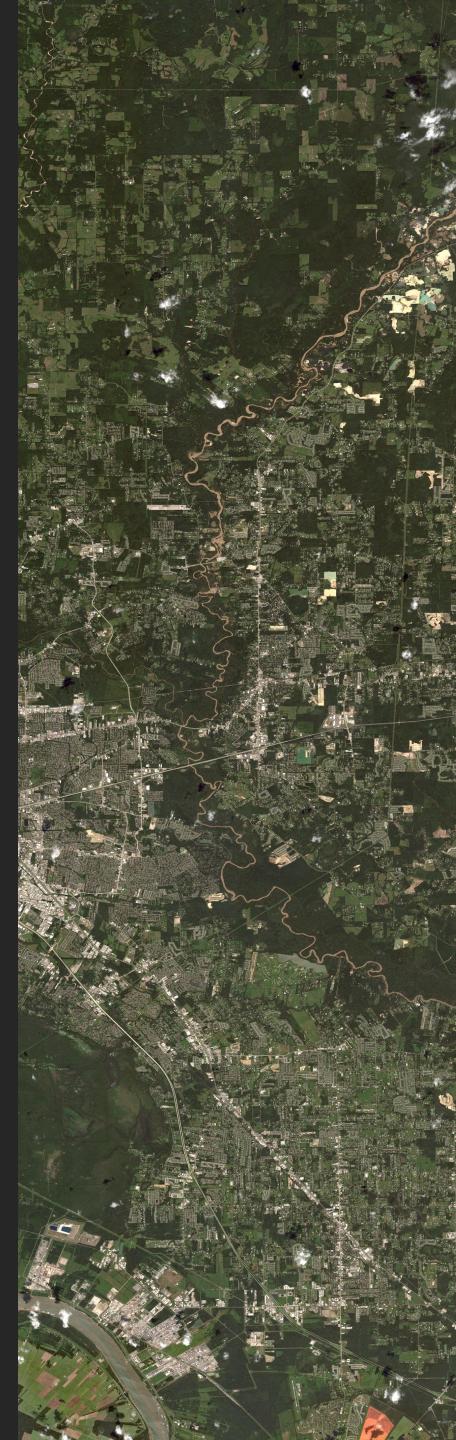


# ROAD MAPS FOR DISASTER RELIEF

Hannah Lewis  
October 1, 2021

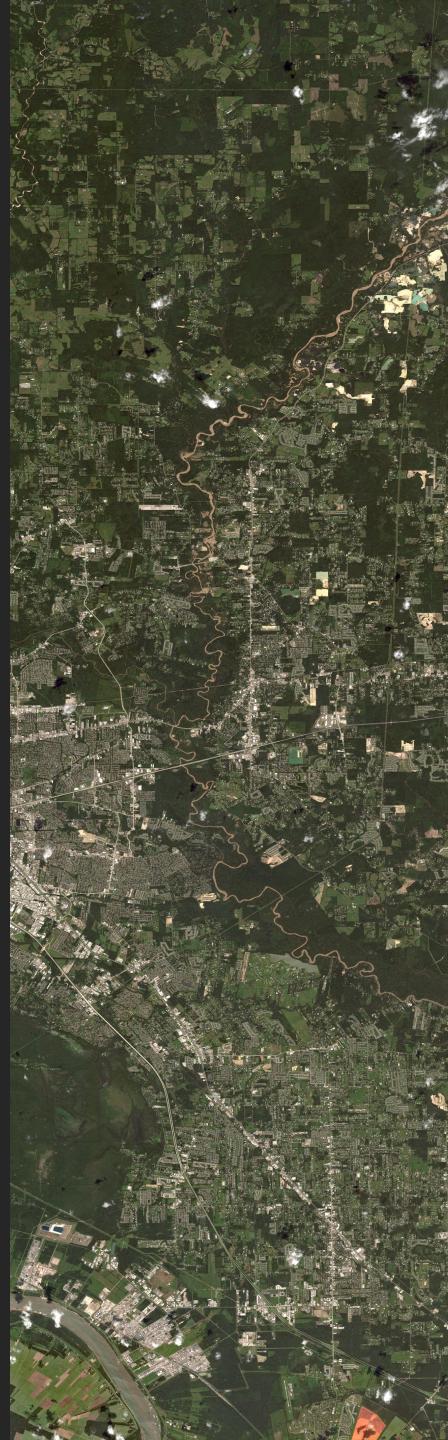
# Motivation

- 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



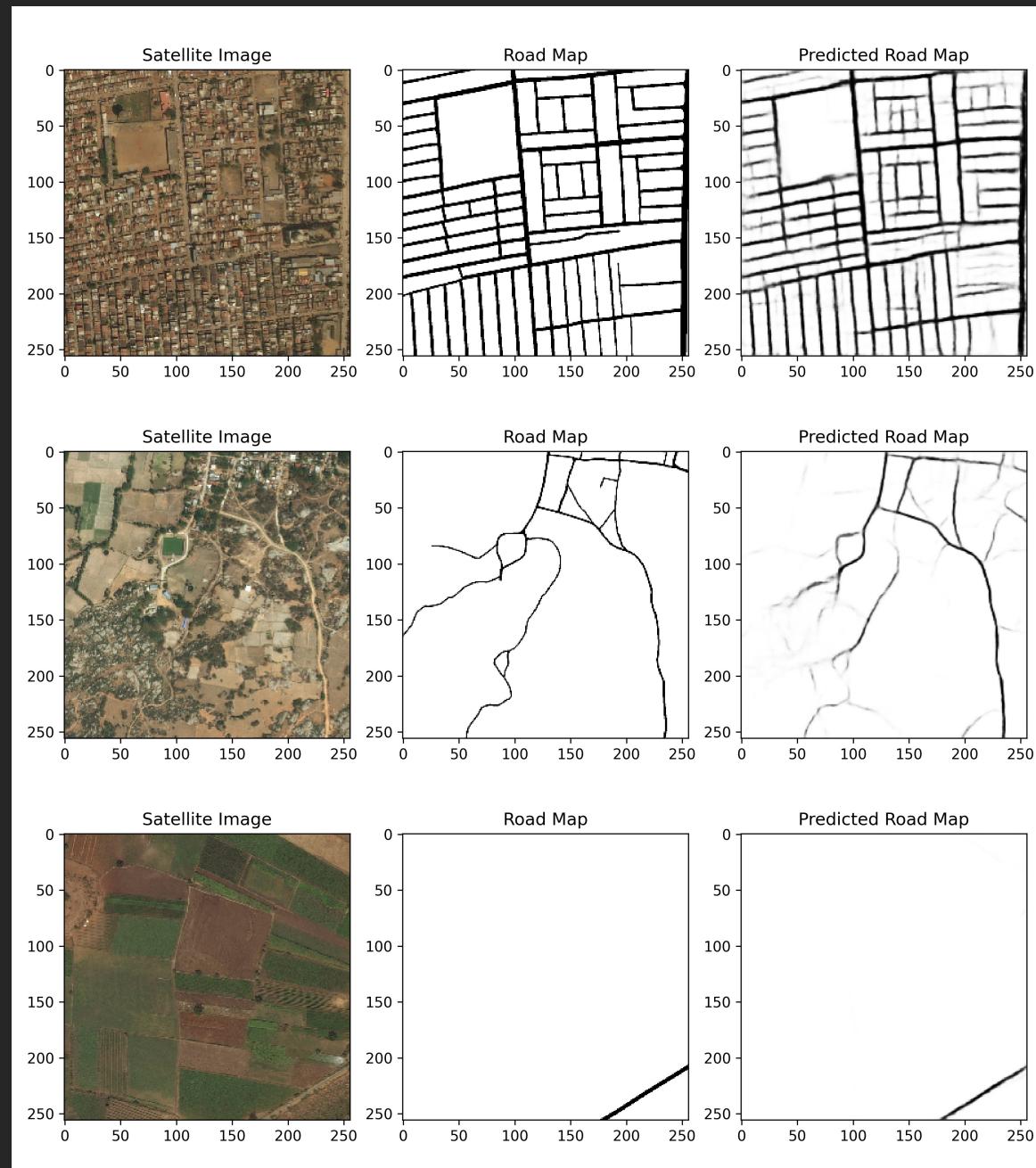
## Deep Learning CNN – U-Net architecture

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



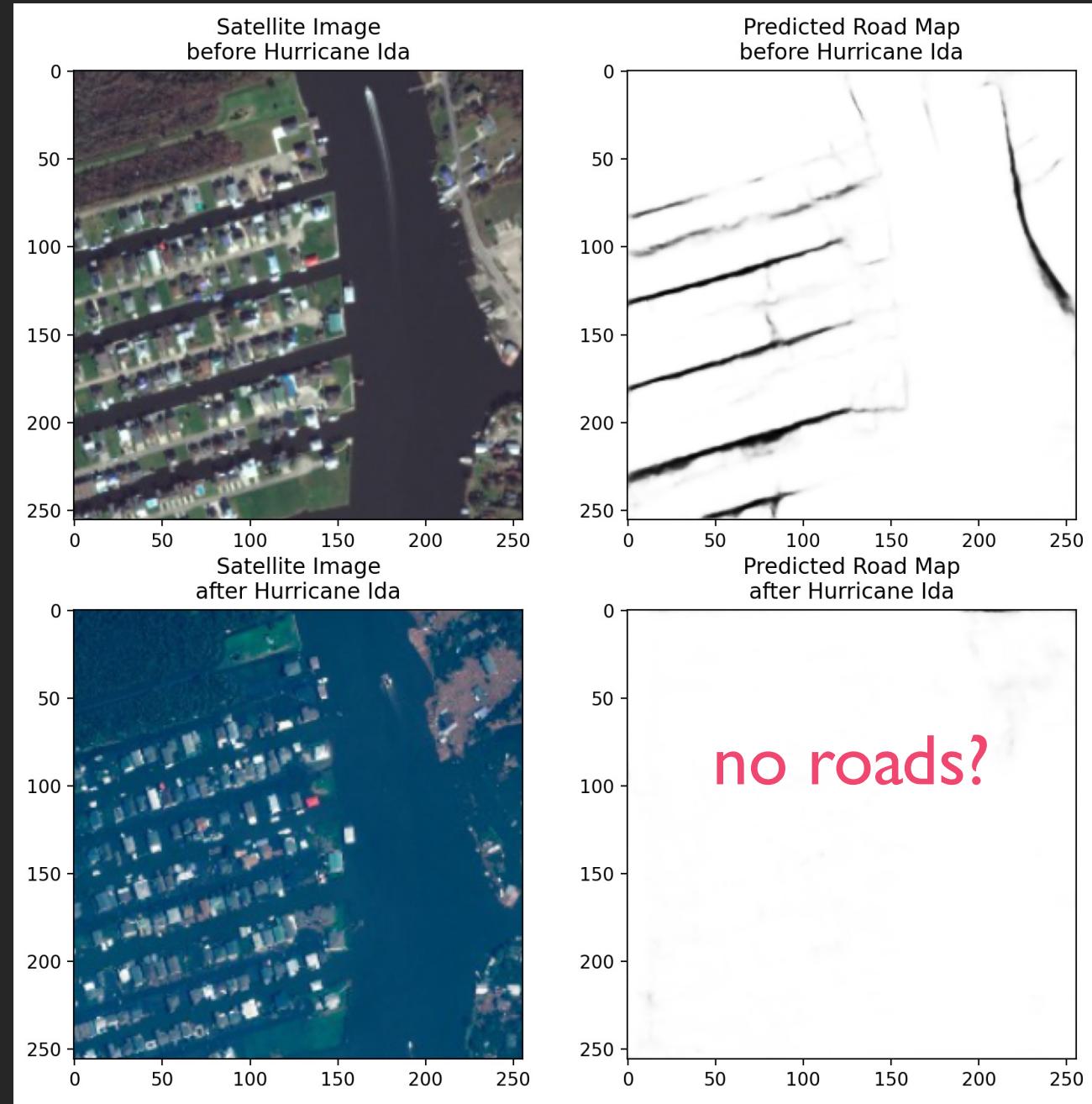
# Results

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



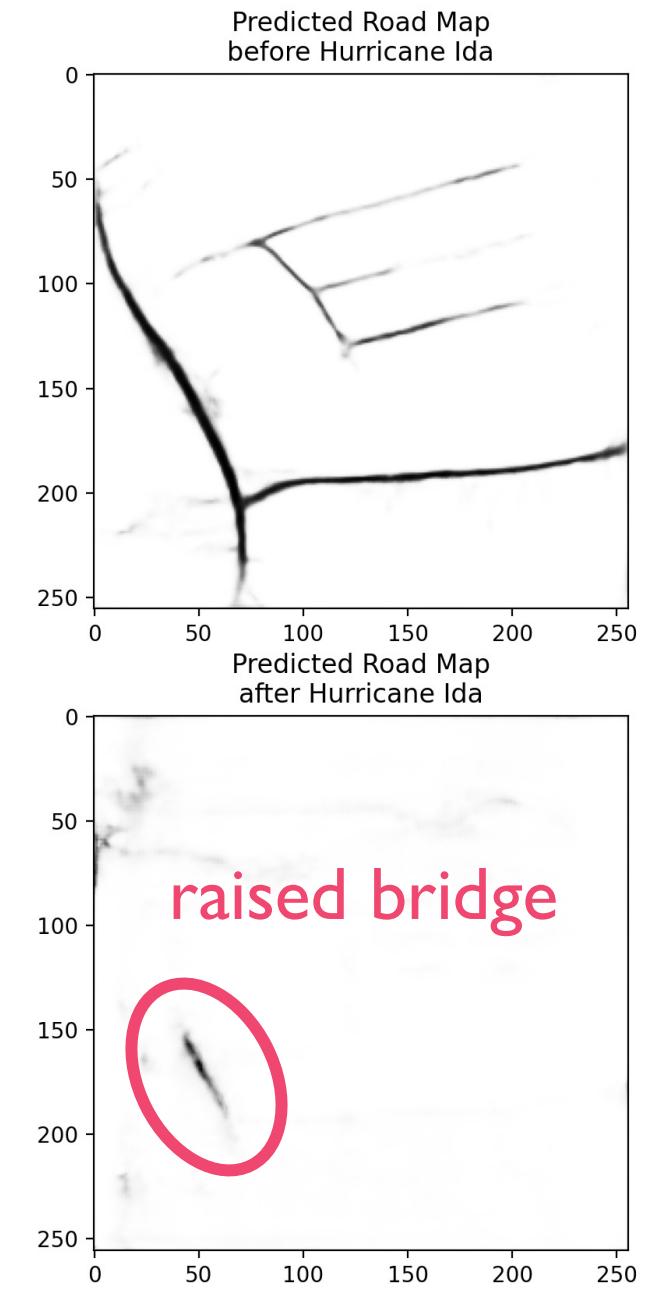
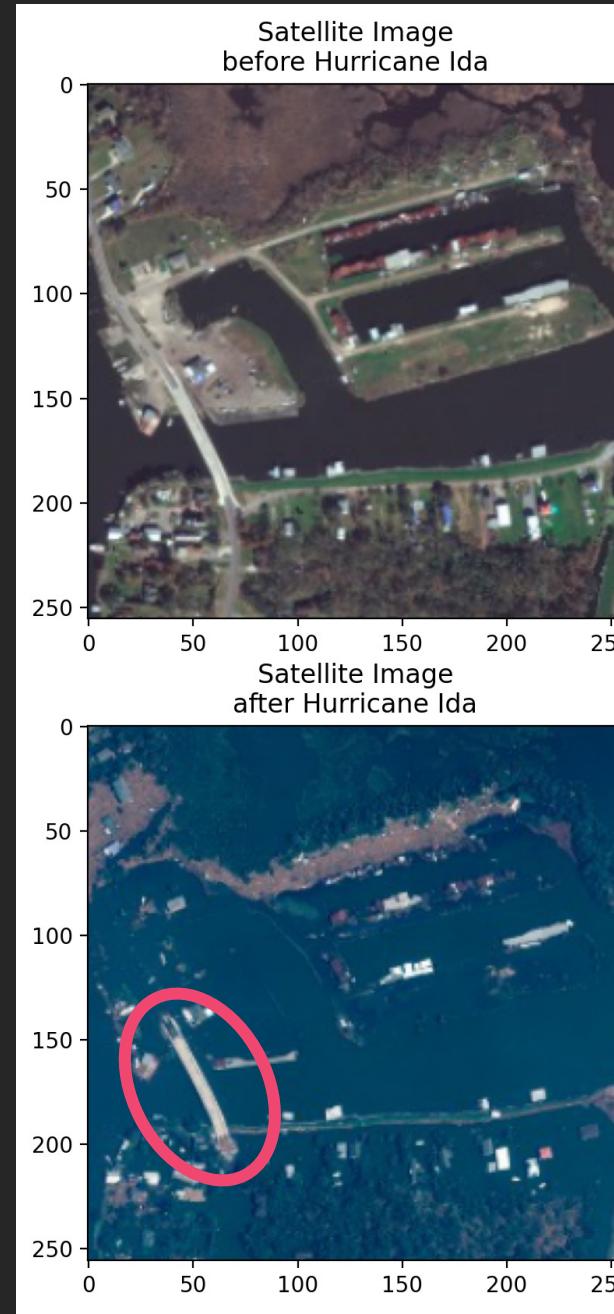
# Results

- 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?

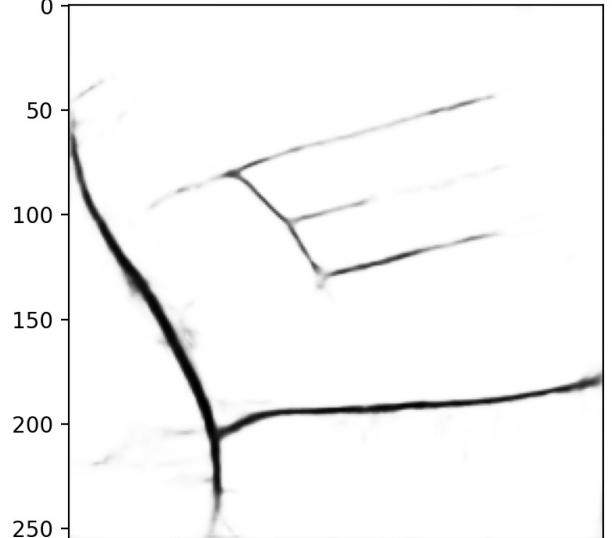
Satellite Image  
before Hurricane Ida



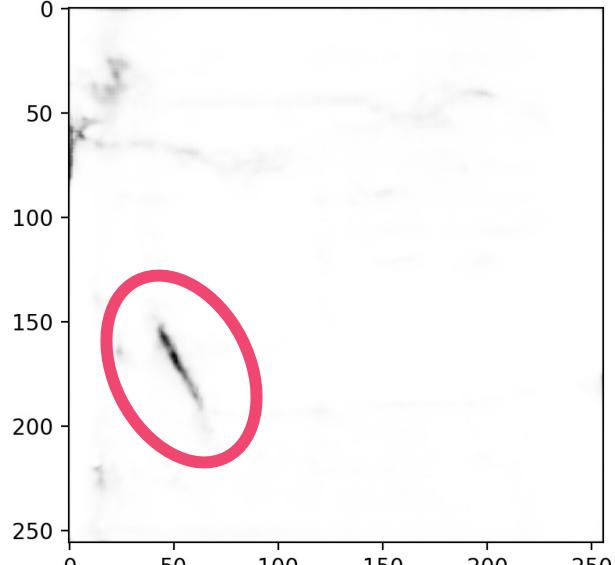
Satellite Image  
after Hurricane Ida



Predicted Road Map  
before Hurricane Ida



Predicted Road Map  
after Hurricane Ida



# APPENDIX

