DAMAGE ASSESSMENT WITH DINOv3
(Using OSCD Dataset)

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Value-Driven Project

Damage assessment is the process of automatically identifying and classifying damaged buildings and infrastructure from high-resolution satellite images after a natural disaster.

The goal is to rapidly generate accurate damage maps that highlight the location and severity of destruction.

These maps are crucial for first responders, enabling them to:

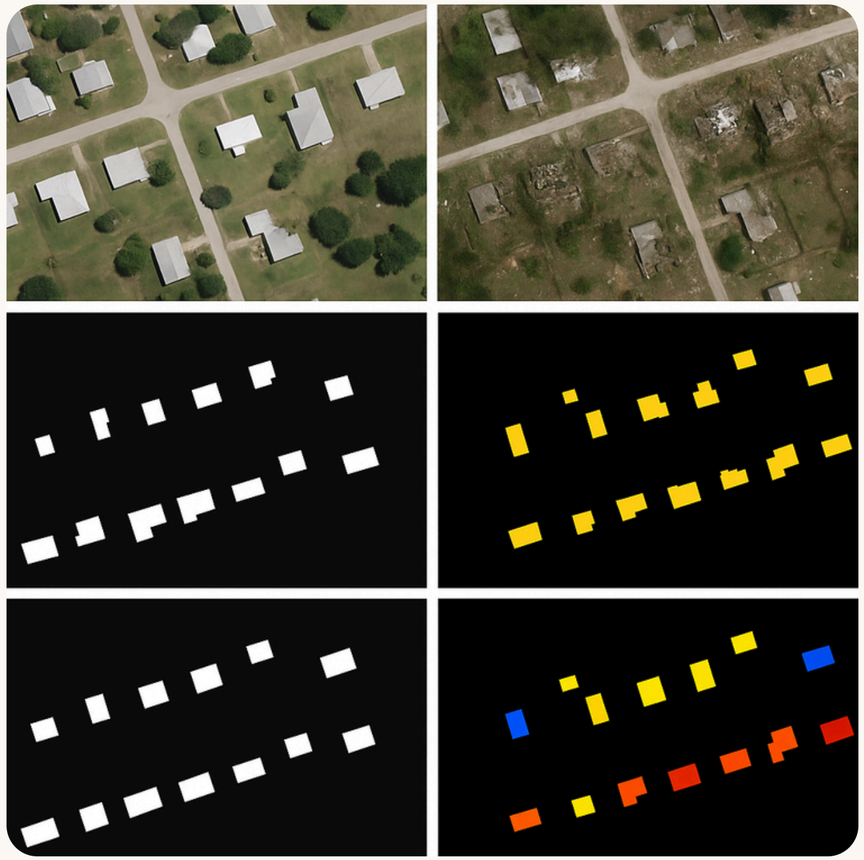
- prioritize rescue operations,
- allocate resources efficiently,
- assess the scale of the disaster,
- and support fast decision-making during emergencies.

The objective of the project is to build a machine-learning framework that analyzes pre- and post-disaster satellite images and automatically produces:

- Building Segmentation Map
- Damage Classification Map

(No Damage, Minor, Major, Destroyed)

The core model will use DINOv3 representations to enhance performance on visual reasoning tasks.



Building

Damage classification

Value Propositions


Rapid Decision Making


Resource Optimization


High Accuracy


Scalable to Entiire Regions


Life Saving Insight

Stakeholders

Product users

- First responders
- Civil protection teams

Involved

- *LINKS organiztion*
- *Satelite image providers*

Informed

- *Government*
- *Insurance companies*
- *Researchers*
- *Local comunities*

Objectives

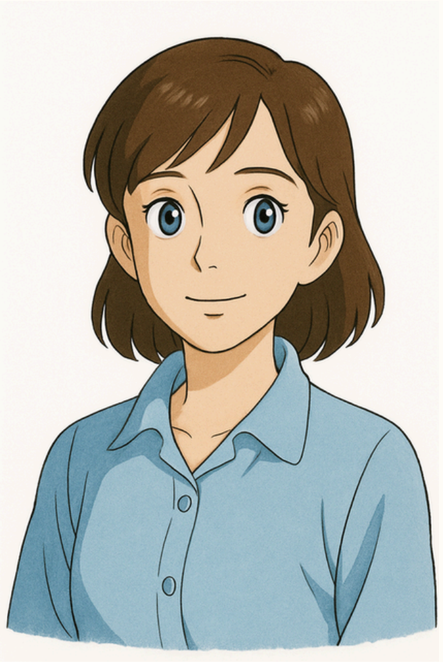
Build automated model for building & damage detection

Integrate DINOv3 features for improved accuracy

Reduce manual effort of damage assesment

Provide actionable visual maps to emergency responders

Ensure robustness across multiple disaster types



User Persona — Sarah Johnson
Name: Sarah Johnson
Age: 36
Nationality: American

Role: Emergency Response Coordinator at FEMA
Responsible for:
– Post-disaster coordination
– Damage assessment
– Prioritizing emergency actions

GOAL:
Quickly obtain reliable maps showing which buildings are damaged or destroyed.

NEED:
Automated and precise building damage detection without manual annotation.

FRUSTRATION:
Slow field inspections, inconsistent human analysis, outdated information.

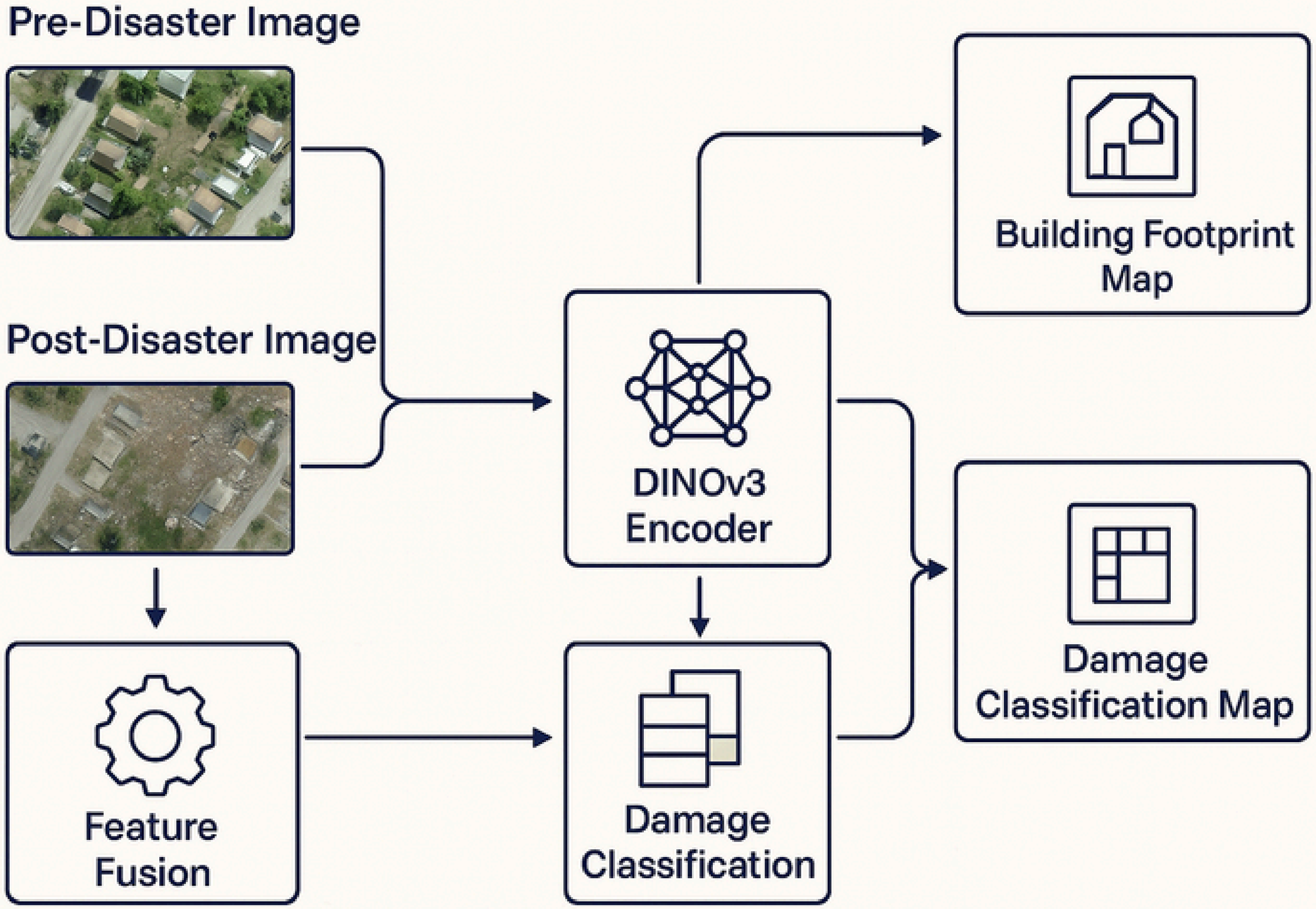
User Requirements

Functional requirements

- Detect buildings: The system must identify building footprints on satellite images.
- Classify damage: The system must provide one of the four classes: No damage, Minor, Major, Destroyed.
- Compare pre/post images: The system must integrate both pre-disaster and post-disaster imagery.
- Learn from new events: The model must be able to fine-tune on new disasters or regions.
- Generate maps: Output must include clear visual maps suitable for emergency response.

Non-functional requirements

- Accuracy: Predictions must be reliable and consistent across diverse geographies.
- Robustness: The model should handle different disaster types (earthquake, flood, fire, hurricane).
- Scalability: Should process large regions quickly to support wide-area emergency response.
- Usability: Maps and outputs must be simple and intuitive for non-technical personnel.
- Speed: Results should be generated rapidly to support time-critical decision making.


Pre-Disaster Image
Post-Disaster Image
Feature Fusion
DINOv3 Encoder
Damage Classification
Building Footprint Map
Damage Classification Map

Strategies

Machine Learning Approaches

- Baseline CNN models for segmentation
- Classical change detection techniques
- Feature engineering for pre/post image comparison

Analyze & Predictions

- Pixel-level classification for detailed damage assessment
- Building-level damage aggregation
- Evaluation using IoU, F1 and confusion matrices

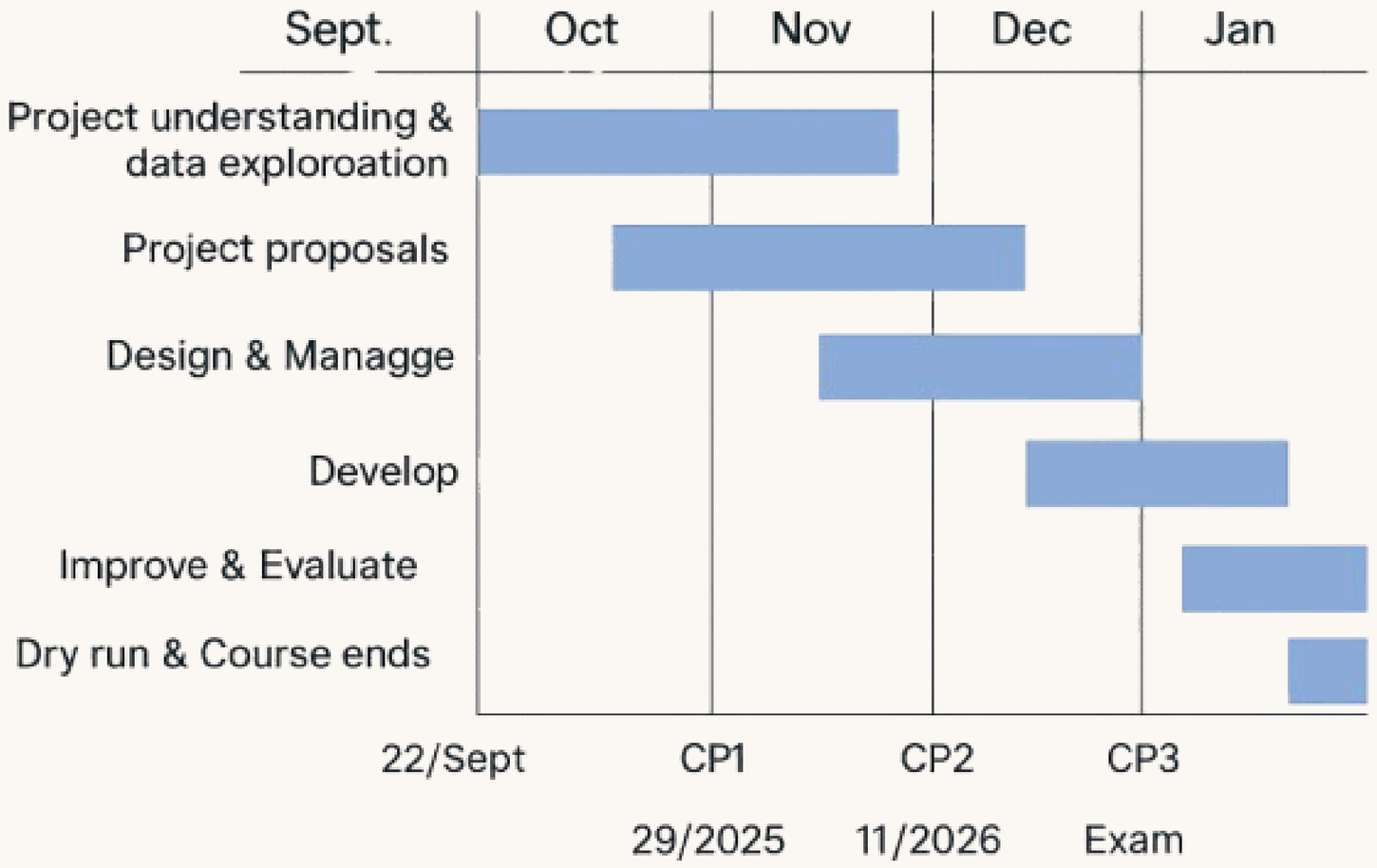
Deep Learning Approaches

- U-Net based architectures for building segmentation
- Siamise or two-branch network for change detection

Condition Monitoring

- Structure change maps
- Probabilistic image heatmaps
- Severity-level visualization for emergency responders

Gantt Chart


Sept.
Oct
Nov
Dec
Jan
Project understanding & data exploroation
Project proposals
Design & Managge
Develop
Improve & Evaluate
Dry run & Course ends
22/Sept
CP1
29/2025
CP2
11/2026
CP3
Exam

WBS

WP1 — Design & Management

–Duration: 1 Nov 2025 → 19 Nov 2025

- *T1.1 Define Value Proposition*
- *T1.2 Set Objectives*
- *T1.3 Identify Stakeholders*
- *T1.4 Build Functional Diagram*
- *T1.5 Draft Project Architecture (DINOv3 + model heads)*
- *T1.6 Prepare Checkpoint 1 presentation*

WP2 — Data Collection and Preparation–Duration

20 Nov 2025 → 30 Nov 2025

- *T2.1 Gather xBD pre/post-disaster samples*
- *T2.2 Preprocess and align satellite images*
- *T2.3 Generate masks and training patches*
- *T2.4 Perform data quality analysis*
- *T2.5 Create final training/validation splits*

WP3 — Model Development

–Duration: 1 Dec 2025 → 10 Dec 2025

- *T3.1 Implement DINOv3 feature extraction*
- *T3.2 Build building segmentation head*
- *T3.3 Build damage classification head*
- *T3.4 Implement loss functions and training loop*
- *T3.5 Evaluate baseline model & refine*
- *T3.6 Prepare Checkpoint 2 presentation*

WP4 — Deployment and Delivery

11 Dec 2025 → 7 Jan 2026

- *T4.1 Hyperparameter tuning & robustness checks*
- *T4.2 Produce final segmentation & damage maps*
- *T4.3 Prepare Checkpoint 3 (Dry Run) presentation*
- *T4.4 Final documentation & technical report*
- *T4.5 Prepare final exam presentation*

Questions?