

INTRODUCTION

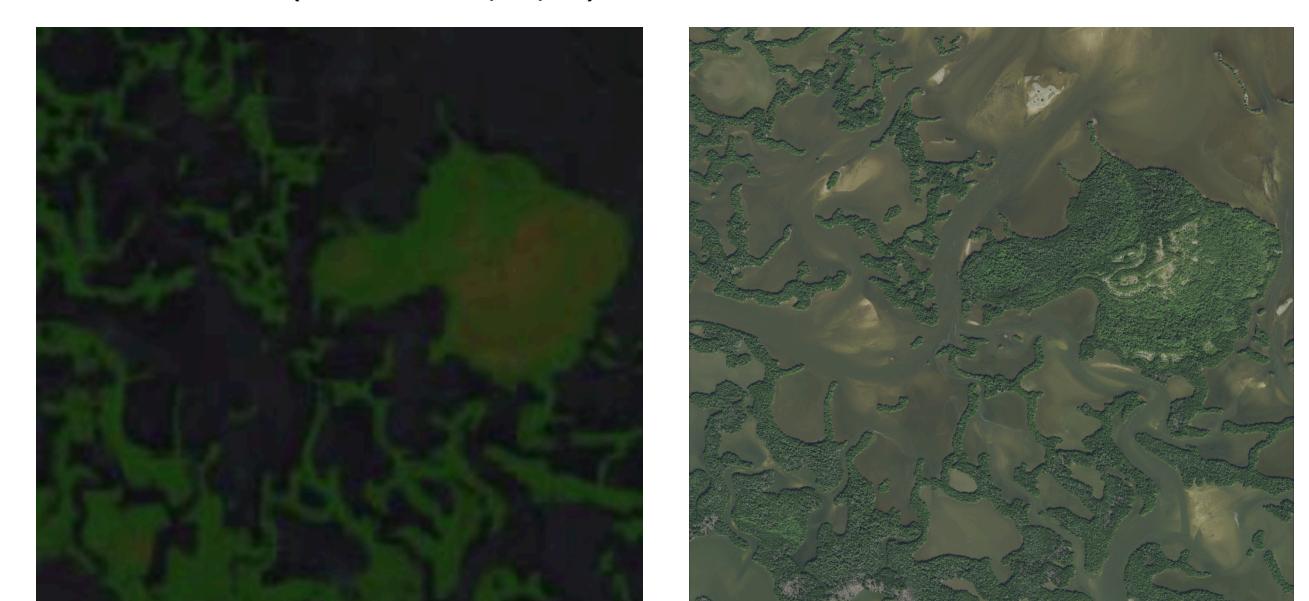
- Shell mounds are large earthworks of shells (clams, oysters, whelks), and other objects, found globally and prevalent along Florida's Gulf Coast.
- Raised fields are terraformed structures created to avoid the destruction caused by intense flooding during the Bolivian wet season.
- These sites provide a unique look at how communities from thousands of years ago lived and altered their natural environments.
- We do not know the locations of many of these sites or whether they have since been destroyed.
- Object detection models can process hundreds of images of Earth's landscape and find underlying patterns.

DATA

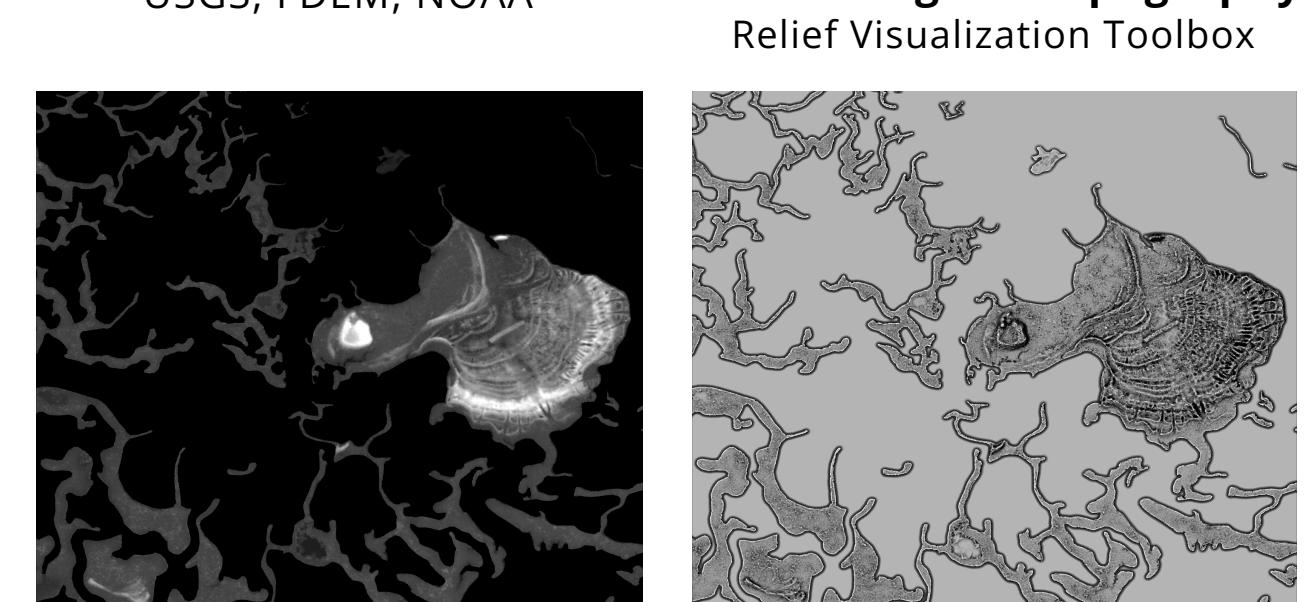
- Shell mounds
 - Labels from the Florida Master Site File
 - LiDAR-derived digital elevation
 - Sentinel-2 satellite imagery
 - National Agriculture Imagery Program
 - Relief Visualization Toolbox processing
- Raised fields
 - Labels from Dr. John Walker
 - ArcGIS Basemap satellite/aerial imagery

Shell Mounds

Satellite Image
Sentinel-2 (Bands 11, 8, 2)



Aerial Image
National Agriculture Imagery Program



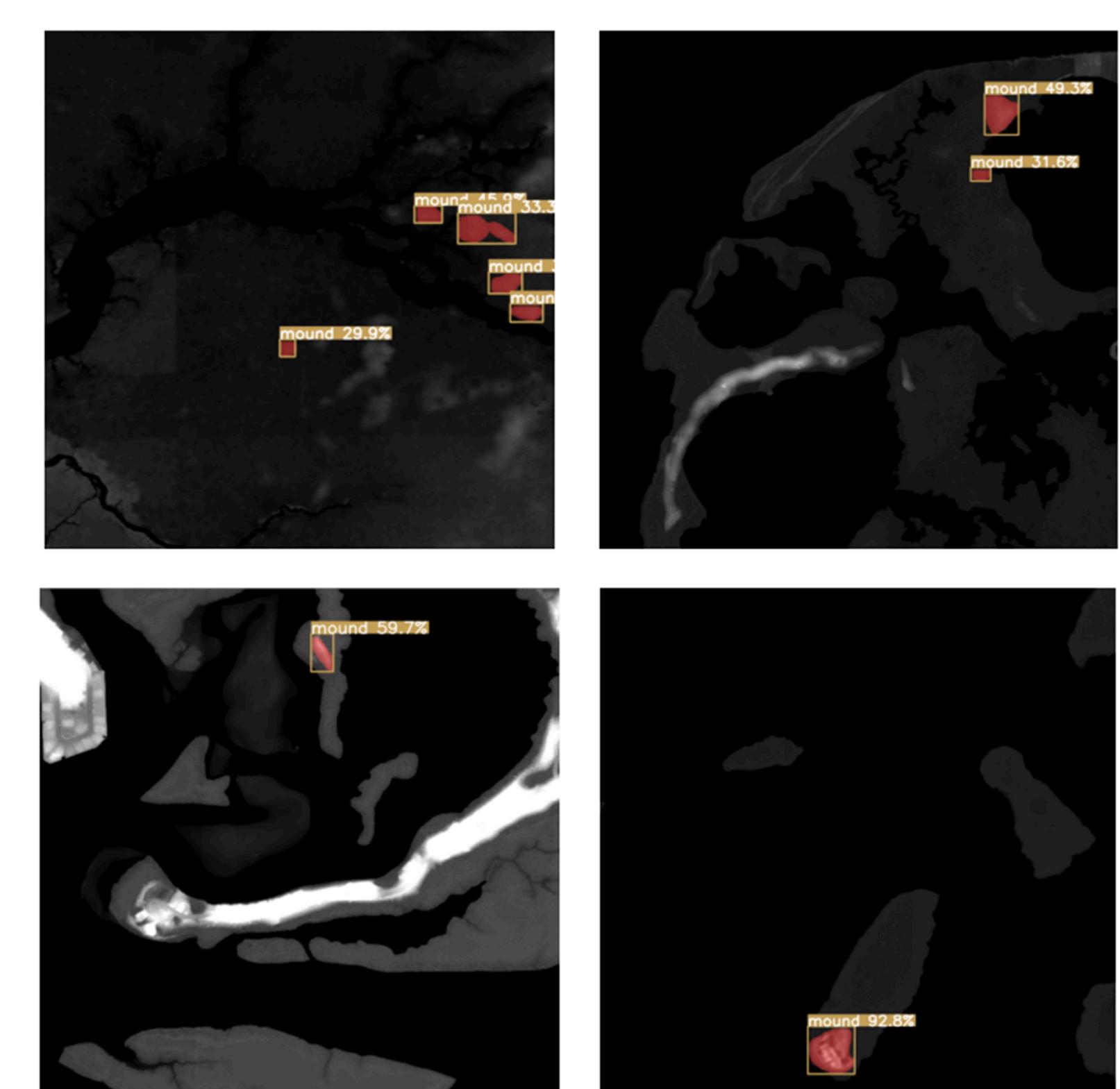
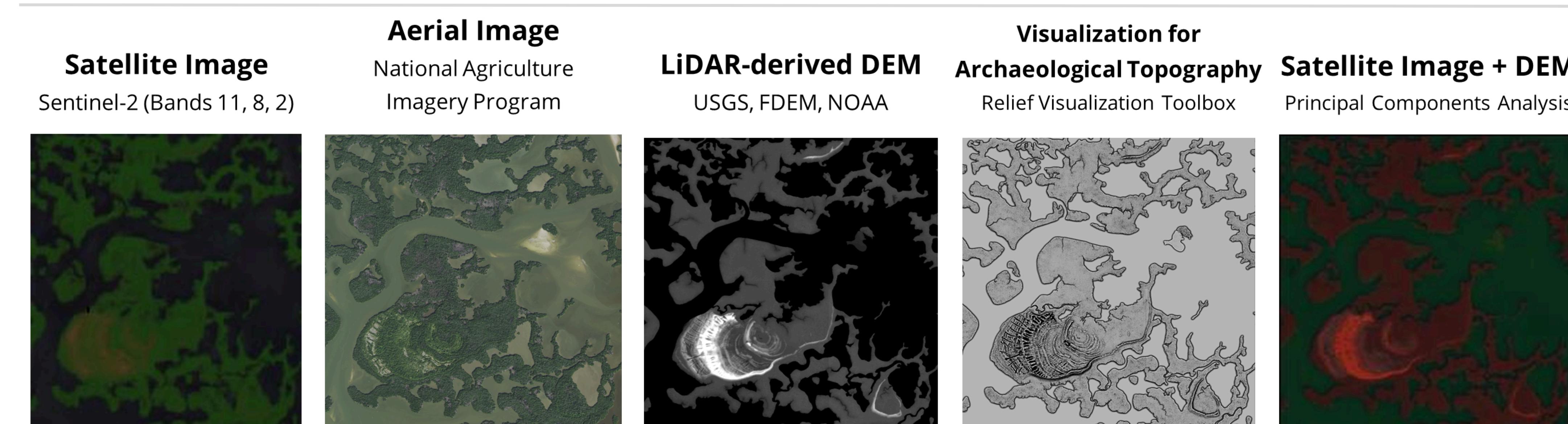
Raised Fields

Aerial Image
ArcGIS Pro Basemap

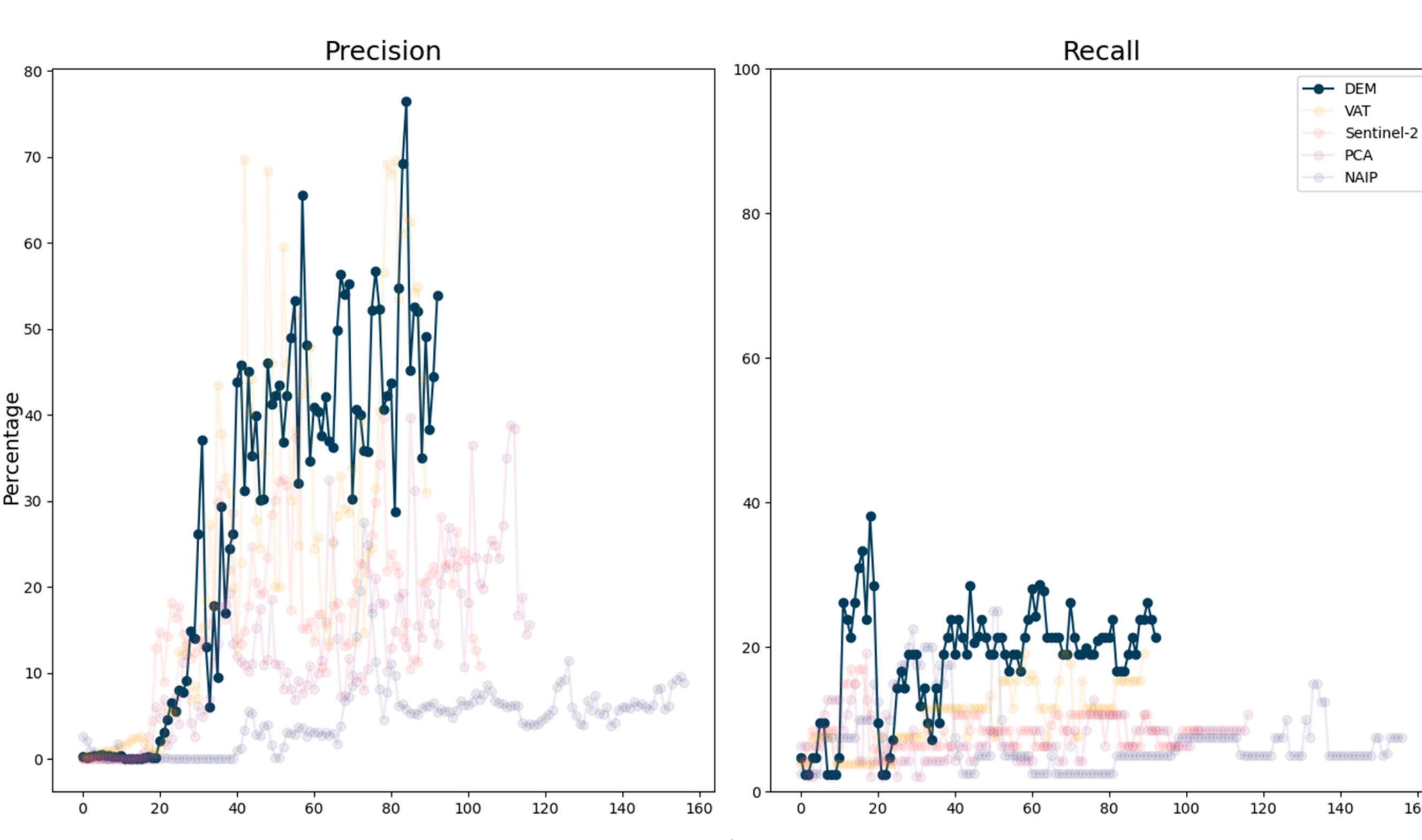


RESULTS

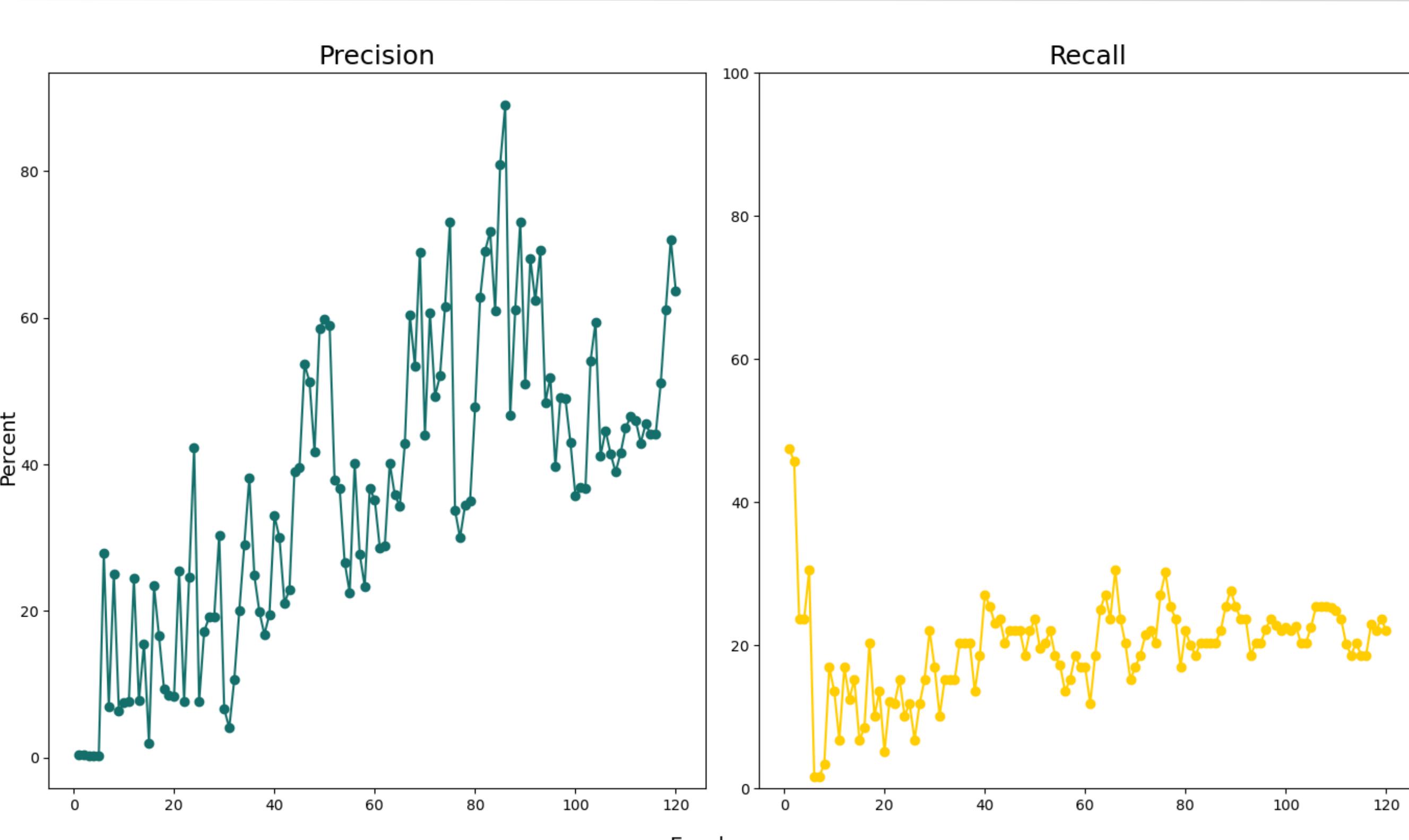
Shell Mounds



Model predictions of shell mounds



Raised Fields



Example training images
(Raised fields labeled in red)

METHODS

- We train an open-source computer vision model, YOLOv8 developed by Ultralytics, in Python to identify archaeological features:
 - Shell mounds in Florida (segmentation)
 - Raised agricultural fields in Bolivia (detection)
- We trained separate models for each data type and archaeological feature, running the models using the University of Florida's supercomputer, the HiPerGator.

DISCUSSION

- Accurately locating archaeological sites is crucial for preserving and protecting these sites.
- One challenge to training the models is the initial lack of data: many potential shell mounds and raised fields may be present *but unlabeled* in the images.
- The trained model has high precision but low recall (of the sites that the model does detect, it is fairly accurate).
- AI and ML can greatly enhance documentation of archaeological sites, but only if applied under the supervision of subject experts and high-quality data.

FUTURE WORK

- Test other models such as Mask-RCNN and YOLOv11.
- Use multi-dimensional remote sensing data to capture unique characteristics.
- Use the predicted outlines to calculate statistics such as change in vegetation and land use/land cover over time.

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