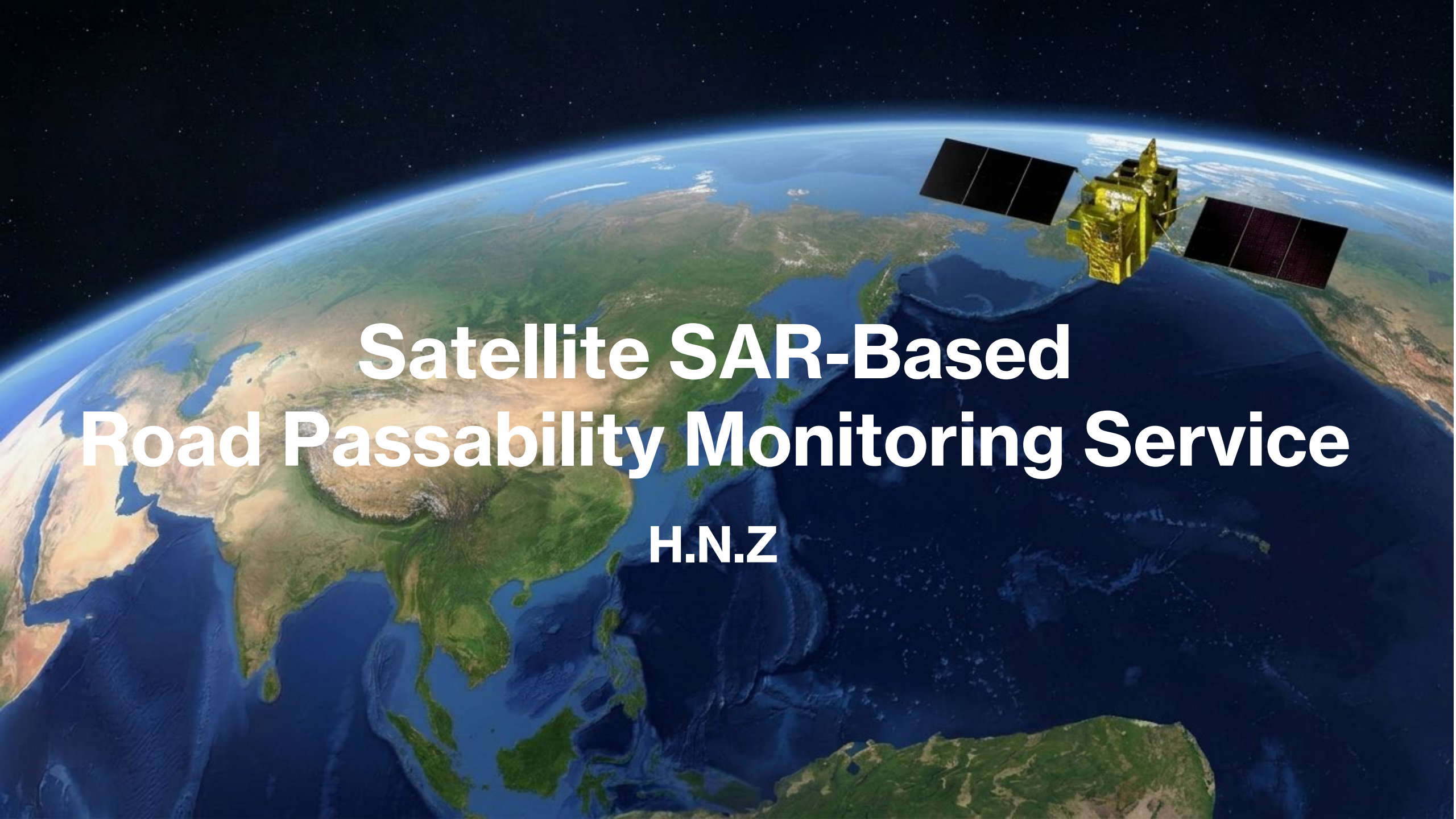


Satellite SAR-Based Road Passability Monitoring Service

H.N.Z

Business Concept

Seeing every road from space,
so you always know which way is open.





[Source: Ishikawa Prefecture website]

Target Users (1/2)

During disasters, **landslides** and **road collapses** can block important roads. This makes it hard to:

Rescue people | **Deliver goods** | **Repair roads**



Landslide



Road Collapse

affects

- ✓ **Infrastructure Operators**
- ✓ **Logistic Companies**
- ✓ **Recovery Teams**
- ✓ **Emergency Services**
- ✓ **Public Transportation**

Target Users

[Source: Road Recovery Visualization Map (MLIT)]

Target Users (2/2)

Wide-area field surveys take **time** and **manpower**.

For example, in the **Noto Peninsula Earthquake** on Jan 1, 2024,



2024/01/13
Travel time
From Anamizu to Noto
Approx. 1 h 40 min

2.5 Months After

2024/04/01
Travel time
From Anamizu to Noto
Approx. 40 min

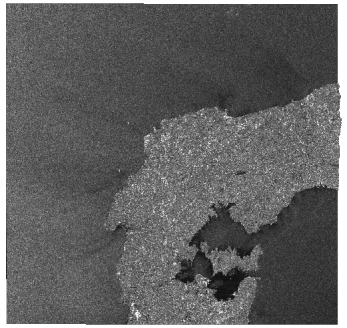
Our service shortens **the time needed to grasp road conditions.**

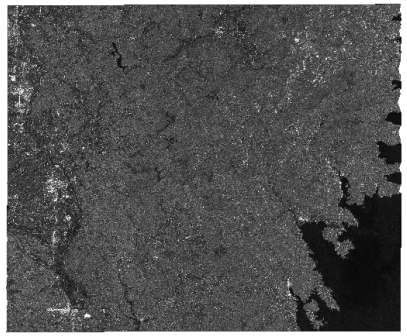
Our Service

Road Passability Monitoring

Service Overview (1/2)

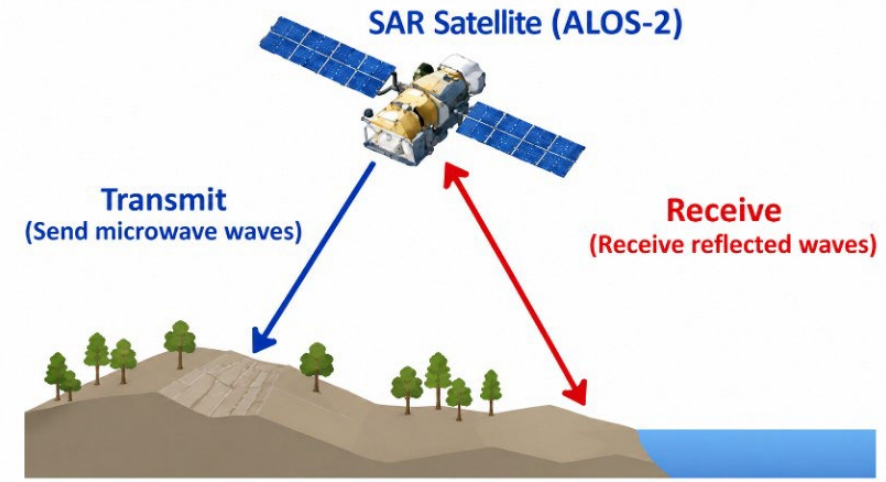
Our service monitors and detects road passability using **Tellus SAR satellite images (ALOS-2)**.





Features of SAR satellite images

- ✓ Observable day and night
- ✓ Observable regardless of weather
- ✓ Captures subtle changes on the ground surface
- ✓ Image analysis requires specialized knowledge



Service Overview (2/2)

1

SAR Data Collection

Collect disaster data and SAR images.

2

Feature Extraction

Extract change signals by calculating backscatter and classifying land types.

3

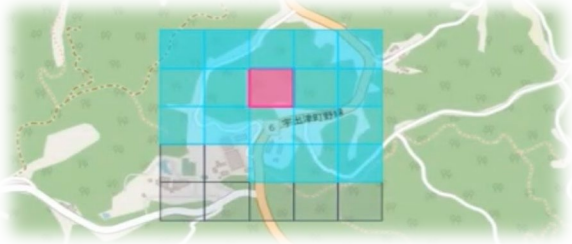
Machine Learning Model (AI)

Select features, then train and validate the model.

4

Detection & Visualization

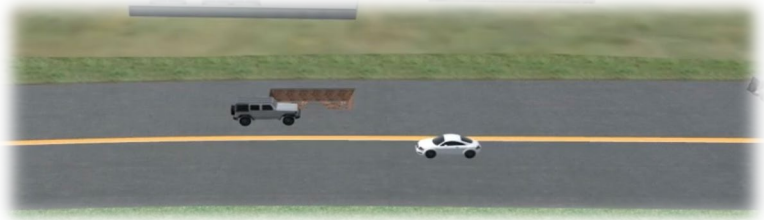
Detect road blockages in a target area and show them on a mesh map.



5

Evaluation in UC-win/Road

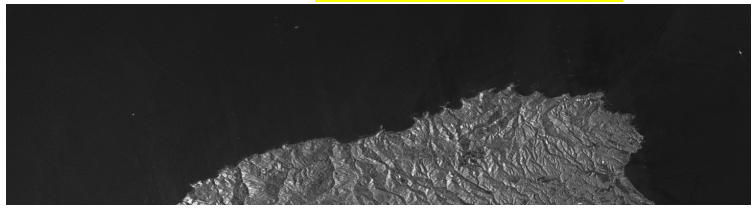
Reproduce the blockages and evaluate their impact on traffic.



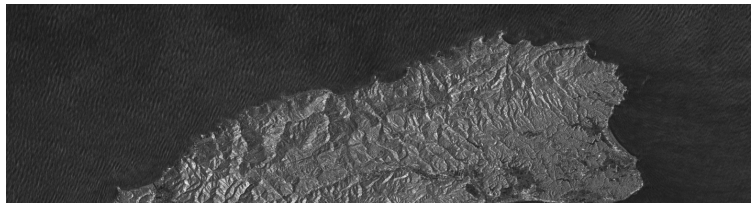
SAR Data Collection

Collect SAR images from **three different days**
to capture **land-type changes** and build the machine learning model.

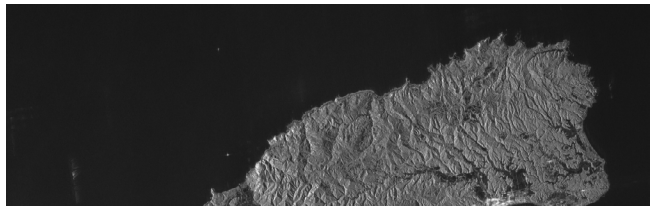
1. Before Disaster
(e.g., 2023/11/03)



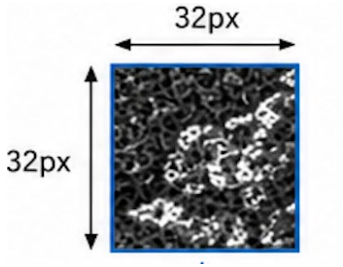
2. Before Disaster
(e.g., 2023/12/17)



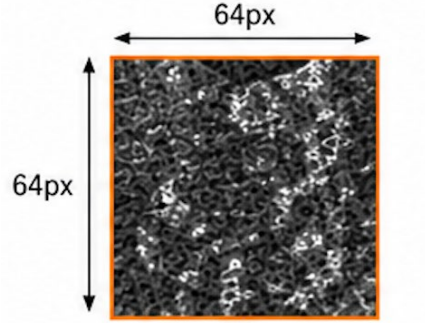
3. After Disaster
(e.g., 2024/01/08)



Crop the target area from the SAR image and calculate **the backscatter coefficients (dB)**.



32px (approx. 80 m square) crop



64px (approx. 160 m square) crop

Land Type	Backscatter Coefficient (dB)
Water Surface	-25 to -15dB
Farmland / Grassland	-15 to -10dB
Forest	-10 to -5dB
Urban / Buildings	-5 to +10dB

Feature Extraction (Example)

Target Area
（Route 470, Nanao）

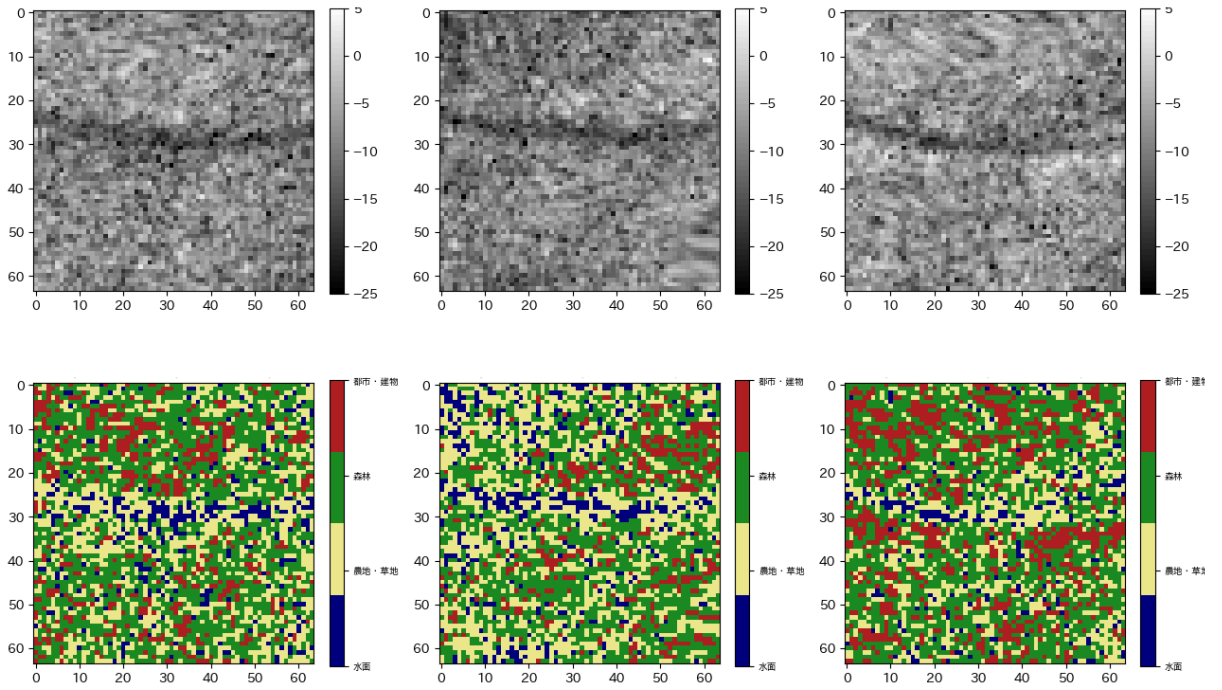


Target Signal

Urban/Buildings → Forest

Backscatter Images & Land Type Maps

1. Before Disaster **2. Before Disaster** **3. After Disaster**



Change: 126 pixels **Change: 432 pixels**

Change Ratio: 3.4x

[Source: Road Recovery Visualization Map (MLIT)]

Machine Learning Model (AI)

Model: Logistic regression with forward feature selection

Features: 12 signals (four land types × three time points) as features

Validation: Leave-One-Out cross-validation

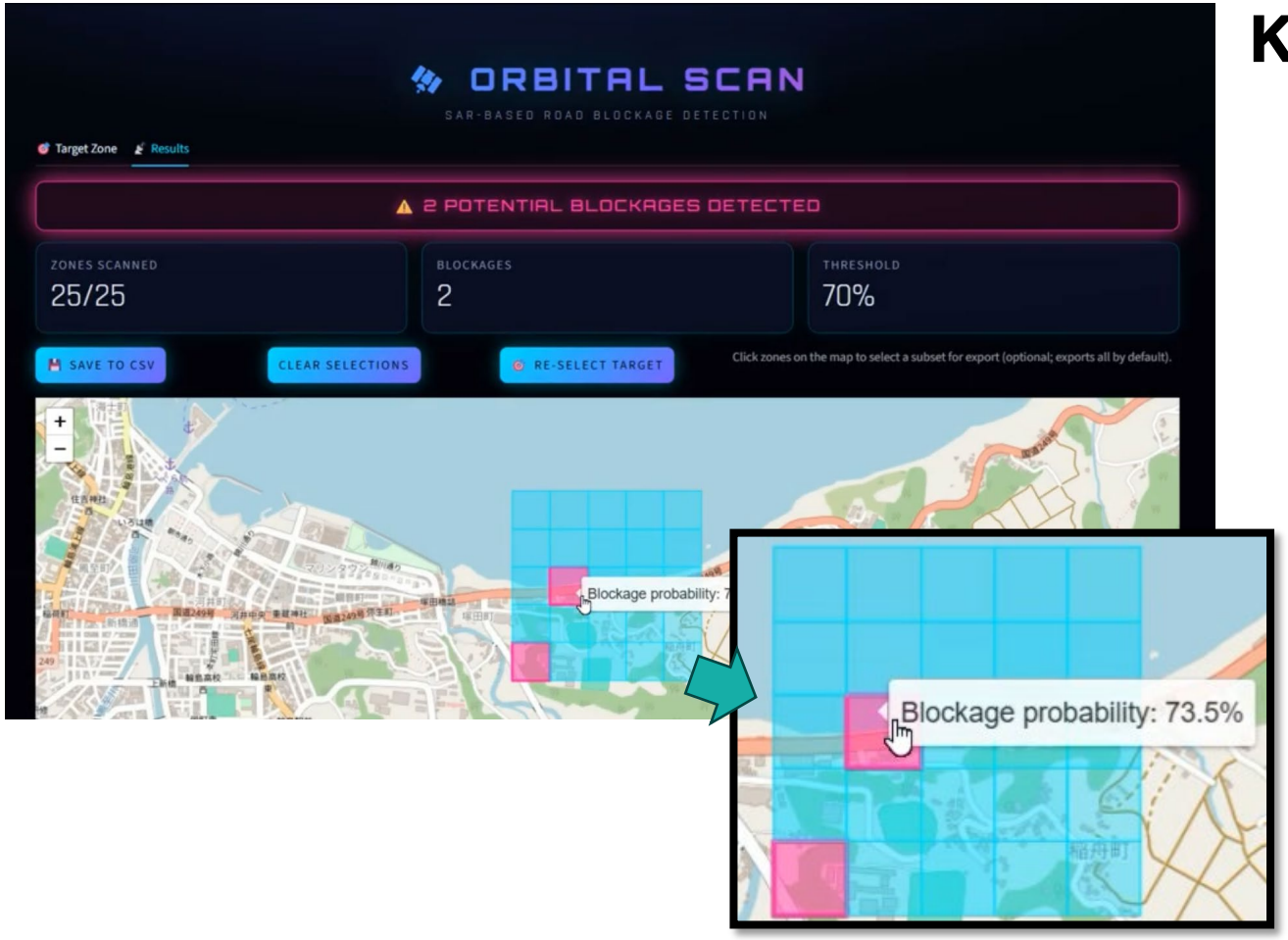
This model performs binary classification of **road blockage** (blocked or not).

Confidence Threshold	Target Maps	Coverage	Accuracy
≥ 50% (all cases)	114	100.0%	74.6%
≥ 60%	61	53.5%	73.8%
≥ 70%	26	22.8%	80.8%

Our Application

For Detection and Visualization

Our Application



Key Features

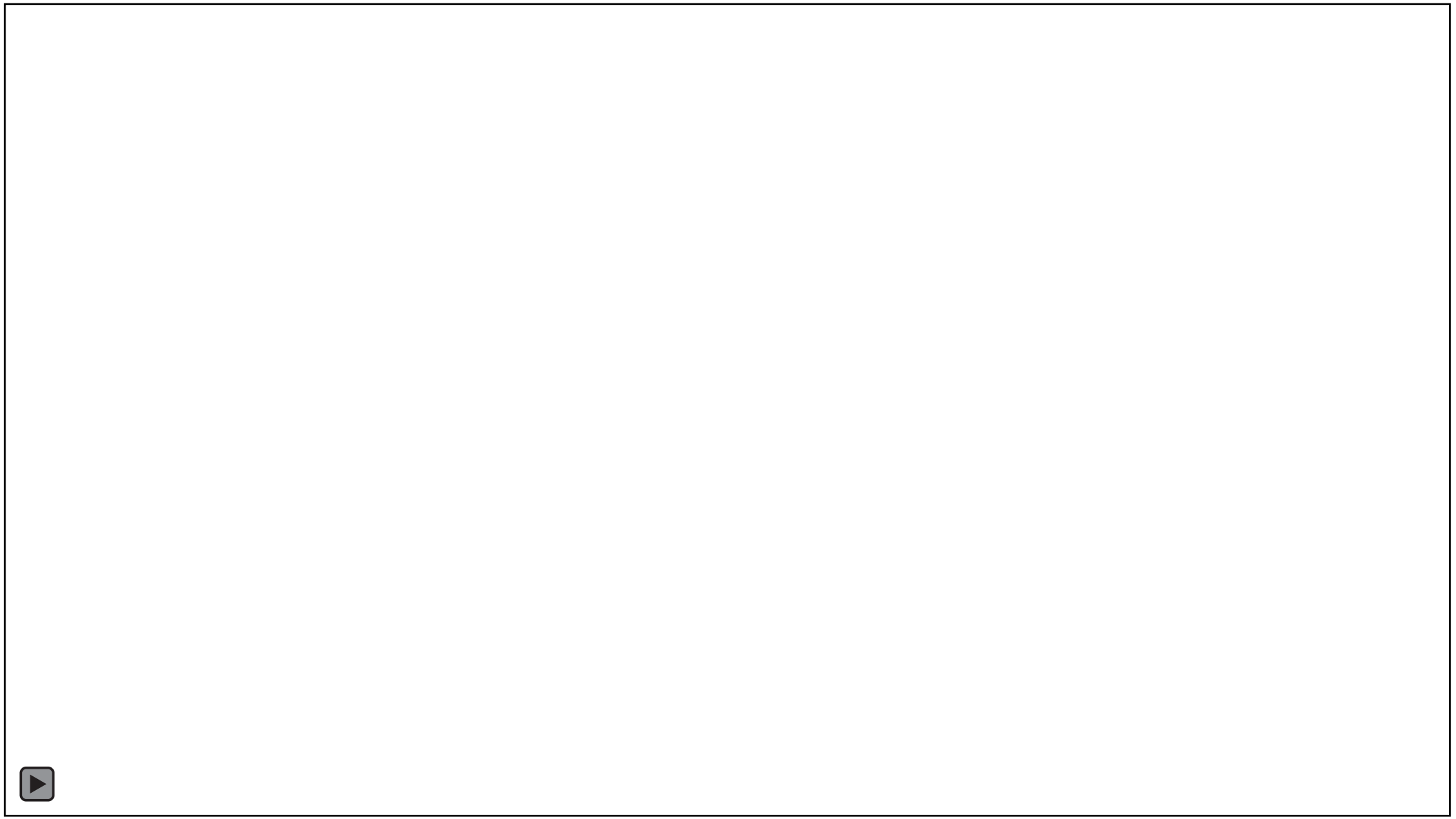
- ✓ Load **SAR images** from different dates and select the target area.
- ✓ Split the target area into cells and estimate **road blockage probability** using the trained model.
- ✓ Export high-probability cells to a **CSV file**.

Detected cells
（High probability of road blockage）

Undetected cells

The exported CSV file is passed to our UC-win/Road plugin and used for the simulation.

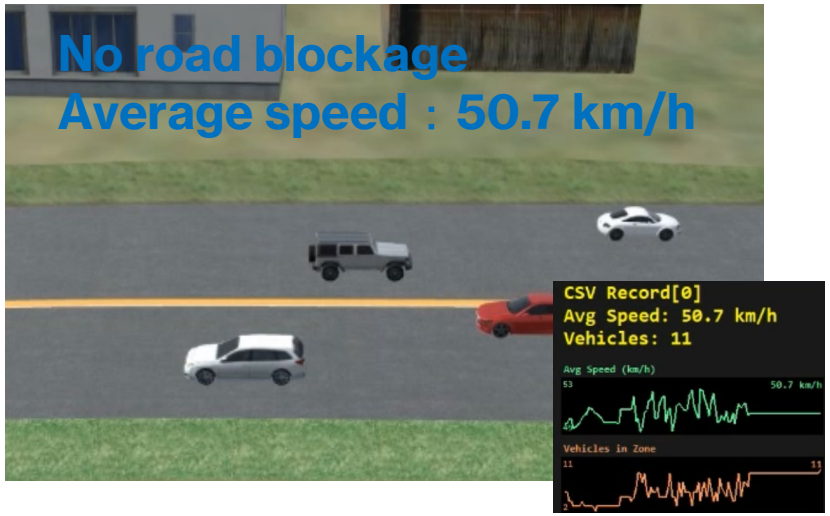
Application Demo

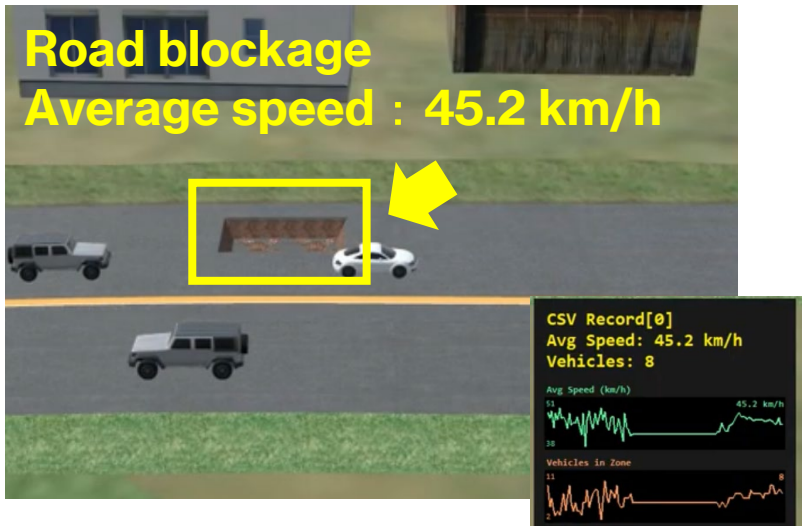


Our Plugin for UC-win/Road

For Evaluation by Simulation

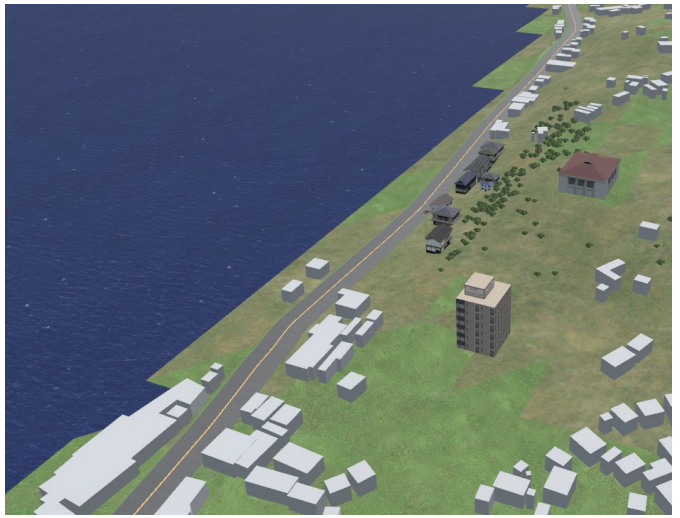
Our Plugin for UC-win/Road





Key Features

- Reproduce National Route 249 in Noto in 3D.
- Load the CSV file and place road obstacles where the road blockage probability is high.
- Measure the average speed of surrounding vehicles.



National Route 249

Plugin Demo



Conclusions

Service Value

Monitor Road Conditions Fast

Monitor wide areas quickly and know which roads are passable.



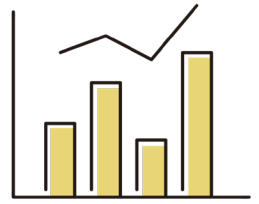
Choose safe route

Avoid blocked roads and plan safe alternative routes.



Predict delays by simulation

Estimate travel delays with UC-win/Road to support planning.



Our Message

When roads stay open,
lives keep moving.

