1636166: Identifying Manufactured Home Communities in North Carolina using Computer Vision and High-Resolution Aerial Imagery for Climate Resilience Planning

UNC COLLEGE OF ARTS AND SCIENCES
City and Regional Planning

Kshitiz Khanal, Nikhil Kaza, Miyuki Hino, Antonia Sebastian
University of North Carolina at Chapel Hill

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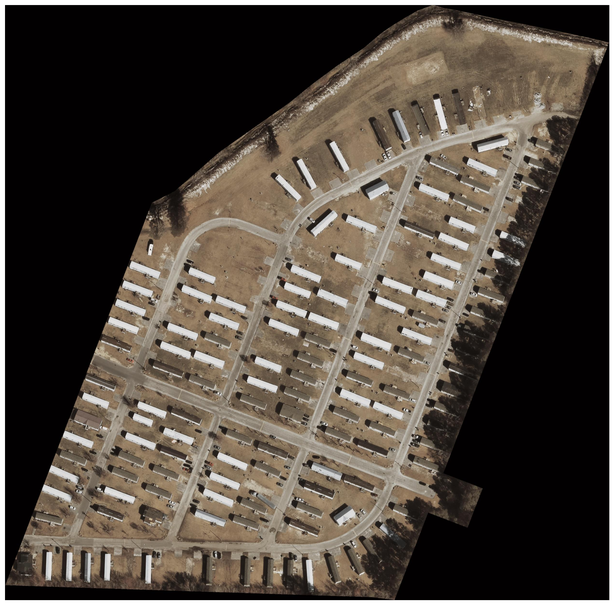
Background
- Largest unsubsidized affordable stock in the US
- 6.7m people in the US (American Housing Survey 2021)
- 12% of housing stock in North Carolina
- Vulnerable to natural hazards, poor urban services,
- No comprehensive public record (data limitations in HIFLD, parcel datasets)

Major objective
- Identify MHPs in North Carolina using a computer vision approach

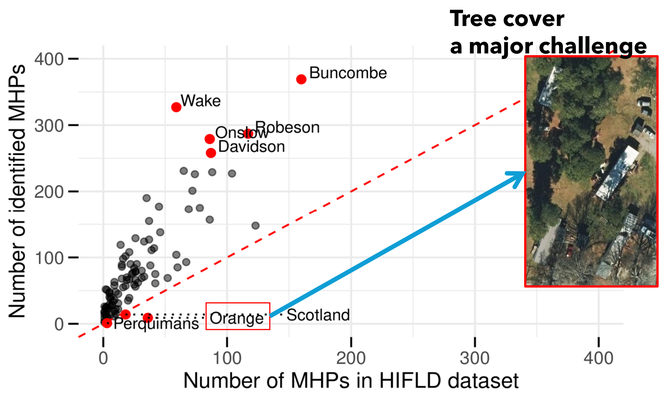
Outcomes
- Identified 8,460 MHPs
- More than 3 times the next best record (HIFLD – 2,602)

GeoAI challenges
- Computationally intensive
- Expansive experimentation of hyperparameters necessary
- Expert judgment critical in post-processing

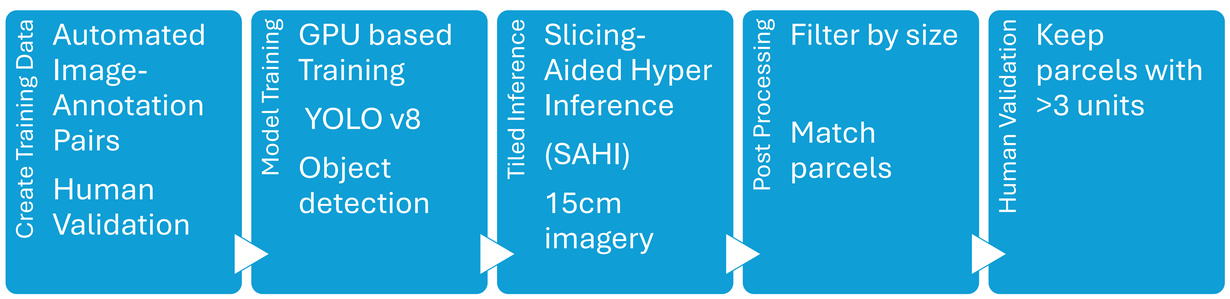


Challenges

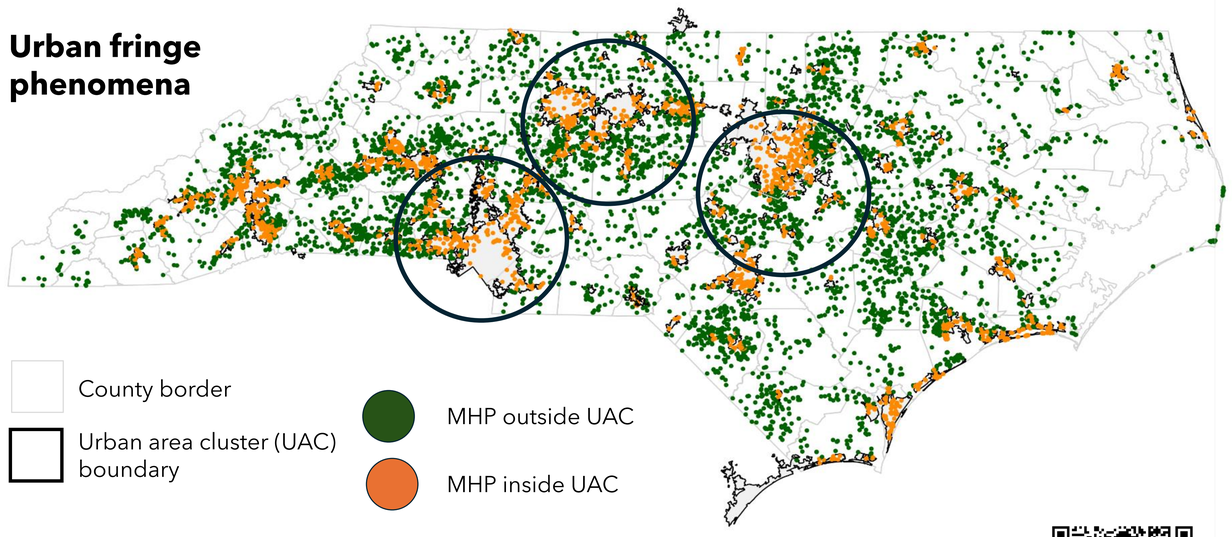
County-wise comparison with Homeland Infrastructure Foundation Level Dataset (HIFLD) record of Mobile Home Parks in North Carolina



Methods



Urban fringe phenomena



Training Data
- 4,674 training image-annotation pairs
- Programmatically generated using ground truth and Microsoft Building Footprints
- Manually validated to ensure training data quality

	Train	Validation	Test	Total
Singlewide	2,207	629	298	3,134
Doublewide	1,143	301	169	1,613
Null	88	22	16	126
Total instances	3,438	952	483	4,873
Total images	3,320	891	463	**4,674**

X, Y, width, height

In-distribution performance

- **Recall** (finding existing objects): **93% singlewide, 93% double wide**
- **Precision** (accuracy of bounding box): **93% singlewide, 93% doublewide**
- **Minimum Average Precision** (Correct categorization with at least 50% bounding box overlap with ground truth): **96% singlewide, 94% doublewide**

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- UNC School of Data Science and Society: Provided seed grant
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- UNC Research Computing: Provided access to an HPC environment

Contact:
Kshitiz Khanal
kshitiz@live.unc.edu
Kshitizkhanal.com
Github.com/kshitizkhanal7