Disaster preparedness and Disaster Response tools
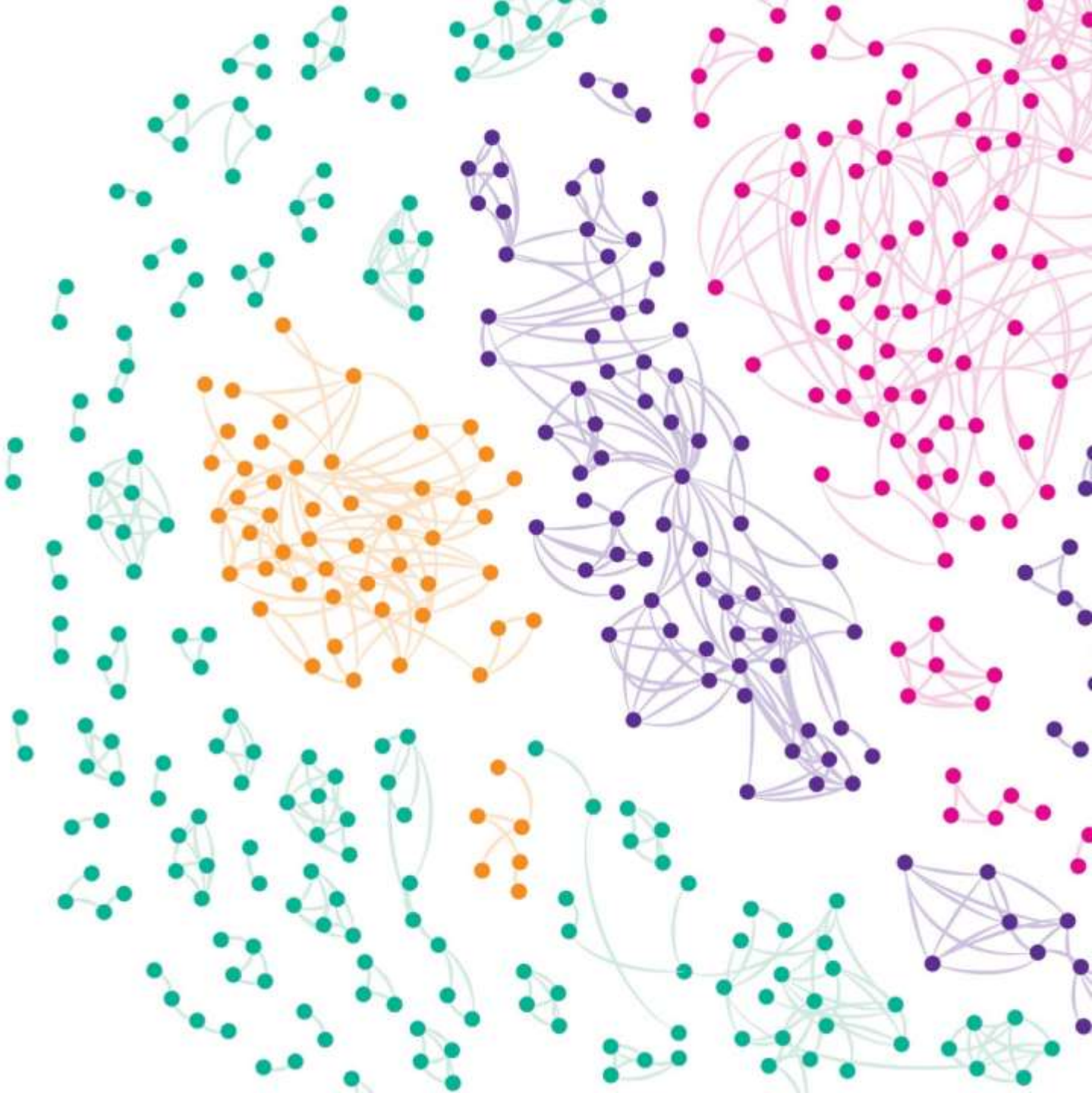
Anthony Cintron, Juan M. Lavista Ferres, Shahrzad Gholami, Md Nasir, Anthony Ortiz, Caleb Robinson, Tina Sederholm, Siyu Yang

Agenda

- **Introduction to our team**
- **Deep Dive 1**
  - Post-Disaster Building Damage Assessment using Satellite Data (*Netherland Red Cross | 510 Global Initiative*)
- **Deep Dive 2**
  - Dwelling type Classification and Risk Assessment for Disaster Vulnerability using Satellite Imagery (SEEDS)
- **Questions and Discussions**

AI for Humanitarian Action

Our $40 million commitment focused on disaster response, refugees and displaced people, human rights, and needs of children

AI for Humanitarian Action

Post-Disaster Building Damage Assessment using Satellite Data

Shahrzad Gholami*, Siyu Yang*, Caleb Robinson*, Anthony Ortiz*, Fabian Salamo*, Anthony Cintron*, Juan M. Lavista Ferres*, Jacopo Margutti**
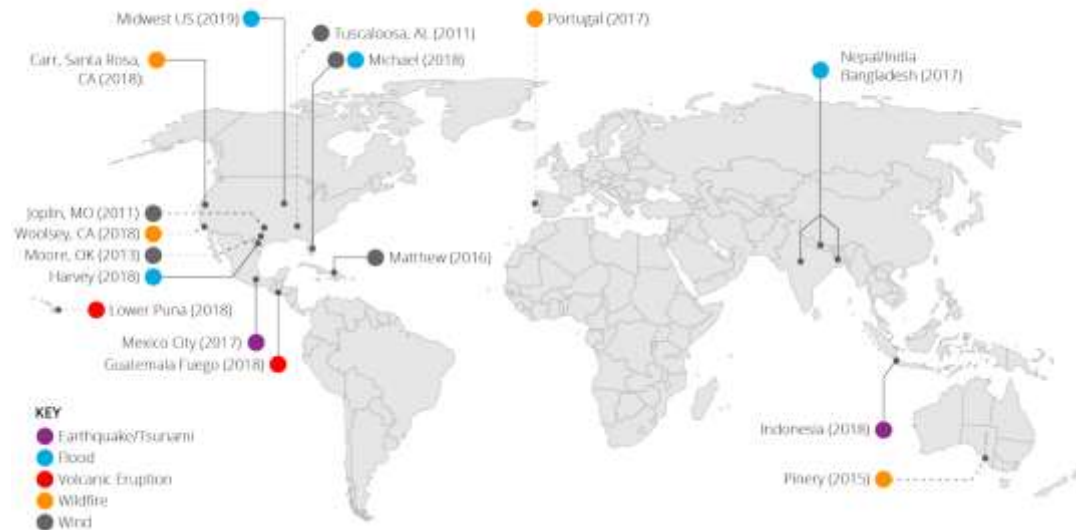
*Microsoft AI for Good
**510 Global Initiative | Netherland Red Cross

Datasets Coverage & Damage Levels

- Disaster types and disasters represented in xBD dataset around the world

- Sourced from the Maxar/DigitalGlobe Open Data Program

- Targeted satellite imagery to be below a 0.8-meter ground sample distance

- 19 different natural disasters across 22,068 images of 1024x1024 and contains 850,736 building polygons

- Imagery covers a total of 45,361.79 sq. km.

Disaster Level	Structure Description
0 (No Damage)	Undisturbed. No sign of water, structural or shingle damage, or burn marks.
1 (Minor Damage)	Building partially burnt, water surrounding structure, volcanic flow nearby, roof elements missing, or visible cracks.
2 (Major Damage)	Partial wall or roof collapse, encroaching volcanic flow, or surrounded by water/mud.
3 (Destroyed)	Scorched, completely collapsed, partially/completely covered with water/mud, or otherwise no longer present.

xBD: A Dataset for Assessing Building Damage from Satellite Imagery
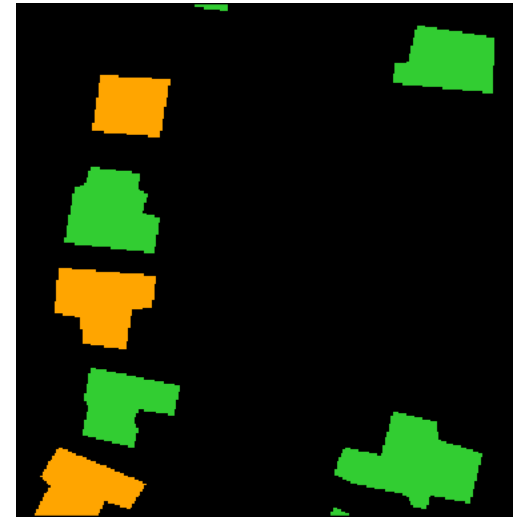
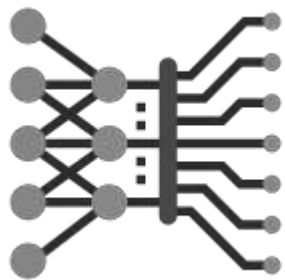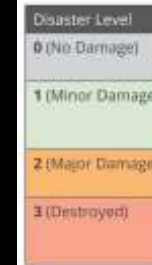# Study Objective: Build Damage Assessment Model

pre-disaster imagery   post-disaster imagery   Building edge & damage level ground truth
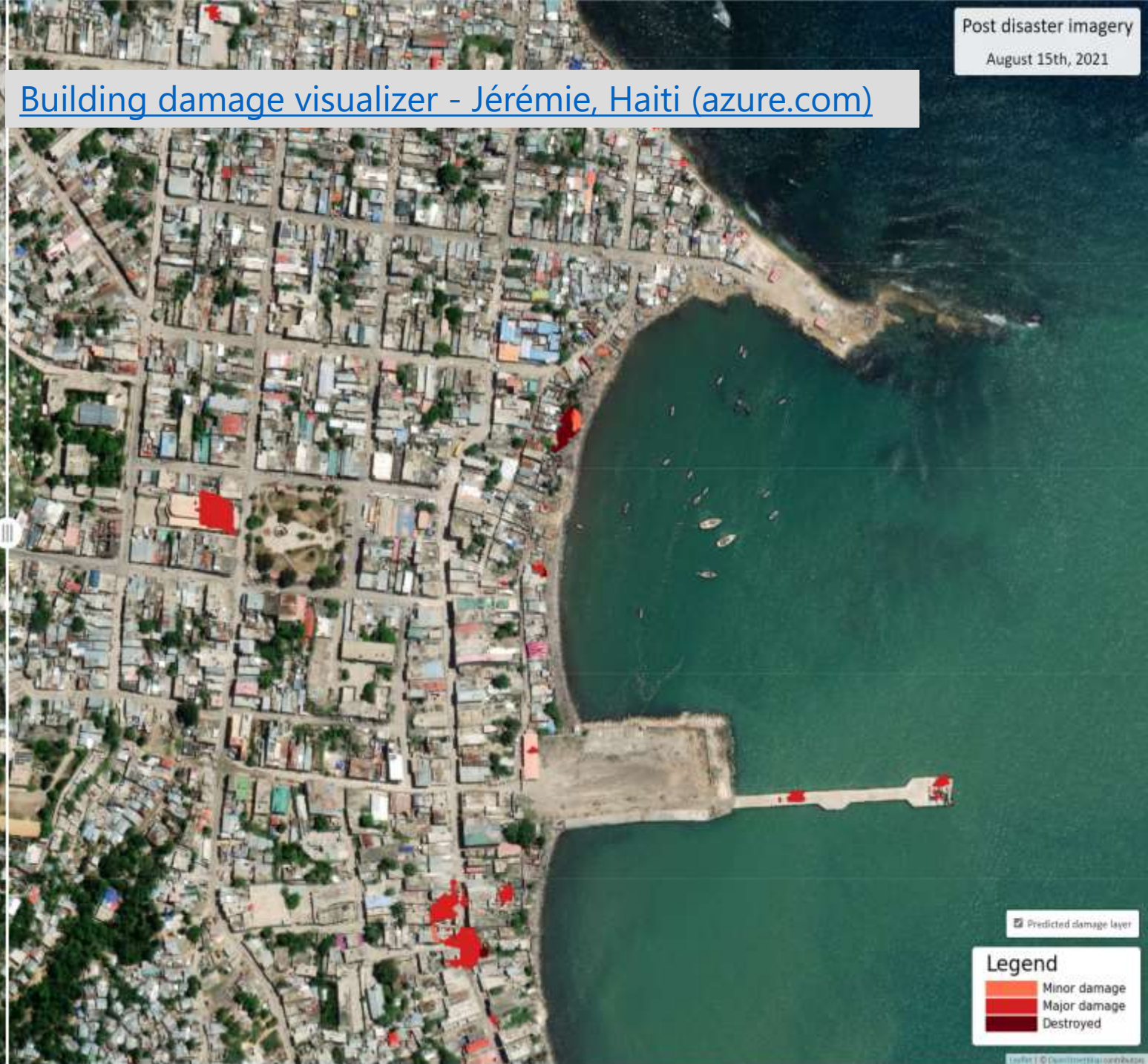
Can we train a model that can be used for future damage assessment purposes in disaster response agencies?

Task I: Building Segmentation
Task II: Damage Level Classification

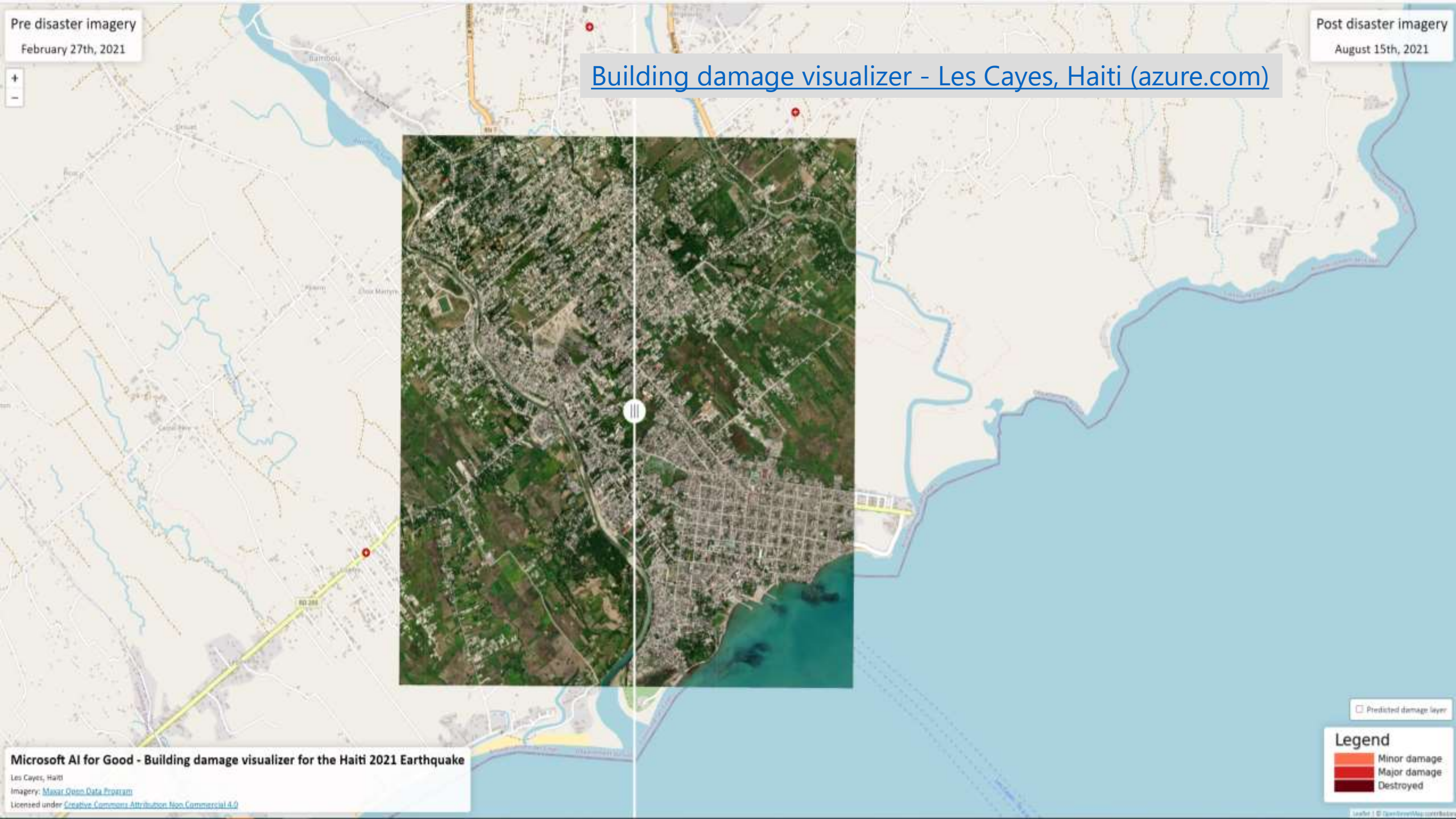| Pixelwise F1 score on validation set					
Tasks	Labels				
	1	2	3	4	Harmonic mean
Building footprint segmentation	0.74	-	-	-	
Damage classification	0.89	0.43	0.56	0.84	0.62

Pre disaster imagery
April 17th, 2021

Post disaster imagery
August 15th, 2021

Building damage visualizer - Jérémie, Haiti (azure.com)

Microsoft AI for Good - Building damage visualizer for the Haiti 2021 Earthquake
Jérémie, Haiti
Imagery: Maxar Open Data Program
Licensed under Creative Commons Attribution Non Commercial 4.0

Predicted damage layer

Legend
Minor damage
Major damage
Destroyed

Building damage visualizer - Les Cayes, Haiti (azure.com)

Microsoft AI for Good - Building damage visualizer for the Haiti 2021 Earthquake

Les Cayes, Haiti
Imagery: Maxar Open Data Program
Licensed under Creative Commons Attribution Non Commercial 4.0

☐ Predicted damage layer

Legend
Minor damage
Major damage
Destroyed

Successful Detection Examples in Haiti

pre-disaster   post-disaster   predictions
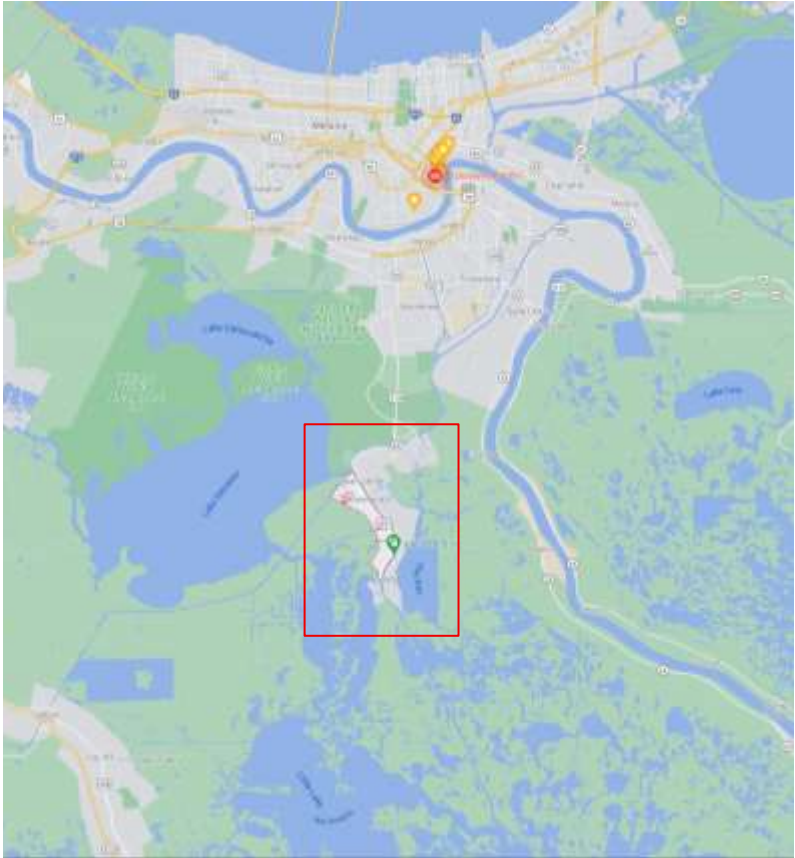
Louisiana Flood from Hurricane Ida: Barataria & Jean Lafitte

pre-disaster

post-disaster

Building damage visualizer - New Orleans, Louisiana (azure.com)

AI for Humanitarian Action

Project Sunny Lives

Dwelling type Classification and Risk Assessment for Disaster Vulnerability using Satellite Imagery

Md Nasir, Microsoft

Tina Sederholm , Microsoft

Anshu Sharma, SEEDS

Sundeep Reddy Mallu, Gramener

Shubham Mishra, SEEDS

Sumedh Rajan Ghatage, Gramener

Juan M. Lavista Ferres , Microsoft

AI for Good Research Lab

Introduction

- Partnership with non-profit **Sustainable Environment and Ecological Development Society (SEEDS)** working towards building disaster resilience in low-income areas

- 2 million houses lost every year in India, only to flood

Dwelling types are good indicator of vulnerability

- Roof type classification of dwellings indicate the construction material and resilience

- Satellite imagery-based approach for scalability

Determine disaster vulnerabilities in advance

Combining this information with weather warnings and forecasts, vulnerable communities can be identified prior to the disaster
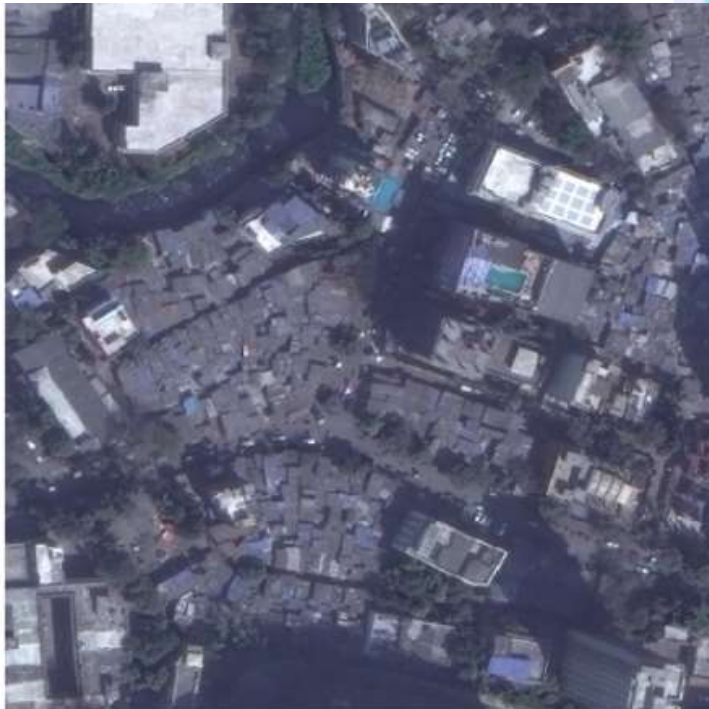

Image source: The Guardian
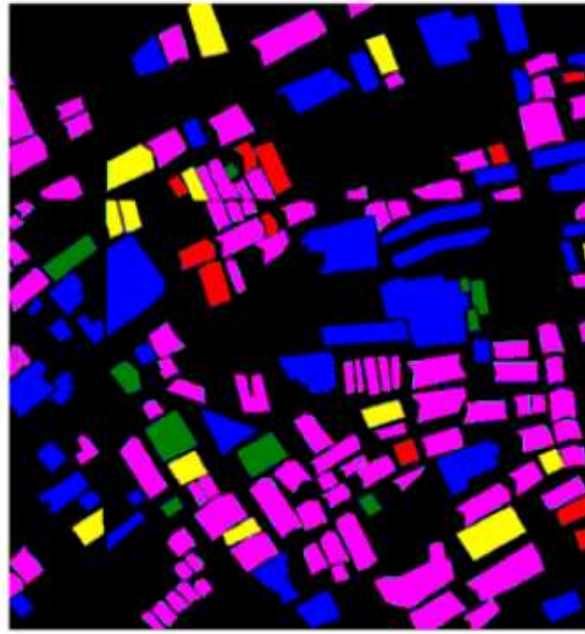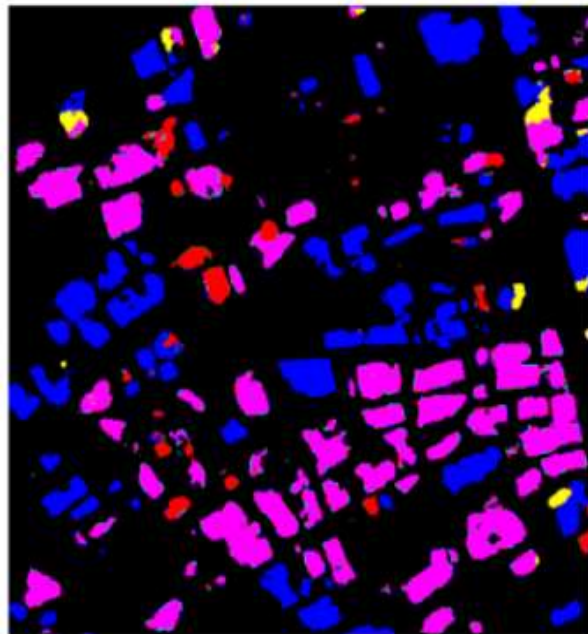
Dataset

Satellite Imagery

- 50 cm resolution RGB data from Maxar partnership

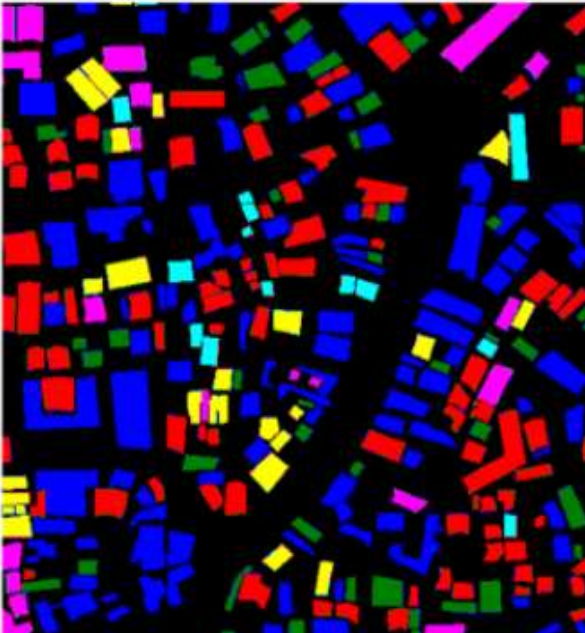- 8 areas of interest (AOIs) were identified by SEEDS from 2 regions in India
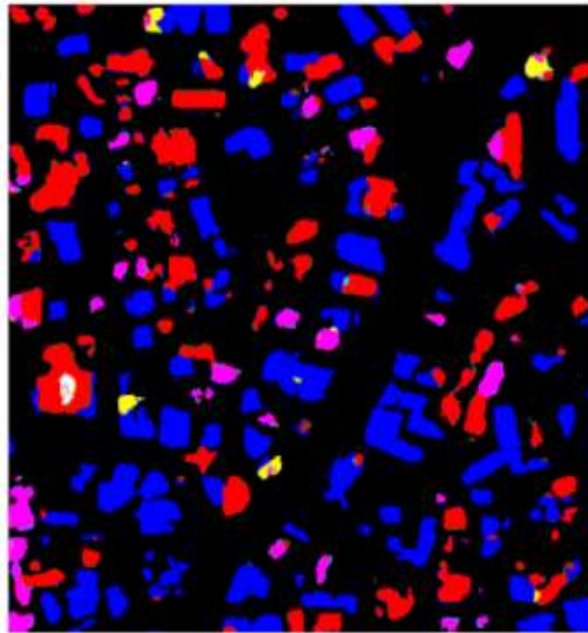

The coastal town of Puri

The city of Mumbai including Dharavi slum

(Left column): predicted label

(Middle): ground truth

(Right): input imagery

Categories

■	0 not_house
■	1 RCC
■	2 CGI_1S
■	3 CGI_2S
■	4 CGI_4S
■	5 TILE_2S
■	6 TILE_4S
	7 TARP

Impact

- **Short term:** can take necessary actions on at a community/neighborhood level
    - such as evacuation, allocation of resources
    - to minimize the loss and provide relief
    - Deployed for two cyclones last year
- **Long-term:** identify vulnerable regions and work towards risk reduction
    - by strengthening of buildings
    - improving water and sanitation management

Microsoft

[Learn more about our work](#)

Thank you.