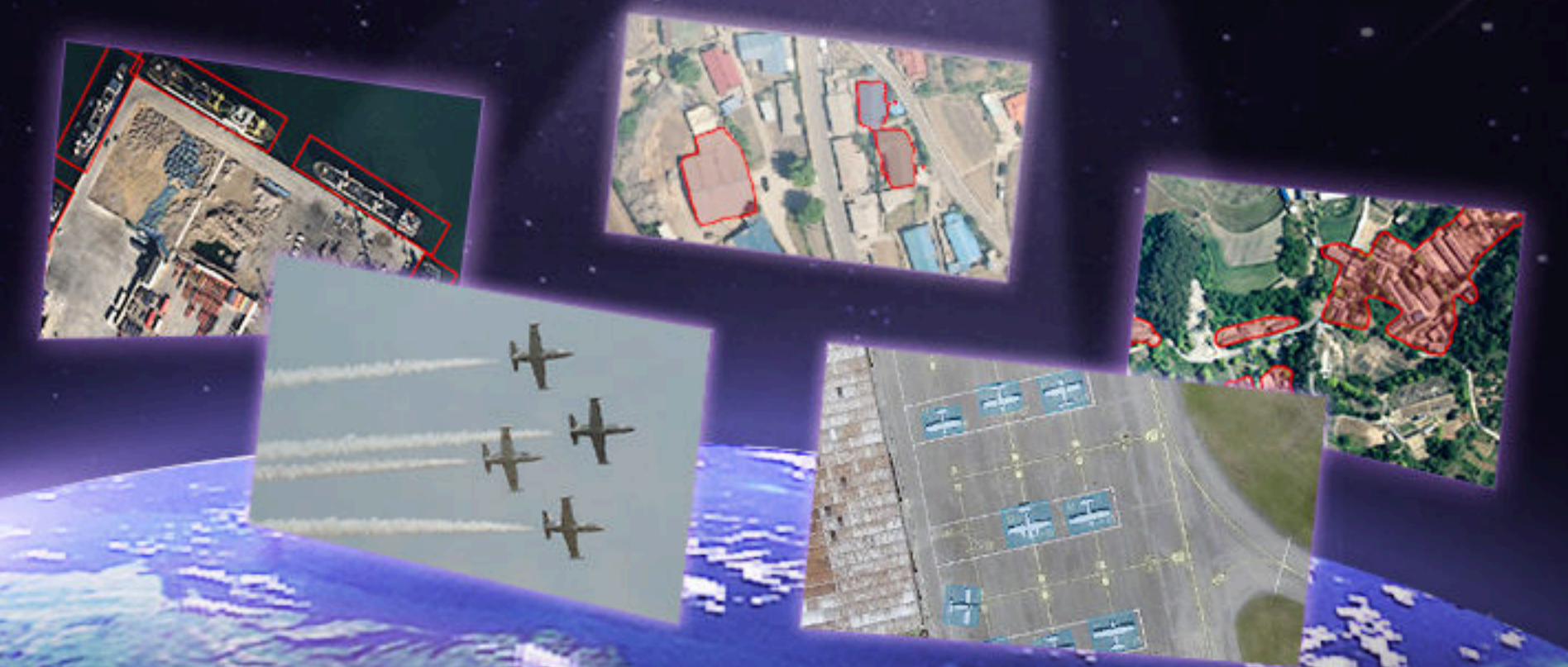


Nara Space Satellite Imagery Analytics Solution

Defense Management Solution



01

Satellite Imagery Analytics Solution Overview

Satellite Imagery Analytics Introduction

Key Industry Applications

Service Delivery Options

Why the Defense Sector Uses Satellite Data

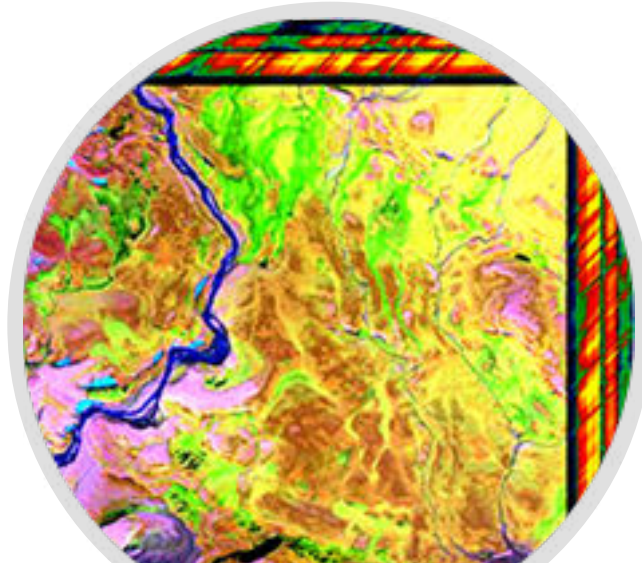


Nara Space Satellite Imagery Analytics Solution

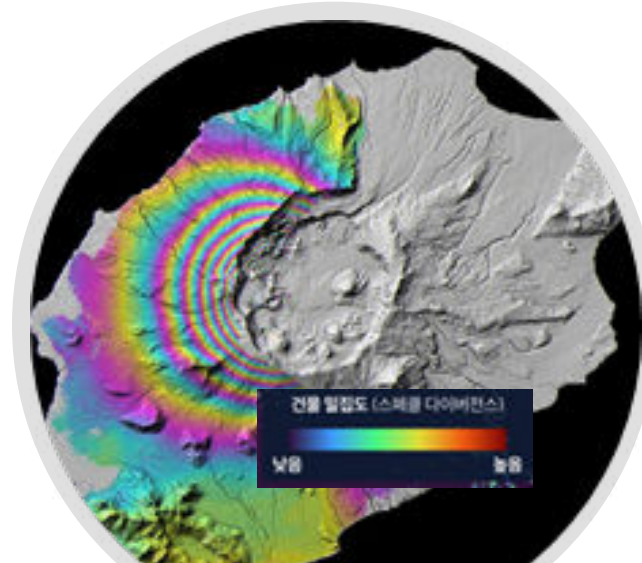
Nara Space collaborates with global data partners and leverages multi-sensor data fusion technologies to deliver highly accurate analytics results



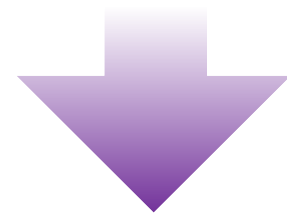
Multispectral



Hyperspectral



SAR



MULTI-SENSOR DATA FUSION

Key Industry Applications



Natural Disaster

Wild Fire Detection

Flood Detection

Landslide / Earthquake / Ground Subsidence



Finance

Construction Monitoring

Economic Intelligence



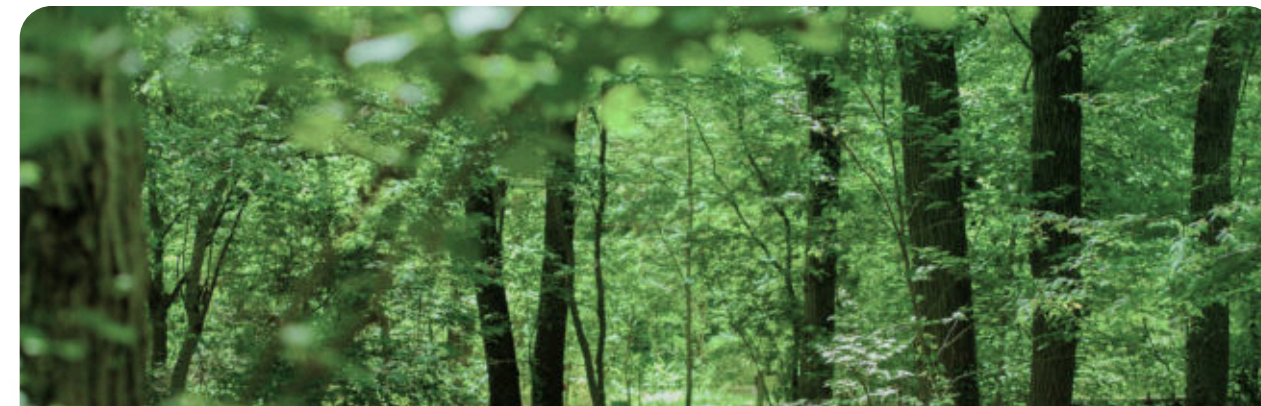
Agriculture

Yield Prediction

Corn

Soybean

Wheat



Environment

Tree Detection

Land Classification

Water Quality Assessment



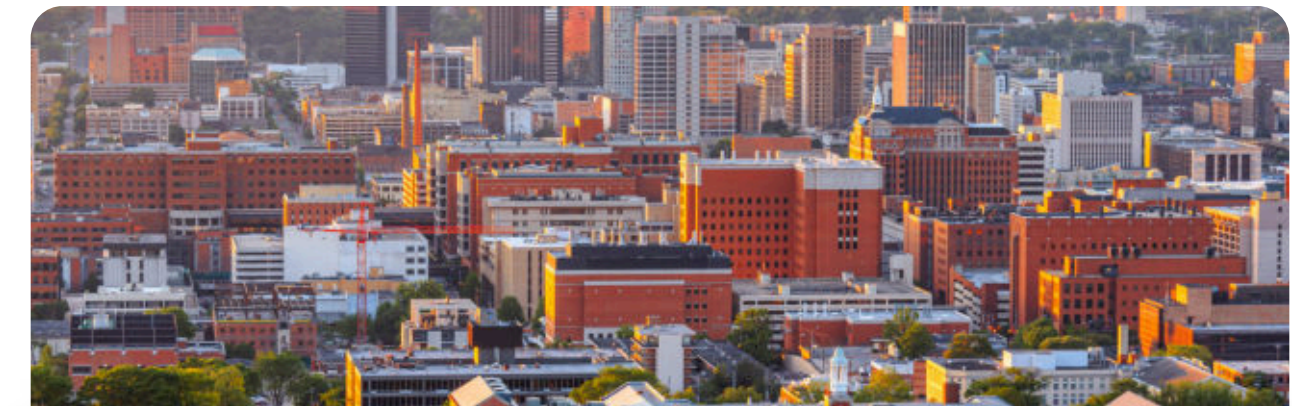
Defense

Super-Resolution Imaging

Object Detection

Object Segmentation

Change Detection



Urban

Urban Management

Smart City Strategy Development

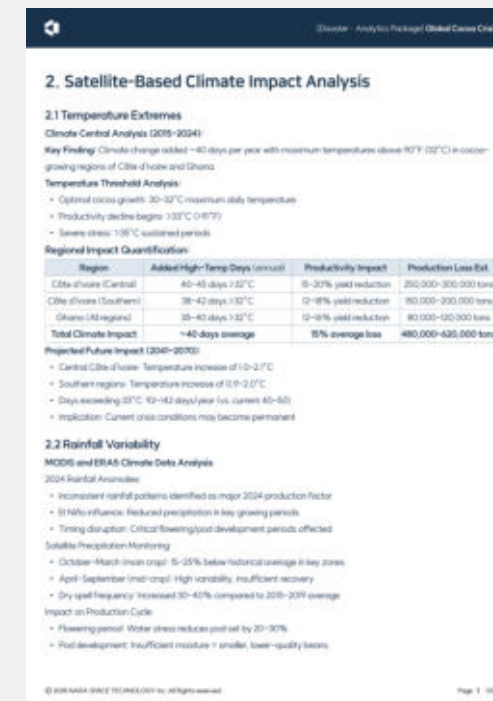
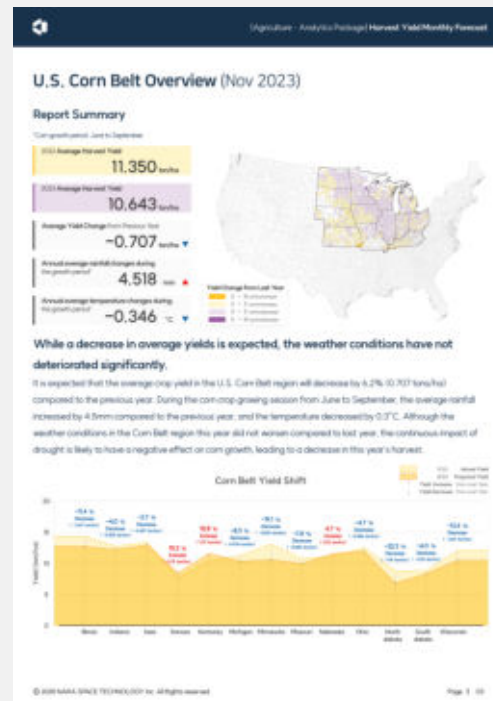
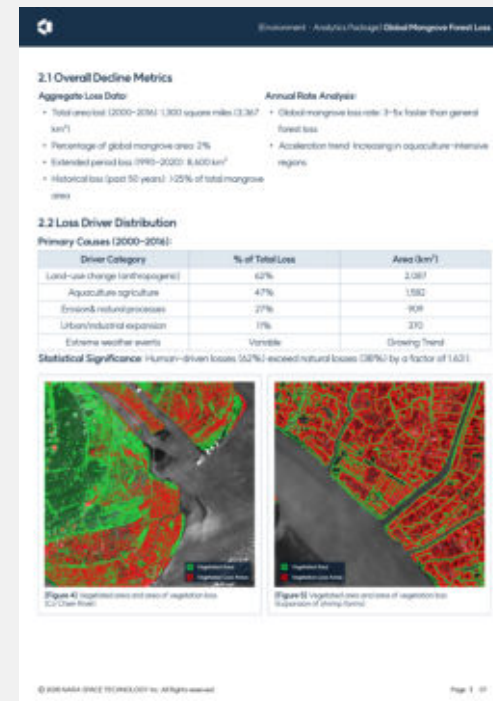
Land Use & Construction Monitoring

Service Delivery Options

On-Demand Insight Reports

Get concise, decision-ready summaries without handling satellite data

Examples



Custom Web Platform

A dedicated platform tailored for your organization



For APIs, additional analysis requests, or detailed customization, please contact us separately

Paradigm Shift in Defense Satellite Intelligence Solutions

Limitations of Legacy Defense Satellite Data


Sub-optimal image resolution inhibits the identification and detection of critical low-profile targets.

Manual interpretation of high-volume imagery introduces significant latency and increases the risk of human error.


Environmental variables—such as seasonal shifts and lighting conditions—result in target misclassification and delayed threat detection.

Reliance on third-party data providers restricts timely intelligence acquisition in prioritized Areas of Interest.

The Value Delivered by NARA SPACE

→  **Resolution Enhancement through Super-Resolution (SR) Technology**

Enhancing legacy data quality to provide superior object detection accuracy and mission-critical detail.

→  **Precision Identification via Automated Classification AI Models**

Delivering an industry-leading 0.91 Average Precision (AP) for near real-time, wide-area surveillance to accelerate the decision-making cycle.

→  **Environment-Agnostic High-Precision Change Detection**

Optimizing analytical reliability by isolating genuine physical changes from seasonal and environmental noise.

→  **End-to-End Intelligence via Sovereign Satellite Operations**

Providing full-spectrum intelligence—from wide-area monitoring to deep analysis—ensuring data sovereignty and rapid battlefield situational awareness.

Paradigm Shift in Defense Satellite Intelligence Solutions

Key Applications

Strategic Intelligence: High-Value Target & Infrastructure Monitoring

Detecting base expansion, assessing industrial operational status, and tracking high-value asset deployment.

Advanced Maritime Domain Awareness (MDA) & Illicit Activity Monitoring

Autonomous detection and identification of non-cooperative ("dark") vessels, IUU fishing operations, and asymmetric infiltration threats.

Tactical Intelligence: Infrastructure Dynamics & Asset Change Analysis

Volumetric Change and Asset Utilization Analysis: Monitoring large-scale construction, analyzing strategic stockpiles, and assessing asset readiness.

Geospatial Intelligence (GEOINT): Environmental & Terrain Dynamics

Terrain Analysis for Mobility and Route Clearance, Tracking Physical Alterations including Coastal Erosion and Deforestation.

Value for Defense Stakeholders

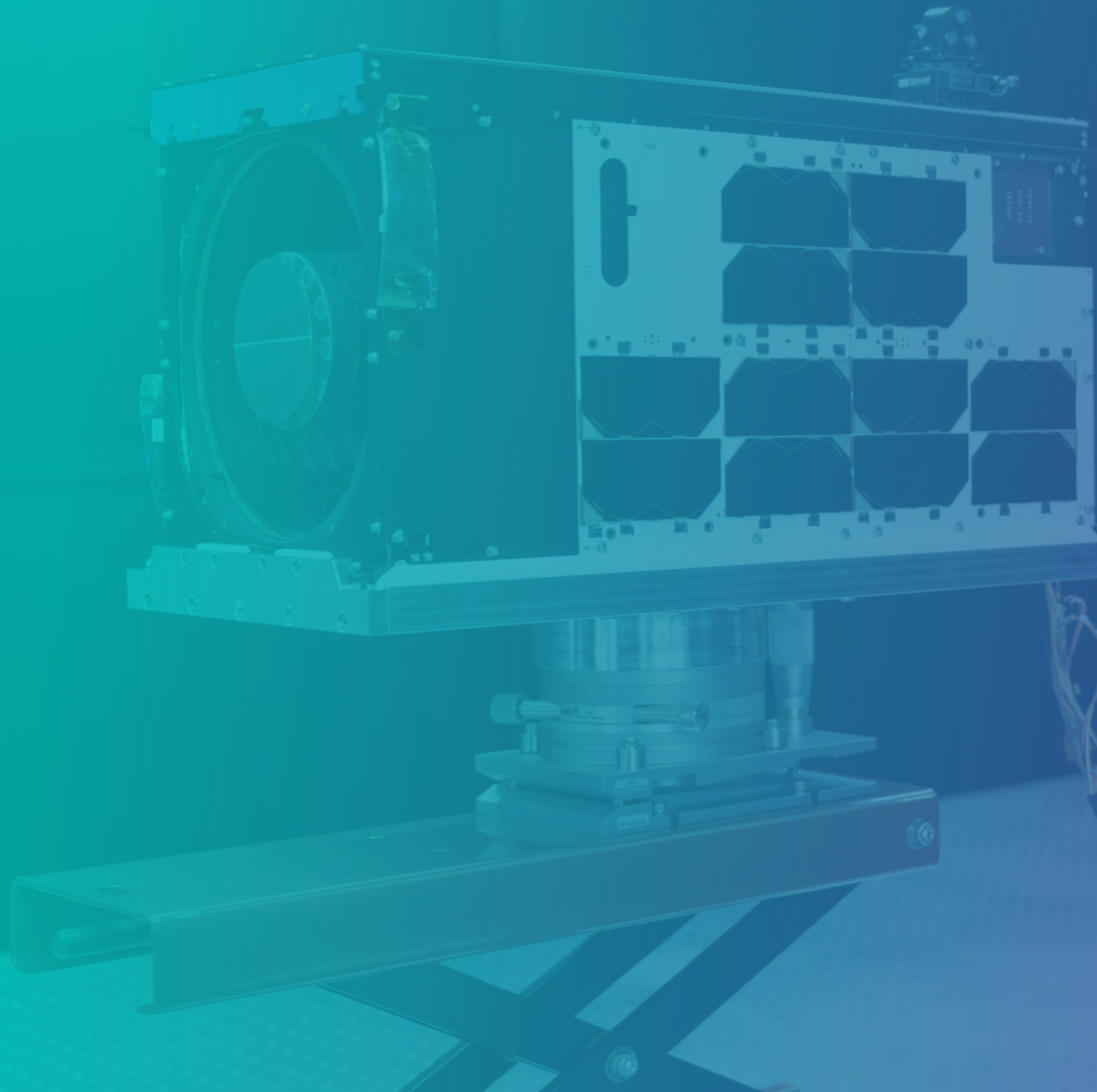
Data-Driven Policy Formulation and Early Warning Systems for Potential National Security Threats

Defending Maritime Territory and Sovereignty through Rapid Anomaly Detection and Response

Asset Readiness: Remote Monitoring & Data-Driven Strategic Risk Mitigation

Enhancing Operational Success by using Up-to-Date Battlefield Intelligence and National Land Change Data





02

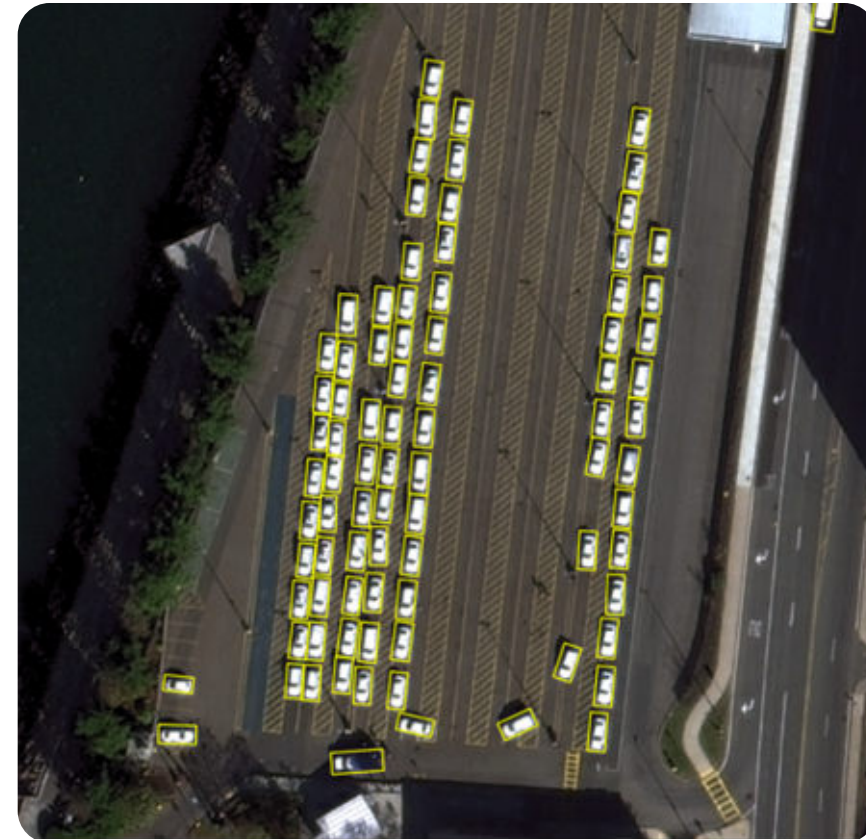
ISR Monitoring

- Ground Vehicle Activity Analysis
- Airbase Aircraft Activity Monitoring
- Maritime Vessel Activity Surveillance
- Facility Change Detection and Indications & Warnings

Ground Vehicle Activity Analysis



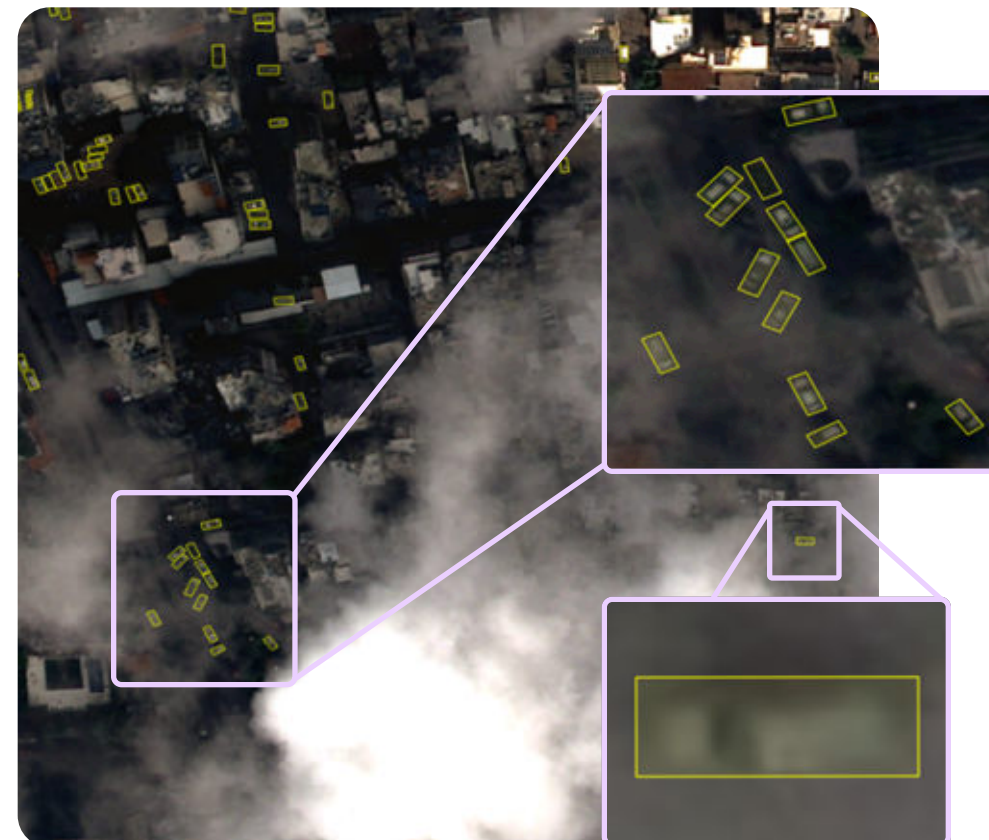
Pleiades-Neo / Seoul, Korea



SpaceEye-T / Boston, USA



WorldView-3 / Adelaide, Australia



Pleiades-Neo / Beirut, Lebanon

Model Detection Accuracy(AP) **0.79**

(*AP : Average Precision)

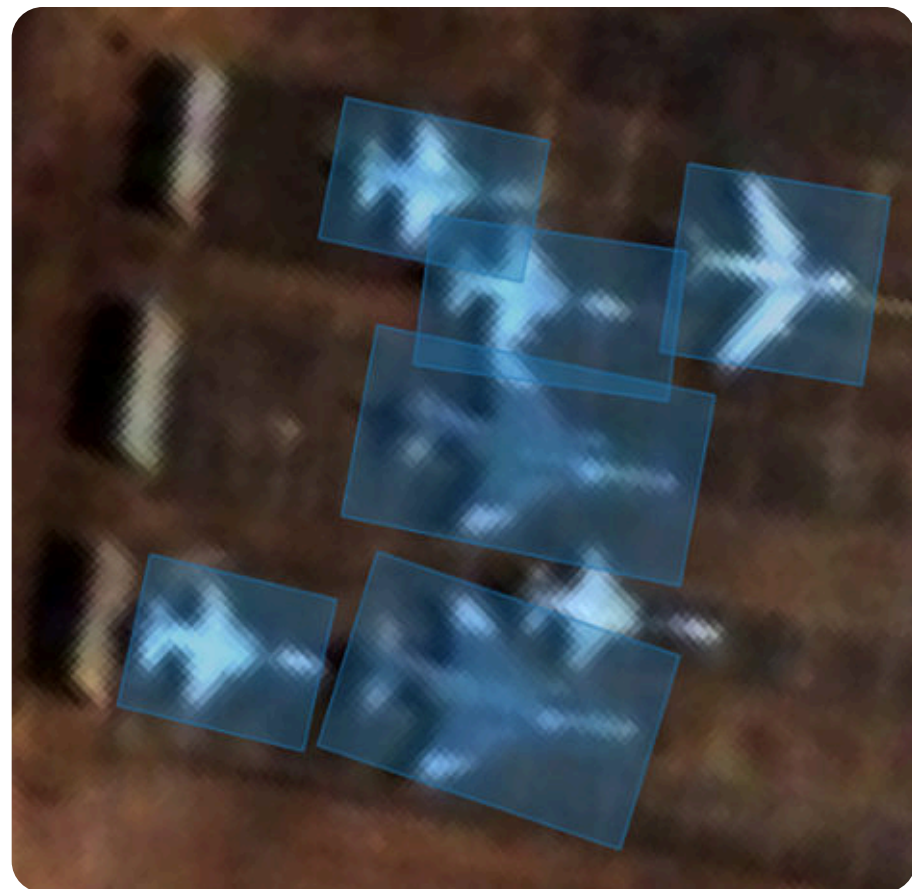
Technical Specifications

Supported Resolution	~0.5 m
Input Data Source	Kompsat-3/3a, WorldView-2/3, WorldView-Legion, Pleiades-Neo, SpaceEye-T, Aerial Imagery
Output Format	Raster (GeoTIFF, PNG), Vector(<u>GeoJSON</u>)

Key Advantages

- 1 Automated Vehicle Identification Based on High-Resolution Optical Imagery**
 - Automated vehicle identification in urban and operational areas through sub-meter resolution satellite imagery analysis.
 - Automated extraction of vehicle counts and density within wide-area regions.
- 2 AI-Powered Precision Vehicle Classification**
 - Leveraging AI models trained on the morphological characteristics of diverse transportation modes.
 - Automated classification of vehicle types including sedans, trucks, and military vehicles.
- 3 Near Real-Time Monitoring for Situational Awareness**
 - Tracking vehicle fluctuations in supply routes and parking lots based on satellite revisit cycles.
 - Identifying vehicle positions even in challenging environments with obstructions like building shadows, haze, and street trees.
- 4 Time-Series Urban Activity & Flow Pattern Analysis**
 - Analyzing periodically observed satellite data to visualize hourly inflow/outflow patterns and movement path.
 - Providing intelligence for decision-making by detecting anomalous traffic flows at large-scale events, disasters, or military movements.

Airbase Aircraft Activity Monitoring



Model Detection
Accuracy(AP)

0.91

Model Classification
Accuracy

0.97

(*AP : Average Precision)

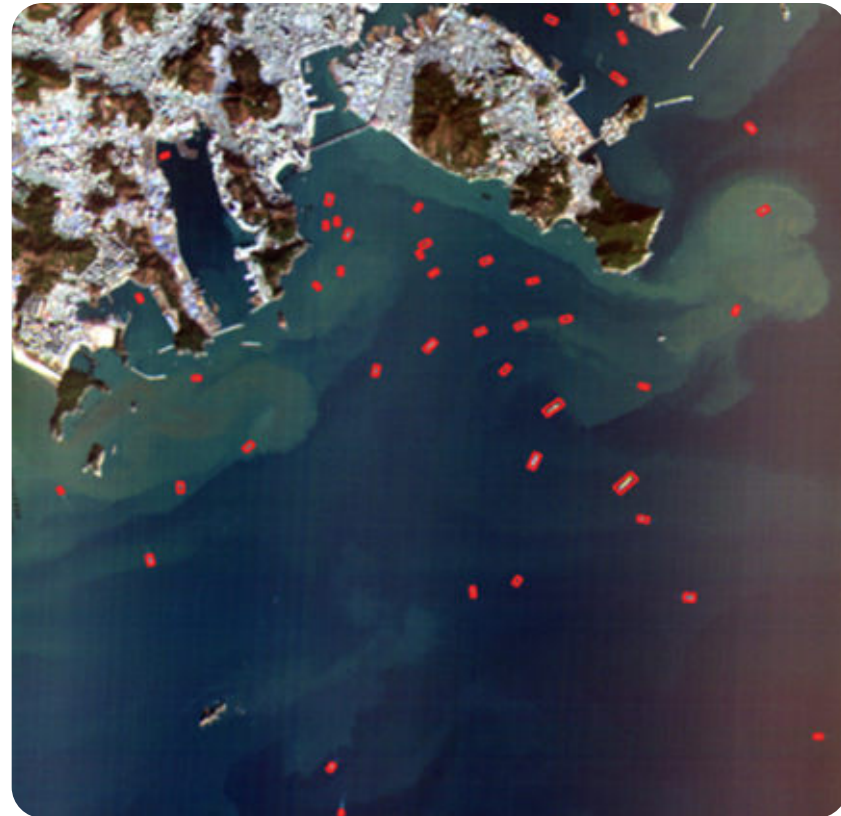
Technical Specifications

Supported Resolution	~5 m
Input Data Source	Kompsat-3/3a, Pleiades-Neo, Aerial Imagery
Output Format	Raster (GeoTIFF, PNG), Vector(GeoJSON)

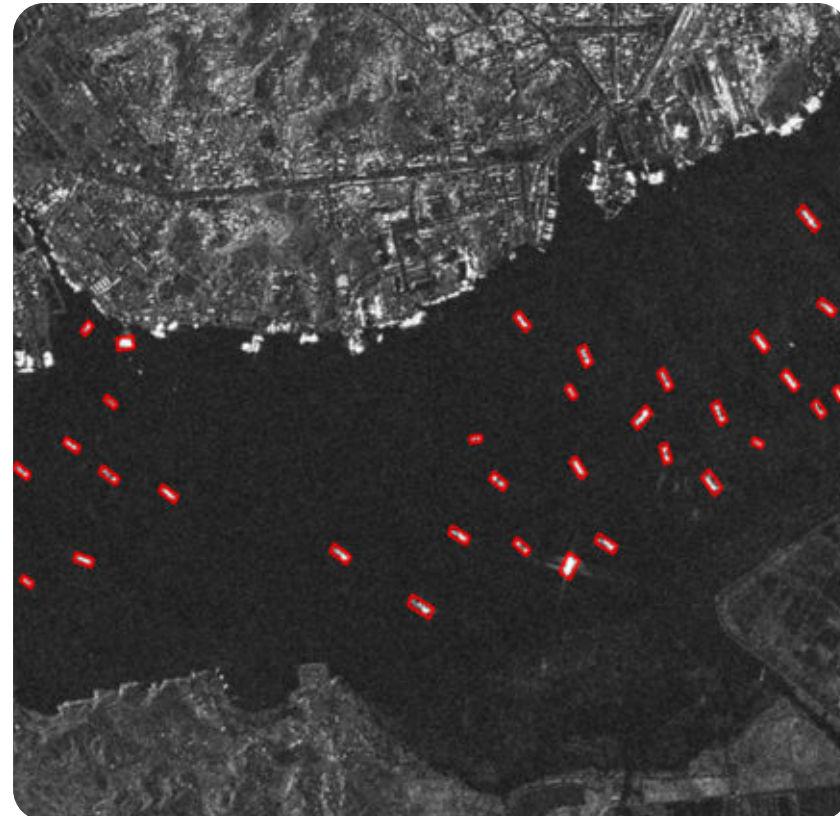
Key Advantages

- 1 Automated Identification of Aircraft Type Based on High-Resolution Optical Imagery**
 - Automated detection of aircraft near runways and hangars using sub-meter satellite imagery
 - Precision classification by aircraft type (Commercial, Military Aircraft, etc.) moving beyond simple detection.
- 2 Near Real-Time Airbase & Runway Monitoring**
 - Rapid delivery of analysis through persistent surveillance of airfields and airports via satellite revisit cycles.
 - Early detection of sortie indications and unit movements by analyzing changes in aircraft deployment on runways to support warning systems.
- 3 Strategic Asset & Combat Power Analysis**
 - Full-inventory analysis of aircraft on aprons and taxiways to determine the scale of **operational assets**.
 - Pre-identifying the possibility of mass troop movements or long-range deployments by analyzing the concentration of heavy transport aircraft and fuel tankers.
- 4 Precision Data Analytics via Advanced Detection Technology**
 - Improved detection reliability for obscured or camouflaged targets through contextual environmental analysis.
 - Assigning precise geospatial coordinates to extracted targets for seamless integration with other GIS (Geospatial Information Systems).

Maritime Vessel Activity Surveillance



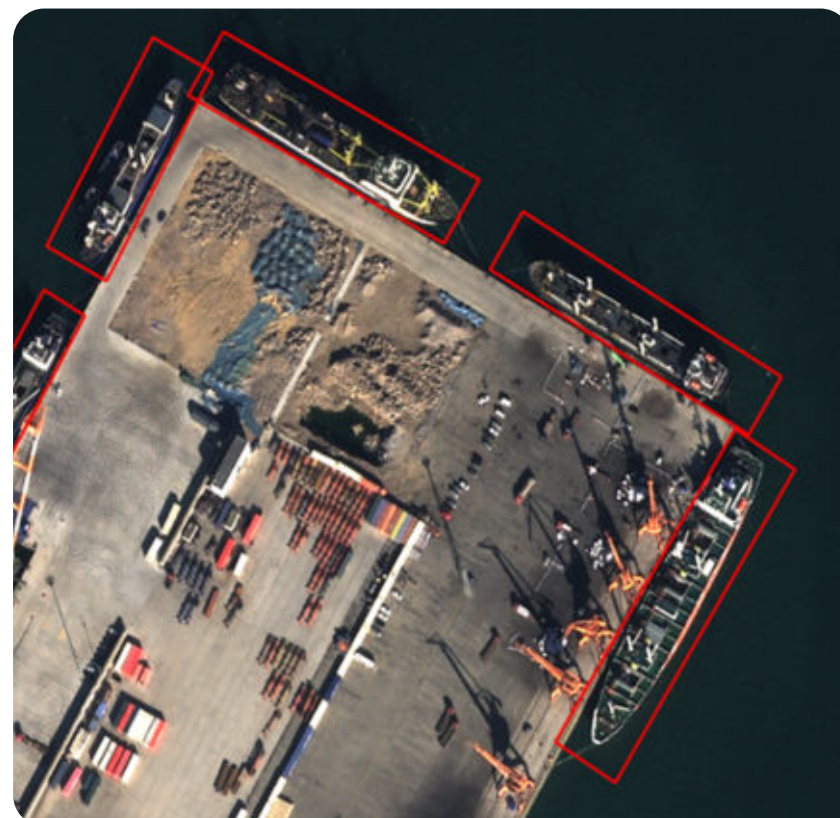
Observer-1B Busan



ICEYE Nampo, North Korea



BlackSky Shidao Port, China



PNEO Shidao Port, China

Model Detection Accuracy(AP) **0.903**

(*AP : Average Precision)

Technical Specifications

Supported Resolution	~10 m
Input Data Source	Optical : Sentinel-2, Observer-1A/B, Blacksky, Kompsat-3/3a, Pleiades-Neo, Aerial Imagery SAR : Sentinel-1, ICEYE
Output Format	Raster (GeoTIFF, PNG), Vector(GeoJSON)

Key Advantages

1 AI-Driven Automated Vessel Identification

- Automated detection and precision classification of vessel types (e.g., warships, fishing vessels, and merchant ships) from high-resolution satellite imagery.

2 AIS Integration for Anomaly Detection

- Cross-analyzing satellite-detected vessels with real-time AIS data to identify Vessels with location discrepancies or disabled AIS (Dark vessels).
- Analyzing anomalous trajectories of illegal fishing boats or suspected infiltration vessels operating with AIS disabled and support rapid first response.

3 Near Real-Time Monitoring and Multi-Target Tracking in Wide-Area Maritime Domains

- Implementation of a persistent maritime surveillance system capable of operating day/night and in severe weather conditions based on EO/SAR data fusion.
- Enhancing the efficiency of maritime border operations by simultaneously tracking the movement patterns of multiple vessels across vast oceanic areas.

4 Integrated Satellite-UAV Collaborative Framework

- Primary target detection in wide maritime areas via satellite, followed by the deployment of UAVs (Unmanned Aerial Vehicles) for close-range precision reconnaissance based on shared coordinates.
- Strengthening maritime security capabilities through "Detect-Identify-Track" surveillance chain.

Facility Change Detection & Early Warning Systems

Aerial Imagery-Based Facility Change Detection (Bonghwa, Namwon)



3m-Resolution Satellite Imagery-Based Facility Change Detection (Seongnam, Anyang)



Key Advantages

- 1 Time-Series Automated Change Detection**
 - Automated detection of new construction, expansions, and terrain shifts using pixel-level temporal analysis.
 - Applying of AI algorithms designed to minimize false positives caused by seasonal variations or shadows, extracting only genuine physical alterations.
- 2 Threat Detection on Defense and National Security**
 - Enabling early warnings of potential provocations by capturing changes in hangar facilities, fuel storage expansions, and missile launcher deployments within key military bases.
- 3 Supporting Policy and Operational Planning via Surface Feature Change Analysis**
 - Monitoring surface changes near bridges, dams, roads, etc. to utilizing as supporting data for safety inspections and the updating of operational military maps.
 - Tracking long-term surface changes such as mass deforestation and coastline erosion to provide objective metrics for national land management and environmental protection policies.
- 4 Precision Data Analysis via Advanced Imagery Interpretation Technology**
 - Detect clandestine activity by analyzing subtle texture and color variations, even in areas using camouflage or netting.
 - Assigning precise geospatial coordinates to area where changes being detected for immediate link with field inspection teams and integrated management systems.

Technical Specifications

Supported Resolution	~3 m
Input Data Source	PlanetScope, Sub-meter Resolution Satellite Imagery, Aerial Imagery
Output Format	Raster (GeoTIFF, PNG), Vector(GeoJSON)

Model Accuracy (IoU) 0.82

(*mIoU : Mean Intersection over Union)

03

Core Analytics Technologies

Object Detection

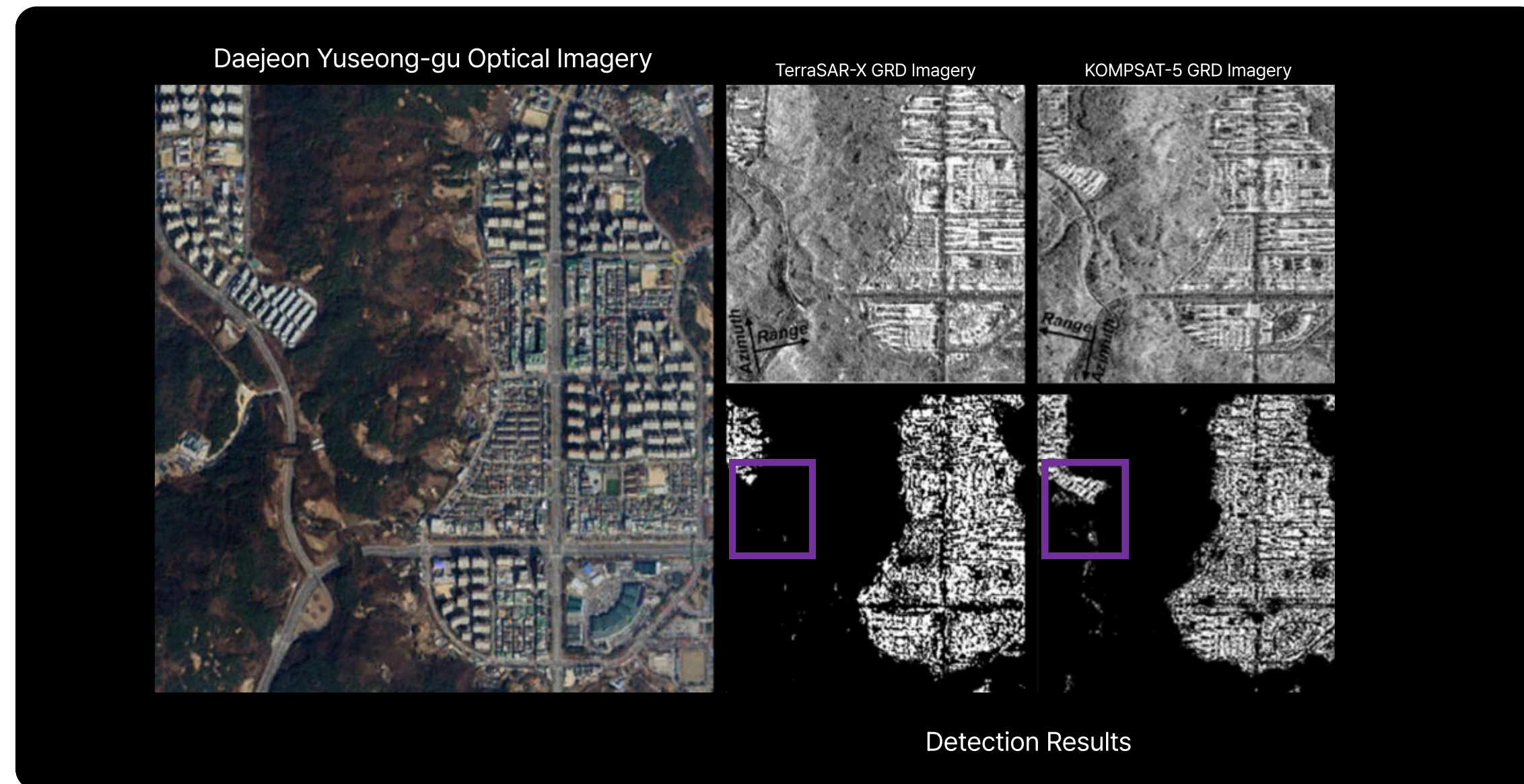
Super Resolution

Gap-Filling

GenAI (Generative AI)

Object Detection : Urban Area Detection Based on SAR Imagery

Daejeon Yuseong-gu Optical Imagery



Technical Specifications

Available Resolution	3 m (TerraSAR-X), 5 m (KOMPSAT-5)
Input Data	SAR GRD Image Before and After the Event
Output Format	Raster (GeoTIFF, PNG)

Key Advantages

1 Extraction of building-specific SAR scattering mechanisms

Achieve high-precision detection by analyzing building-specific SAR scattering behaviors—such as shadowing and double-bounce effects—far surpassing the limitations of traditional backscatter-only analysis.

2 High-precision detection of urban environments

Using extracted morphological features, our solution can accurately identify densely built-up zones and urban structures, enabling valuable applications in urban planning, infrastructure monitoring, and post-disaster damage assessment.

3 Comparative analytics across multiple imagery types

Enable robust cross-verification by comparing not only identical SAR images but also data from different SAR sensors, providing a more comprehensive and multi-layered analytical perspective.

Object Detection : Optical Image-Based Building / Road Detection

Mandalay, Myanmar



Technical Specifications

Recommended Resolution	~ 1 m
Input Data	RGB band
Output Format	Raster (GeoTIFF, PNG), Vector (GeoJSON)
Model performance (mIoU)	0.84 (on test data with resolution under 1 meter)

(*mIoU : Mean Intersection over Union)

Key Advantages

1 Robust Object Detection Model Built on Global Datasets

By jointly training on diverse domestic and international datasets, the model ensures consistent and stable performance regardless of regional characteristics or environmental variations.

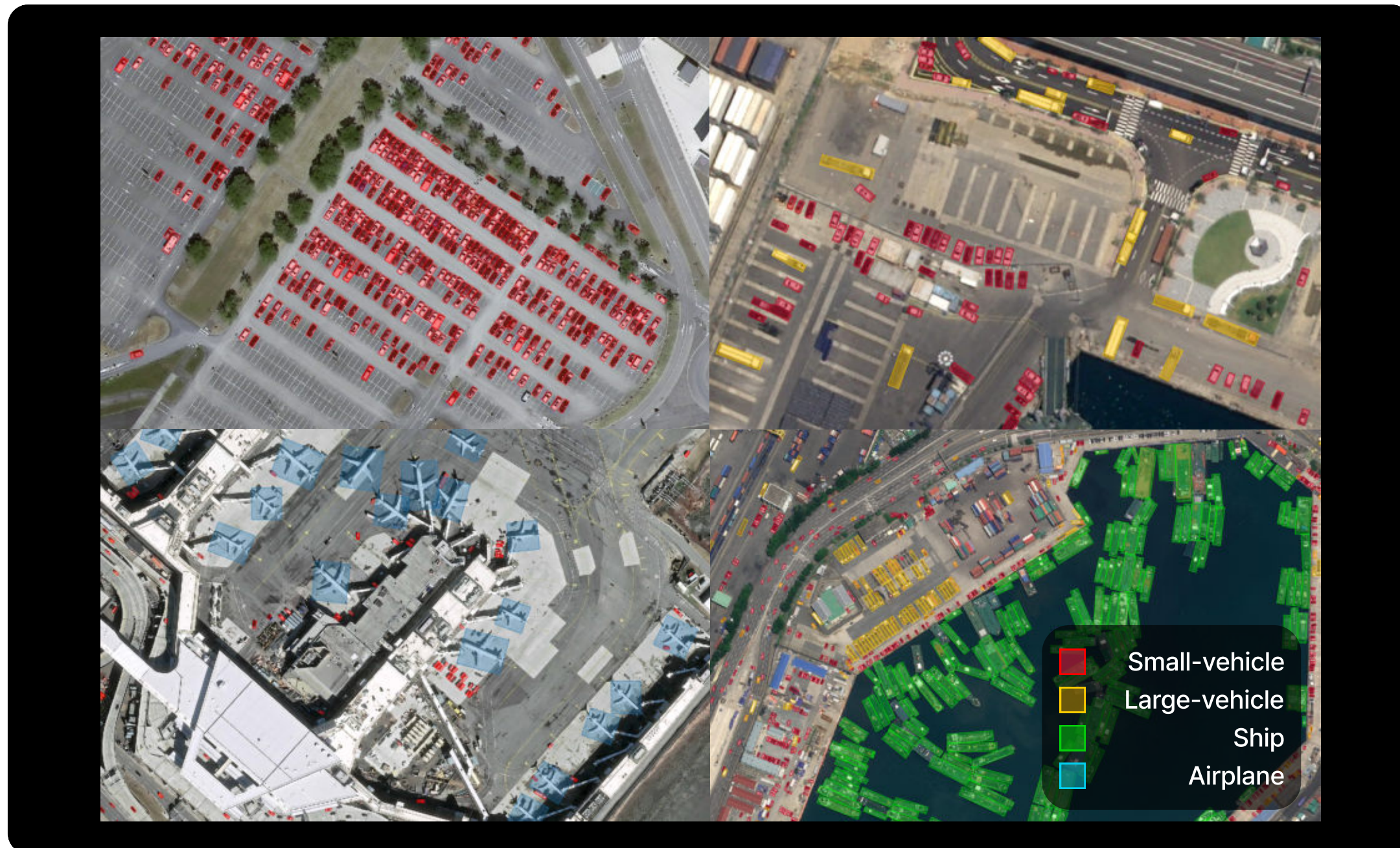
2 High-Precision Urban Area Detection through Ultra-High-Resolution Training

Achieves mIoU of 0.84 on imagery with spatial resolution finer than 1 meter.

3 High-Speed Analysis Enabled by an Efficient Inference Model

Achieves fast inference of approximately 13 seconds per 1000 × 1000 pixel input, enabling rapid and accurate detection across large-scale spatial areas.

Object Detection : Transportation Means



Key Advantages

1 Training on multi-resolution satellite and aerial imagery

Leveraging datasets such as Pleiades, Pleiades Neo, and DOTA, we combine imagery at various resolutions with Super-Resolution (SR) outputs to deliver robust detection performance at 0.5 m-class high resolution.

2 Enhanced accuracy through Super-Resolution integration

By sharpening object boundaries with advanced Super-Resolution technology, we simultaneously improve detection accuracy and the visual quality of the results.

3 High-precision detection across five transportation classes

The model distinguishes multiple transportation asset types—such as fire trucks, heavy vehicles, ships, and aircraft—achieving an average recall above 0.98 accuracy across five transportation classes.

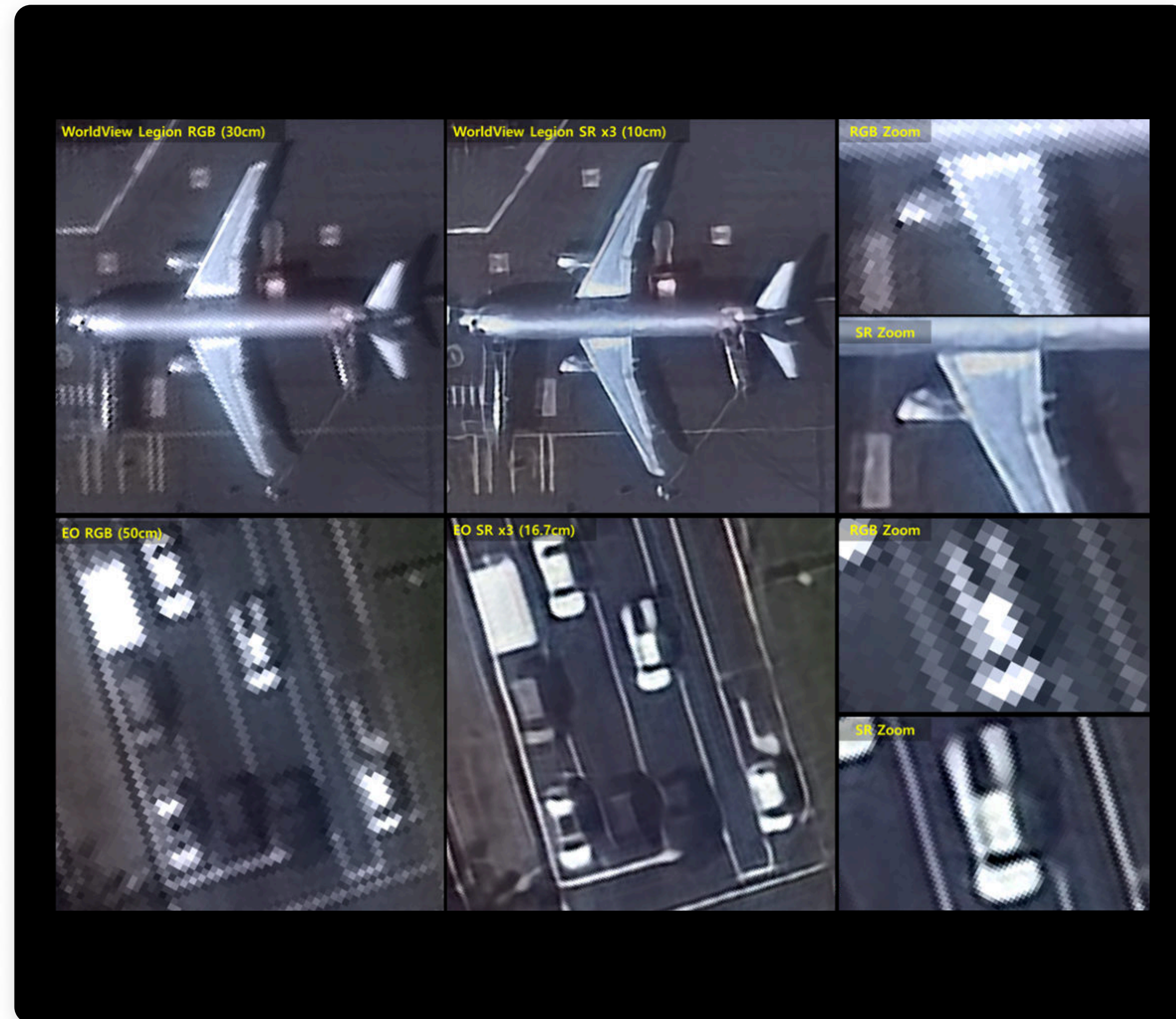
Technical Specifications

Recommended Resolution	~ 0.5 m
Training Data	Self-Constructed Data (Pleiades, Pleiades Neo), DOTA Dataset (Satellite and Aerial Imagery), AI Hub (Kompsat-3, Kompsat-3A)
Input Data	RGB band
Output Format	Vector (GeoJSON, SHP)

Transportation Means Object Detection Accuracy

Class	Small Vehicles	Large Vehicles	Ships	Airplanes	Average
Recall	0.98	0.93	1.00	1.00	0.98
AP	0.90	0.73	0.94	0.90	0.87

3X Super Resolution to a WorldView Legion (30 cm) image



Key Advantages

1 High-quality super-resolution tailored to your satellite imagery

Incorporates satellite-specific characteristics—such as brightness, noise patterns, and atmospheric effects—to preserve original features while enhancing spatial resolution, enabling more precise object detection and analysis.

2 Fast processing of large-scale imagery through model lightweighting and optimization

By lightweighting the model and optimizing inference, high-volume, large-area satellite imagery can be processed at high speed, ensuring both high throughput and consistent image quality.

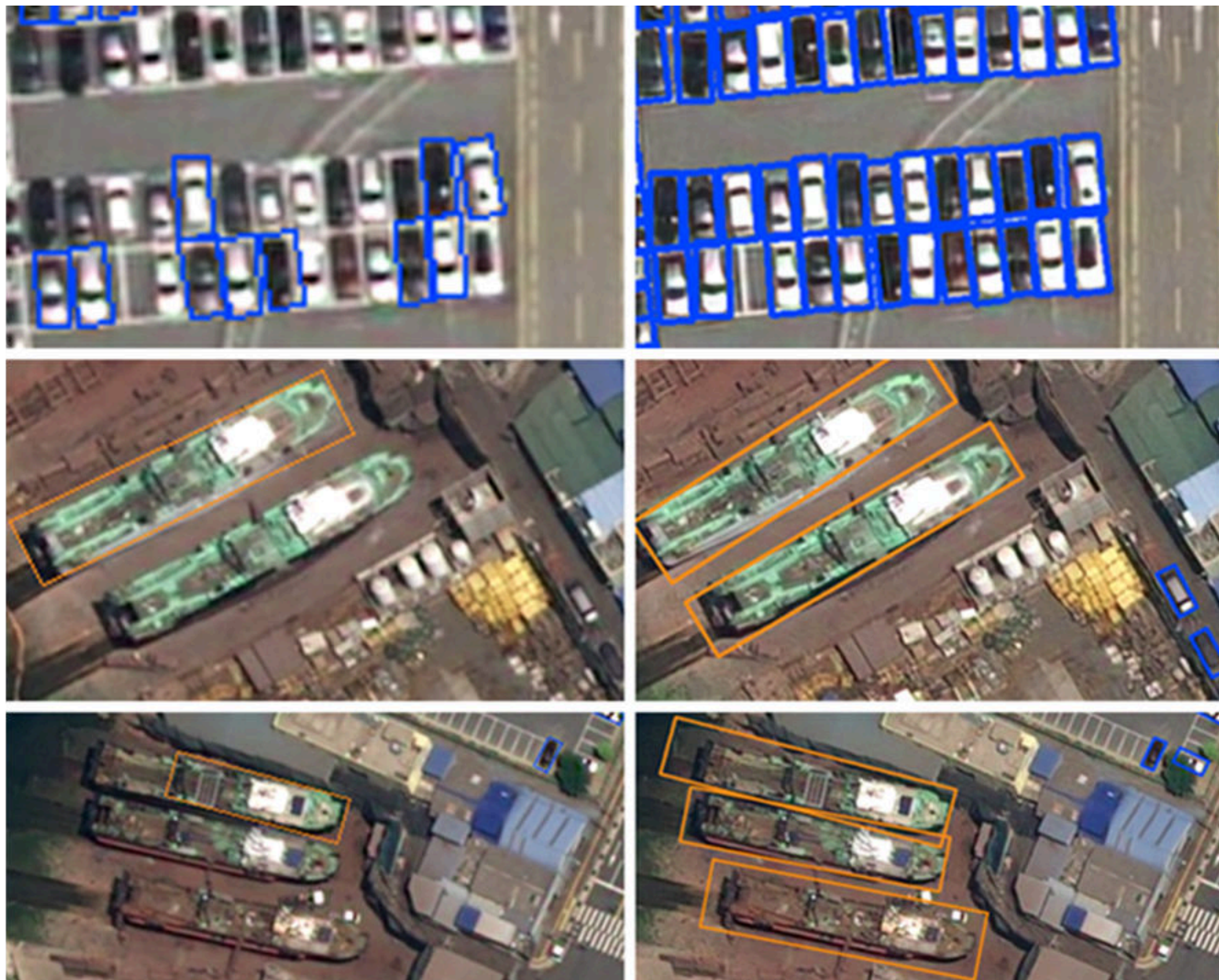
3 Maximizing value from existing low-resolution imagery and reducing costs

By upscaling existing low-resolution archives—such as Landsat and Sentinel—into high-resolution products, you can reduce reliance on costly high-resolution acquisitions while significantly increasing data utilization.

4 Boosting accuracy across multiple analysis workflows

Applying super-resolution enhances performance in change detection, object detection, and disaster monitoring, improving both detection accuracy and overall analysis quality.

Accuracy Improvement After SR Application



Performance Improvement Cases Before / After SR Application

Performance Improvement Cases Before / After SR Application					
Class	Small Vehicles	Large Vehicles	Ships	Airplanes	Average
Recall	0.61 → 0.98	0.84 → 0.93	0.97 → 1.00	1.00 → 1.00	0.85 → 0.98
AP	0.59 → 0.90	0.55 → 0.73	0.89 → 0.94	0.98 → 0.90	0.75 → 0.87

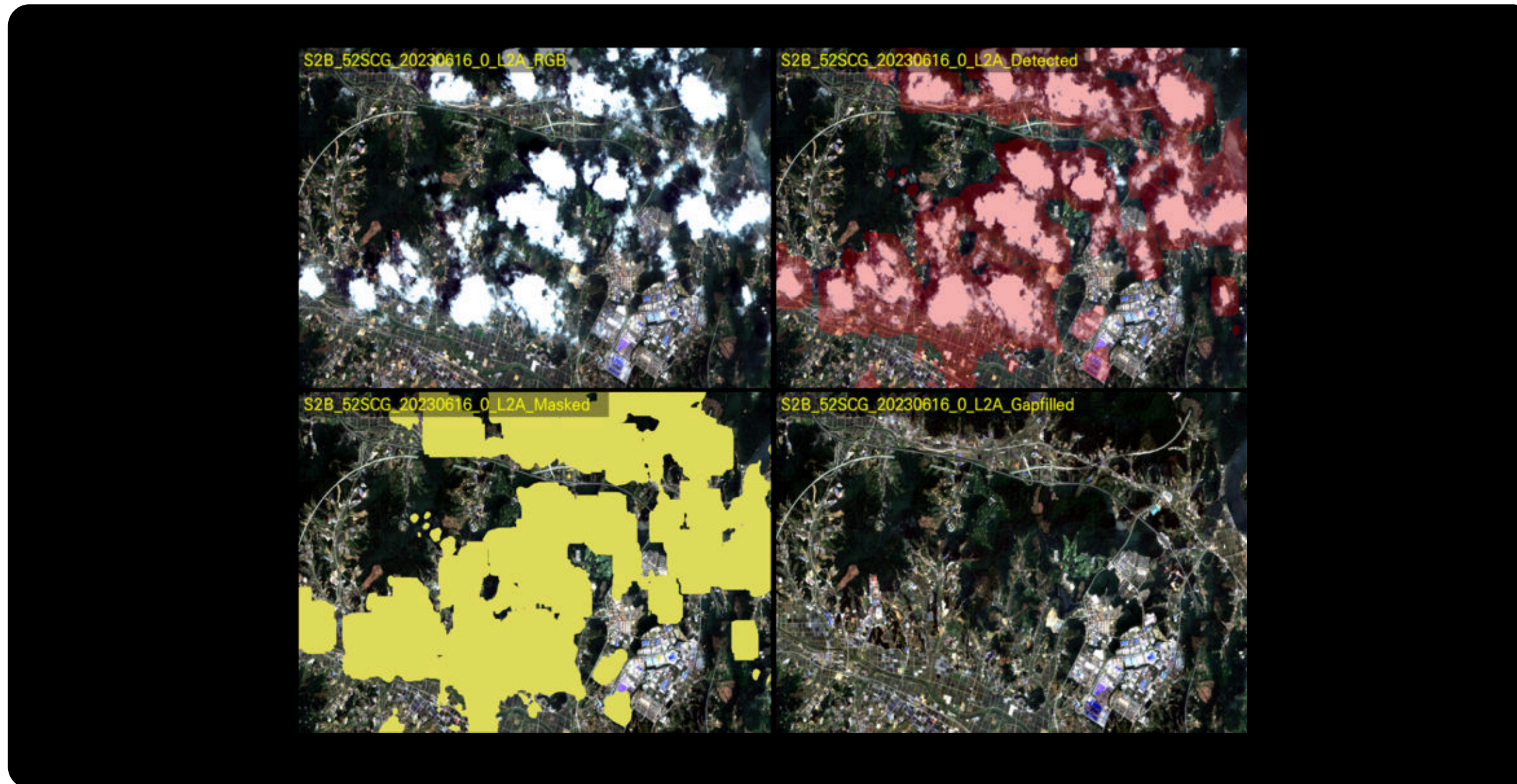
Technical Specifications

Recommended Resolution	0.3 m - 10 m
Applicable Satellites	Applicable to more than 20 high- to low-resolution satellite types
Input Data	RGB / RGBN
Output Format	Raster (GeoTIFF, PNG / 8bit)

Gap-Filling

The images illustrate the cloud and cloud-shadow masking and gap-filling process applied to Sentinel-2 (10 m) imagery for the Korean peninsula

Gap-filling



Key Advantages

1 Deep learning-based precise cloud detection

Leveraging advanced deep learning models, cloud-covered areas are detected far more accurately than with conventional threshold-based methods.

2 Continuous monitoring without cloud constraints

By reconstructing areas obscured by clouds and cloud shadows, continuous observation becomes possible without interruption, while preserving both spatial and temporal resolution.

3 Seamless restoration of cloud-obscured areas

Advanced machine learning algorithms naturally reconstruct missing regions, preserving land-cover patterns even in complex terrain.

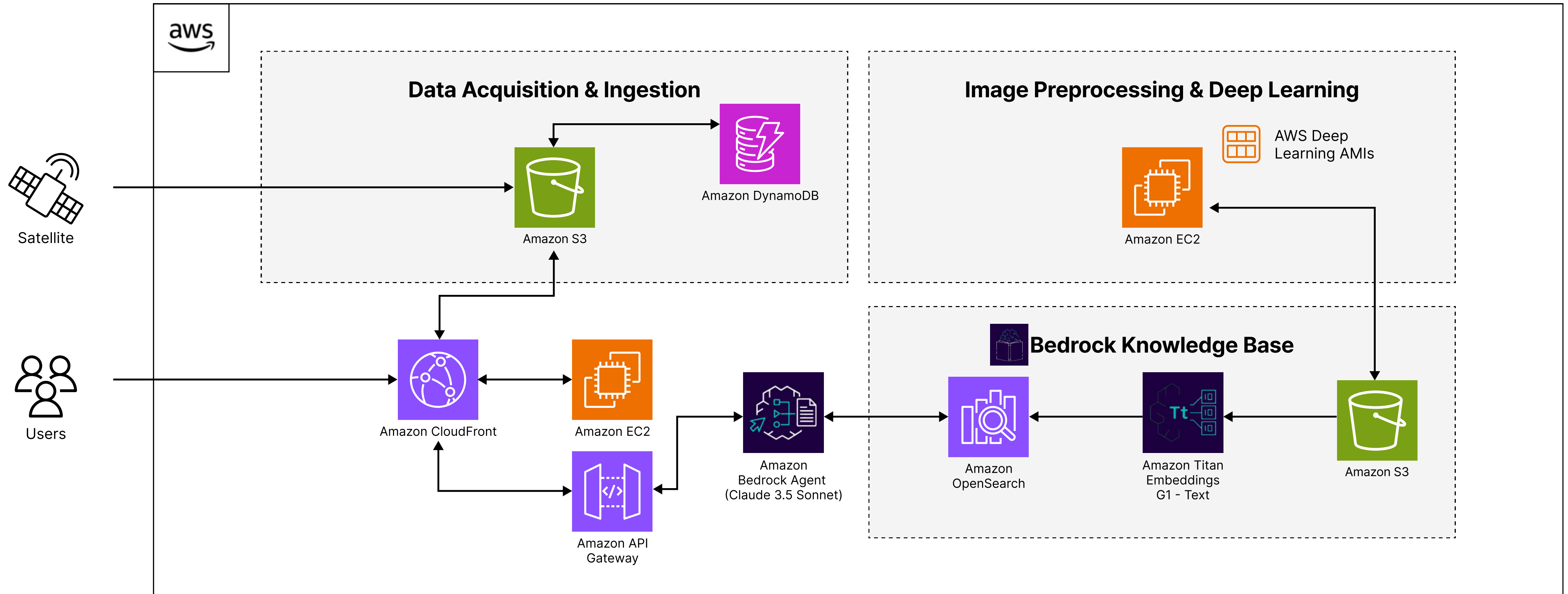
4 Purpose-built for time-series intelligence

Delivers gap-free time-series imagery for use cases that demand continuous monitoring, including land-cover change detection, agricultural monitoring, and water resource management.

Technical Specifications

Recommended Resolution	~ 30 m
Training Data	Landsat 8-9 (30 m) , Sentinel-2 (10 m)
Input Data	RGB + a
Output Format	Raster (GeoTIFF, PNG / 8bit , 16bit)

Automatic Reporting Using GenAI



Key Advantages

1 Save time

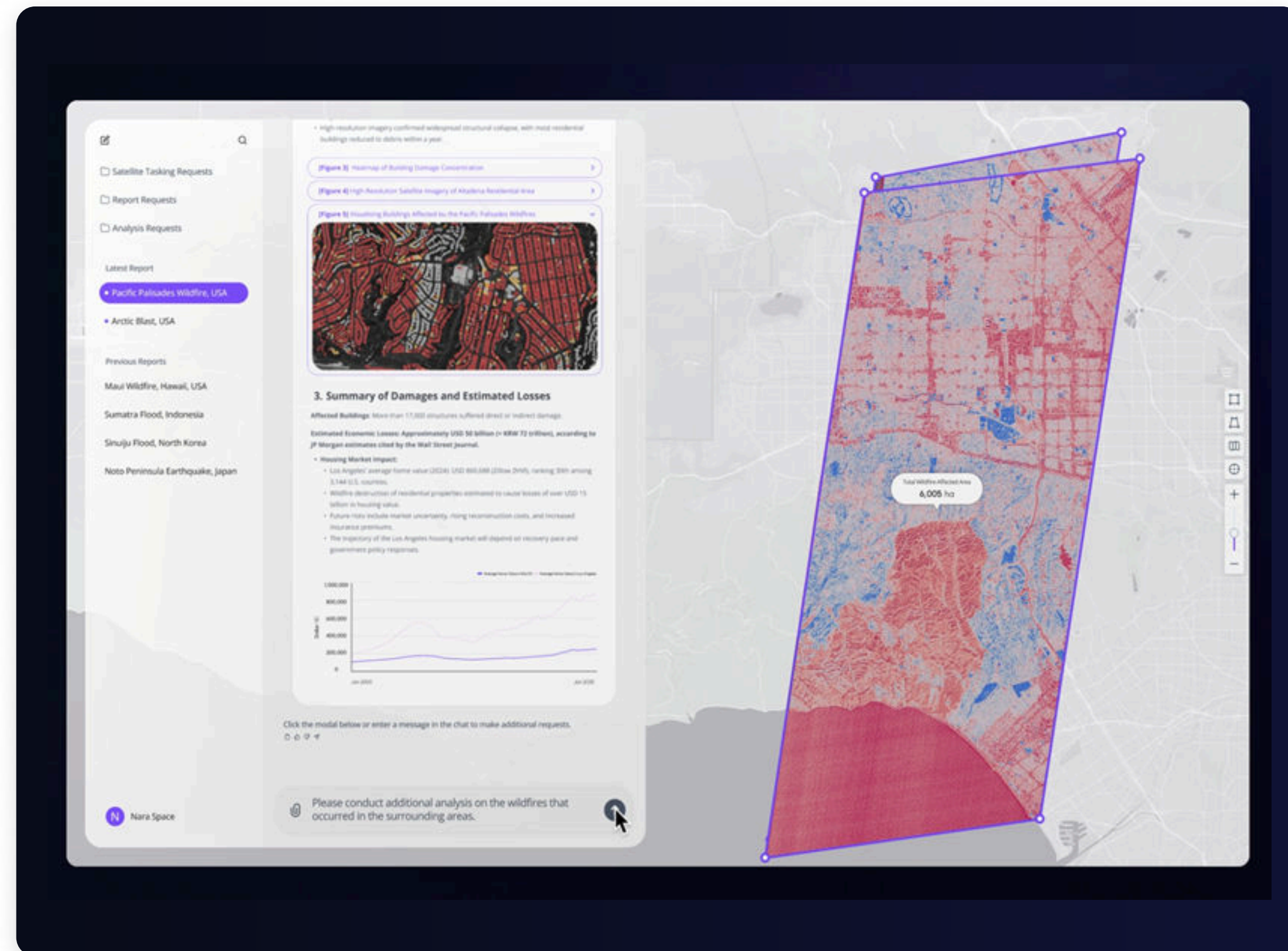
By leveraging Gen AI, report generation is dramatically reduced, enabling actionable insights in record time.

2 Minimized Hallucinations

By leveraging a rich, domain-specific knowledge base, the system significantly reduces hallucinations and delivers reliable analytical results.

GenAI-Based Customer-Specific Copilot System

Copilot System Example



Key Advantages

1 User-friendly chatbot interface

An intuitive, conversational system that lets users easily request satellite image analysis and receive their results in no time.

2 Proactive, automated reporting

When a disaster occurs, the system automatically runs the analysis and delivers a report to the user, without requiring any manual request.

3 On-demand, deeper analysis

Once an initial report has been generated, users can immediately request additional or more detailed analyses to support in-depth decision-making.

4 24/7 Availability

The Gen AI system delivers essential information instantly, without time constraints or waiting periods, enabling timely decision-making during critical moments.

Thank you

Contact us: sales@naraspace.com

