

Monday, March 24 at 1:00 PM

Detecting Cool Roofs in New York City Using Image Segmentation

Presented by:

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Mentor:

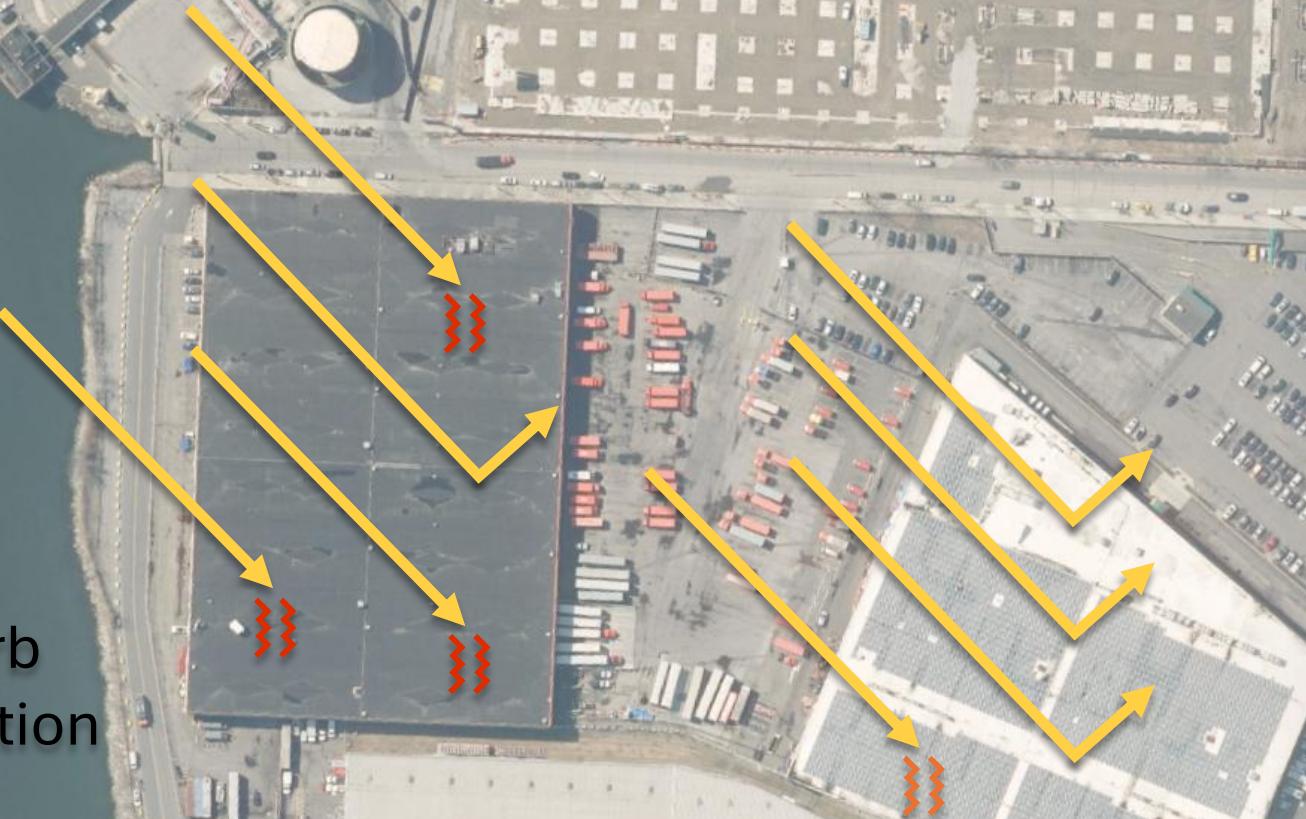
Maddalena Romano

Visit open-data.nyc to view the full program.





Roofs with low reflectivity absorb more solar radiation

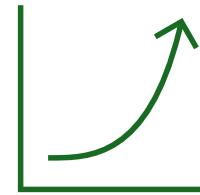


Cool roofs, or roofs with high reflectivity, reflect more solar radiation than they absorb

Project Goals



Classify rooftop reflectivity using
machine learning



Quantify the change in reflectivity
and associated energy savings

Data Sources

2022 Orthoimagery
Building Footprints

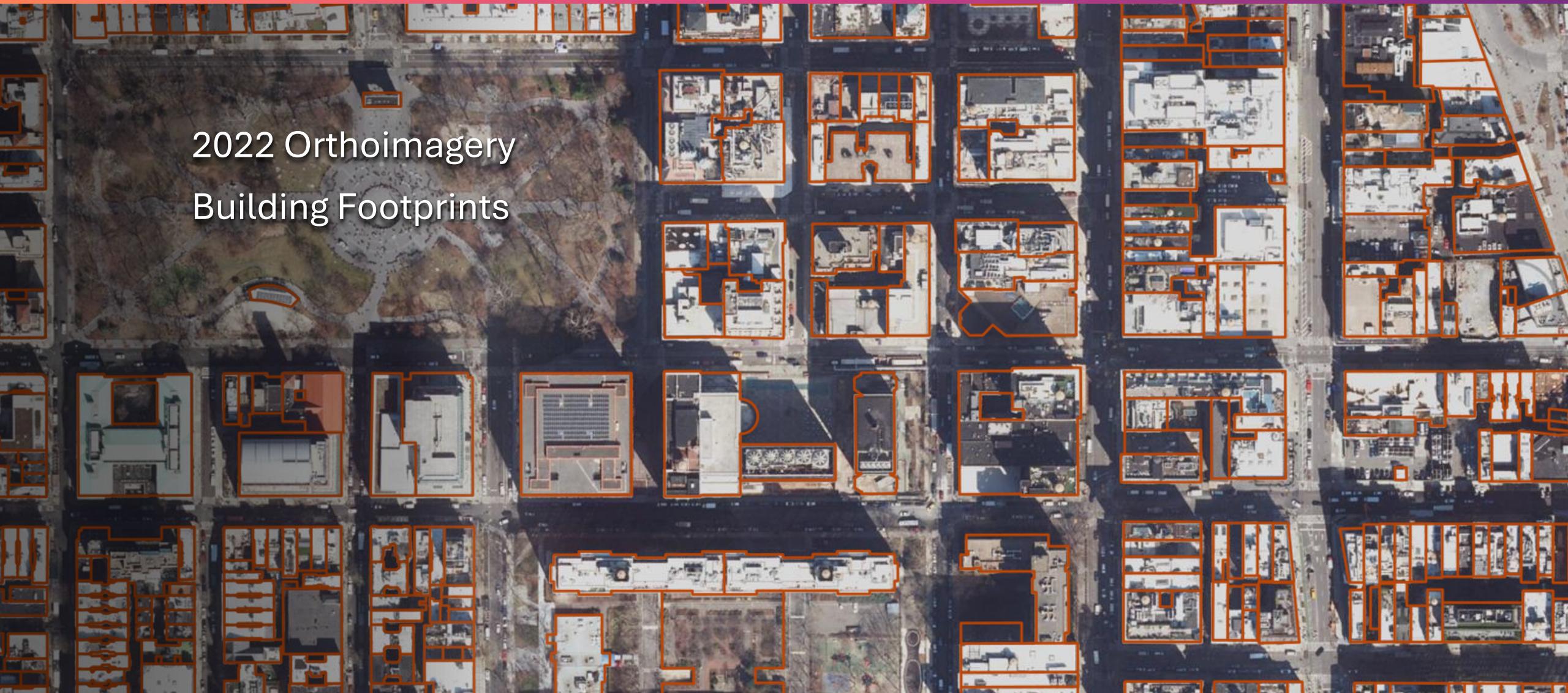


Image Segmentation

- Identifies and segments individual occurrences of an object
- Outputs a mask, bounding box, and label for every prediction



Input



Output

Warm roof
Cool roof

Comparing Datasets



Tech Used



- rasterio
- pyshp
- shapely
- pyyaml
- geopandas



ArcGIS Pro

Methodology



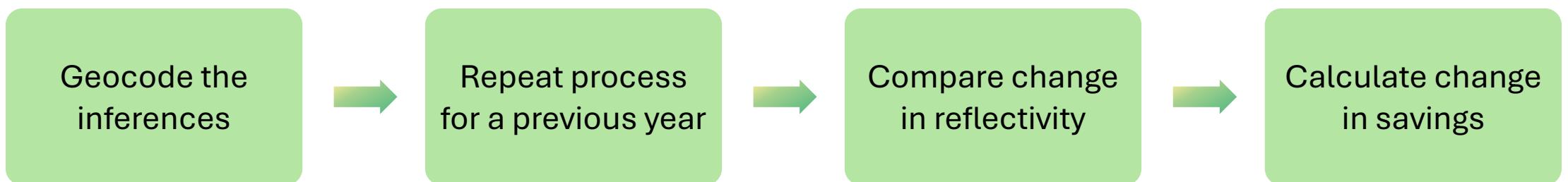
Classify reflectivity



Methodology



Quantify changes

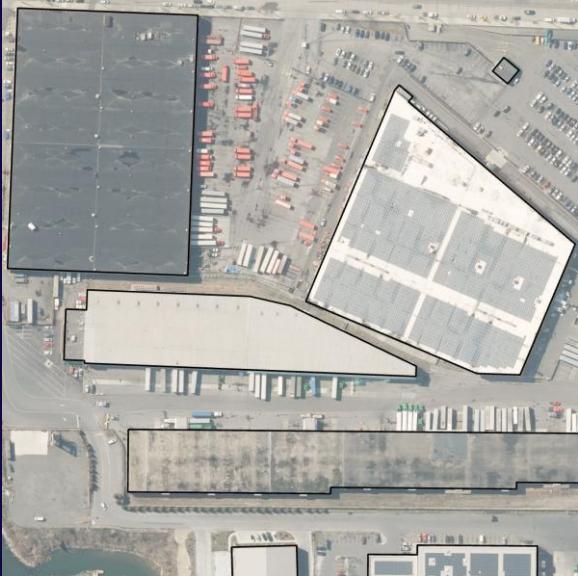


Demonstration

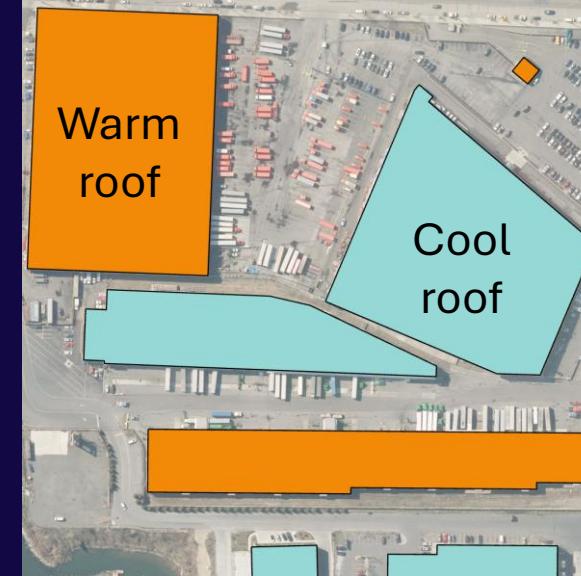
Follow along using the QR code or link:



github.com/johnhocknell/cool_roofs_detection



Calculate reflectivity
and classify roofs



Custom training dataset



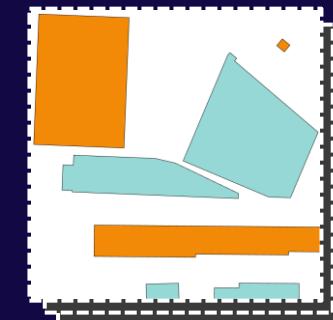
Images



img1.jpg, img2.jpg...



Labels



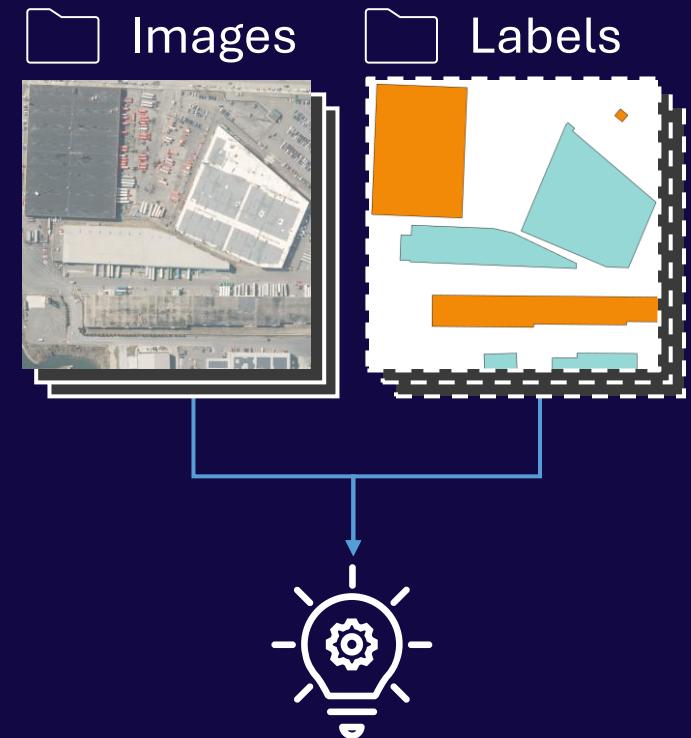
img1.txt, img2.txt...

```
from ultralytics import YOLO

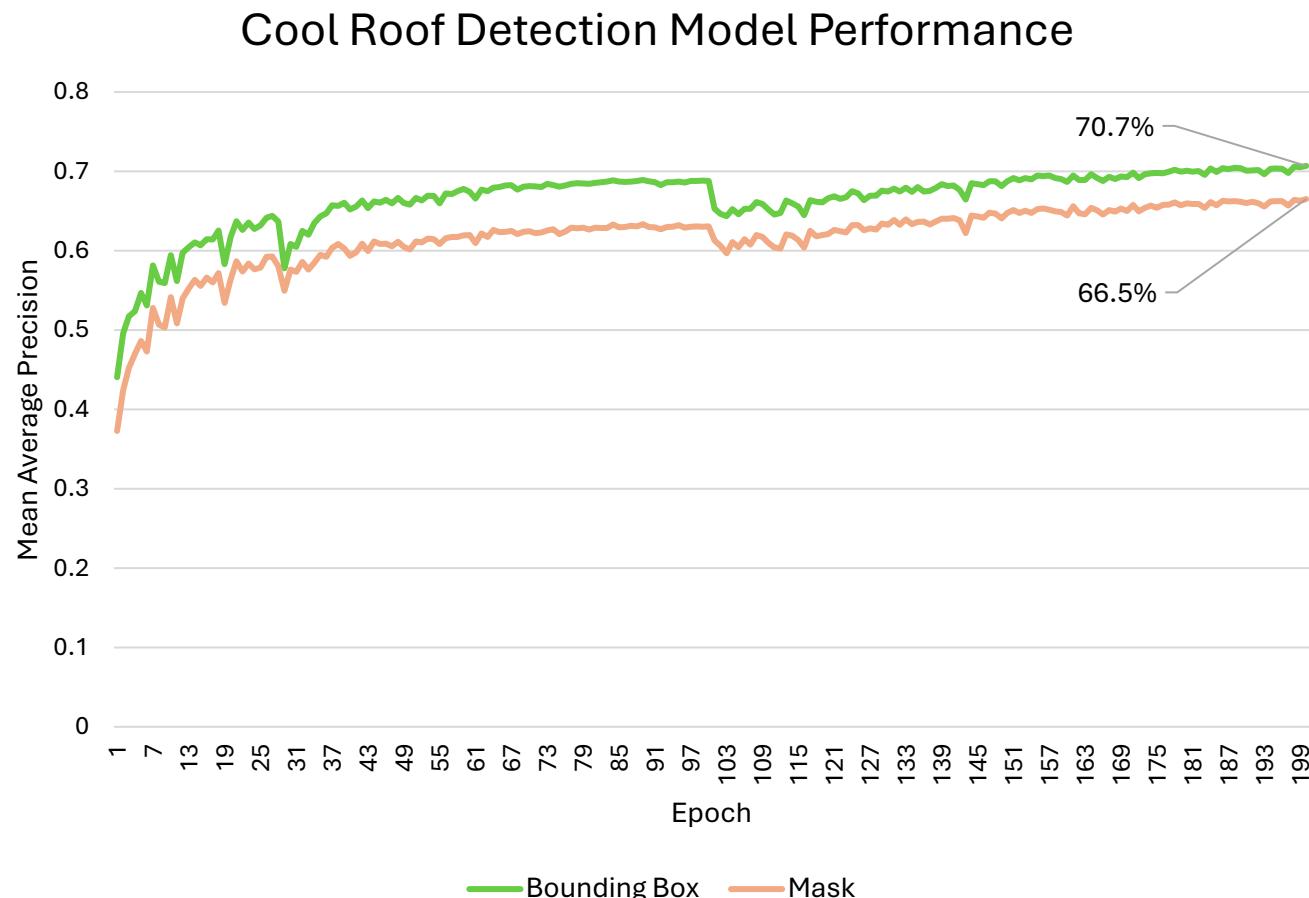
# Load a pre-trained YOLO image segmentation model
model = YOLO("yolo11n-seg.pt")

# Train the model using the custom dataset
results = model.train(data="path/to/custom_dataset")

# Use the trained model to predict rooftops on images
results = model("path/to/image")
```



Model Results

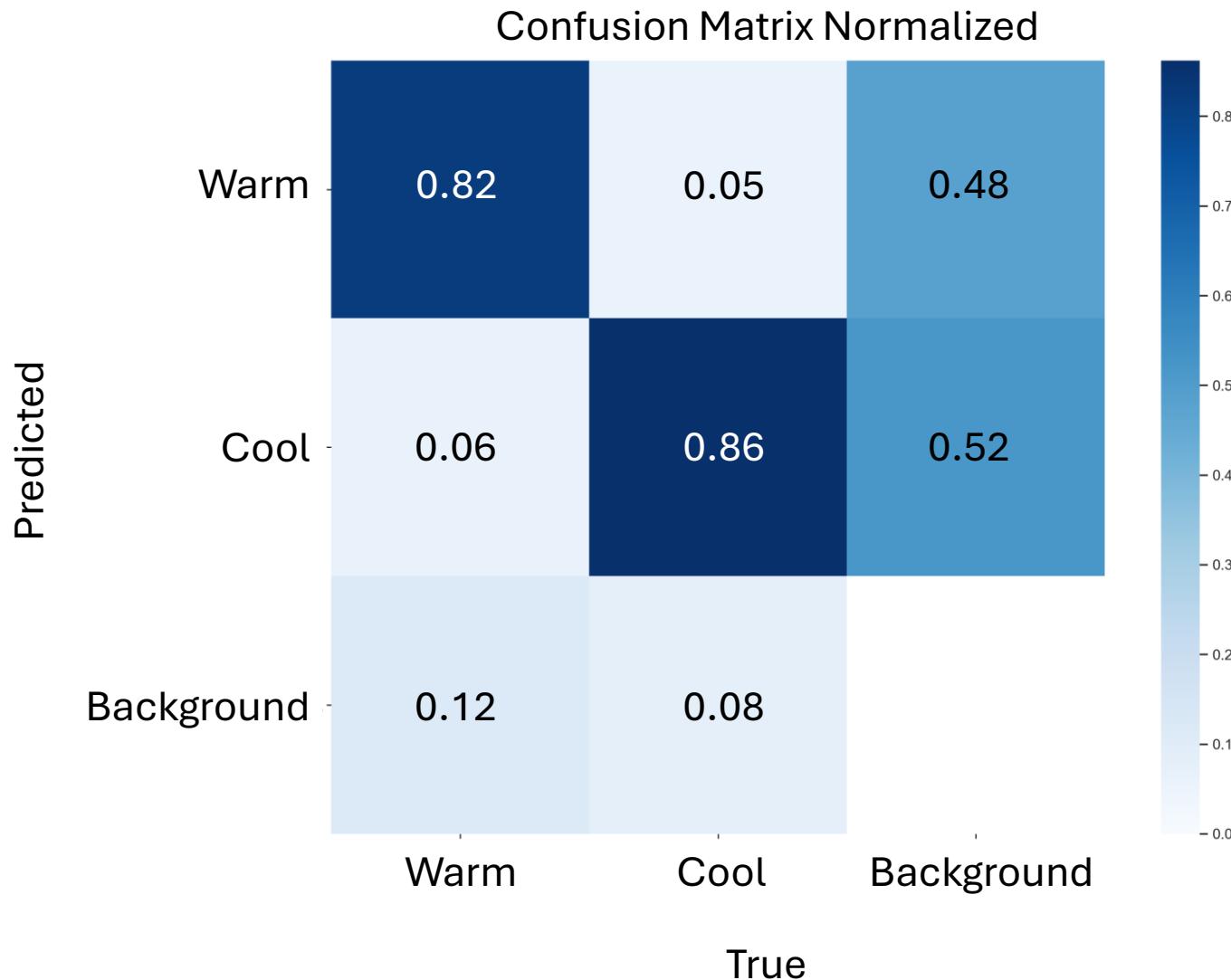


Bounding box predictions and confidence scores classified by roof type



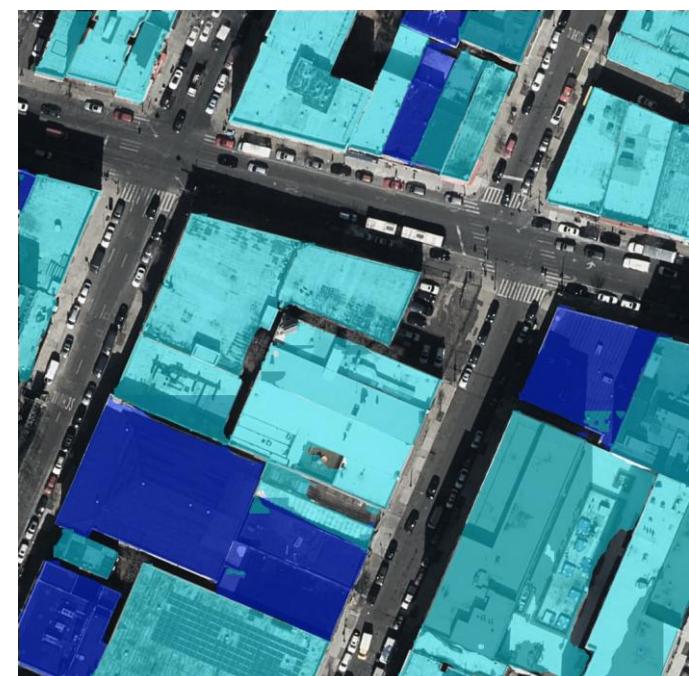
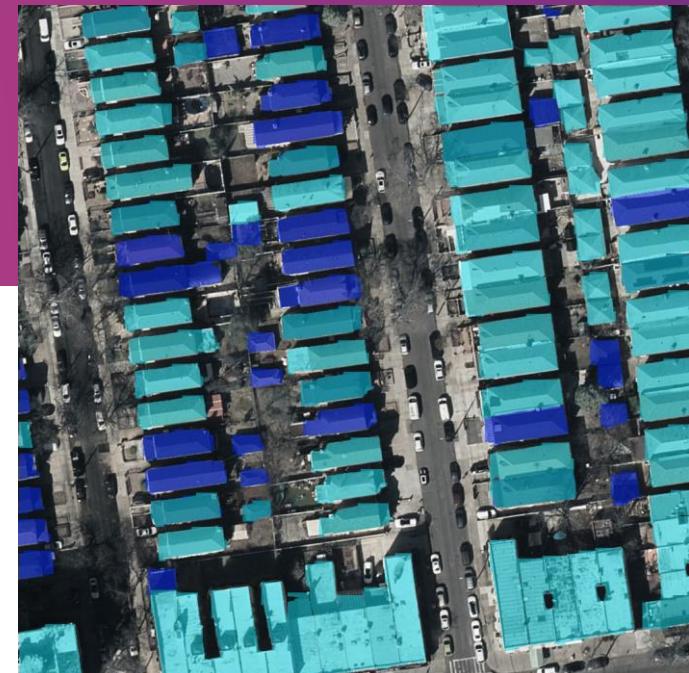
Mask predictions classified by roof type

Model Results



Model Results

- Performs best on small to medium-sized rooftops
- Performs well on irregularly shaped buildings
- Struggles to accurately mask underrepresented roof types from:
 - Large buildings
 - Warehouses
 - Airports



Model Uses

- Detecting cool and warm rooftops
- Identifying buildings not mapped or mismatches with orthoimagery
- Can be applied to any orthoimage with the same specifications

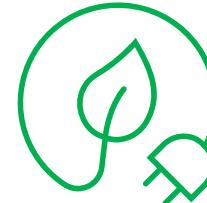
Next Steps



Improving the model

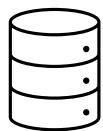


Quantifying changes
in reflectivity



Translating this into
energy savings

References



[Building Footprints - Office of Technology and Innovation \(OTI\) - NYC OpenData](#)

[Orthoimagery - Discover GIS Data NY](#)

[NYC CoolRoofs Program Participants - NYC Emergency Management](#)

[Ultralytics YOLOv11 Segmentation](#)



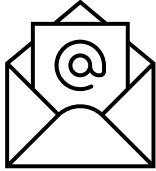
[Cool Roofs in a Warm City - Hunter College and NYC Mayor's Office of Climate & Environmental Justice](#)

[NYC Cool Roofs Dashboard - Hunter College and NYC Mayor's Office of Climate & Environmental Justice](#)

[NYC CoolRoofs - NYC Business](#)

[Ban-Weiss, G. A., Woods, J., & Levinson, R. \(2015\). Using remote sensing to quantify albedo of roofs in seven California cities, Part 1: Methods. *Solar Energy*, 115, 777–790.](#)

Thank you!



Contact me at:

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Check out the repository for this project using the QR code or at:
github.com/johnhocknell/cool_roofs_detection

Thank you for
participating in
Open Data Week!

Join us at more events through
Sunday, March 30. View the
program at open-data.nyc.

