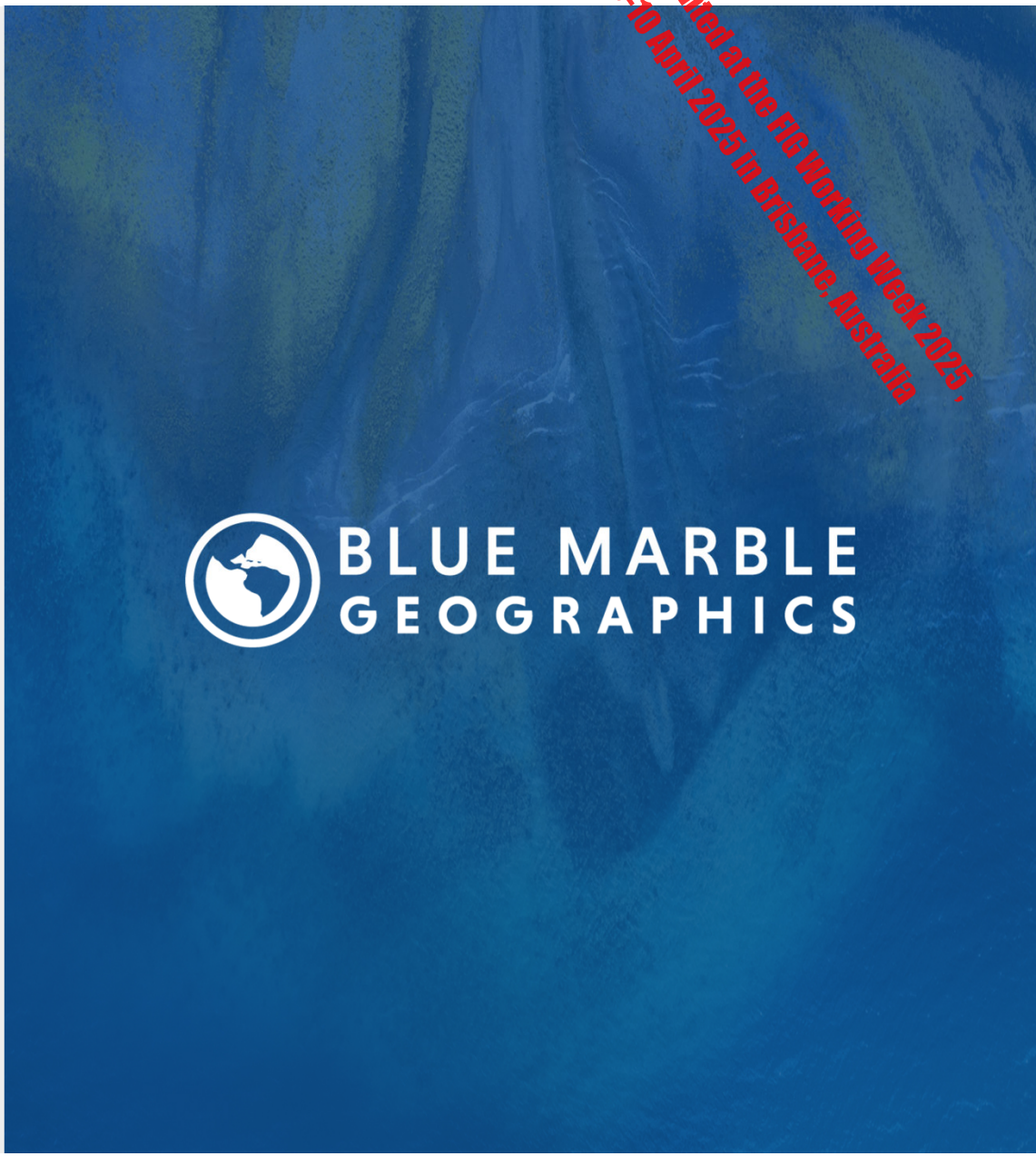
Leveraging AI

to analyze high-resolution point clouds and imagery

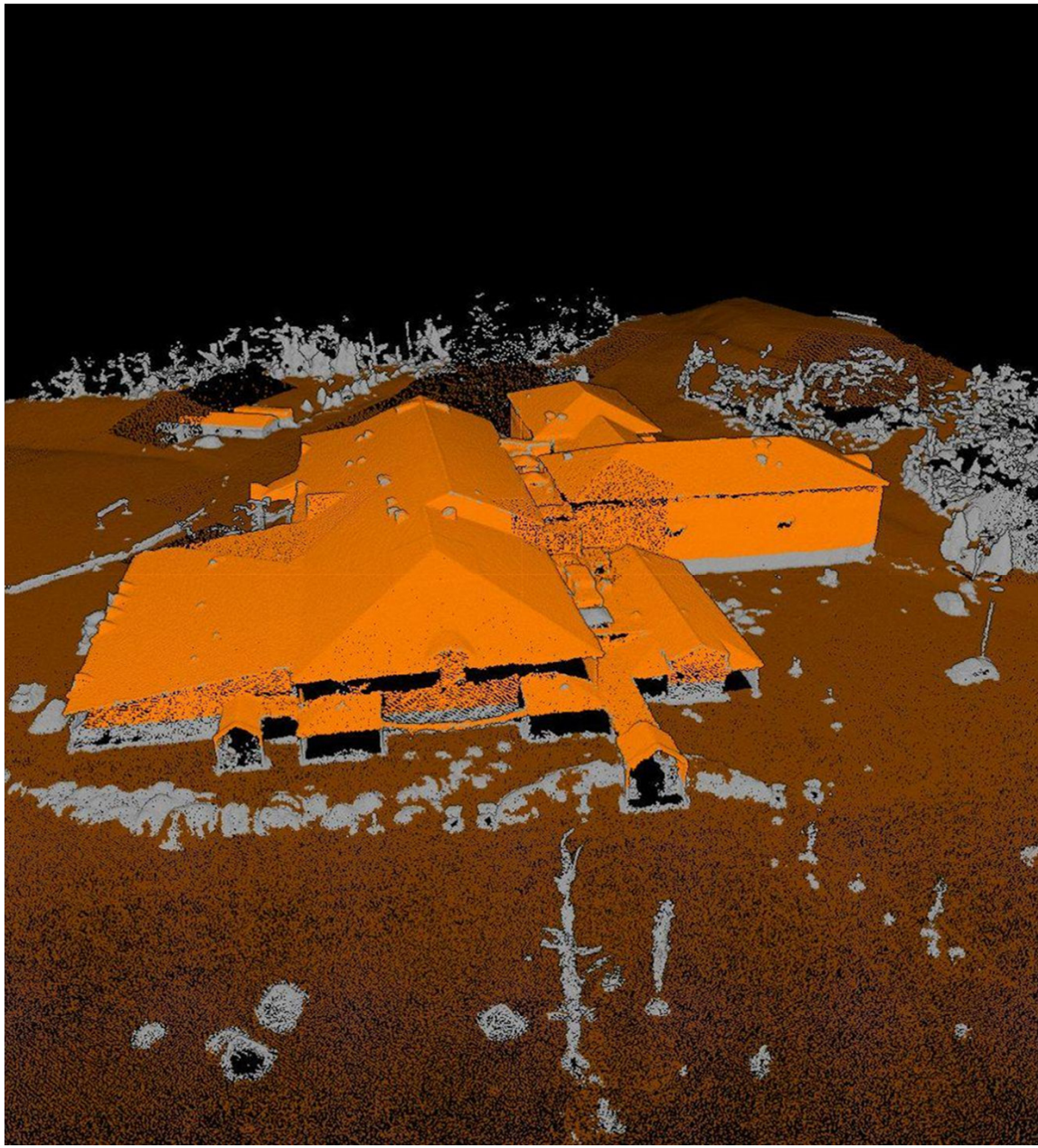
with Global Mapper Pro



OUTLINE

Leveraging AI to analyze high-resolution point clouds and imagery

- AI-powered tools in Global Mapper software
  - Machine Learning
  - Deep Learning
- Point cloud classification
  - User-trained models
- Imagery analysis
  - Land Cover Classification
  - Object Detection
  - Model training



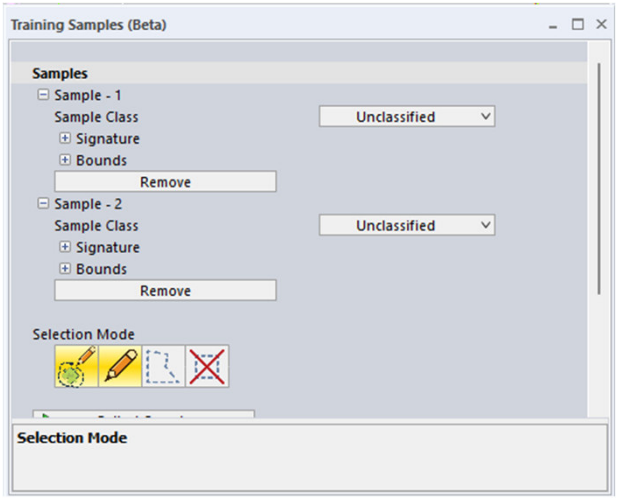
What are Machine Learning & Deep Learning?

	Machine Learning	Deep Learning
Definition	Computer systems that learn from data to make predictions and decisions.	A subset of machine learning that leverages layer(s) of artificial neural networks to recognize complex patterns.
Data	Machine Learning works well with smaller, structured datasets.	Requires substantial / large amounts of data
Processing	Less computationally intense.	High computation needs; deep learning can often require Graphics Processing Units (GPUs) or Tensor Processing Units (TPUs).
User Input	More user input before processing.	Minimal user input, but heavy development and engineering effort(s) required.

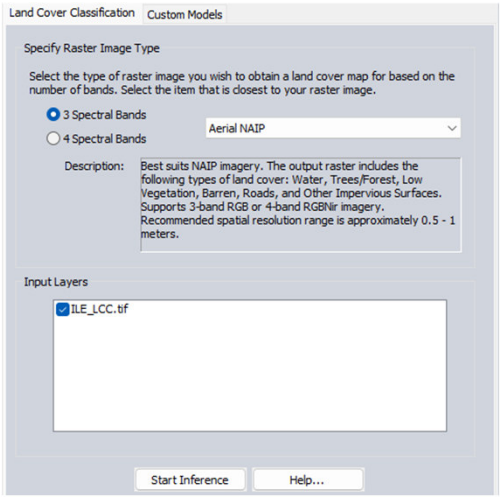
Machine and Deep Learning in Global Mapper Pro

Mimics human intelligence for tedious tasks (i.e. pattern recognition)

Point Cloud Classification
Machine Learning



Imagery Analysis
Deep Learning



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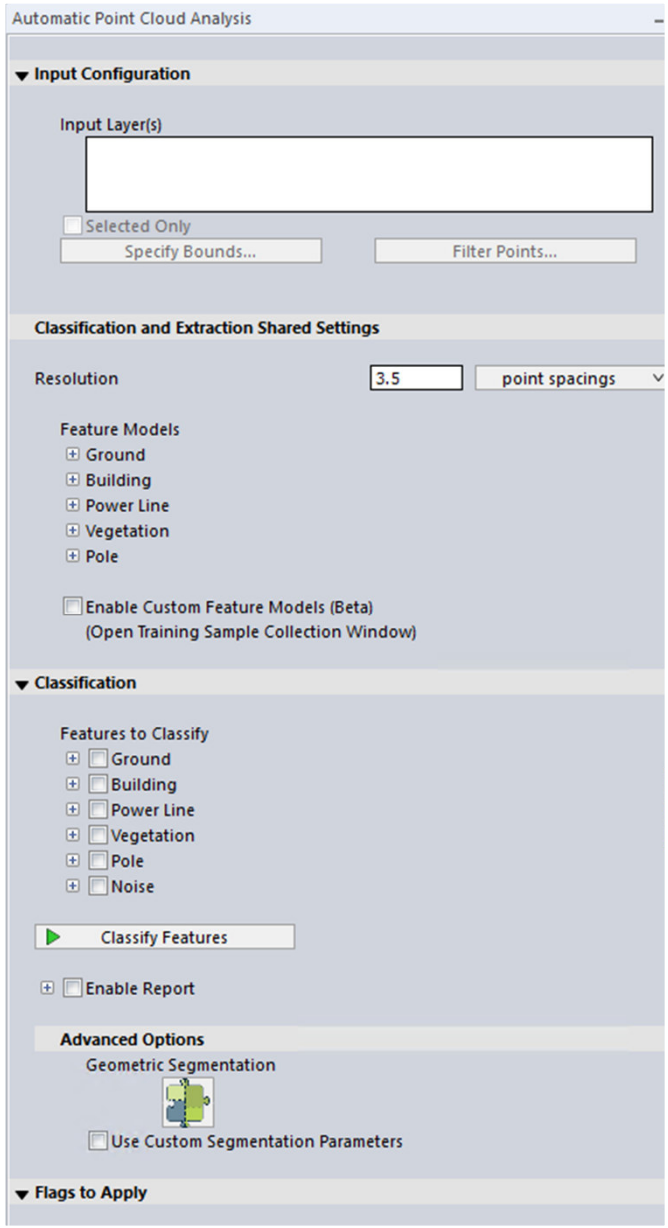
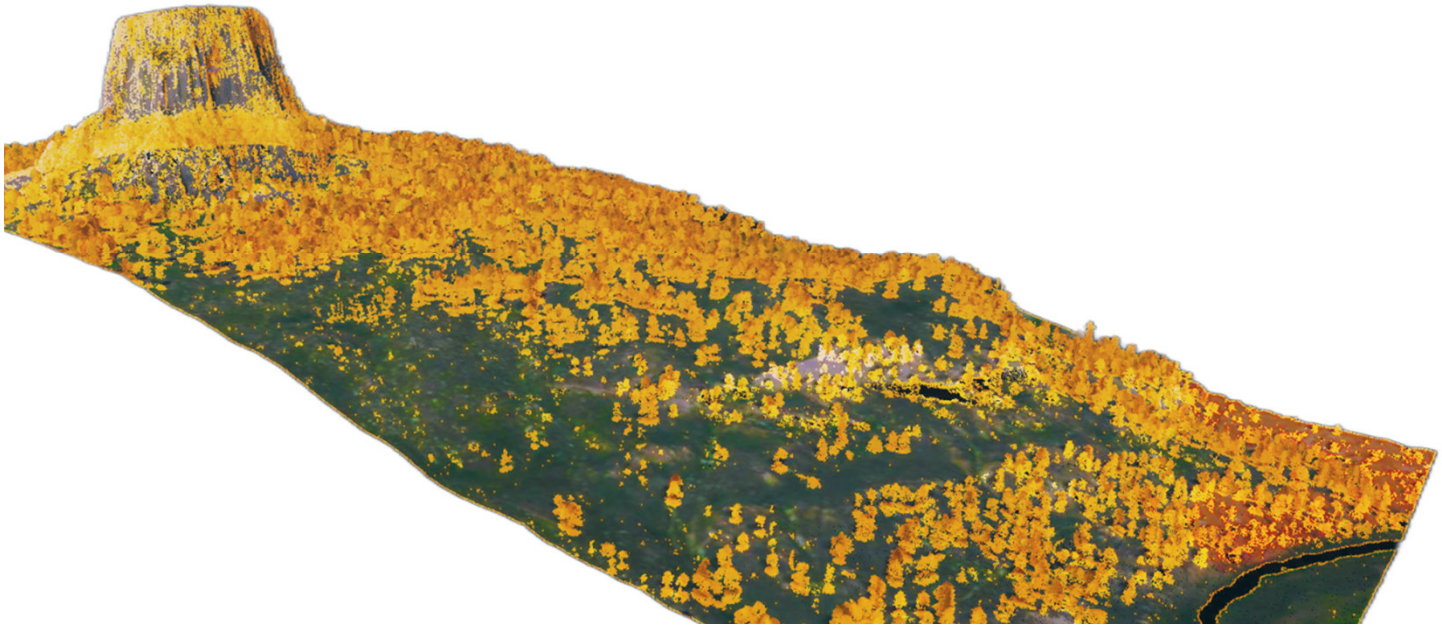


Global Mapper Pro

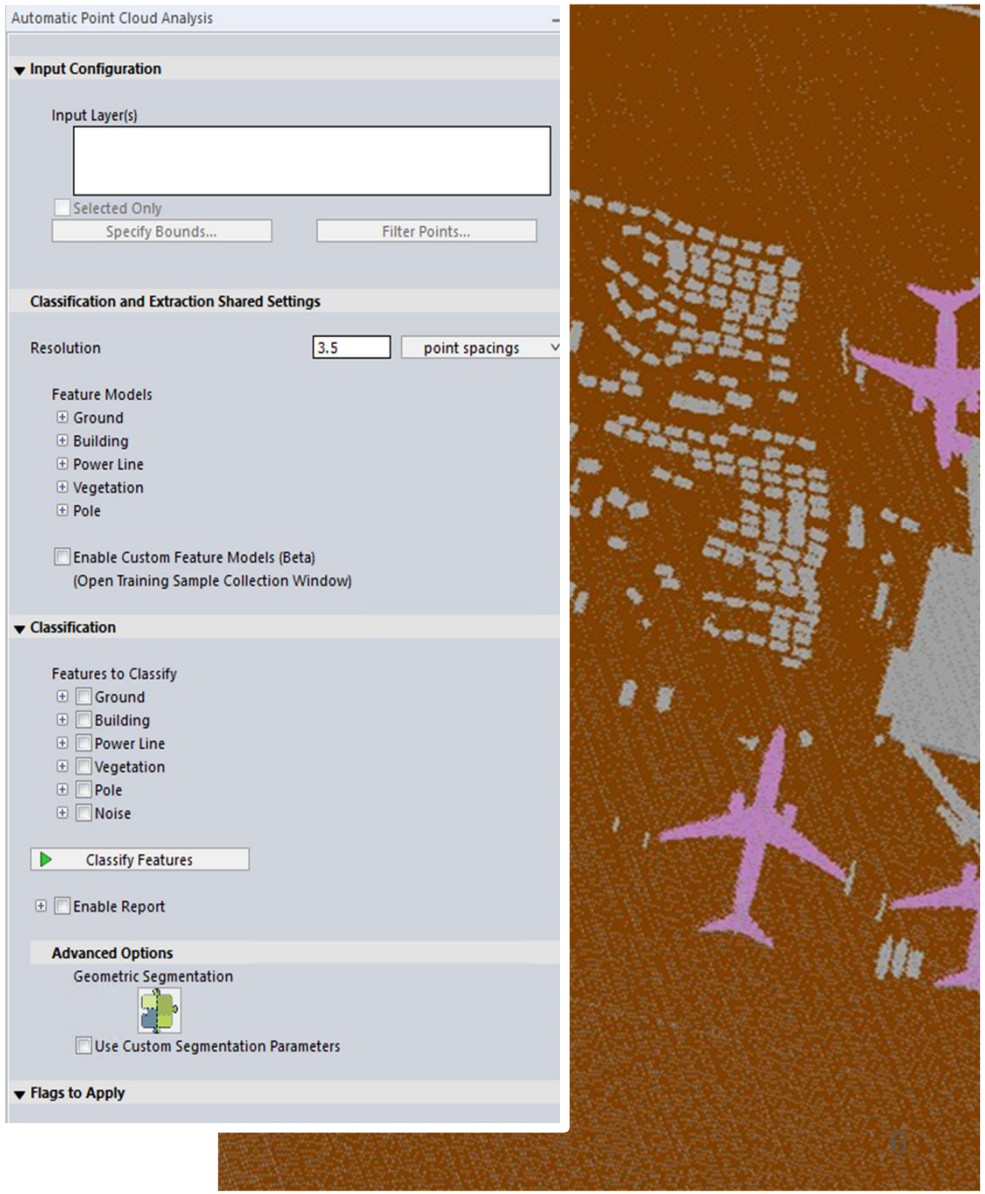
Automatic Point Cloud Analysis

- Machine learning-powered feature classification
- Employs geometric and semantic segmentation
- Train custom classification models with user-defined samples



AUTOMATIC POINT CLOUD CLASSIFICATION

- Built-in models
  - Train these models to your data samples to fine-tune the models
- User-trained models
  - Create new models for custom classification



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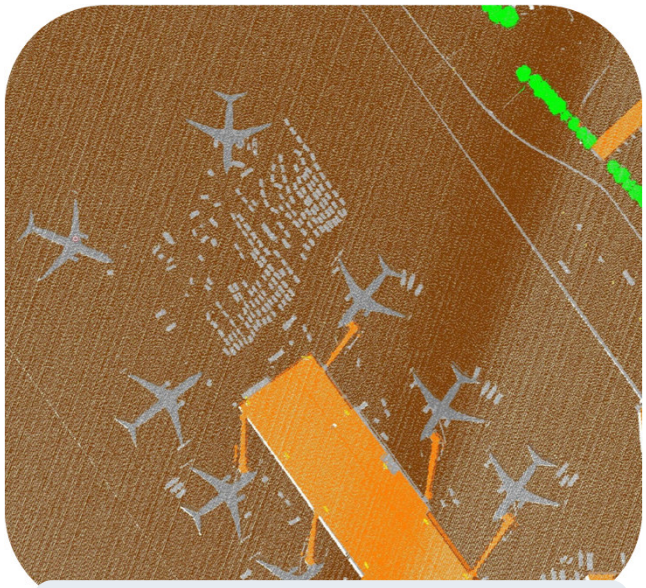
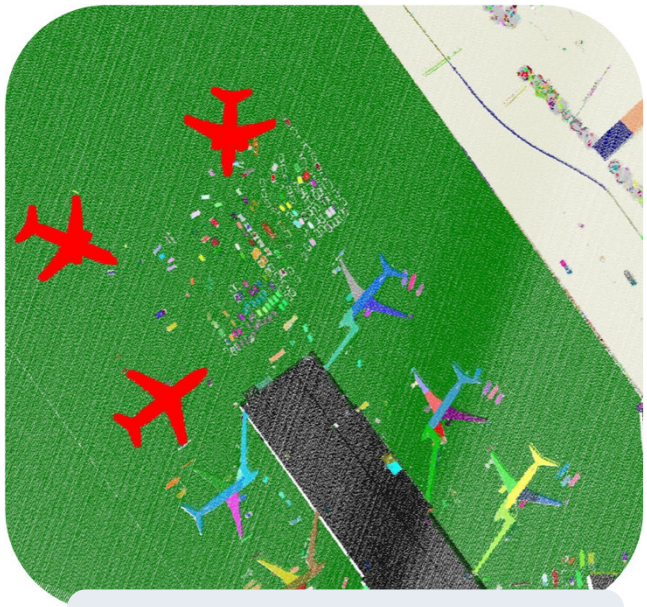
Machine Learning for Training Classification Models

Automatic Point Cloud Analysis • Global Mapper Pro



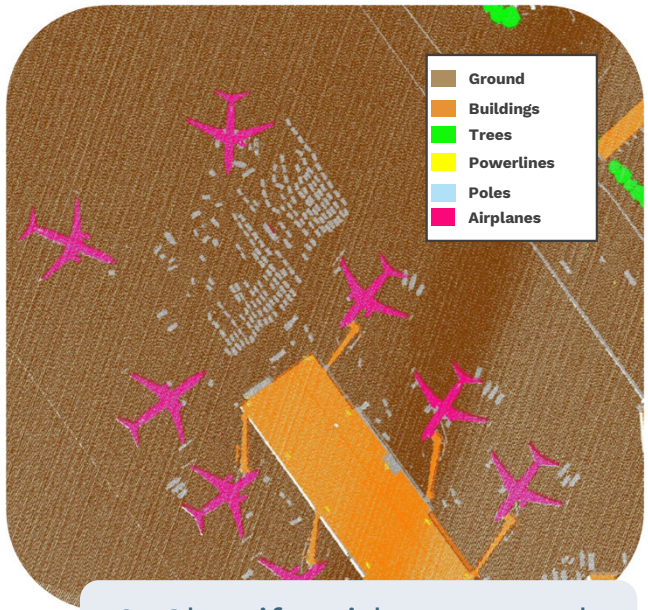
1. Run built-In classifications

- The **Segmentation** tool can also be used to isolate groups of points to use as training samples



2. Select clusters of points to use as training samples

- Global Mapper uses machine learning to derive point attributes and spatial structure



3. Classify with your newly trained model

- Models can be saved and shared amongst Global Mapper Pro users

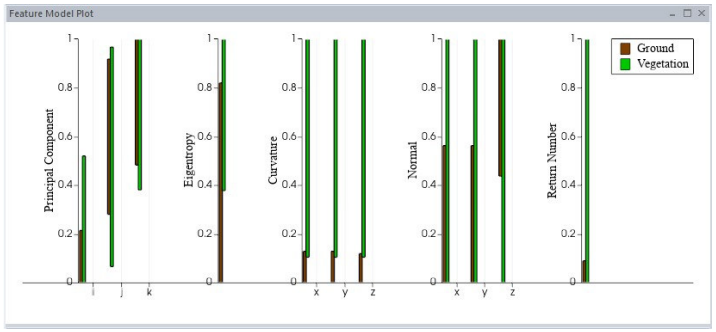
AUTOMATIC POINT CLOUD CLASSIFICATION

Built-in Classification Models

Train these models to your own data samples:

- ✓ Ground
- ✓ Buildings
- ✓ Vegetation
- ✓ Power lines
- ✓ Poles

The machine learning in Global Mapper Pro determines **signature** characteristics:



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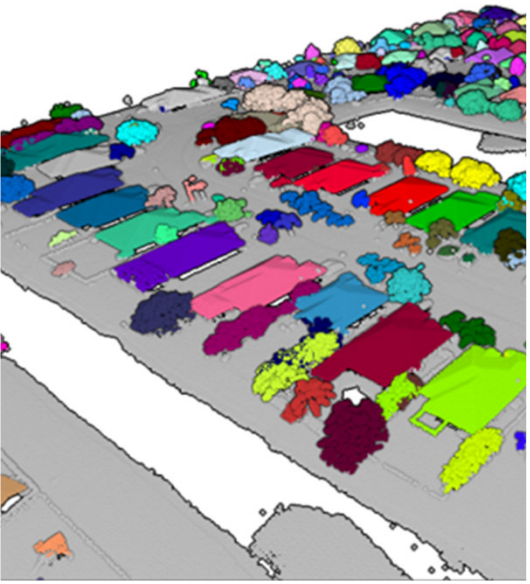
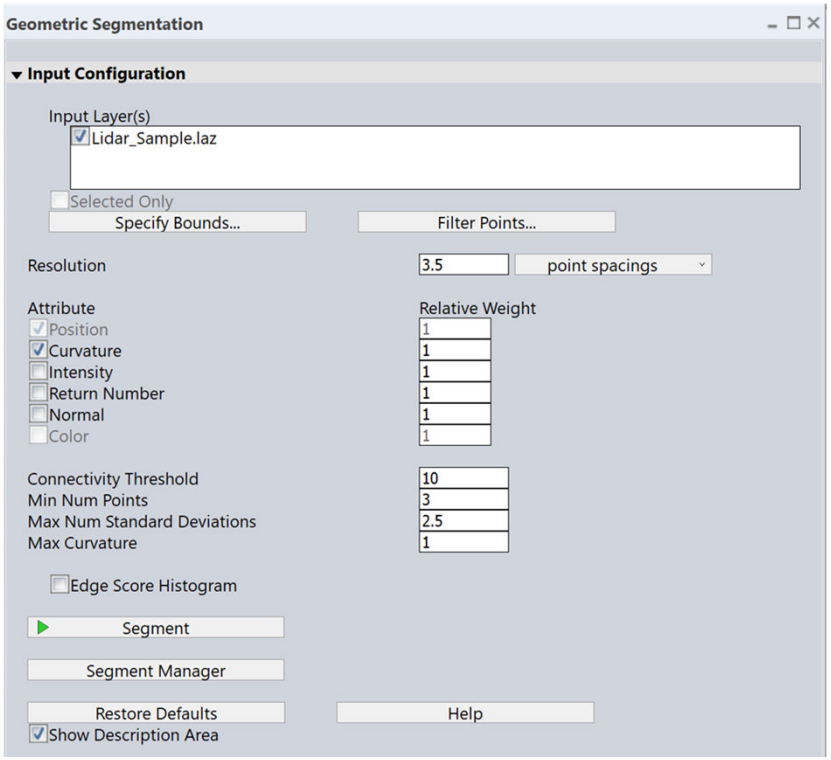
Identifying Training Samples with Geometric Segmentation





- Spectral partitioning
- Partitioning points by unique object (cluster)
- User-defined settings and weights

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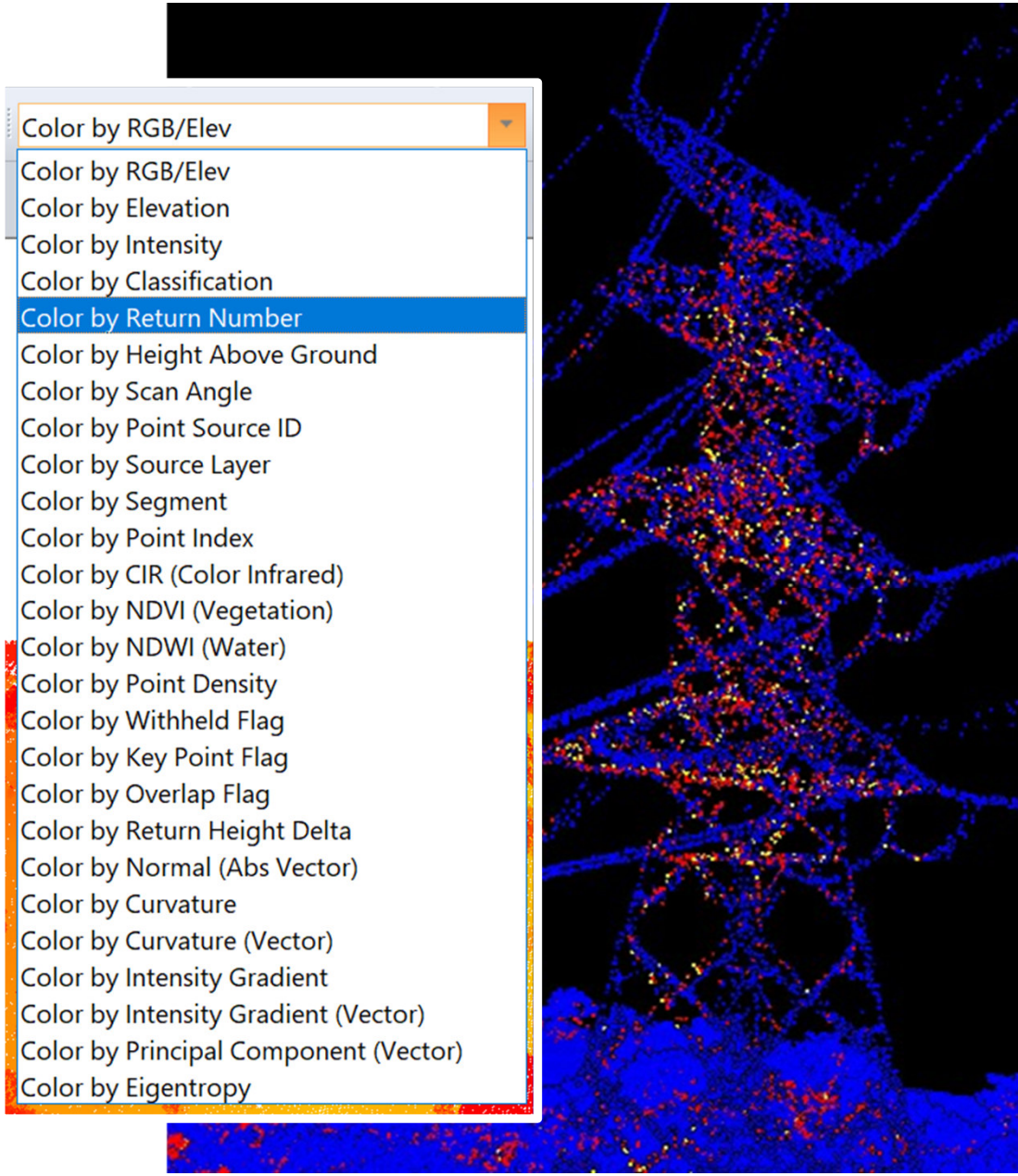
AUTOMATIC POINT CLOUD CLASSIFICATION

Visualizing point attributes

Color the points by attributes to determine segmentation settings

- Curvature
- Intensity
- Return Number
- Normal



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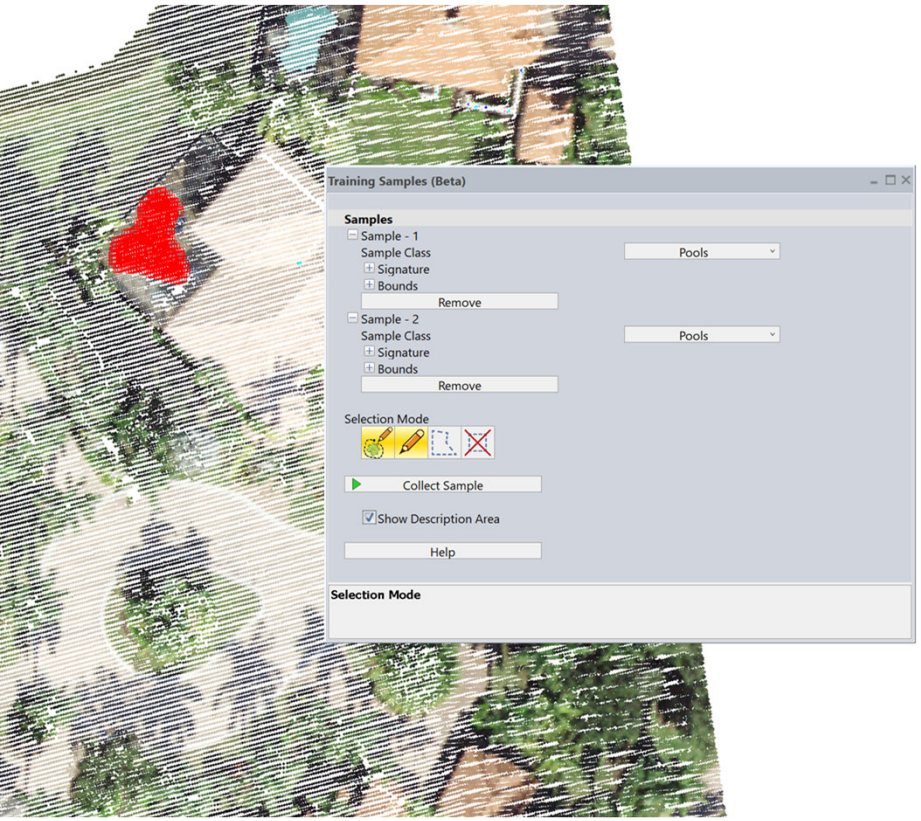
AUTOMATIC POINT CLOUD CLASSIFICATION

Collecting Training Samples



- Adjust segmentation settings to identify potential sample segments
- Collect training samples from segments or selected points
- Train a new classification model or built-in model
  - ✓ Subclassification

Use Case:
Bridge Pillars

Identify Support Pillars

- Clear & consistent geometric structure

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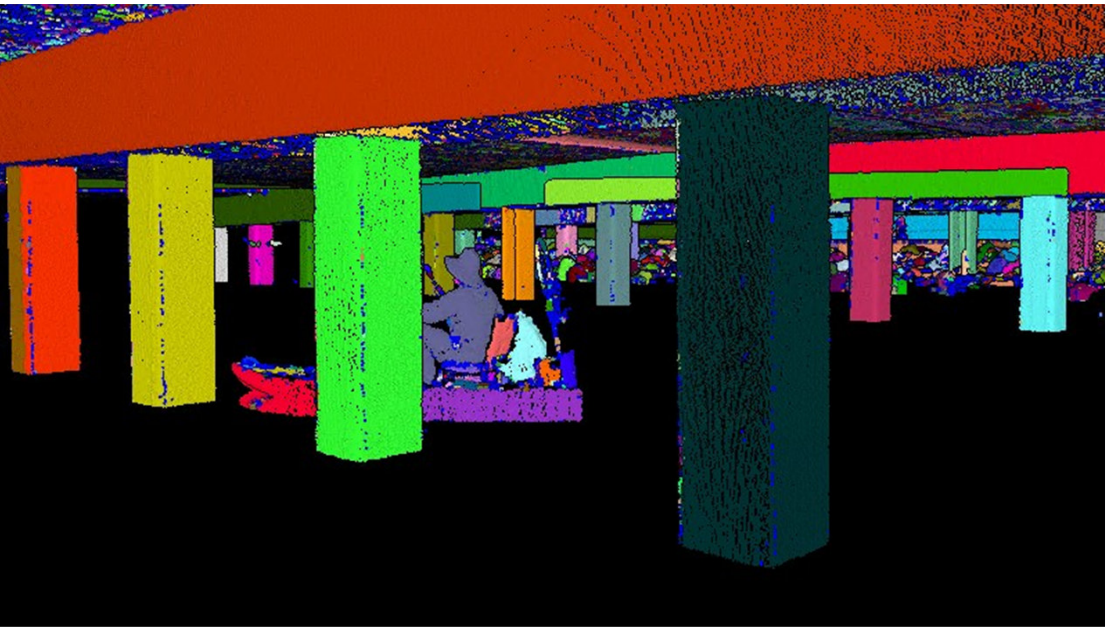
Use Case:
Bridge Pillars



Identify Support Pillars

- Segmentation of pillars

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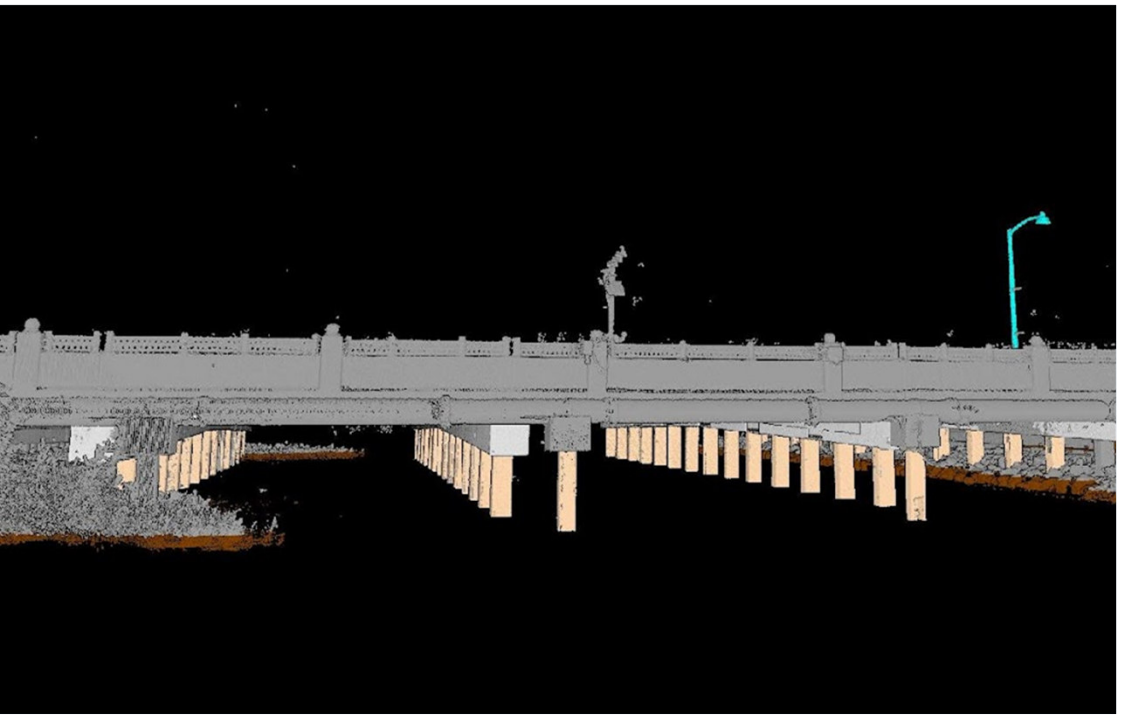
Use Case:
Bridge Pillars



Identify Support Pillars

- Train a new custom feature model
- Run auto-classification
- Successful custom classification results
- Point cloud processing report
  - Training model saved to file

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AI and Deep Learning

- Models are trained for a specific task
- Deep Learning tools in Global Mapper are currently in Beta
- 3 models currently built-in
  - Land Cover Classification
  - Object Detection
    - Building detection
    - Vehicle detection
  - Create your own model

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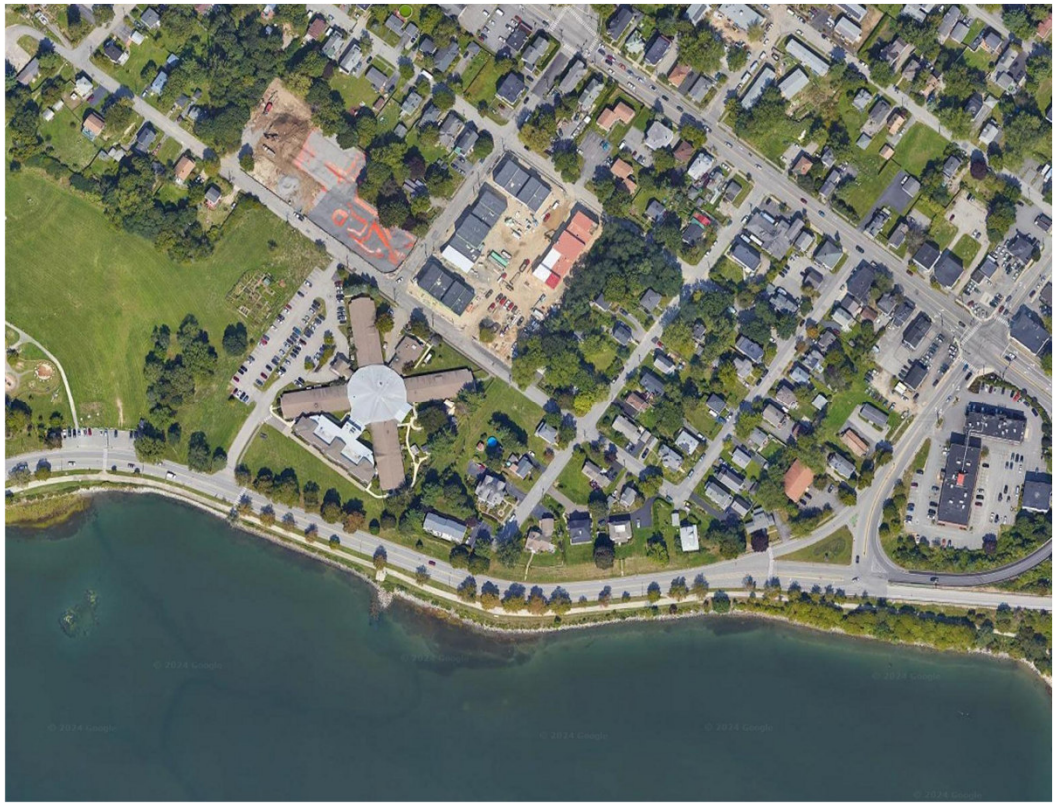

Land Cover Classification

- Under the hood: Semantic Segmentation
- Model trained on NAIP imagery
- Recommended resolution is 0.5-1 meters.
- 3 or 4 spectral bands supported

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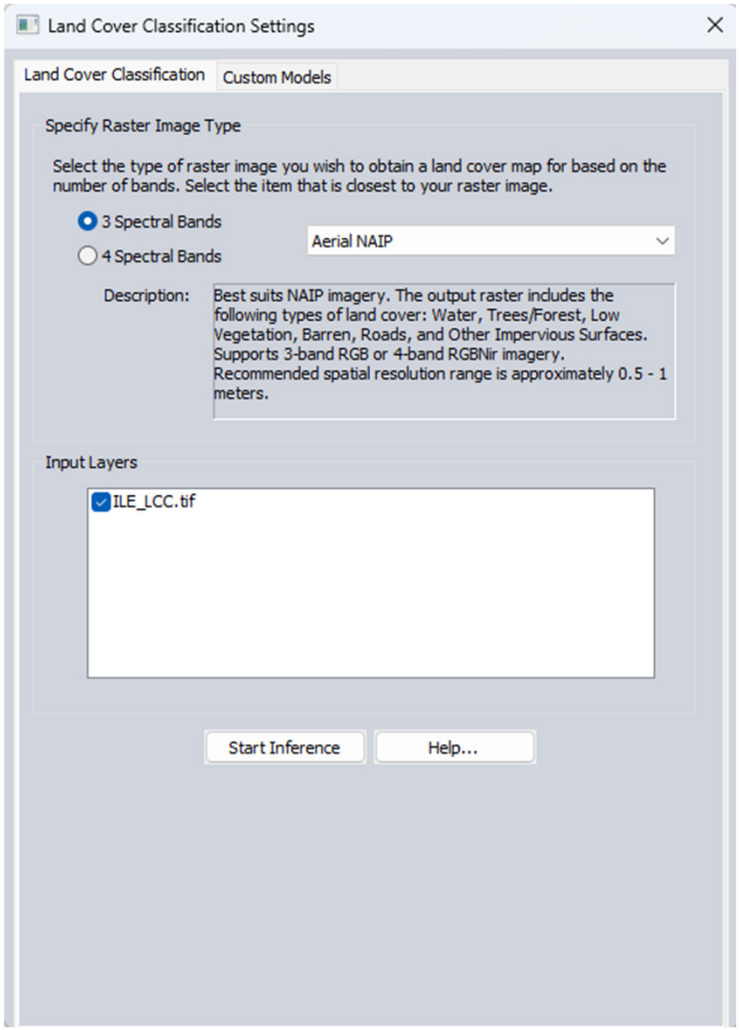

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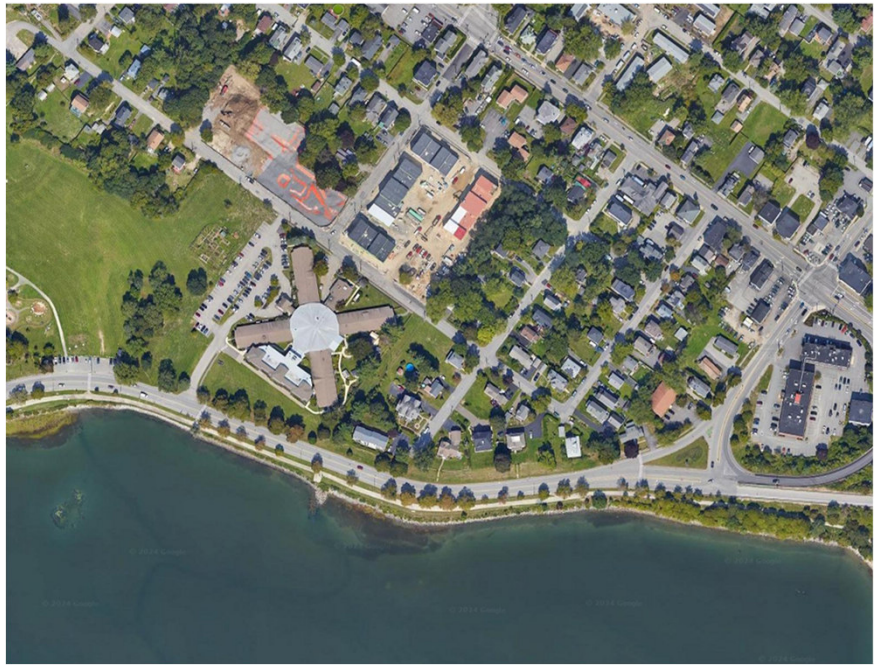

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Land Cover Classification

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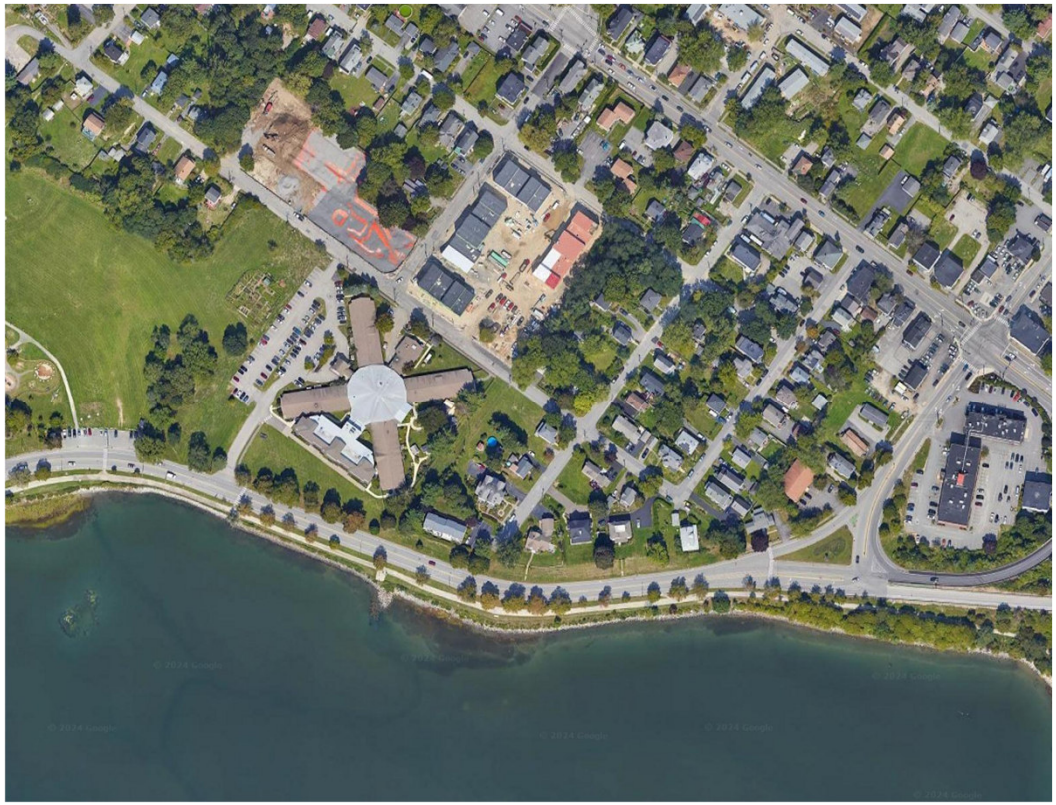

Building Extraction

- Also segmentation-based
- Model trained on 3-band, 0.3 meter resolution aerial imagery
- Recommended resolution is 0.03 – 0.3 meters
- Additional post-processing options available

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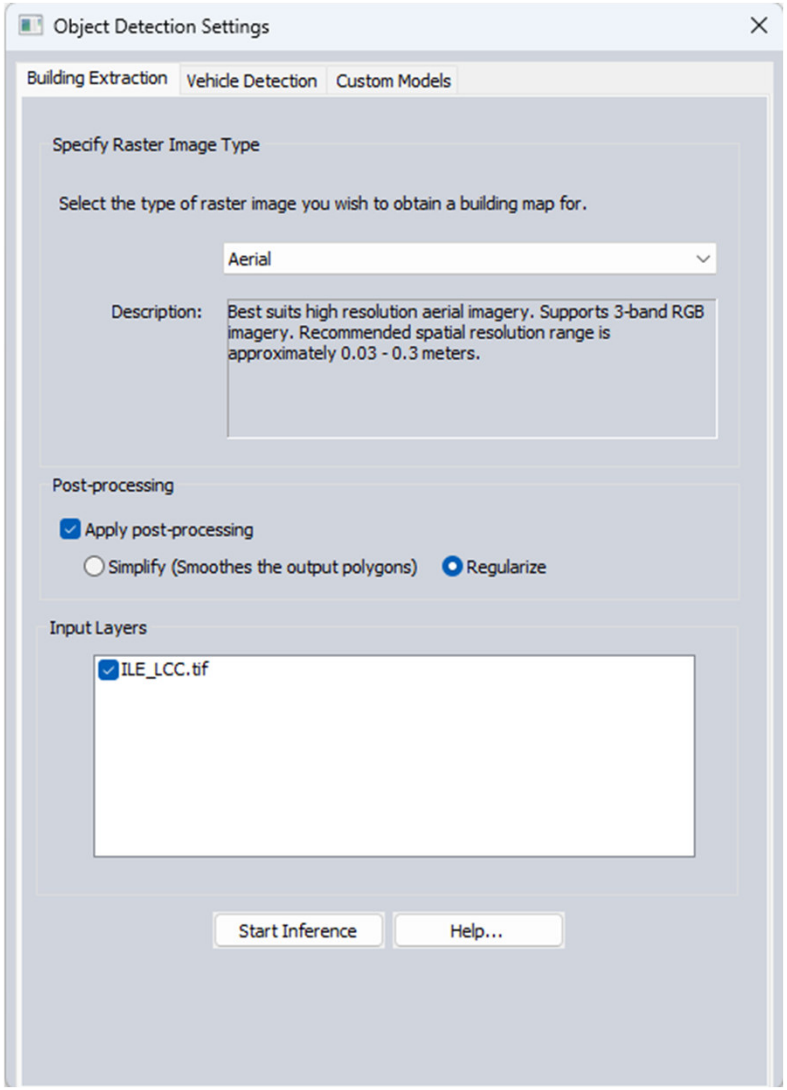

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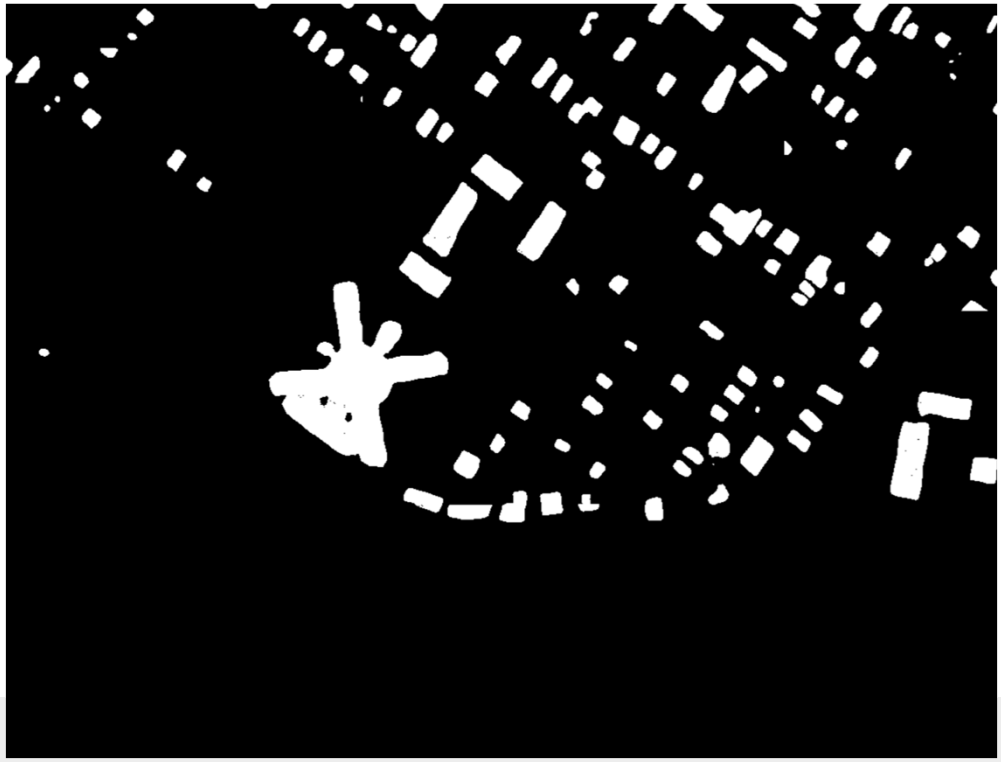
Building Extraction



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Building Extraction

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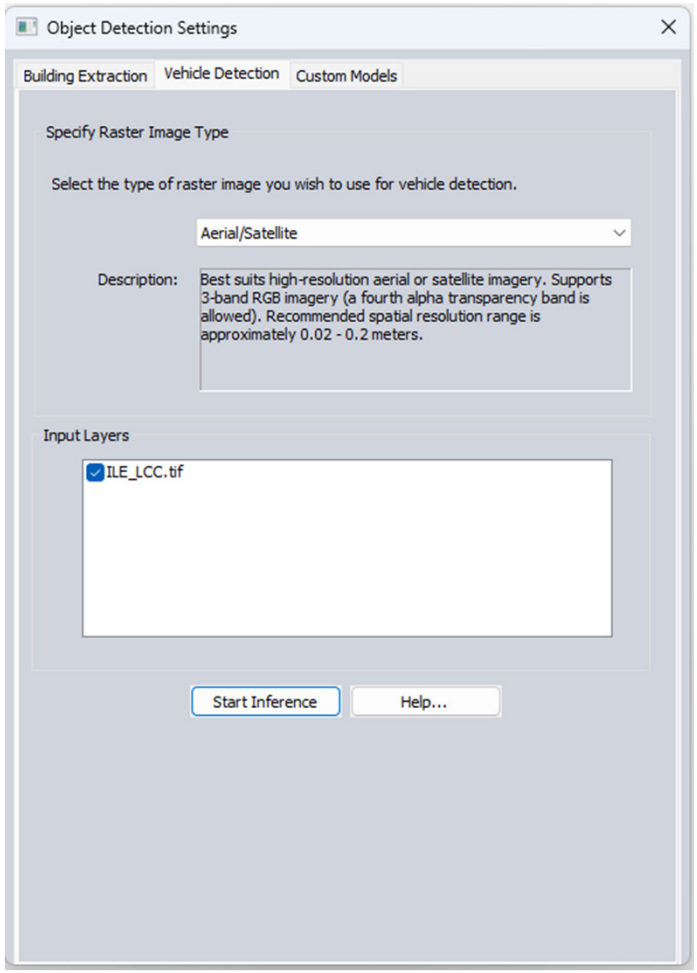

Vehicle Detection

- Object Detection model rather than segmentation
- Model trained on 3-band, 0.15 meter resolution aerial and satellite imagery
- Supports 3-band RGB imagery, plus alpha band

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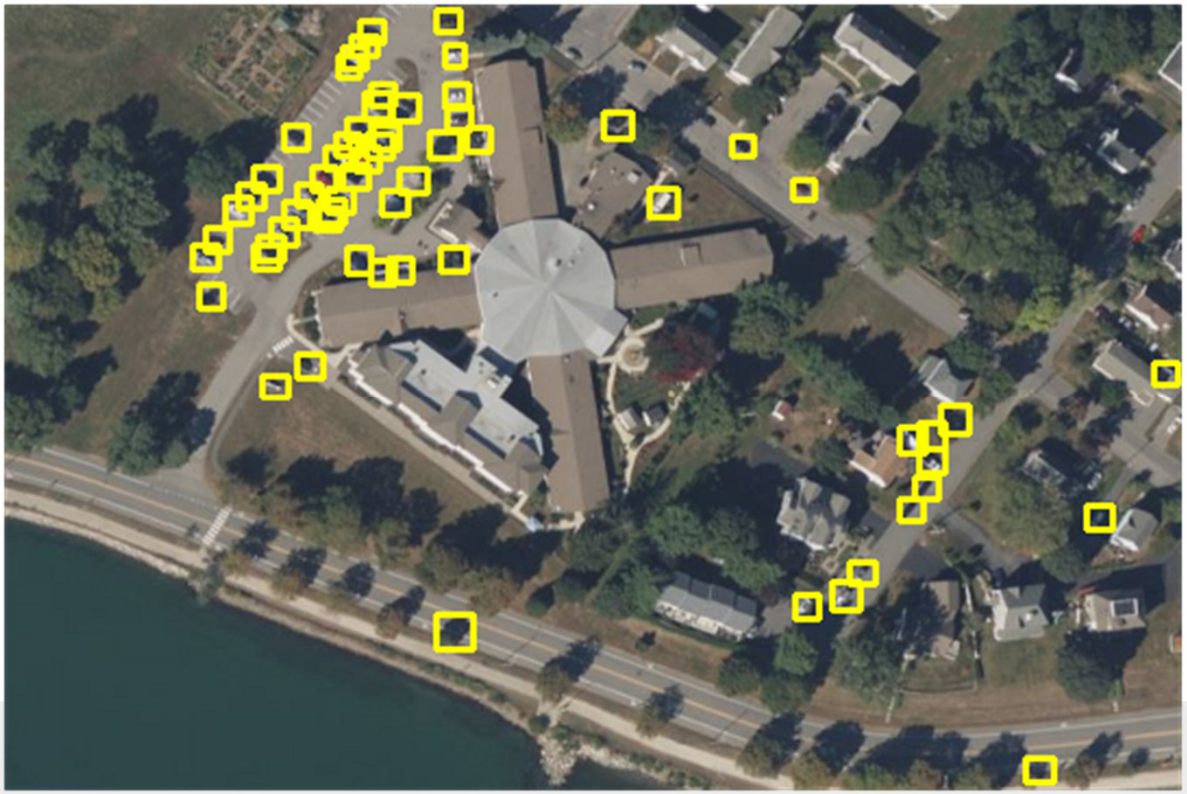
Vehicle Detection



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Key Takeaways

- Deep Learning can save time and effort
- One-button solution for common data types and tasks
- Increase potential of what users can accomplish without custom development

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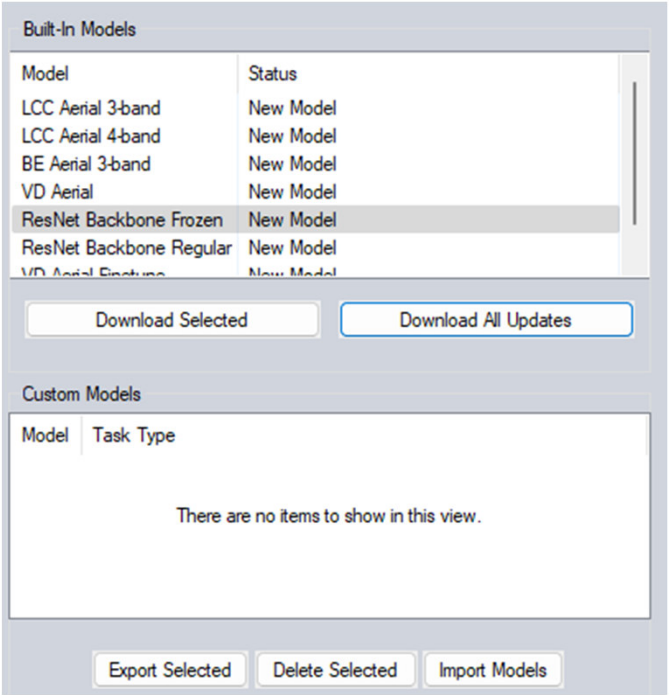
Future Research

Coming Soon:

- Advanced settings
- Download/Save/Share models

Long-Term Plans:

- Data Fusion
- General Model?



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Questions?

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