Copyright Notice

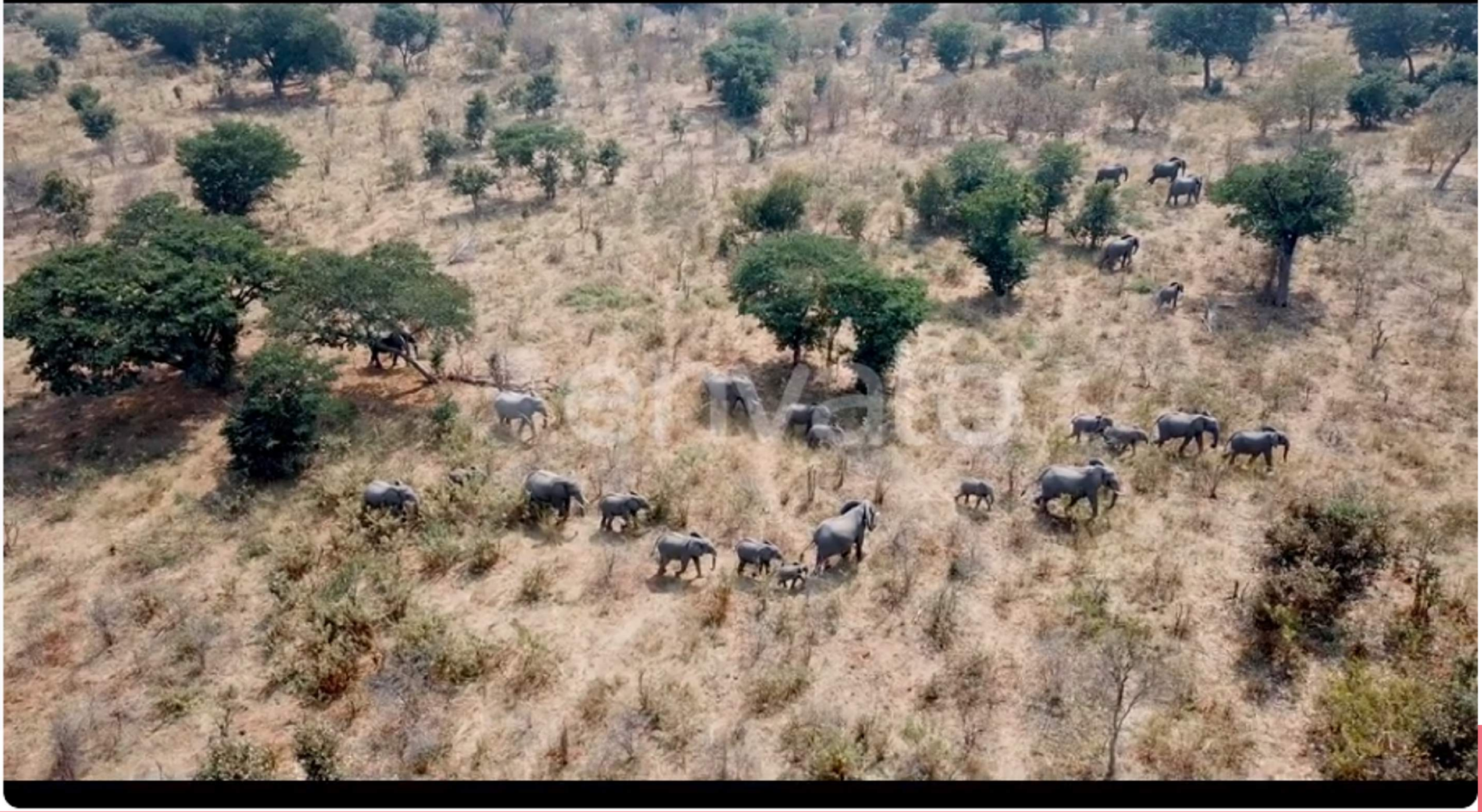
Week 2

W2 Lesson 1

DeepLearning.AI

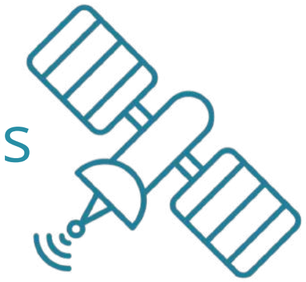
AI and Disaster Management

Welcome to Week 2

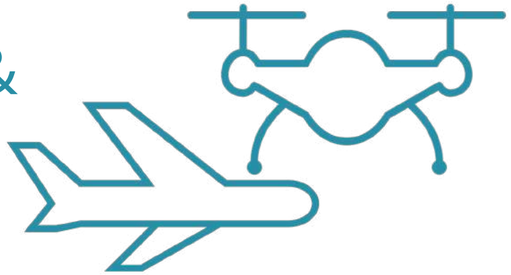


Overhead Imagery

Satellites



Planes &
Drones



- ⊕ Cover larger areas
- ⊖ Lower resolution
- ⊖ Clouds could be a problem

- ⊖ Cover smaller areas
- ⊕ Higher resolution
- ⊕ Clouds less of a problem

Hurricane Sandy 2012

Landfall in Eastern U.S.

Civil Air Patrol

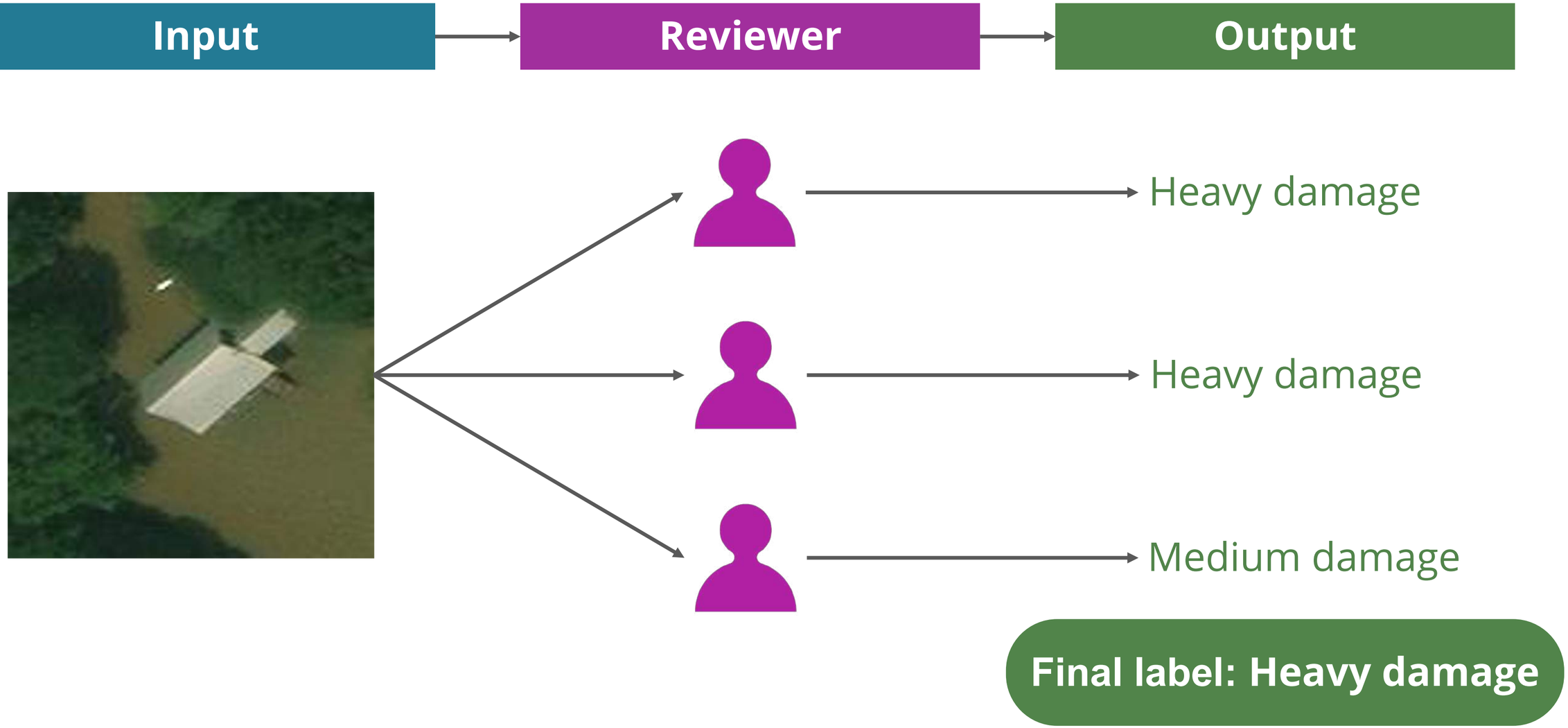
35,000 Images

Damage Assessment

Government

Third Parties

Crowdsourcing System

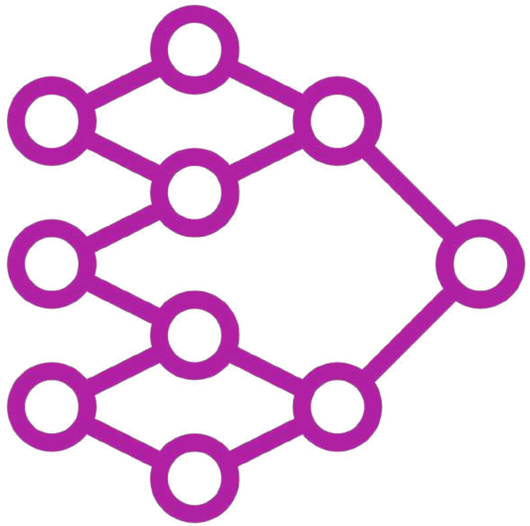


Damage Classifier

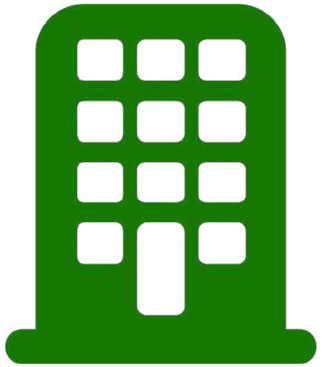
Input → **Model** → **Output**

Aerial image

Neural Network trained on labeled dataset



Damage classification

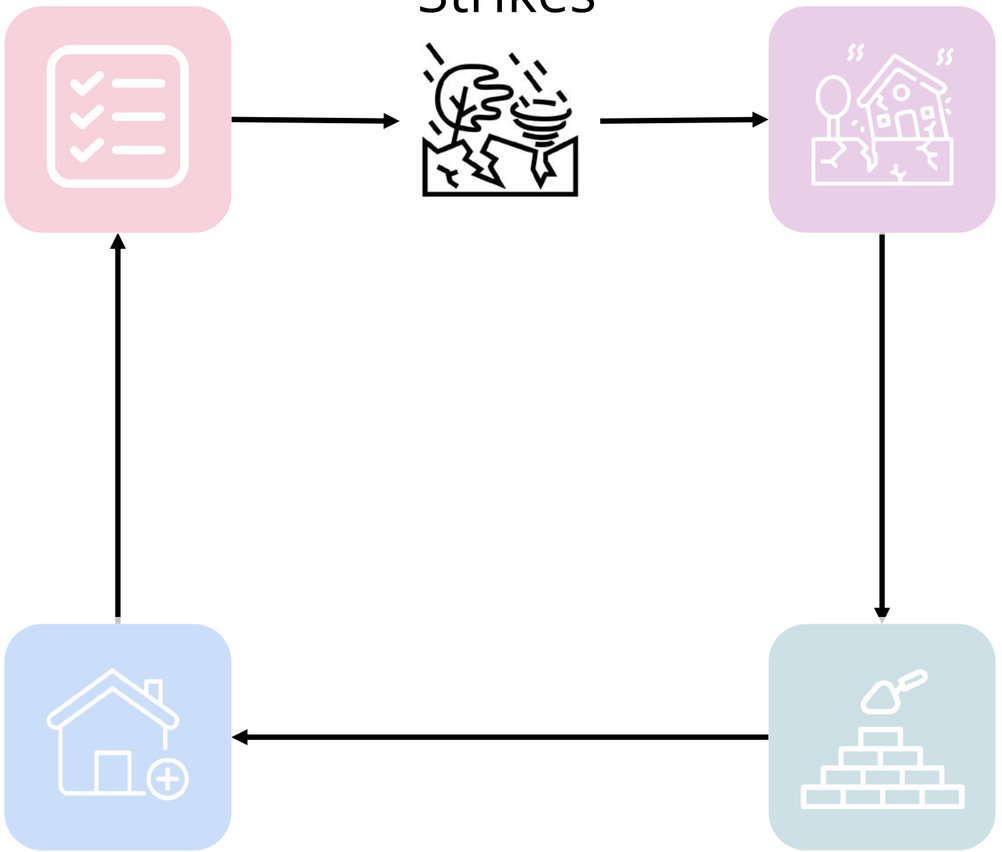


No damage

Pre-Disaster

Post-Disaster

Disaster Strikes



Preparation

Emergency plans
Training and drills

Response

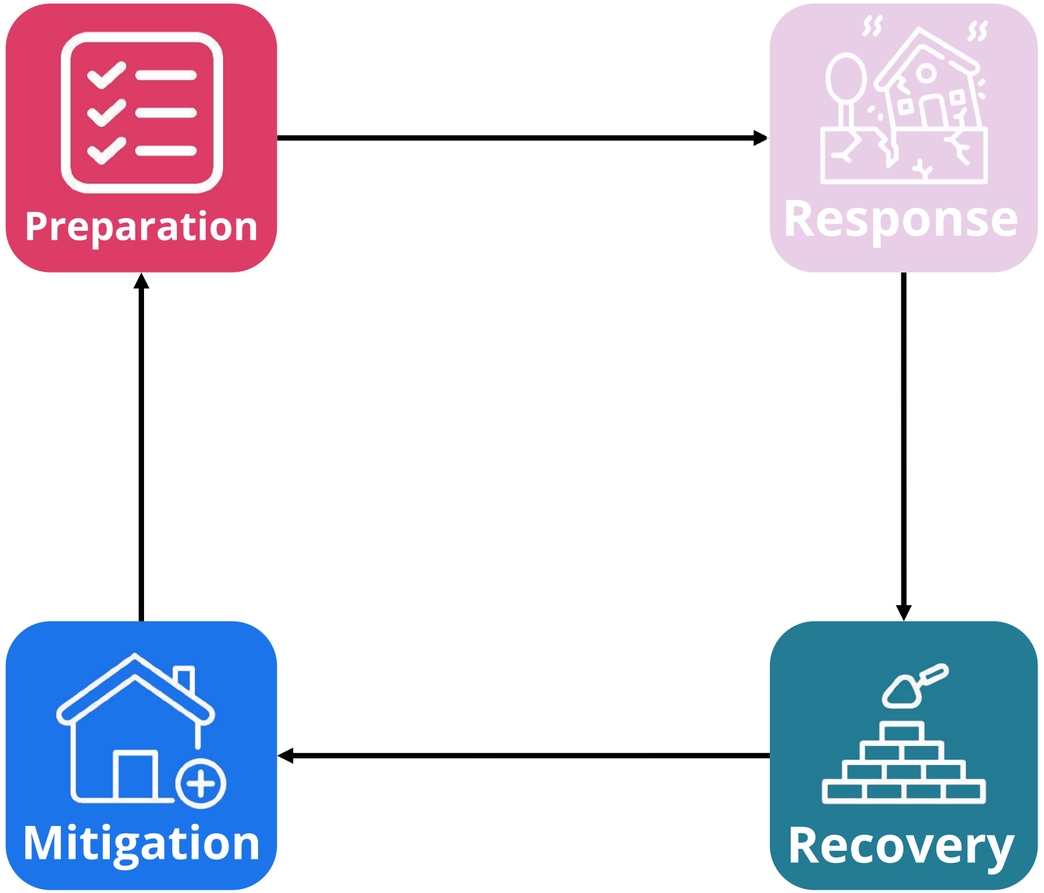
Search & rescue,
Provide essential aid

Mitigation

Resilient infrastructure
Early warning systems

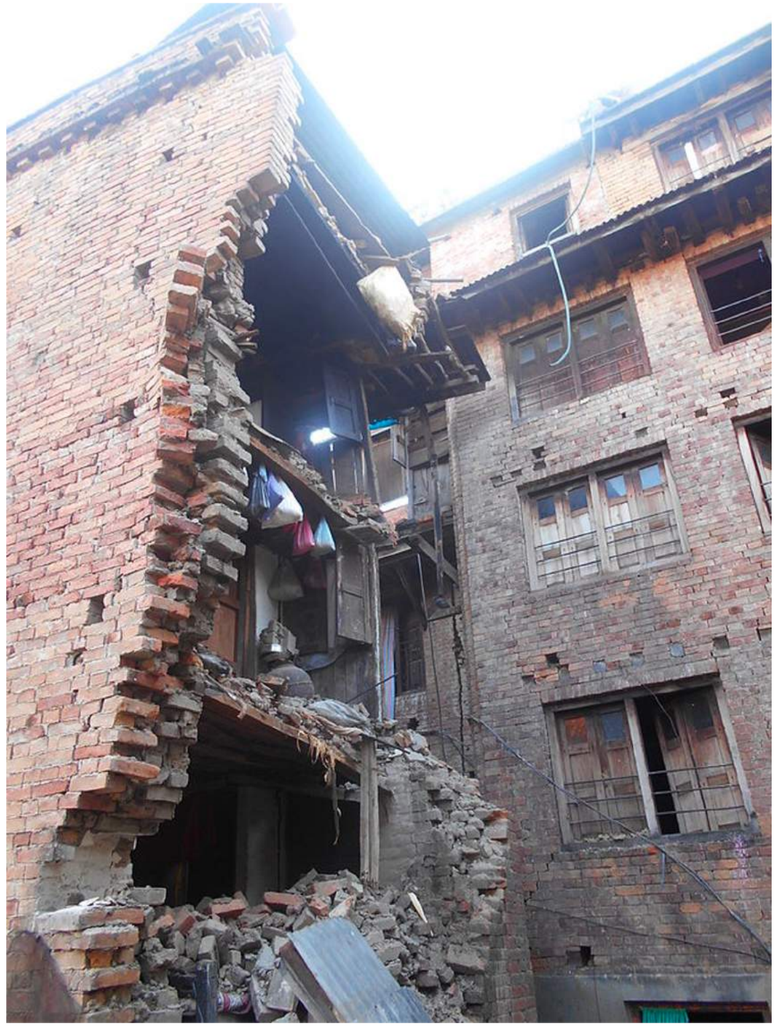
Recovery

Assess damage
Financial assistance


Preparation
Response
Mitigation
Recovery

Nepal earthquake 2015

Earthquake Nepal 2015. Nirmal Dulal

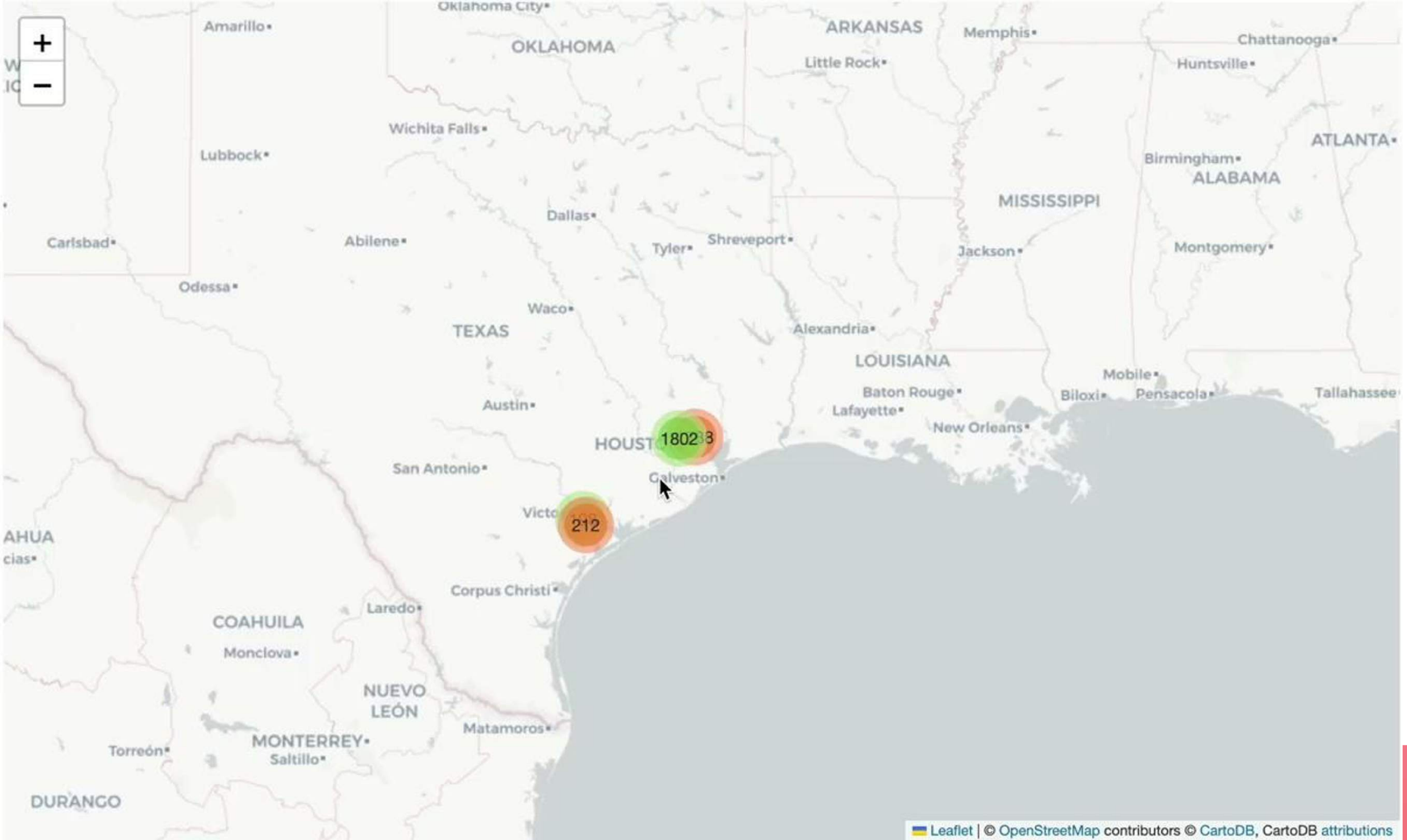


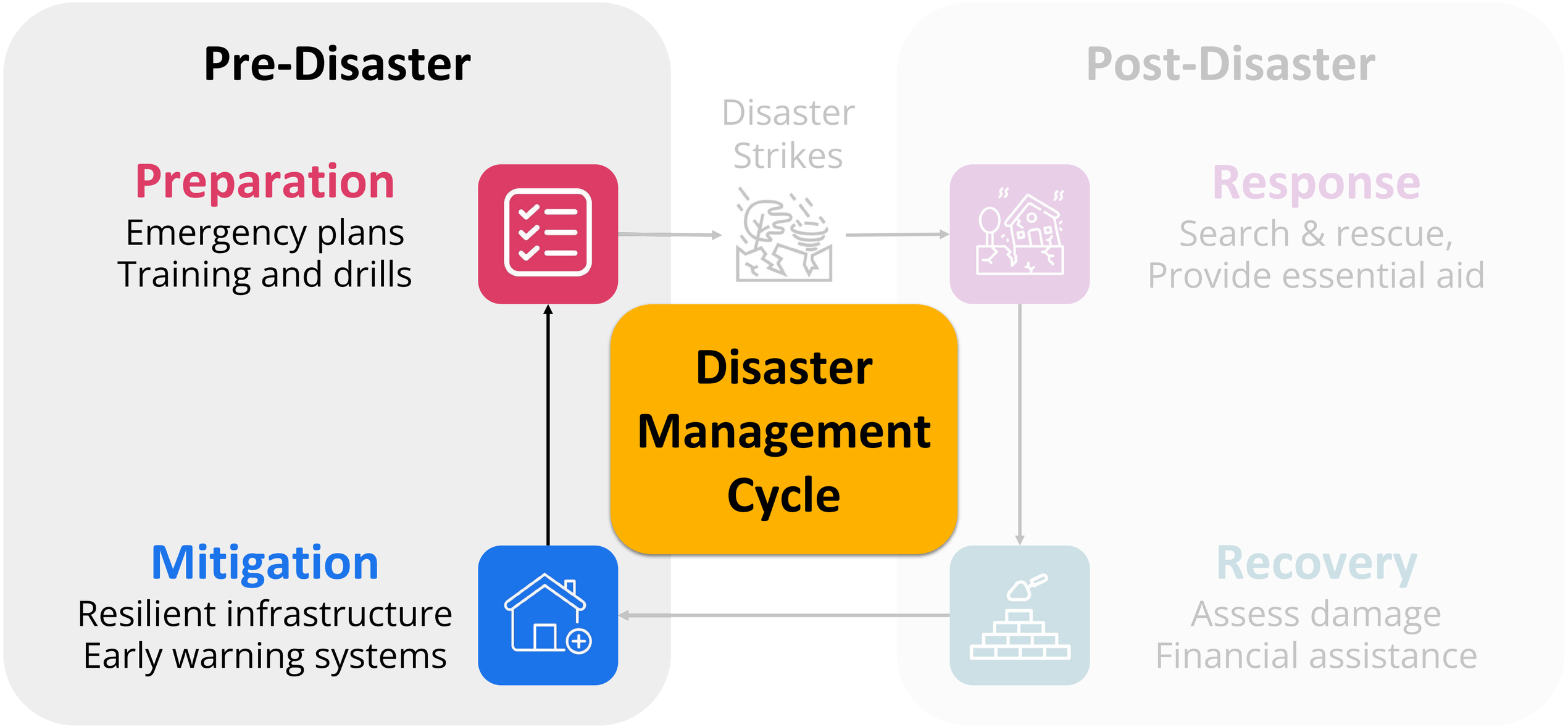
Earthquake Nepal 2015. Punya

Damage Assessment

Undamaged

Damaged


+
−
Amarillo
Oklahoma City
OKLAHOMA
ARKANSAS
Memphis
Chattanooga
Little Rock
Huntsville
Wichita Falls
Lubbock
ATLANTA
Birmingham
ALABAMA
MISSISSIPPI
Dallas
Carlsbad
Abilene
Tyler
Shreveport
Jackson
Montgomery
Odessa
Waco
TEXAS
Alexandria
LOUISIANA
Mobile
Baton Rouge
Biloxi
Pensacola
Tallahassee
Austin
Lafayette
New Orleans
1802
HOUST
San Antonio
Galveston
212
Victo
AHUA
cias
Corpus Christi
Laredo
COAHUILA
Monclova
NUEVO
LEÓN
Matamoros
MONTERREY
Torreón
Saltillo
DURANGO
Leaflet | © OpenStreetMap contributors © CartoDB, CartoDB attributions

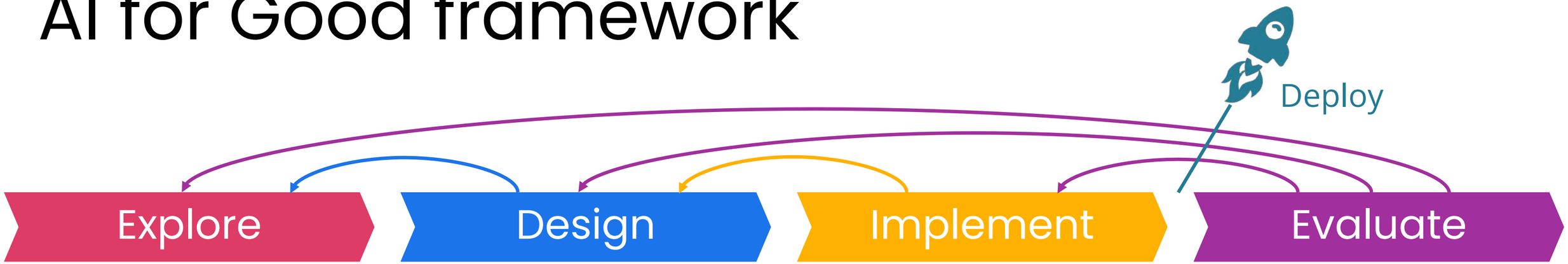

Pre-Disaster
Post-Disaster
Preparation
Emergency plans
Training and drills
Disaster
Strikes
Response
Search & rescue,
Provide essential aid
Disaster
Management
Cycle
Mitigation
Resilient infrastructure
Early warning systems
Recovery
Assess damage
Financial assistance

DeepLearning.AI

AI and Disaster Management

AI for Good Framework

AI for Good framework



1. Engage stakeholders
2. Define the problem
3. Determine if AI could add value

1. Prototype your solution
2. Ensure data privacy
3. Design the user experience

1. Productionize AI models
2. Integrate the user experience
3. Test with end users

1. Measure project impact
2. Communicate results
3. Determine next steps

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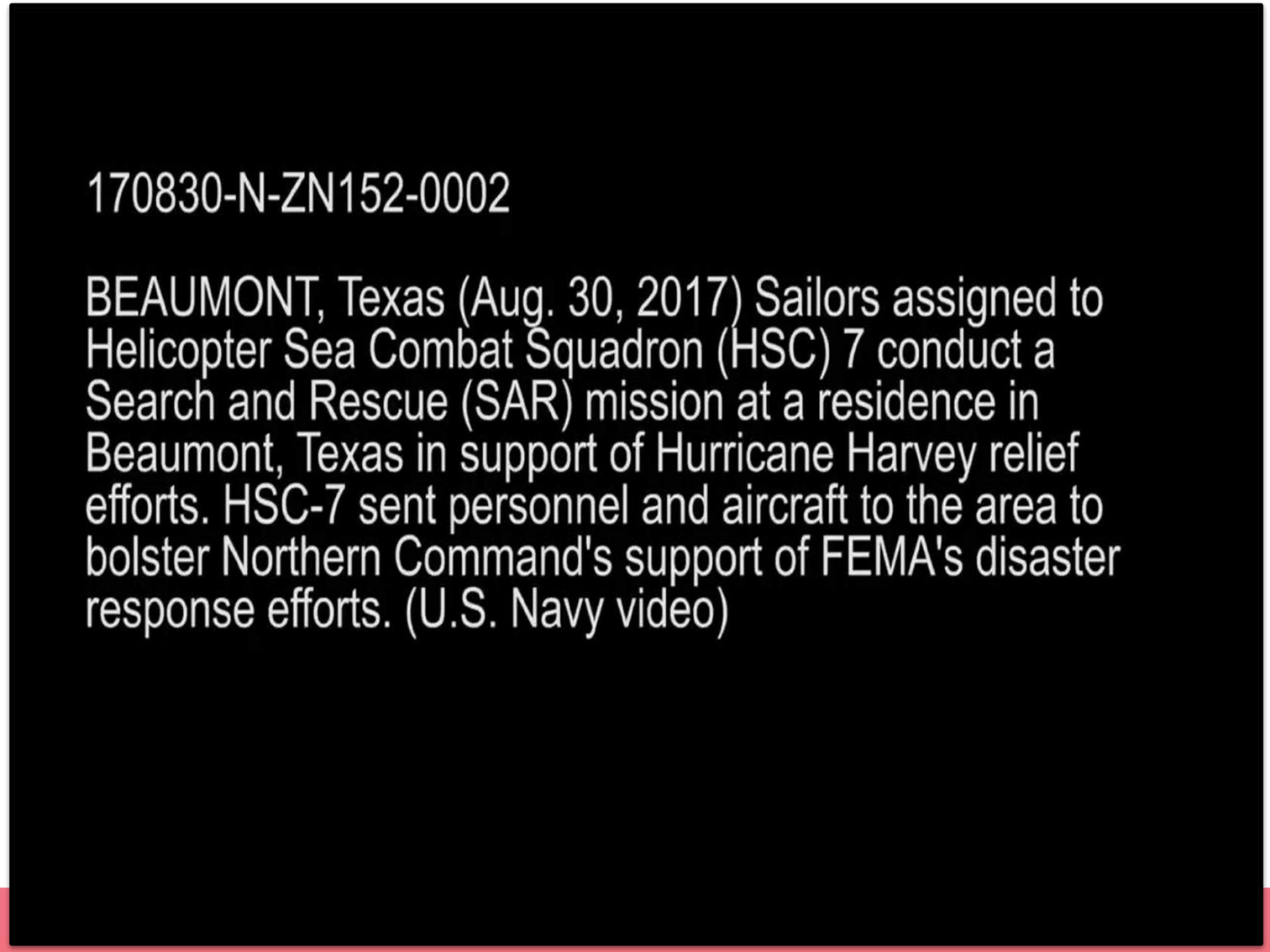
AI and Disaster Management

Damage Assessment

Explore Phase

Hurricane Harvey August 2017

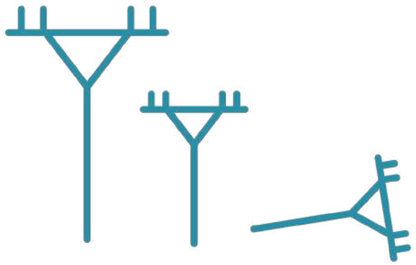
B-roll



Damaged Infrastructure

Aftermath

Power Lines



Buildings

Roads

Temporary Communication Network

Enabled aid requests and up-to-date information

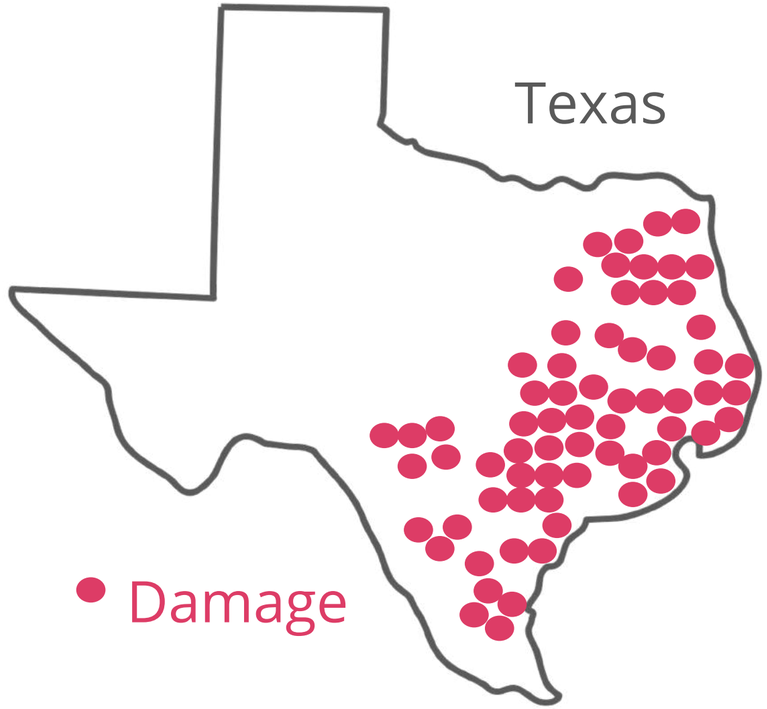
Damage Assessment

Input → **Output**

Satellite images

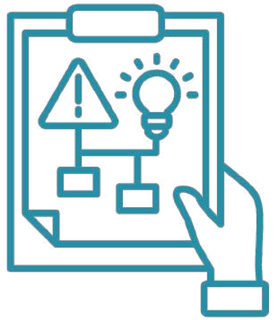
Undamaged Damaged

Map with damaged location



Damage Assessment

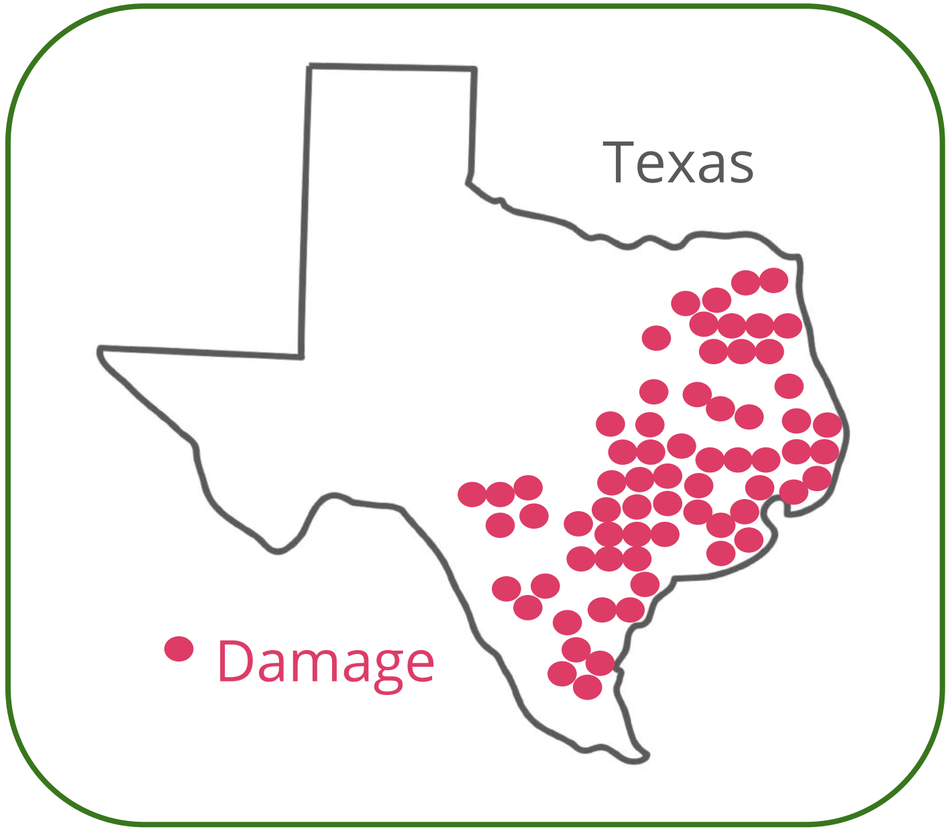
Plan



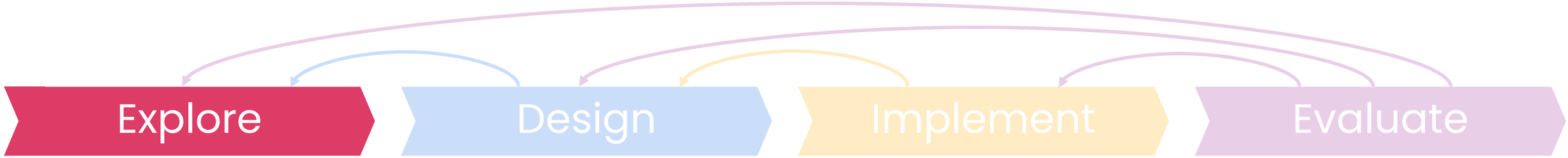
Aid distribution

Prioritize reconstruction

Map with damaged location

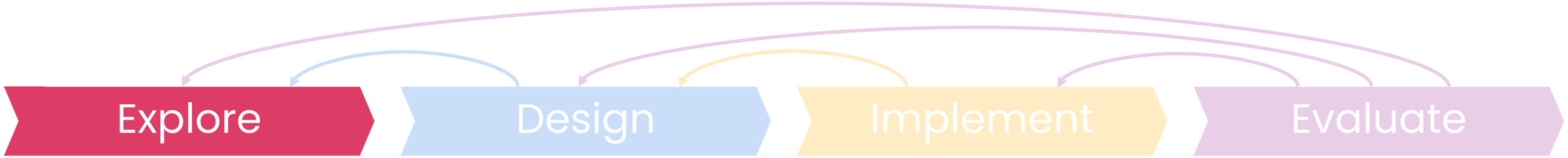


Explore phase



1. Engage stakeholders
2. Define the problem
3. Determine if AI could add value

Explore phase



1. Engage stakeholders
2. Define the problem
3. Determine if AI could add value

Explore phase

Explore

1. Engage stakeholders
2. Define the problem
3. Determine if AI could add value

A good problem statement should:

1. Be clear, concise, and specific.
2. Identify key stakeholders.
3. Give an idea of what success looks like.
4. Not mention the specific technology you aim to deploy.

"Disaster managers need to **identify and assess damaged areas** using large volumes of overhead imagery to prioritize response efforts, allocate resources, and plan for recovery and reconstruction activities."

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AI and Disaster Management

Damage Assessment

Explore the Data

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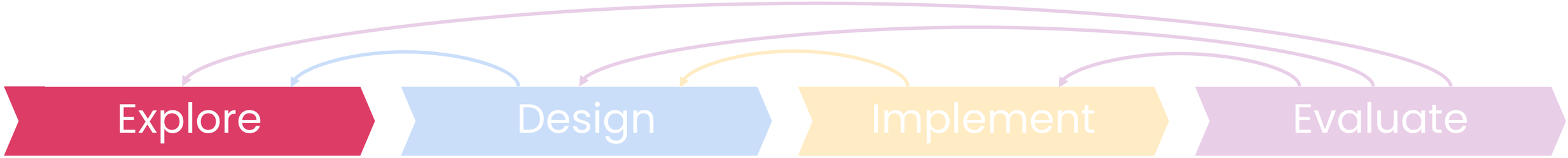
AI and Disaster Management

Damage Assessment

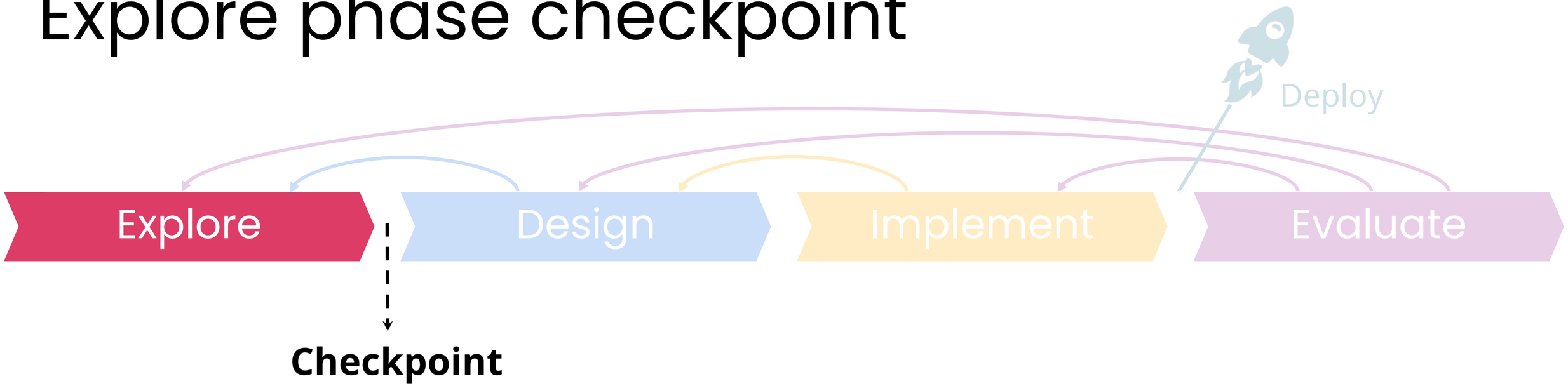
Explore Phase Checkpoint

Explore phase



1. Engage stakeholders ✓
2. Define the problem ✓
3. Determine if AI could add value ✓

Explore phase checkpoint



- What is the specific problem you are addressing?
- Who are the stakeholders?
- Do you have access to or can you collect the necessary data?
- Could AI add any value? Where?
- How does the “do no harm” principle come into play?

Explore phase checkpoint

"Disaster managers need to **identify and assess damaged areas** using large volumes of overhead imagery to prioritize response efforts, allocate resources, and plan for recovery and reconstruction activities."

- What is the specific problem you are addressing? ✓
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Explore phase checkpoint

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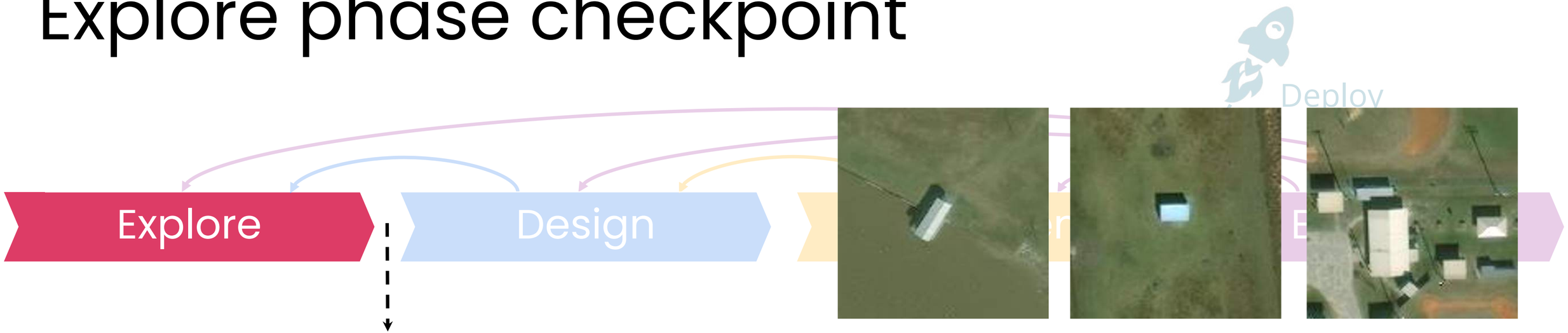

Checkpoint

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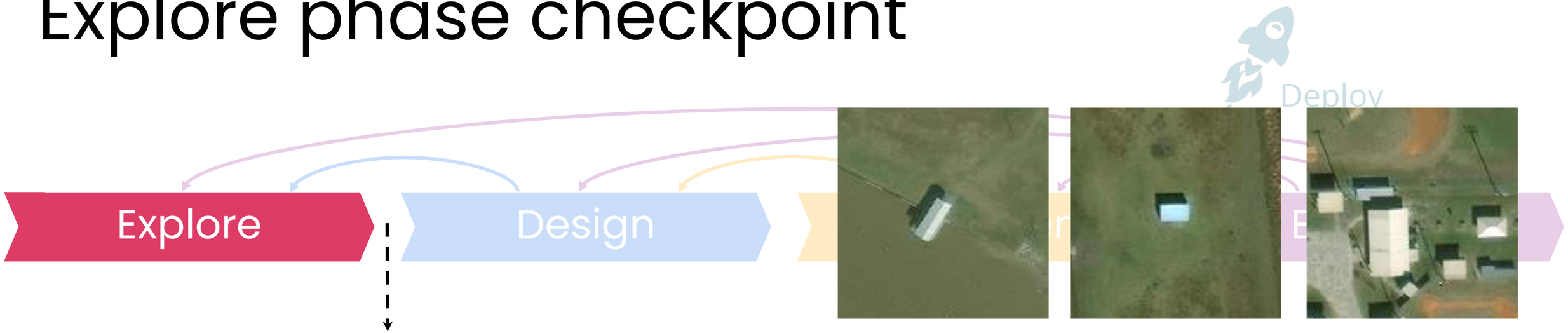
Explore phase checkpoint



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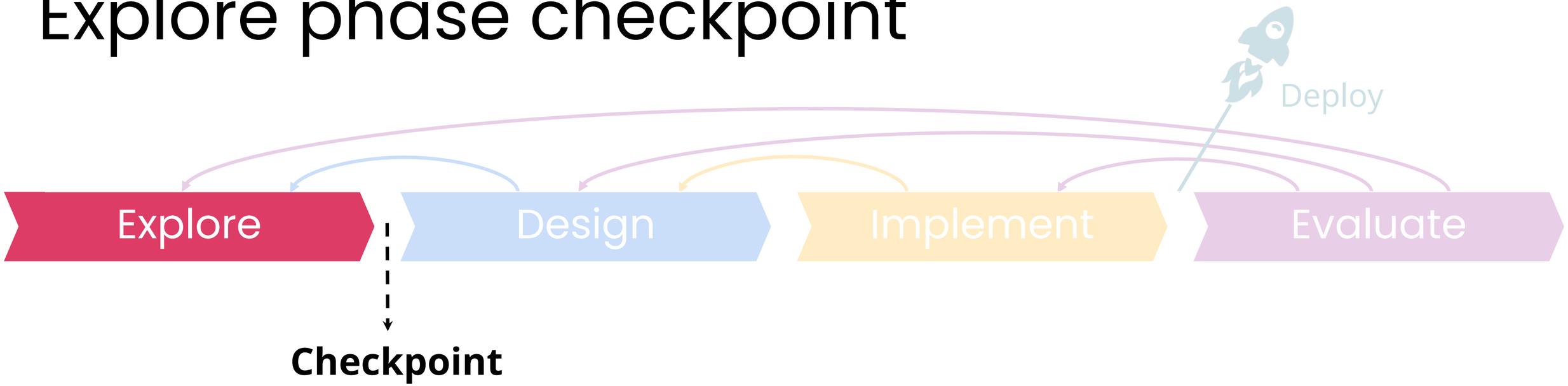

Checkpoint

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W2 Lesson 2

Analyzing Satellite Data from Hurricane Harvey

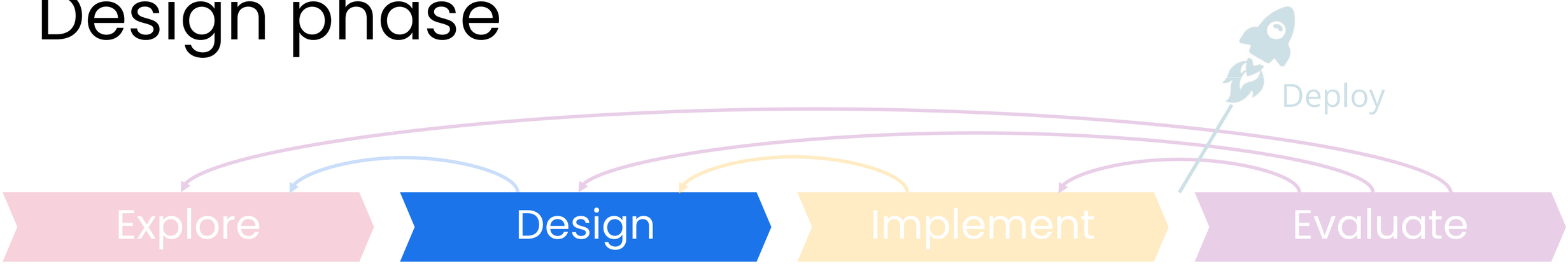
DeepLearning.AI

AI and Disaster Management

Damage Assessment

Design Phase

Design phase



1. Prototype your solution
2. Ensure data privacy
3. Design the user experience

Baseline Mode: Color Threshold

RGB
(117, 115, 103)

no damage

RGB
(117, 115, 103)

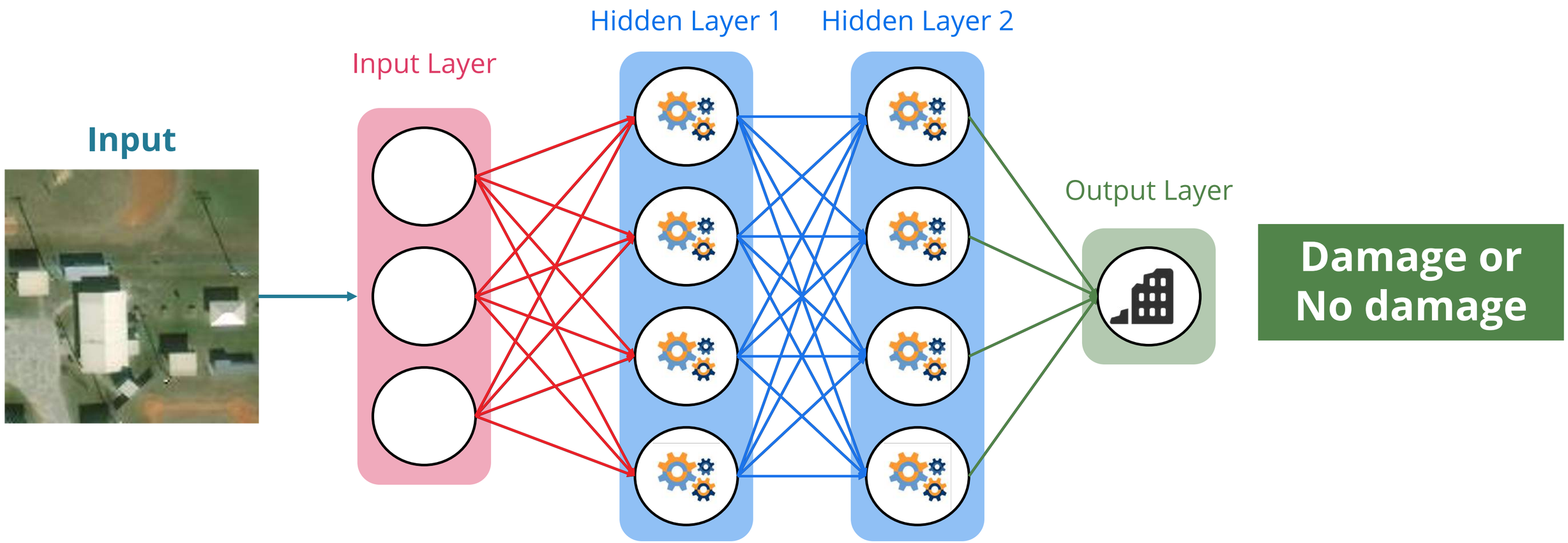
damage

RGB
(89, 99, 111)

no damage

Hurricane Harvey in Beaumont, Texas. Donna Burton.

Neural Networks



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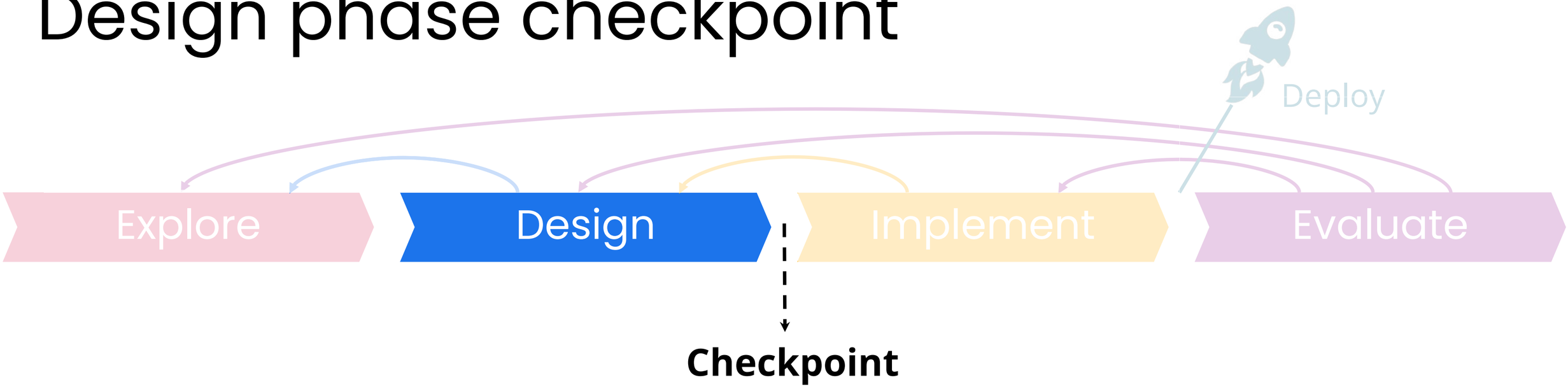
AI and Disaster Management

Damage Assessment

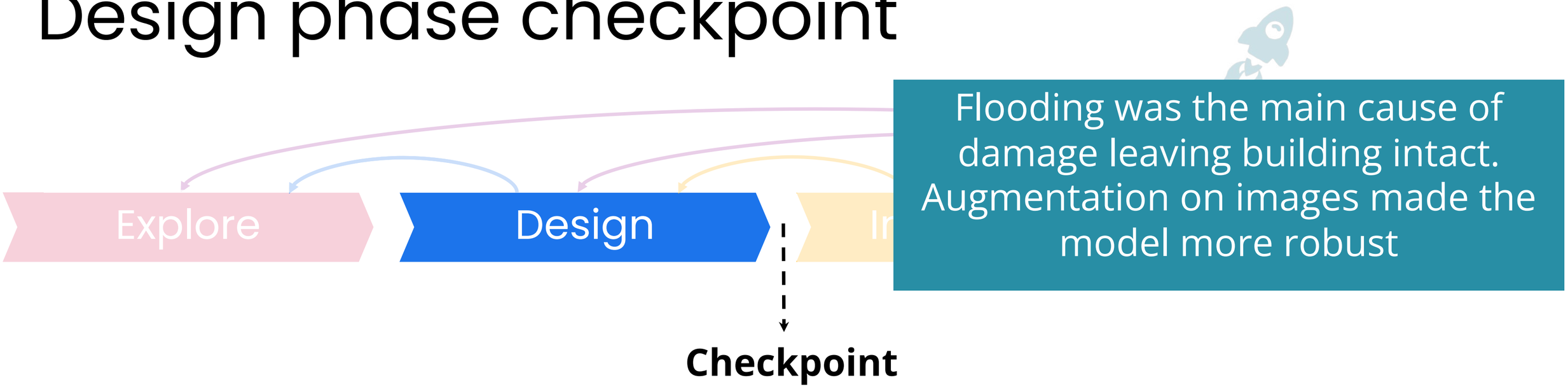
Design Phase Checkpoint

Design phase checkpoint



- How will you address issues with imbalances, biases, privacy, or other concerns with your data?
- What kind of model will you implement, and how will you measure its performance?
- How will your design address the problem you set out to work on?
- How will the end user interact with your system?

Design phase checkpoint



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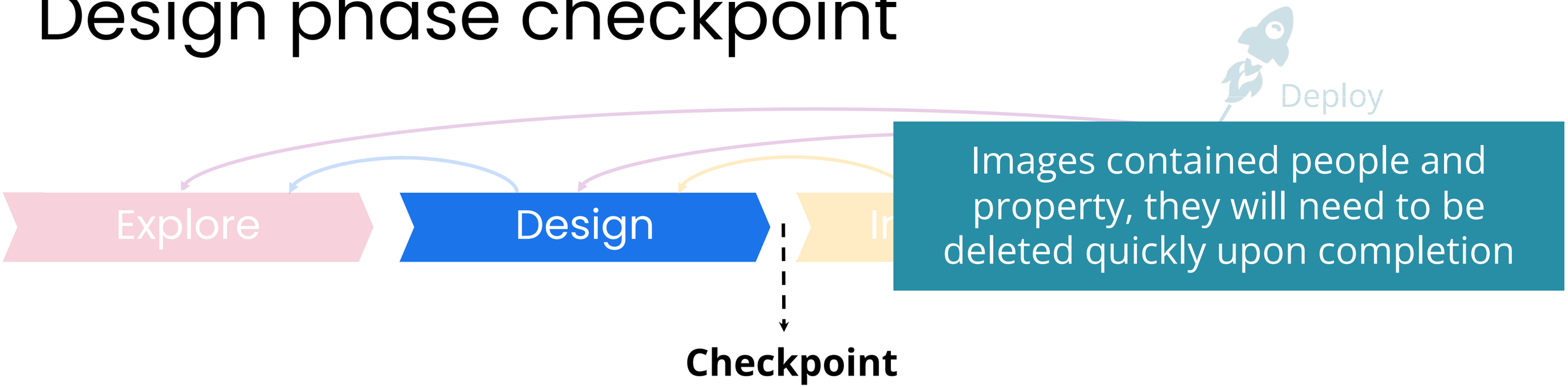

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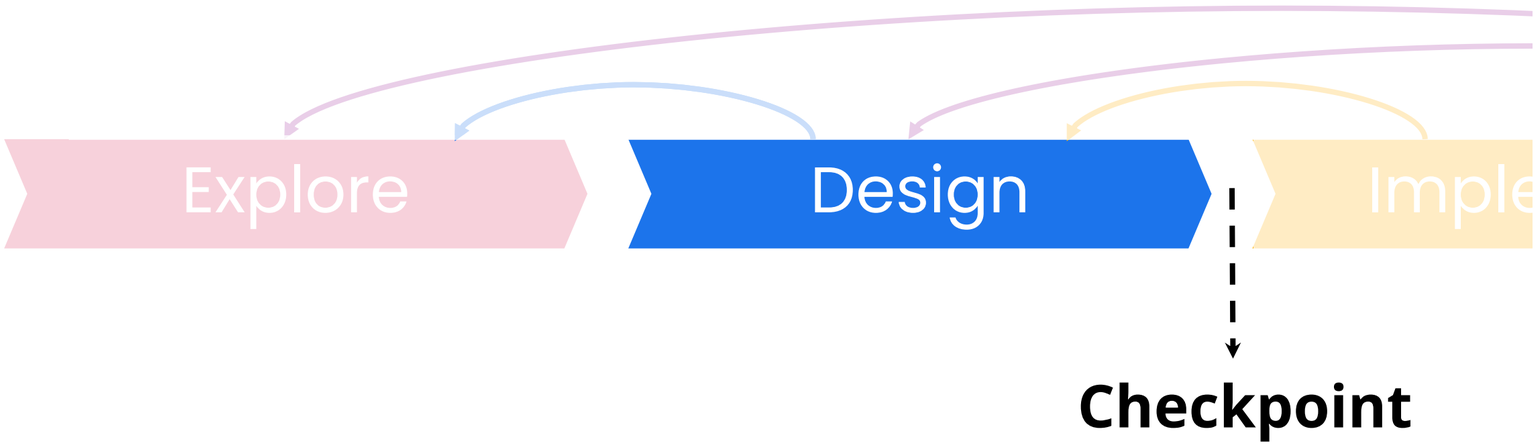

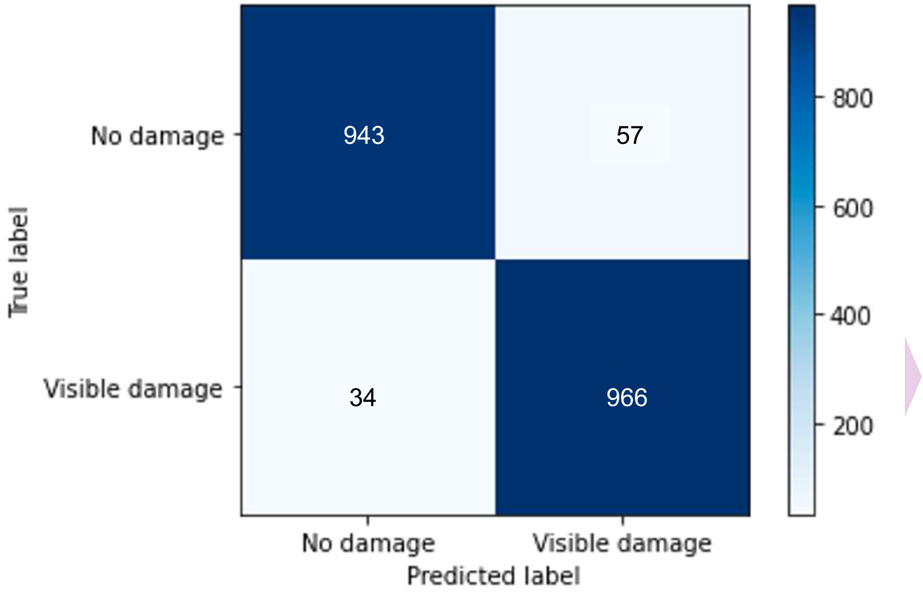

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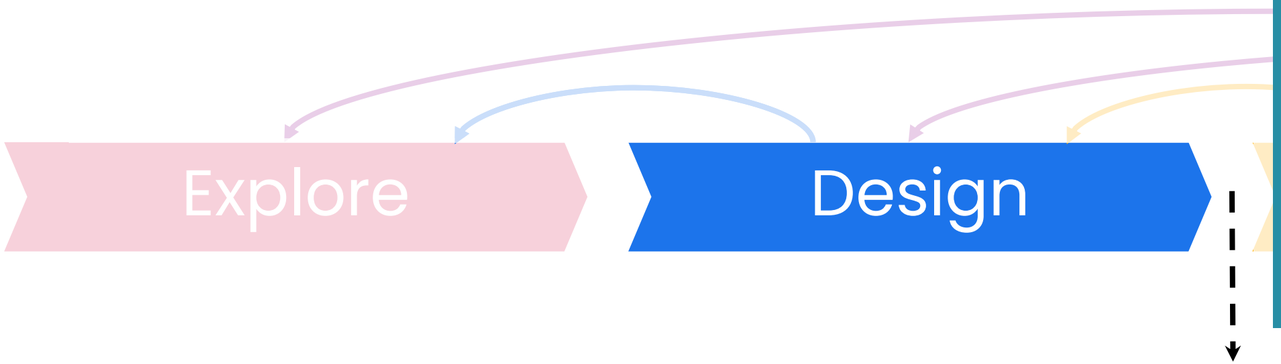

"Disaster managers need to **identify and assess damaged areas** using large volumes of overhead imagery to prioritize response efforts, allocate resources, and plan for recovery and reconstruction activities."

Checkpoint

- How will you address issues with imbalances, biases, privacy, or other concerns with your data?
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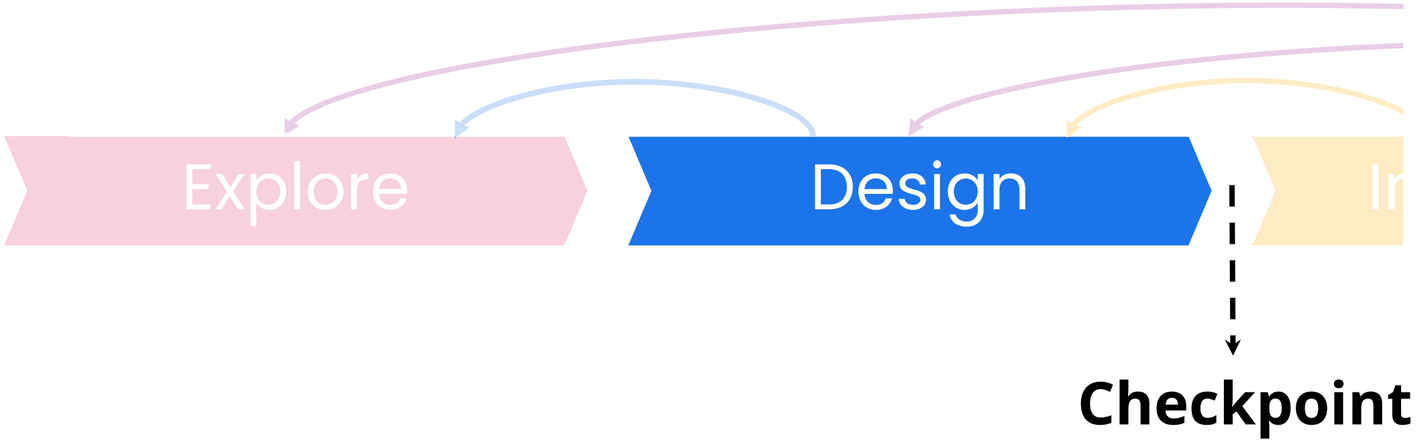
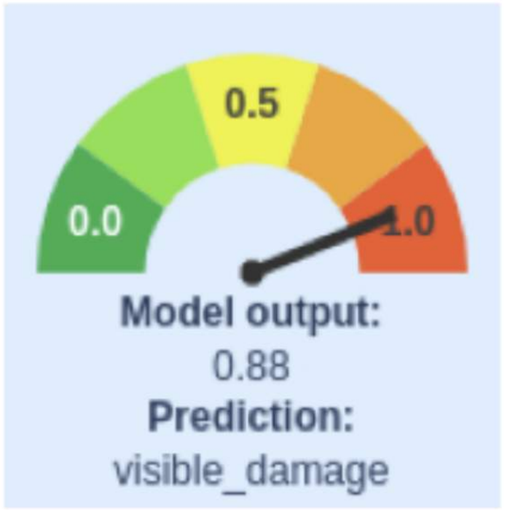
Design phase checkpoint





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- How will the end user interact with your system? ✓

DeepLearning.AI

AI and Disaster Management

Damage Assessment

Implement Phase

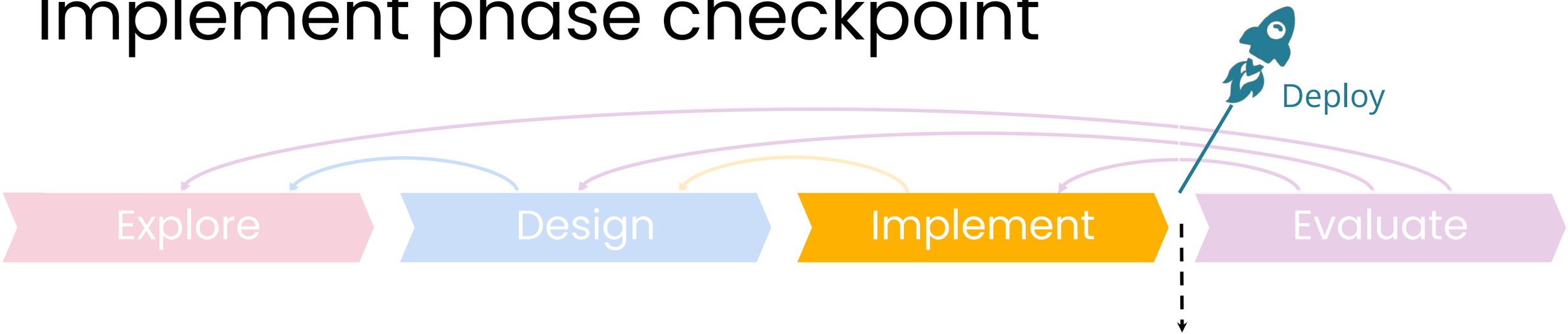
DeepLearning.AI

AI and Disaster Management

Damage Assessment

Project Wrap Up

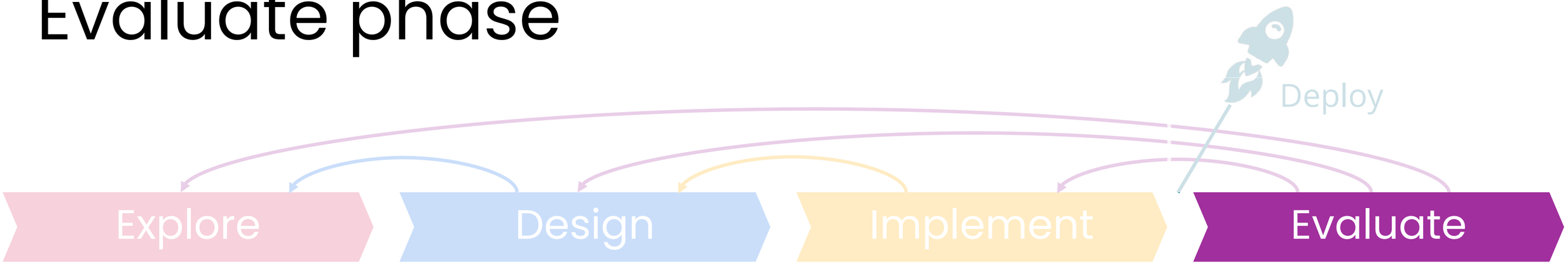
Implement phase checkpoint



Checkpoint

- Is your model performance acceptable?
- Are end users able to successfully use your system?

Evaluate phase



1. Measure project impact
2. Communicate results
3. Determine next steps

Explore phase

Community

Government Agencies

NGOs

Explore

Design

Implement

Evaluate

1. Engage stakeholders ✓
2. Define the problem ✓
3. Determine if AI could add value ✓

"Disaster managers need to **identify and assess damaged areas** using large volumes of overhead imagery to prioritize response efforts, allocate resources, and plan for recovery and reconstruction activities."

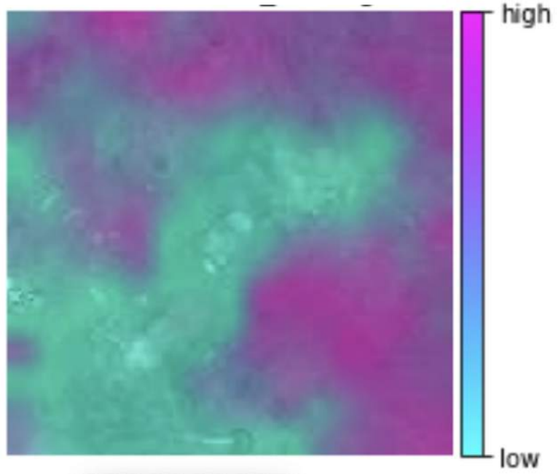




Challenging images in the dataset

True: damage

Prediction: no_damage



True: damage

Prediction: no_damage

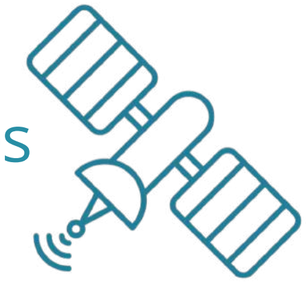
DeepLearning.AI

AI and Disaster Management

Week 2 Summary

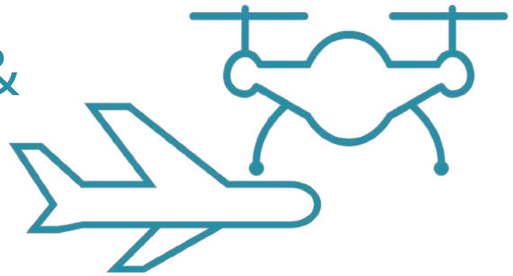
Overhead Imagery

Satellites



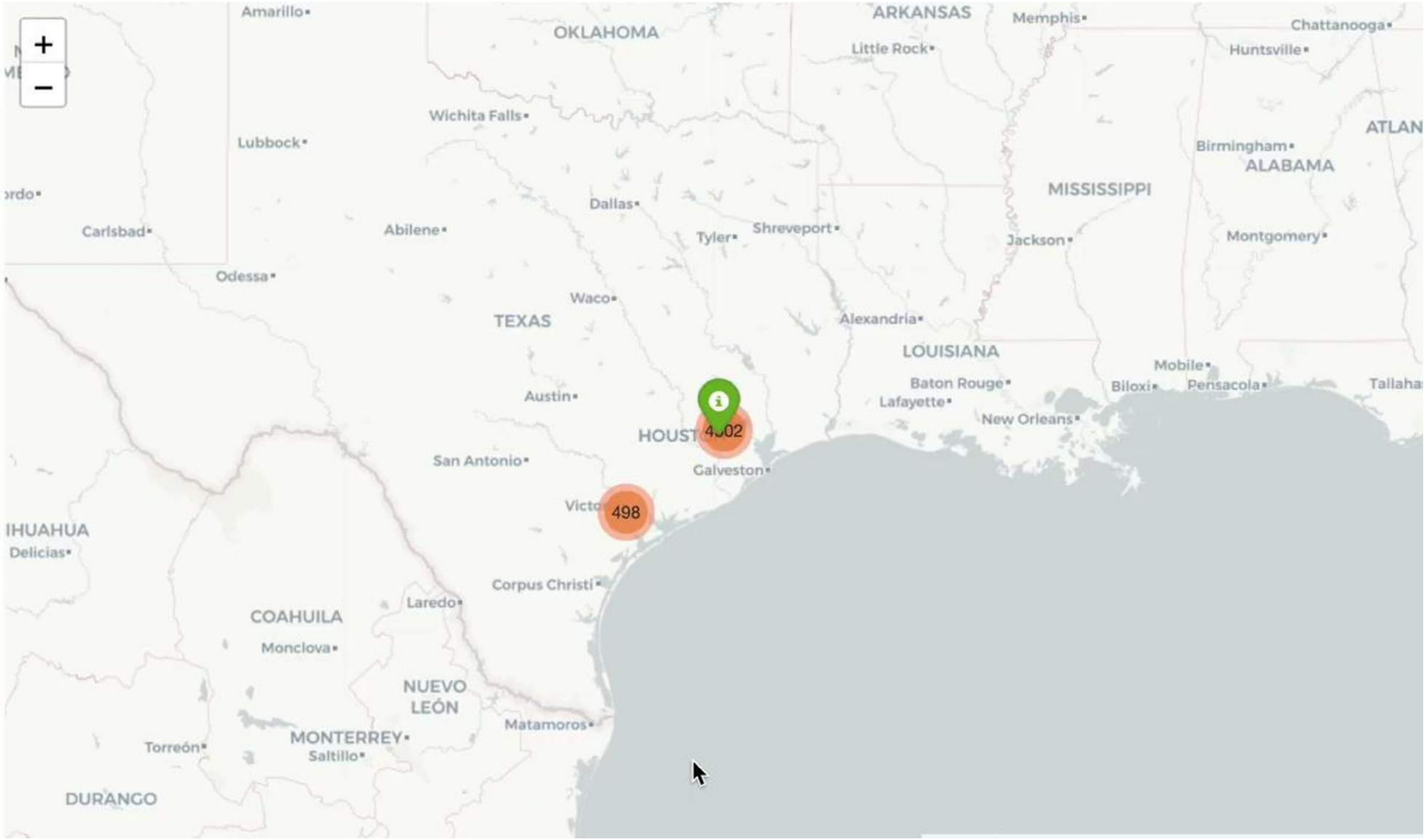
- Cover larger areas
- May present images from before the disaster
- Clouds can obscure view

Planes & Drones

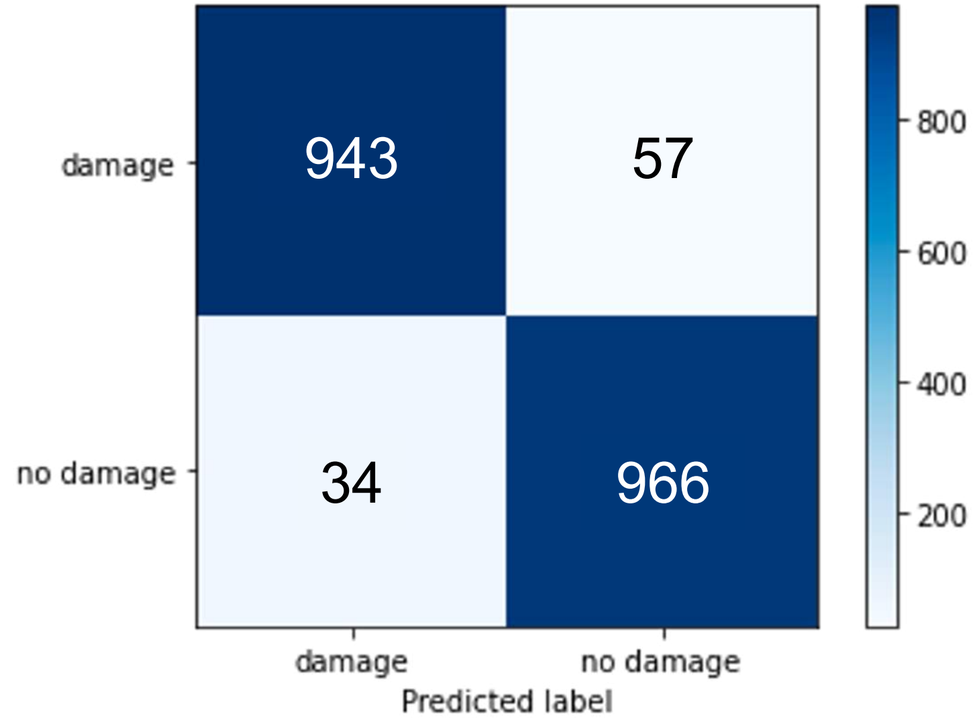


- Cover smaller areas
- More agile
- Clouds less of problem - can fly below clouds

Hurricane Harvey Project



Hurricane Harvey Dataset



Accuracy: 95%