RoadBlockDetectionApp.py User Manual

Program Overview

`RoadBlockDetectionApp.py` is a web application that uses satellite imager captured by the ALOS-2 SAR (Synthetic Aperture Radar) to automatically detect zones where a road may have been blocked following a disaster such as an earthquake.

It uses a machine-learning model (logistic regression, 74.6% accuracy under cross-validation) trained on data from 57 real road-blockage sites from the 2024 Noto Peninsula earthquake. Because the model only needs two satellite images (before and after the disaster), it can estimate a road-blockage probability for any location, even one with no prior damage history of its own.

Detection results can be exported as a CSV file containing coordinates and probabilities, which is then loaded into the UC-win/Road plugin `RoadBlockagePlugin` to reproduce the detected blockages inside the simulation.

Installation and How to Run

Requirements

- Python 3.14 or later
- Key dependencies (see `pyproject.toml`): `streamlit`, `streamlit-folium`, `folium`, `pandas`, `numpy`, `scikit-learn`, `joblib`, `rasterio`, `pillow`, and others

Installation

Using uv:

```
uv sync
```

Using pip:

```
pip install -r requirements.txt
```

Required data (prepared in advance)

- `scenes/` folder: the ALOS-2 SAR scenes used for detection (using high-precision data requires a Tellus contract; note that the files included in this folder are lower-precision data that can be downloaded free of charge)
- `models/` folder: a trained model file (`.joblib`)

Launching the app

```
streamlit run RoadBlockDetectionApp.py
```

After running this command, a browser window opens automatically (if it doesn't, open `http://localhost:8501` manually) and the app's interface is displayed.

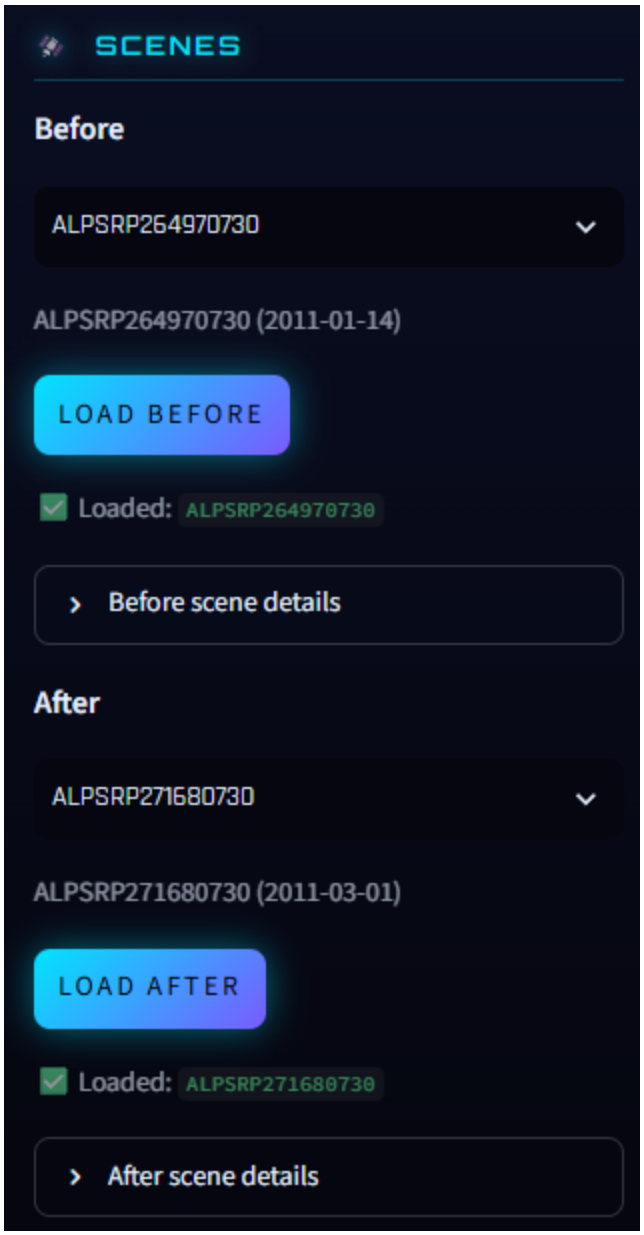
Program Operation Flow

All settings and controls live in the sidebar on the left. The main area on the right shows results in two tabs: "Target Zone" and "Results".

Loading the two scenes (satellite images)

In the sidebar's **Scenes** section, select the "Before" and "After" scene folders for the period you want to evaluate.

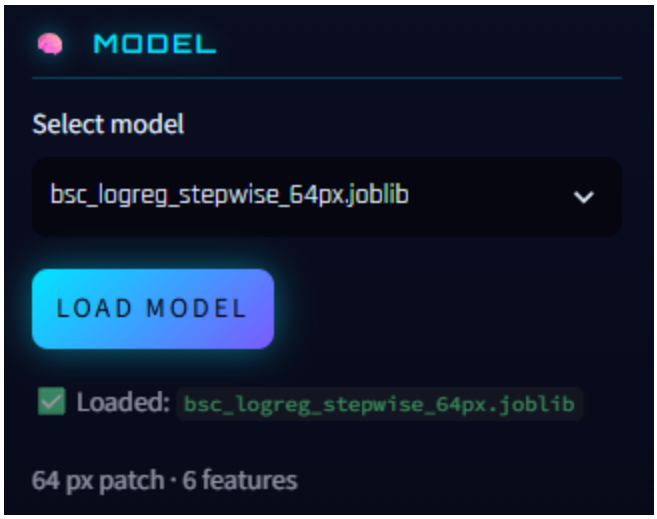
1. Choose a scene from the **Before** dropdown (populated from the `scenes/` folder) and click the "Load Before" button
2. Choose a scene from the **After** dropdown in the same way and click "Load After"
3. Once loaded, the scene ID appears directly below the button



Loading the trained model

In the sidebar's **Model** section, select the trained model to use.

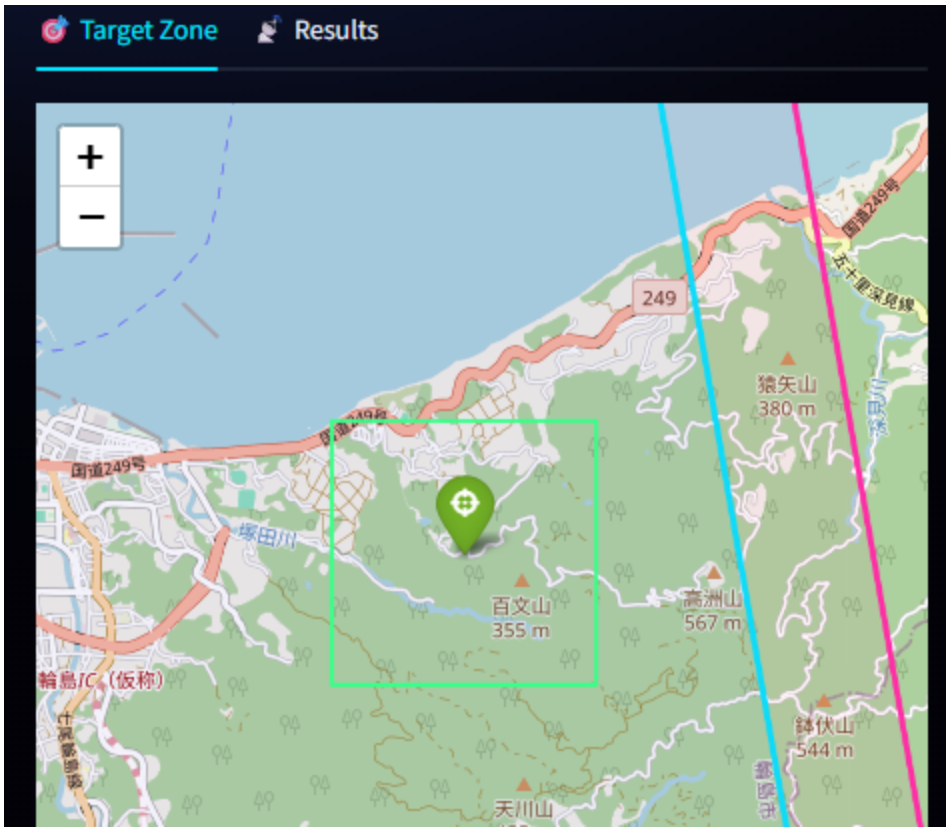
1. Choose a model file (`.joblib`) from the `models/` folder in the dropdown
2. Click the "Load Model" button
3. Once loaded, the model's filename, detection patch size, and the number of features used are displayed



Selecting the target area

Once both scenes and the model are loaded, the sidebar's **Target Zone** section appears.

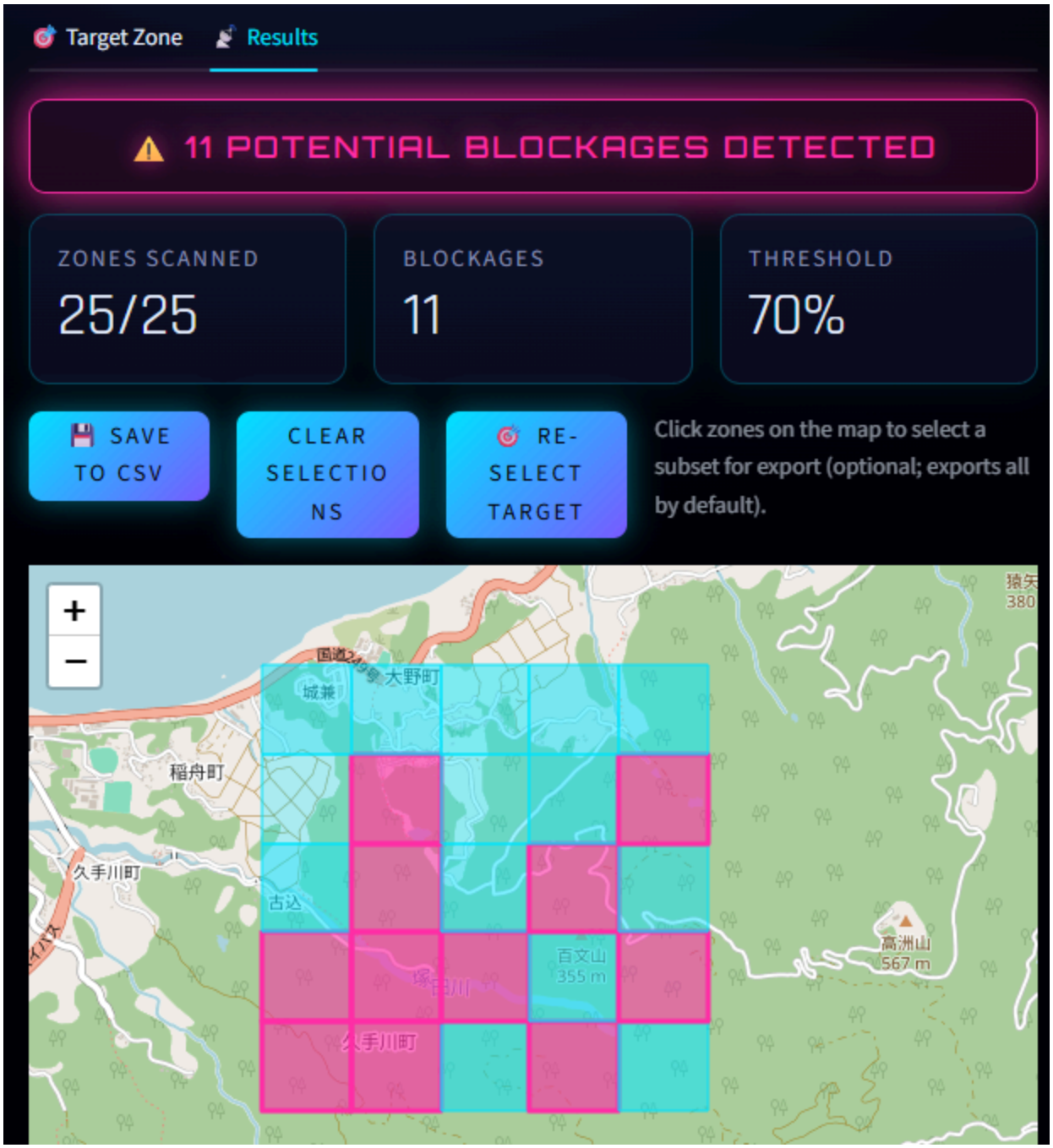
1. Use the "Area size" slider to set the side length of the detection area
2. Open the **Target Zone** tab in the main area, check the two scenes' footprints and their overlap on the map, and **click the map** to set the center point of the area you want to scan
3. A preview rectangle (orange outline) of the requested size appears centered on the clicked point



Calculating the road-blockage probability

Once a target center has been selected, the sidebar's **Execute Scan** section appears.

1. Use the "Detection threshold" slider to set the probability threshold above which a zone is treated as blocked (default: 70%)
2. Click "Launch Scan" to split the selected area into a grid of cells sized to the detection patch size, and calculate the road-blockage probability
3. When the scan finishes, the app automatically switches to the "Results" tab, which shows:
    - A detection alert banner (red/magenta if blockages were found, green if the area is clear)
    - A summary of zones scanned, blockages found, and the threshold used
    - A heatmap-style map of per-zone probabilities



Exporting Results to CSV and Handing Off to UC-win/Road

Selecting which zones to export (optional)

Clicking a zone on the map in the **Results** tab highlights it with a gold outline and adds it to the export selection (click again to remove it; multiple zones can be selected). If no zone is selected, all scanned (valid) zones are exported.

- "Clear Selections" button: clears the current selection
- "Re-select Target" button: resets the app so a new target area can be chosen from scratch

Saving the CSV file

Clicking "Save to CSV" saves the detection results into the `prediction/` folder. The CSV file has the following columns:

Column	Description
`latitude`	Latitude of the zone's center
`longitude`	Longitude of the zone's center
`side_m`	Side length of the zone, in meters
`probability`	Road-blockage probability (0–1)