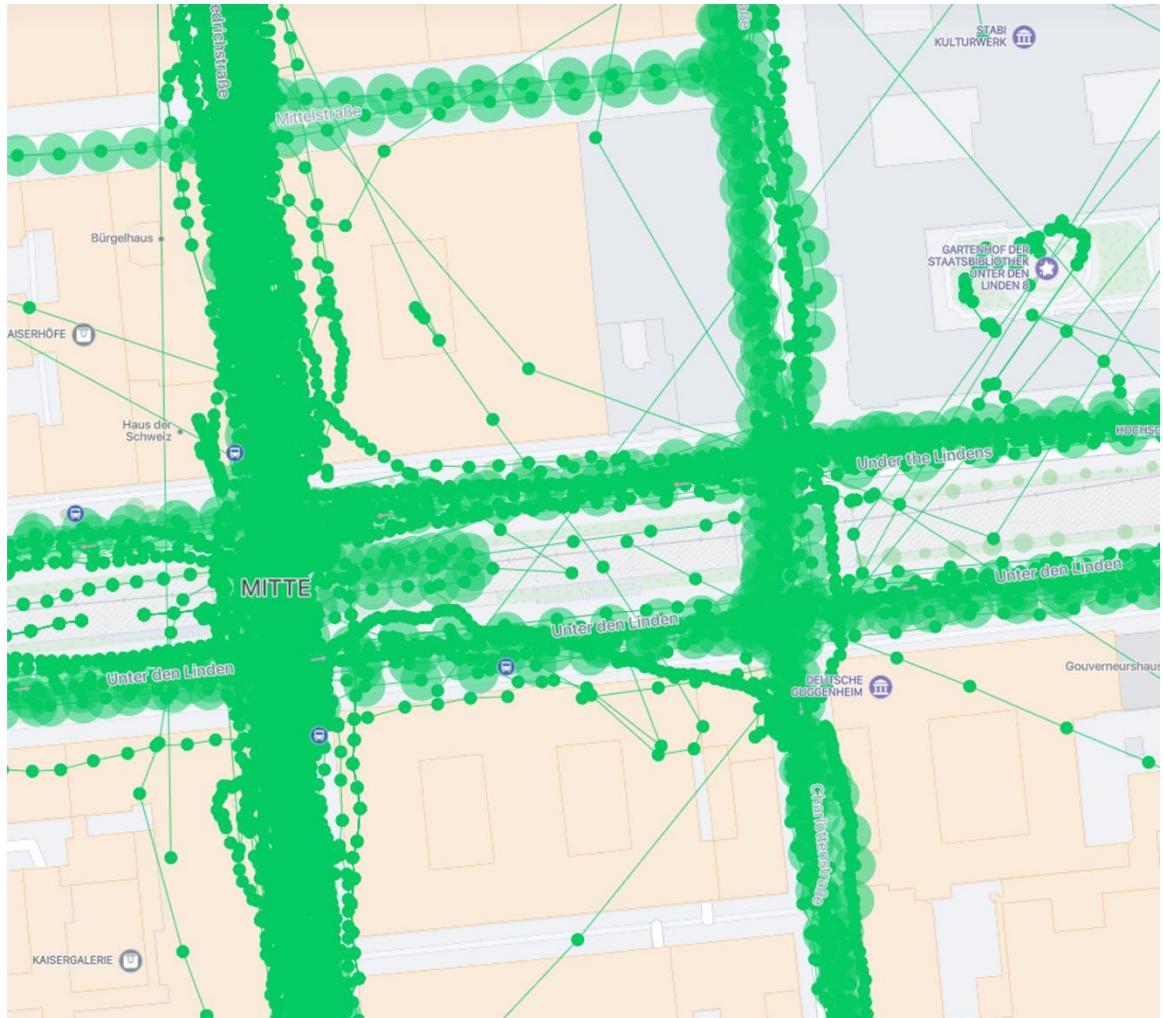
© 2014 Macro Connections | MIT Media Lab Admin Login [Comments / Questions? Contact us!](#)

Training Result

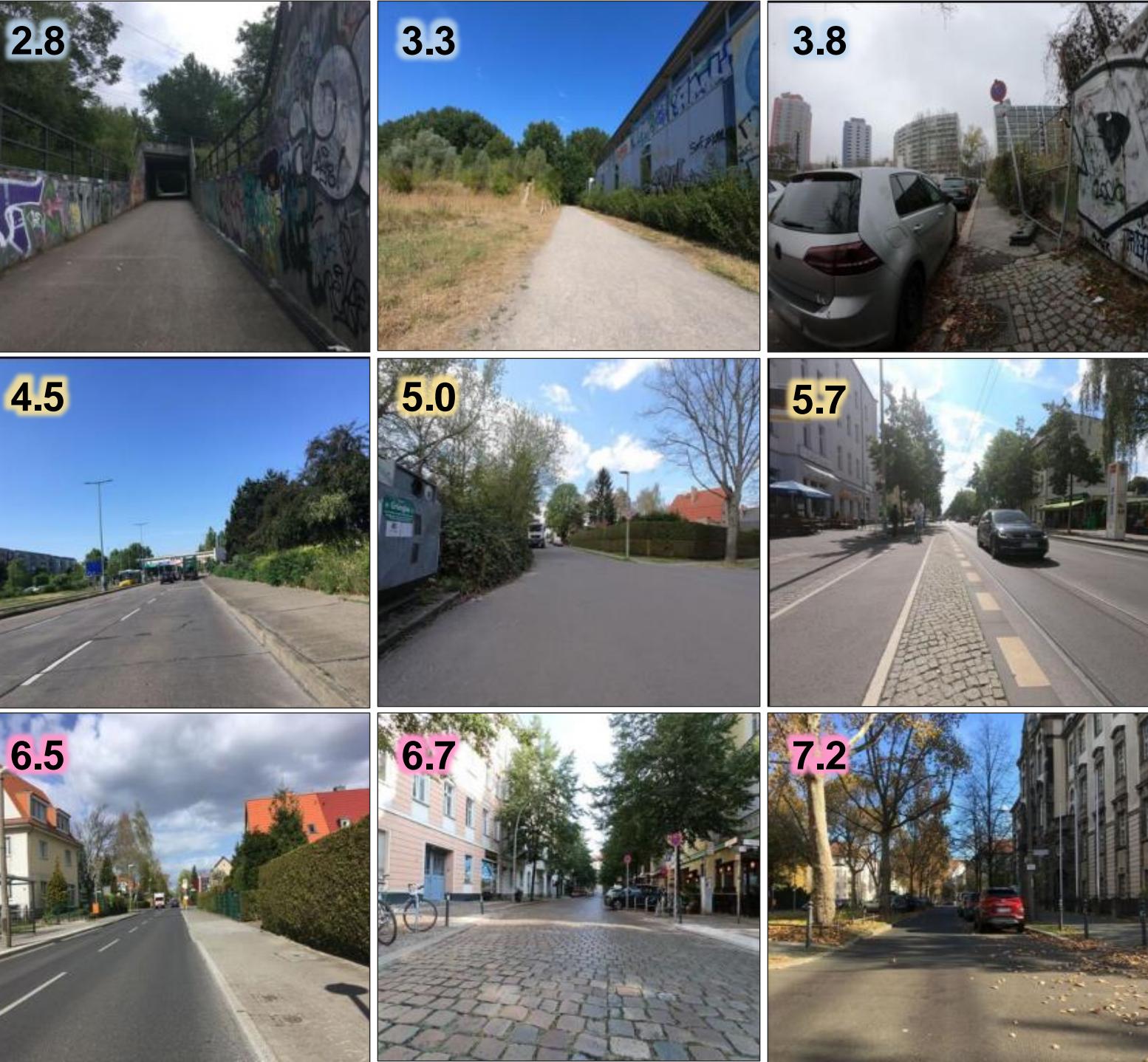


Prediction

- I applied the trained model to 380,000 Mapillary street view images in Berlin, Germany.

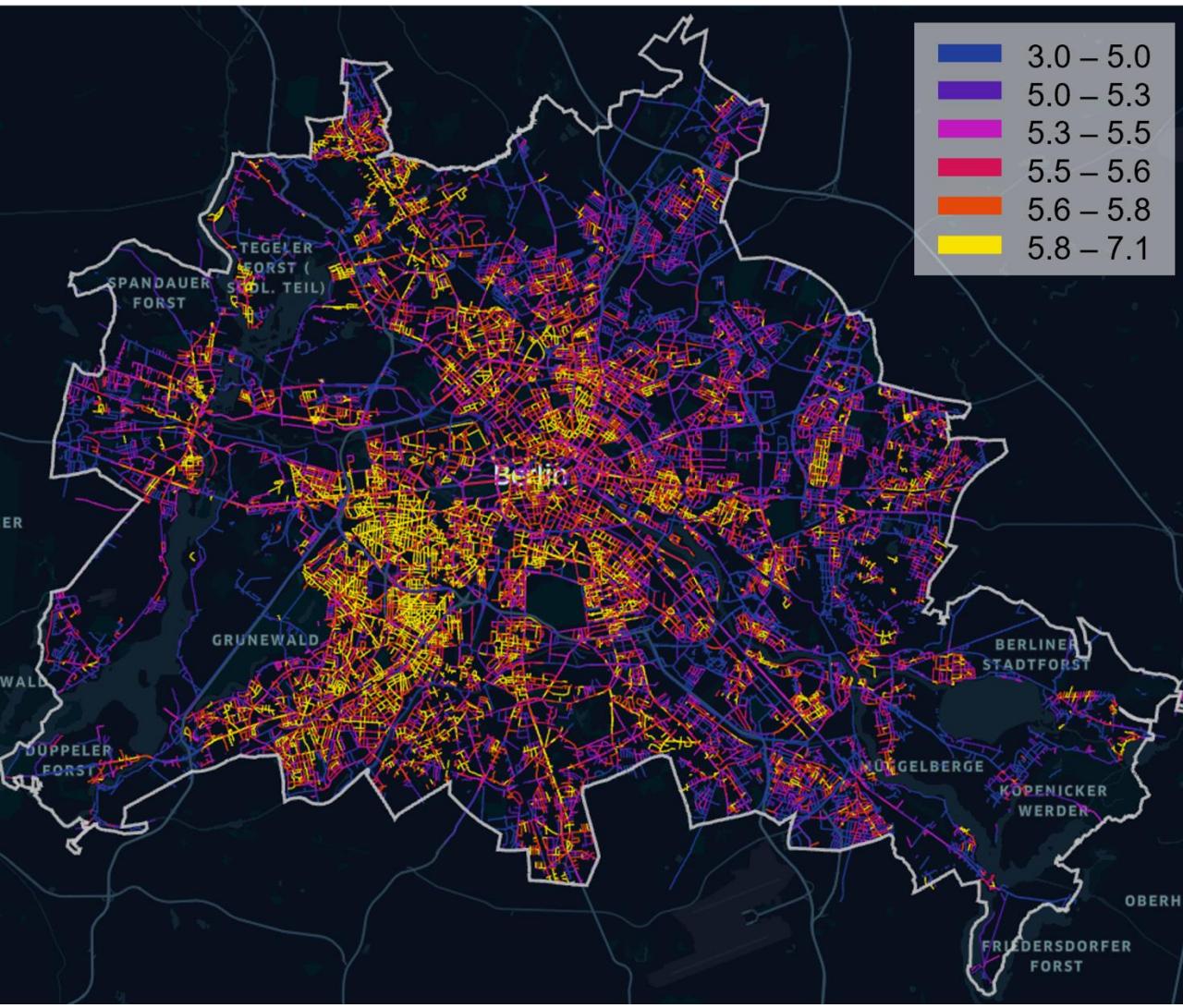


Prediction Result

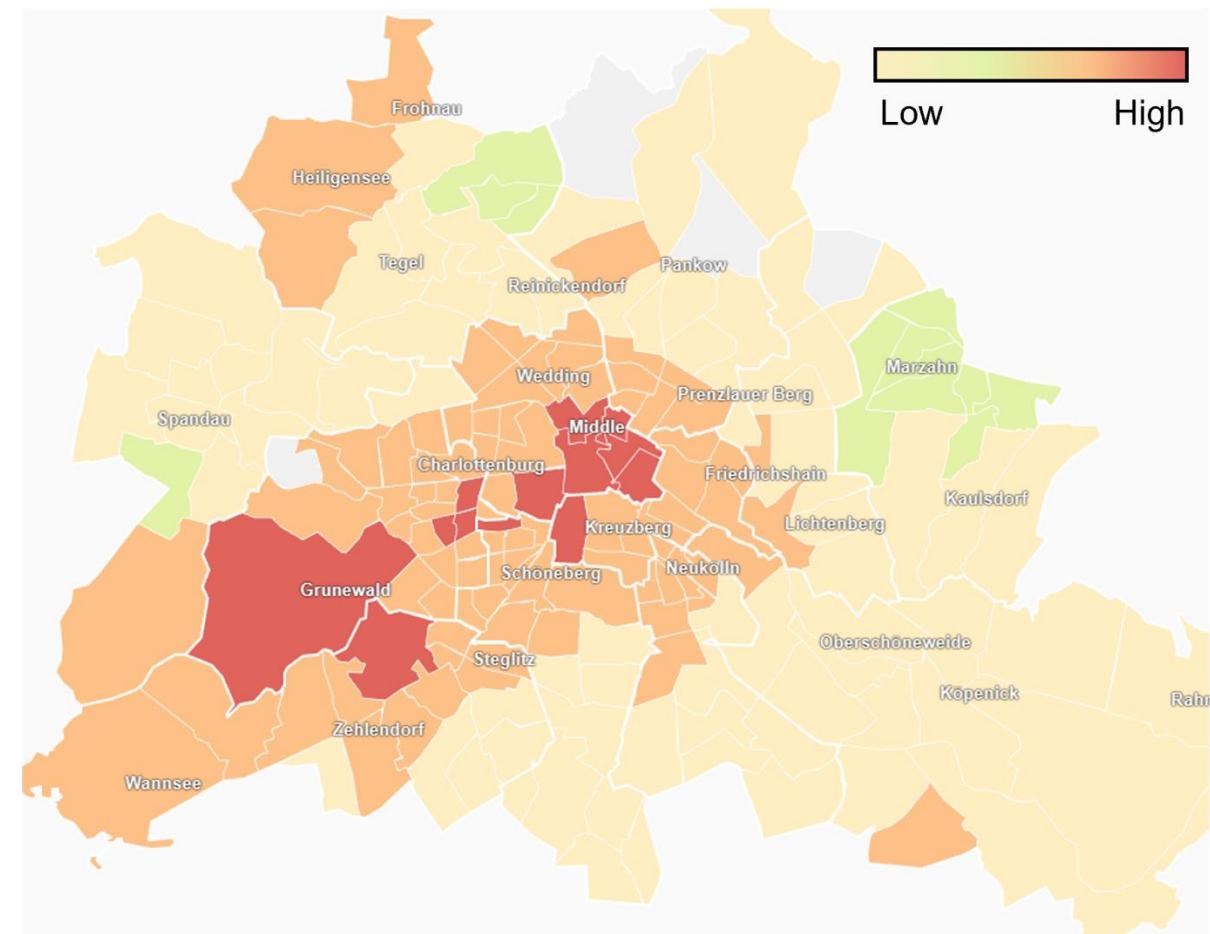


Prediction Result

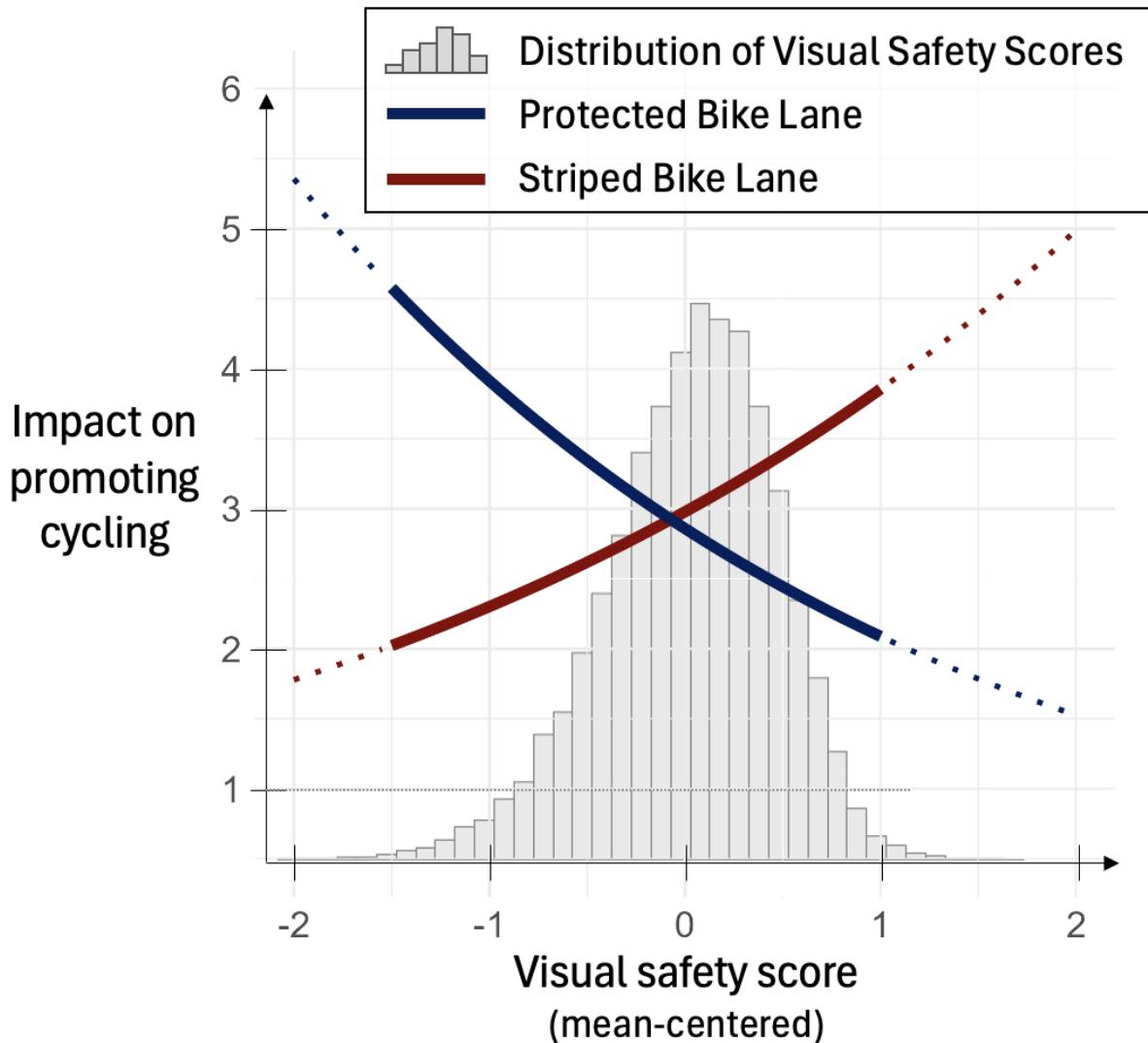
Visual Safety Score



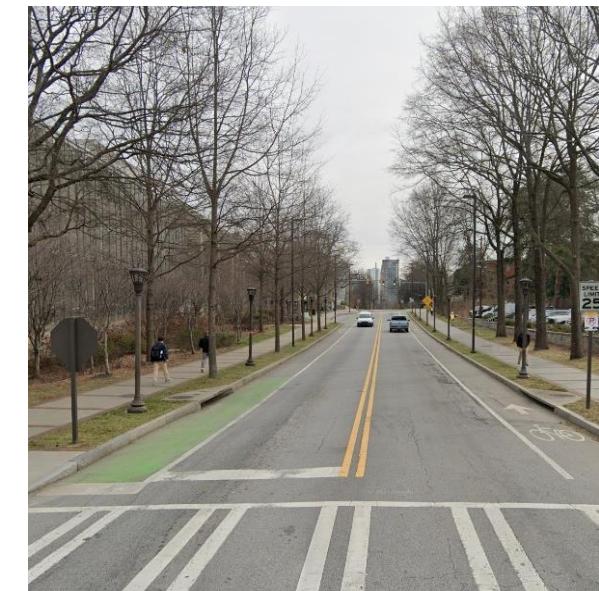
Housing Cost



Regression Model Result



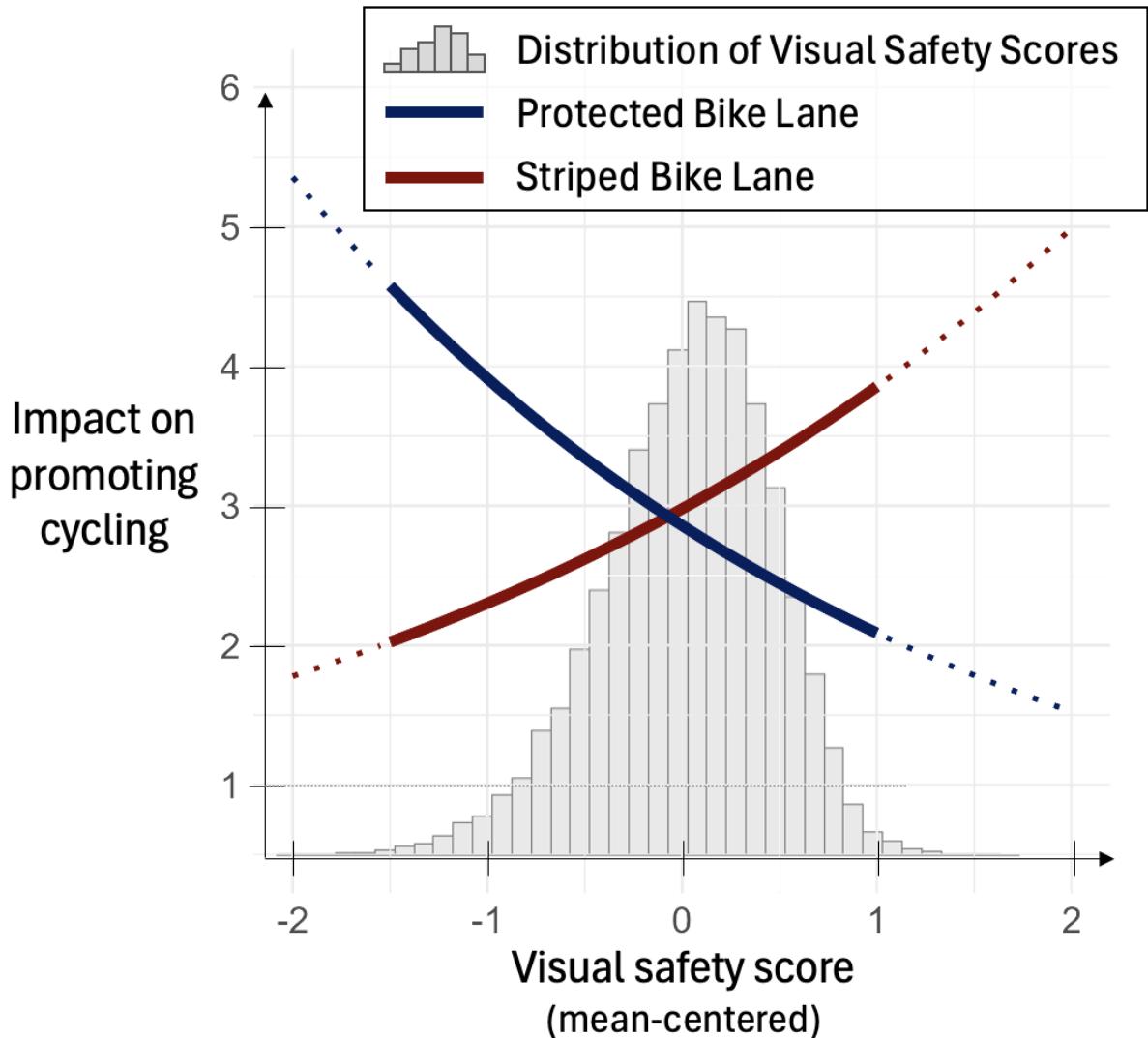
Striped bike lane



Protected bike lane



Regression Model Result



Findings

- Both types of bike lanes encourage cycling.
- Striped bike lanes tend to be more effective on streets that appear safe
=> **a synergistic effect exists between striped bike lanes and the visual safety of streets.**
- Protected bike lanes are more effective on streets that appear unsafe
=> **protected bike lanes are invaluable assets for communities perceived as less safe.**

CONVERTING STREET VIEW IMAGES TO AN AERIAL IMAGE

Street View Images to Aerial Image

- Aerial images are often unsuitable for examining road infrastructure.

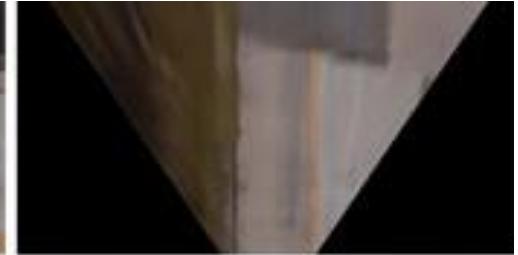


Street View Images to Aerial Image

- "If I have street view images from four directions and transform somehow, I may be able to recreate aerial image?"



Inverse Perspective Transformation



Result

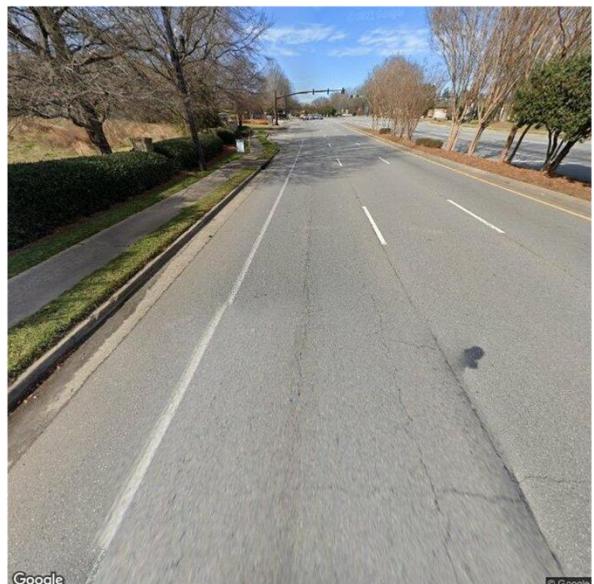
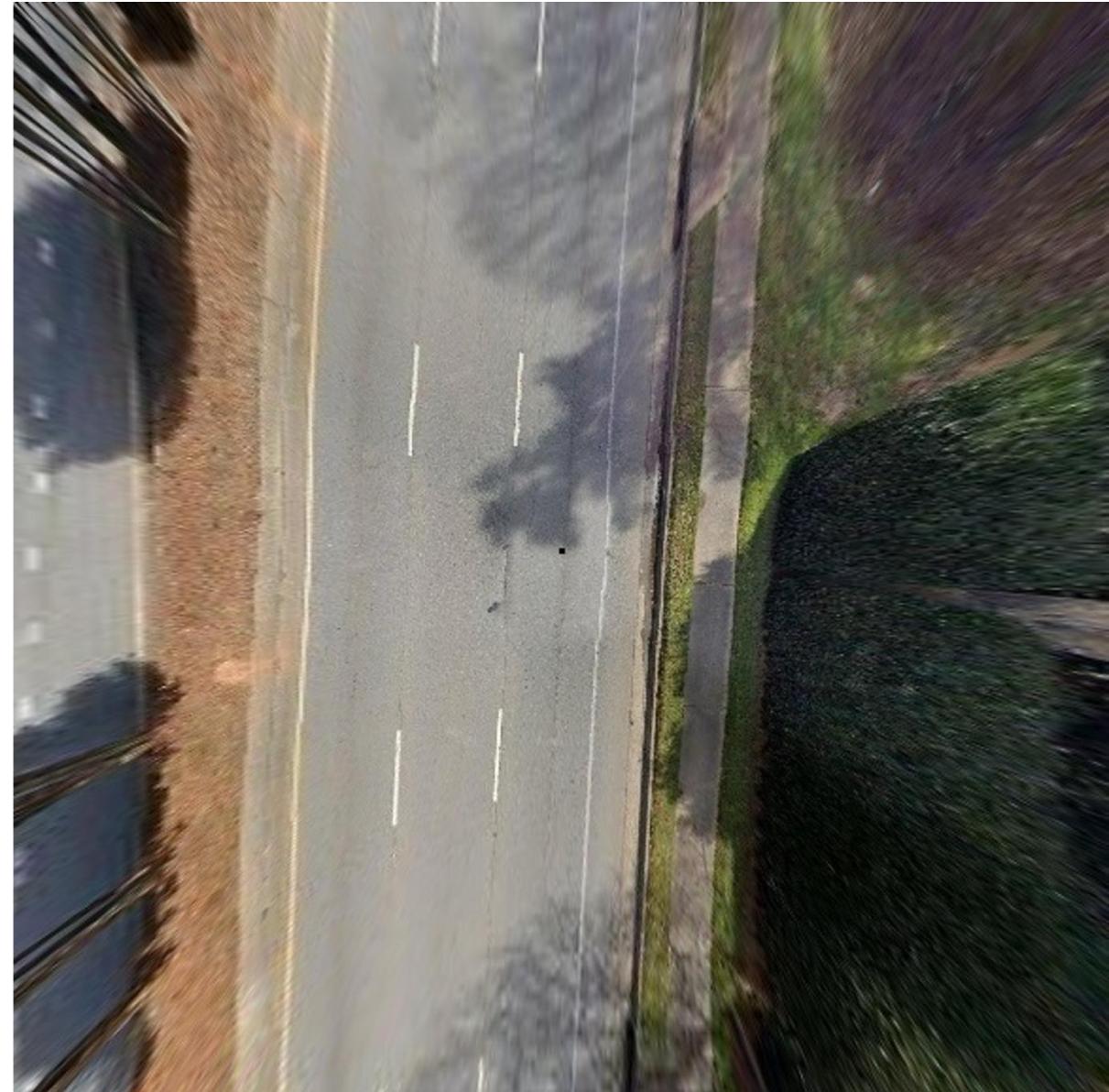
Aerial image



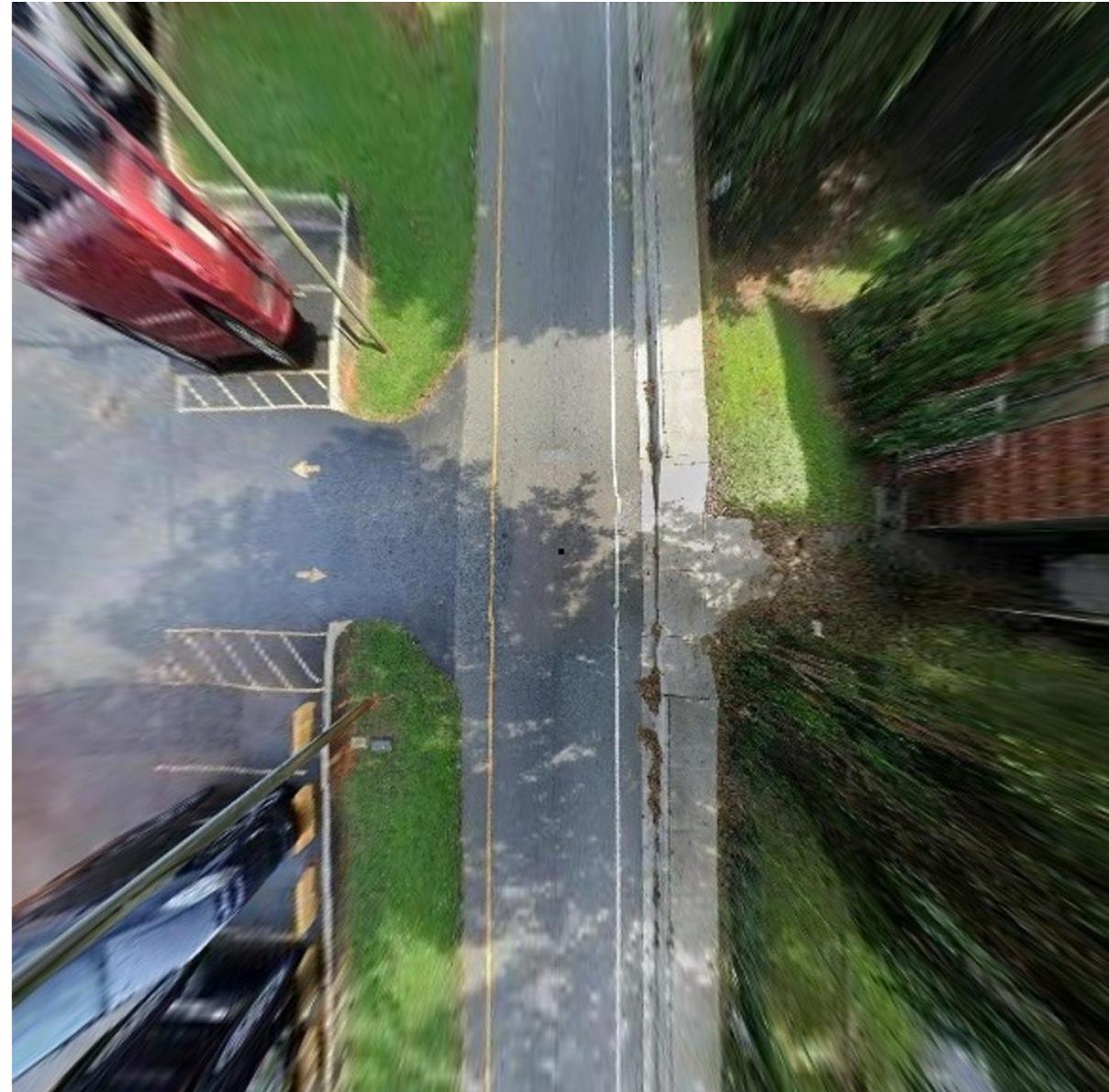
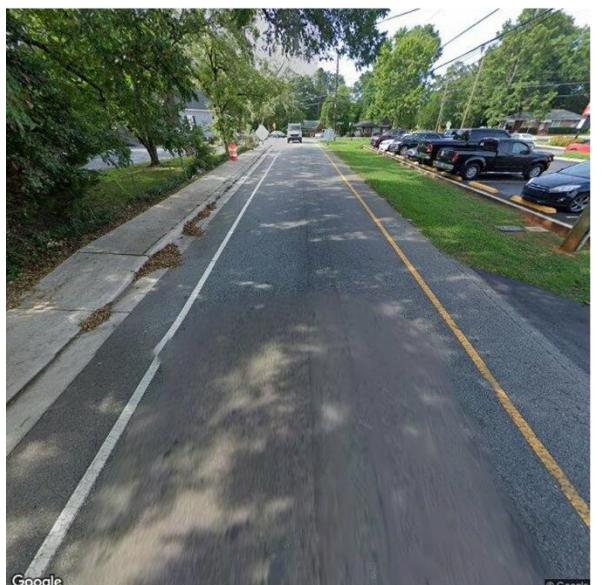
Street view image



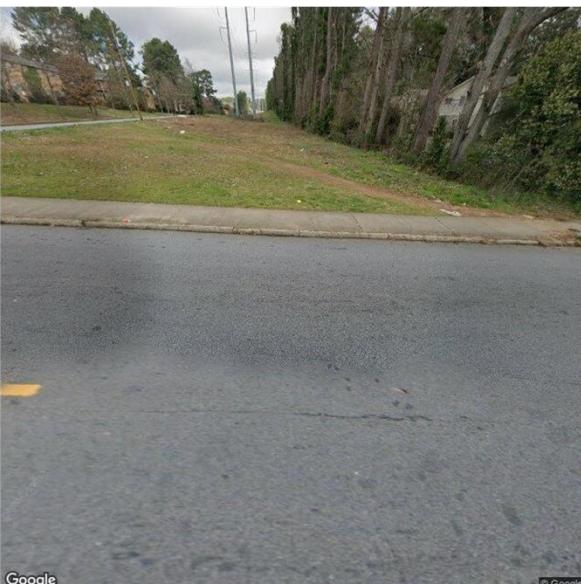
Examples of Recreated Aerial Image



Examples of Recreated Aerial Image



Examples of Recreated Aerial Image



Make Sure Your Google API Key is Ready by Monday!

- Follow the instruction [here](#) to get your Google API key.
- Once you complete getting the key, I highly recommend setting up a budget alert (Billing --> Budgets & alerts --> create budget).
- Add your Google API key to the system environment variable.
 - You can follow the same steps we did for the Census and Yelp API keys.
 - If you are using Docker, you will need to create a new container.