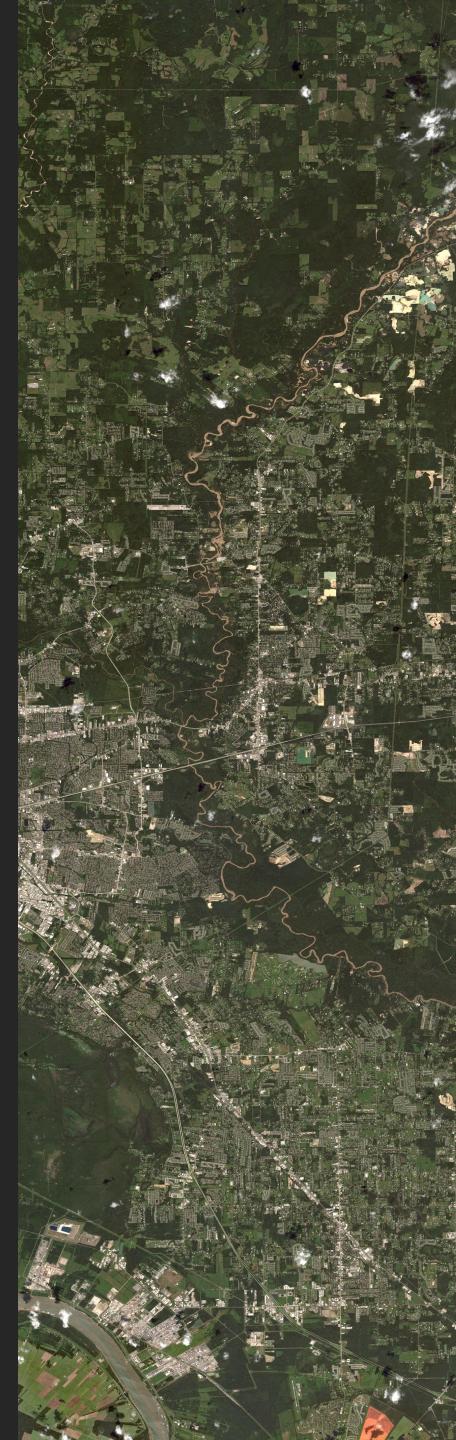


ROAD MAPS FOR DISASTER RELIEF

Hannah Lewis
October 1, 2021

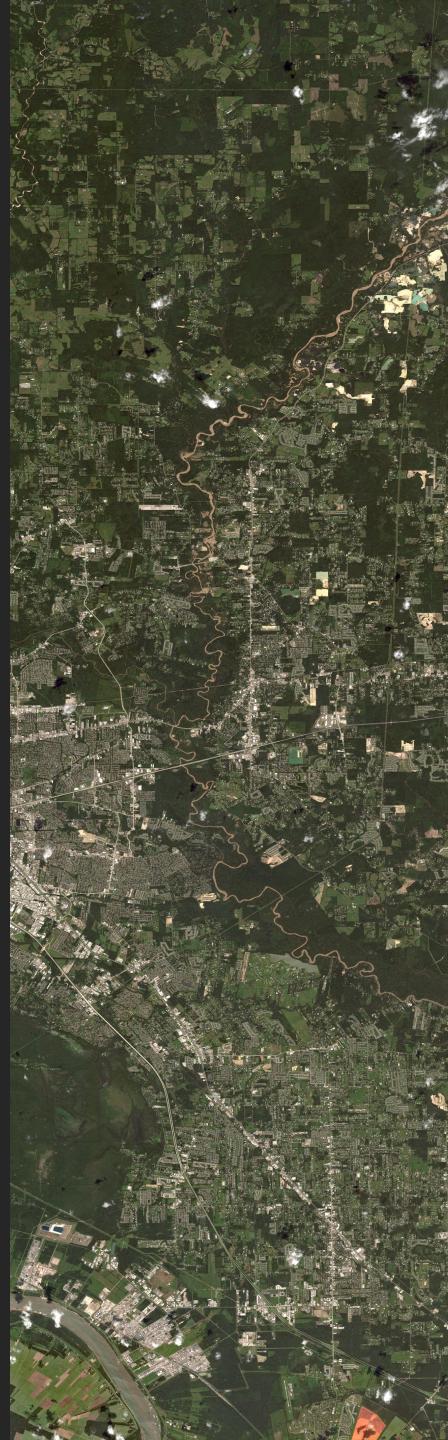
Motivation

- Remote satellite images are an invaluable resource during the aftermath of a natural disaster
- Impacted areas may span large land areas
 - Right: sample image from Maxar's WorldView-3 satellite covers 16,300 sq. km. (6,300 sq. mi.)
- Searching satellite imagery by-hand is time consuming, and may delay aid reaching those in need



Deep Learning

- Neural net trained to extract road maps from satellite images
- Apply to images taken pre- and post-event to identify roads that are still accessible



Data & Methods

DeepGlobe 2018: Road Extraction Challenge

- Maxar's WorldView-3 satellite (Demir et al. 2018)
- 6,200 satellite images with available road masks for training and validation
- 2,300 satellite images without road masks
- Captured over Thailand, Indonesia, India



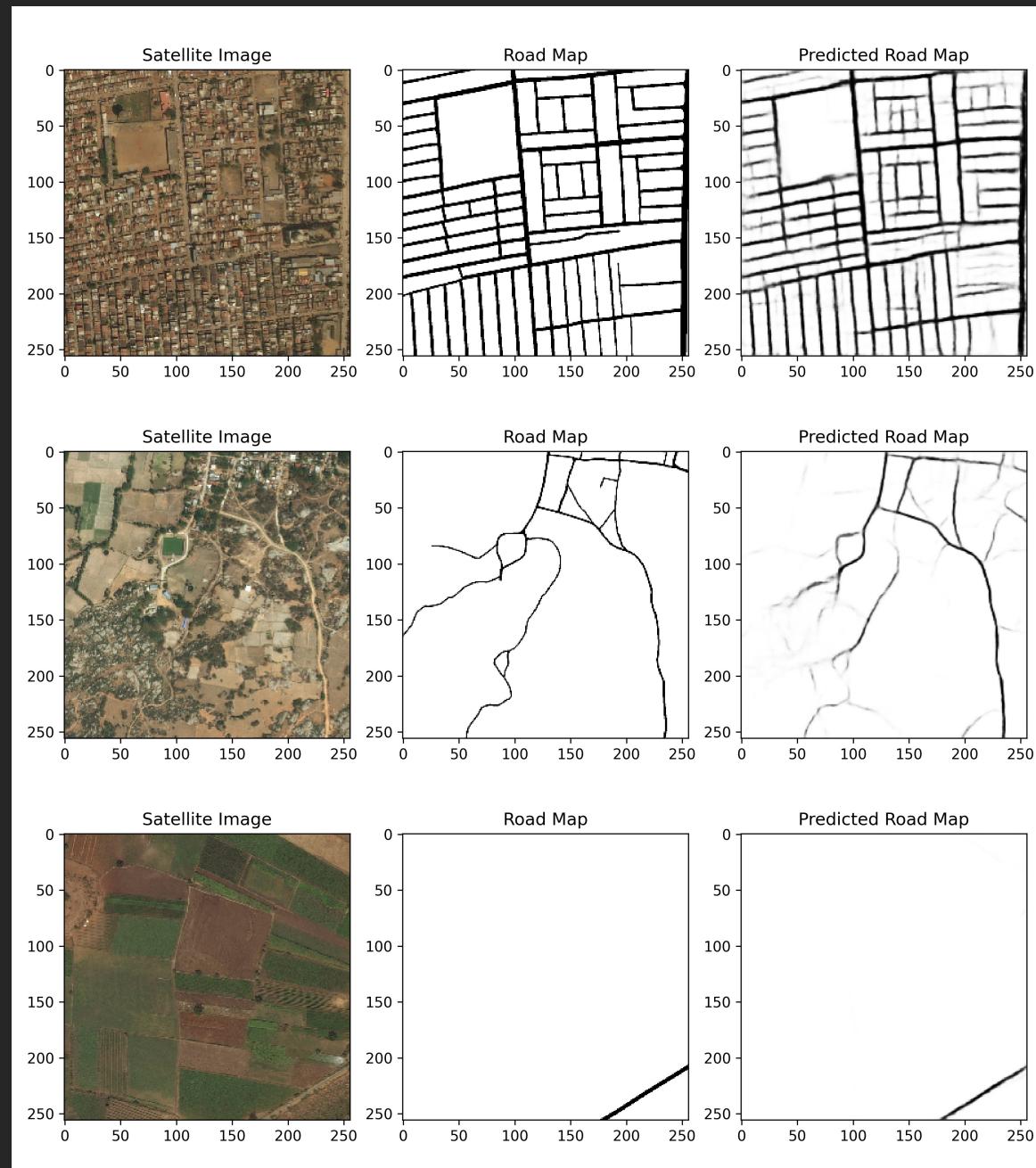
Deep Learning CNN – U-Net architecture

- Developed for biomedical image segmentation
- Encoder-decoder network to predict pixel-wise class labels
- Scored on F1



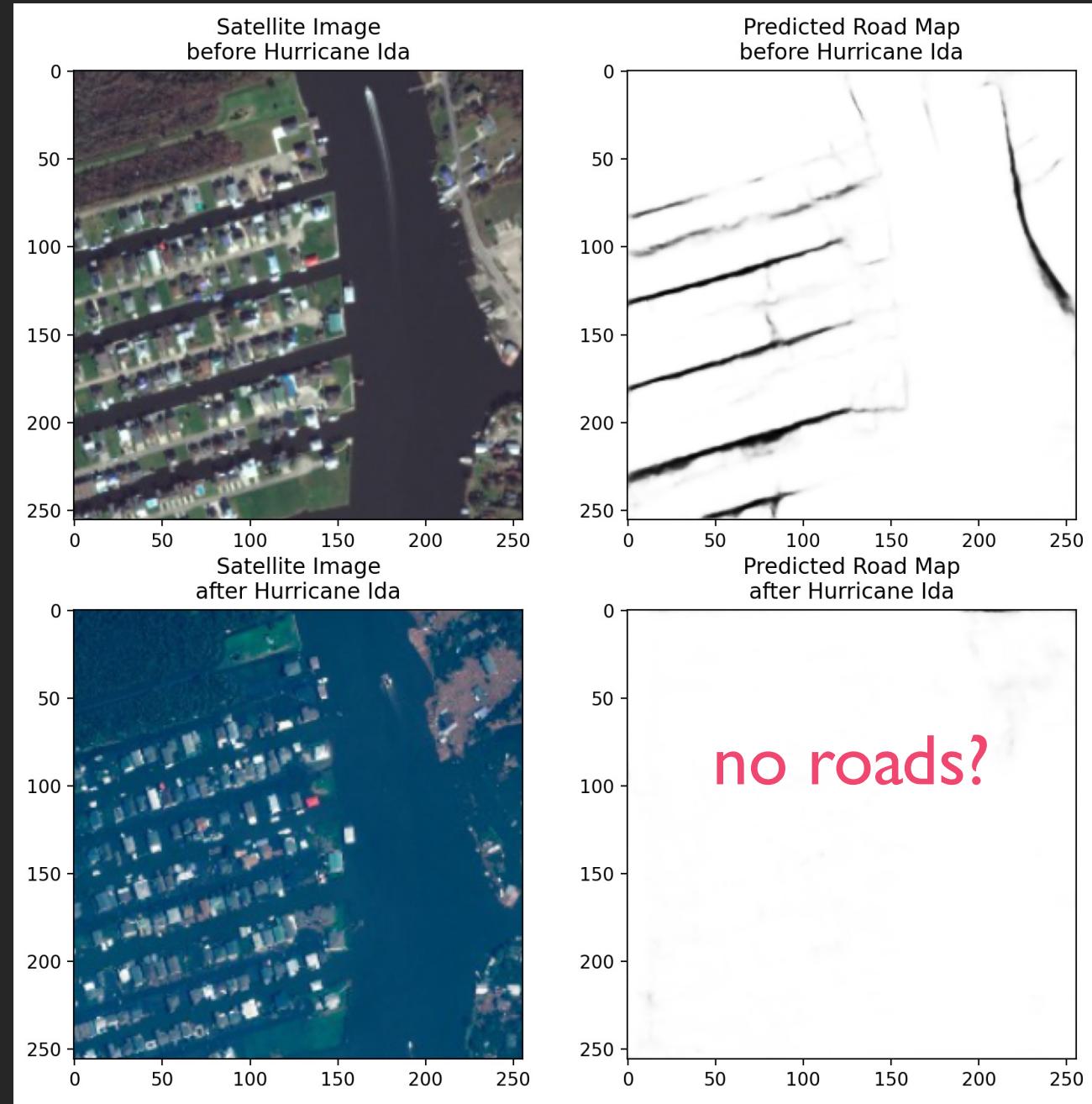
Results

- Final model achieves F1 score = 0.690
- Performs well for rural and urban landscapes, varying road surfaces and densities



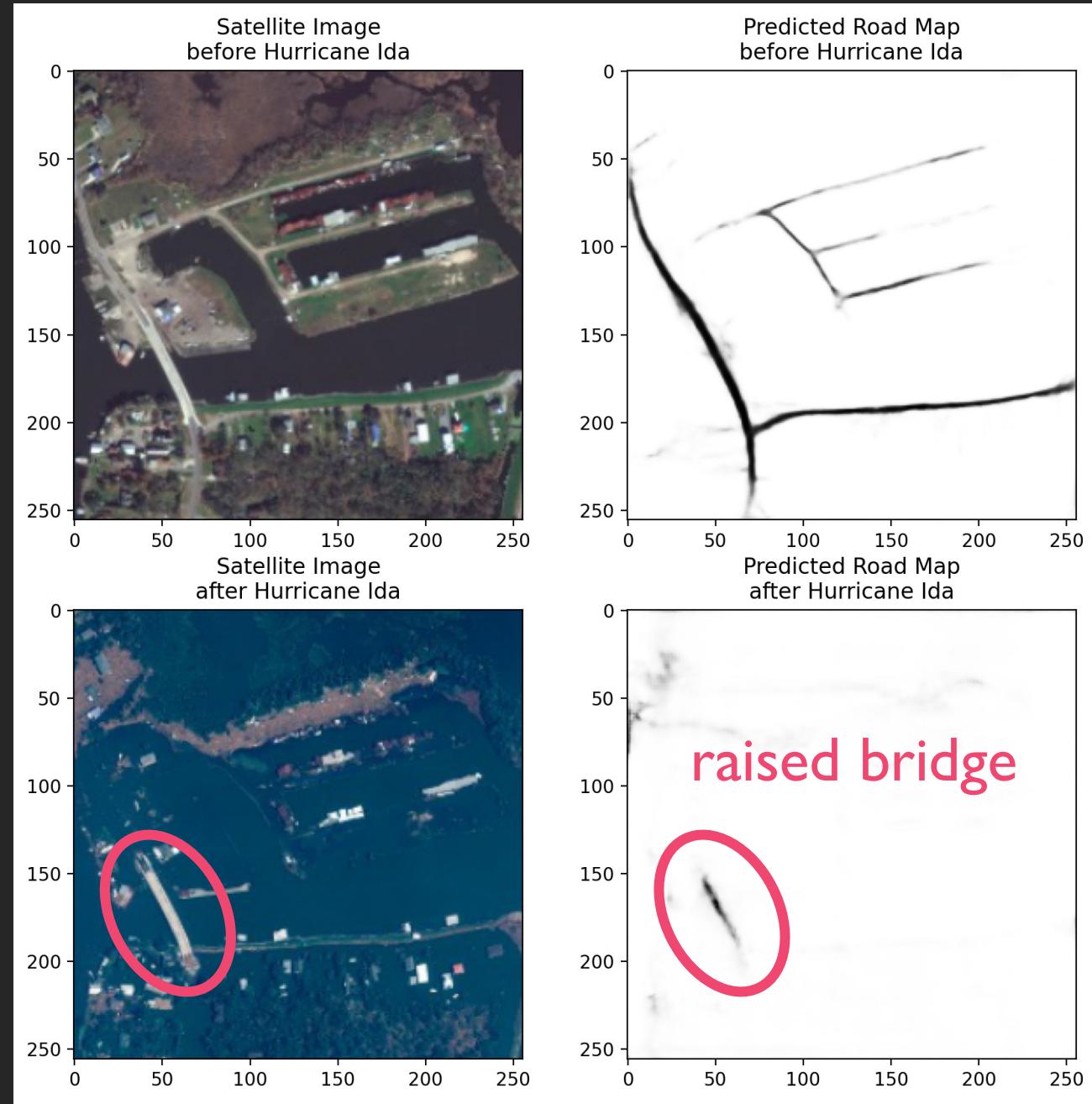
Results

- Applied to images of New Orleans collected before and after the impact of Hurricane Ida, August 2021



Results

- Applied to images of New Orleans collected before and after the impact of Hurricane Ida, August 2021



Conclusions & Future Directions

- Model can identify accessible roads in post-disaster scenarios
- Use data from OpenStreetMap for training data road masks; hand annotations are not high-quality for rural regions
- Include metric for “road connectivity” within image and between tiles of larger image

ROAD MAPS FOR DISASTER RELIEF

ANY
QUESTIONS?

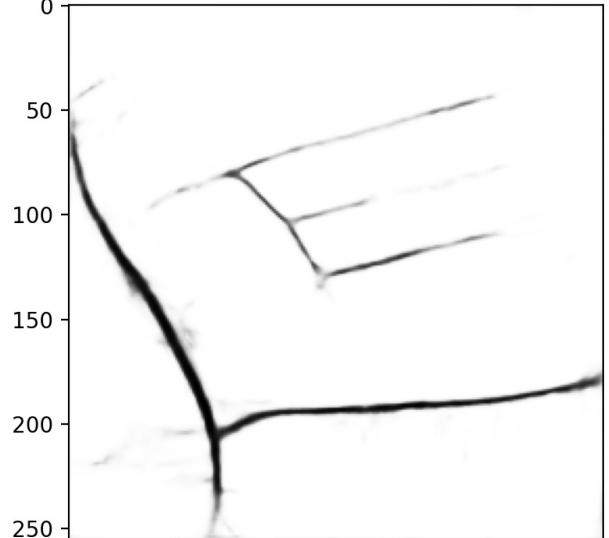
Satellite Image
before Hurricane Ida



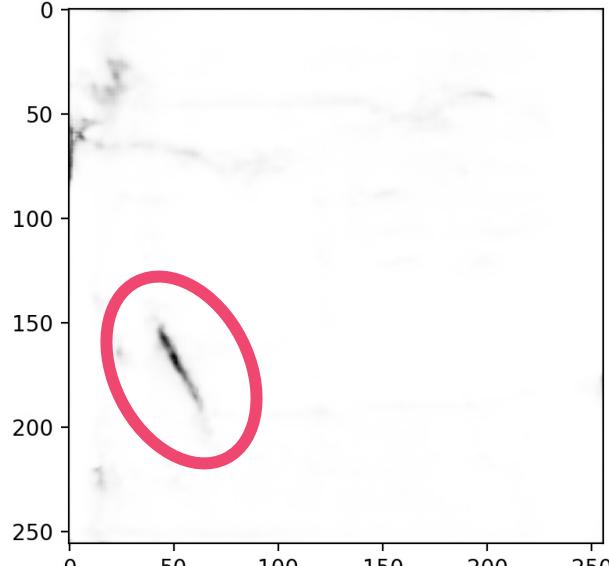
Satellite Image
after Hurricane Ida



Predicted Road Map
before Hurricane Ida



Predicted Road Map
after Hurricane Ida



APPENDIX

