Nara Space Satellite Imagery Analytics Solution

Urban Management Solution

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01

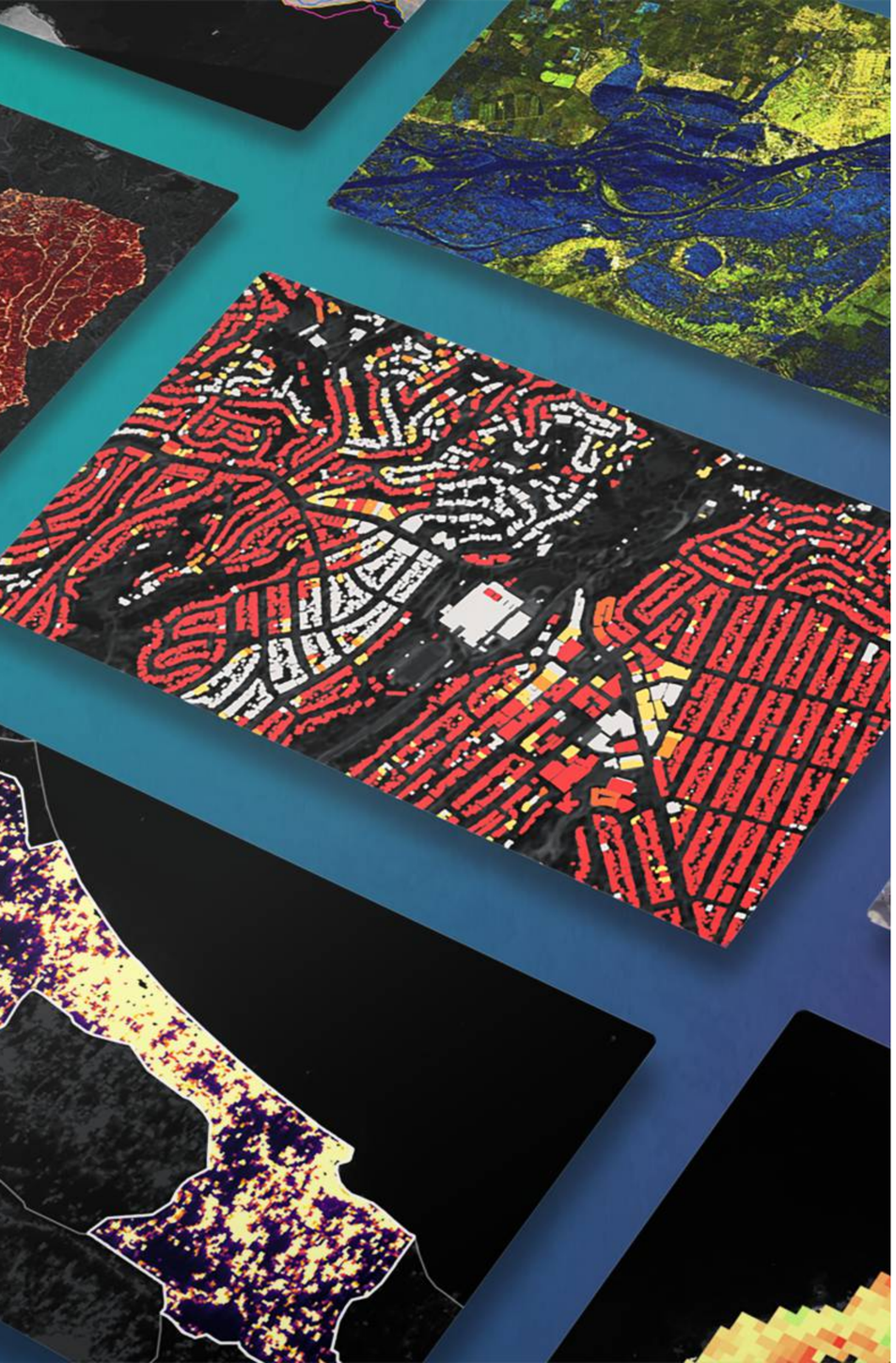
Satellite Imagery Analytics Solution Overview

Satellite Imagery Analytics Introduction

Key Industry Applications

Service Delivery Options

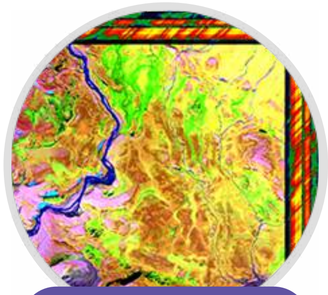
Paradigm Shift in Urban Management Solutions



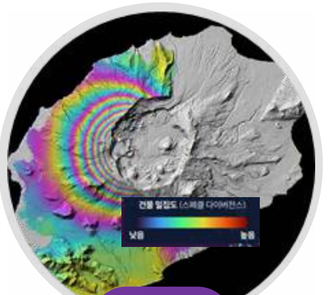
Nara Space Satellite Imagery Analytics Solution

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

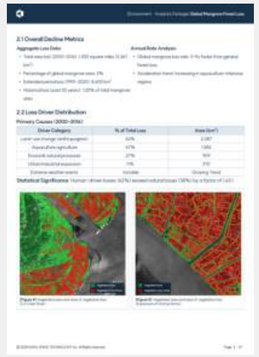
- Urban Management
- Smart City Strategy Development
- Land Use & Construction Monitoring

Service Delivery Options

On-Demand Insight Reports

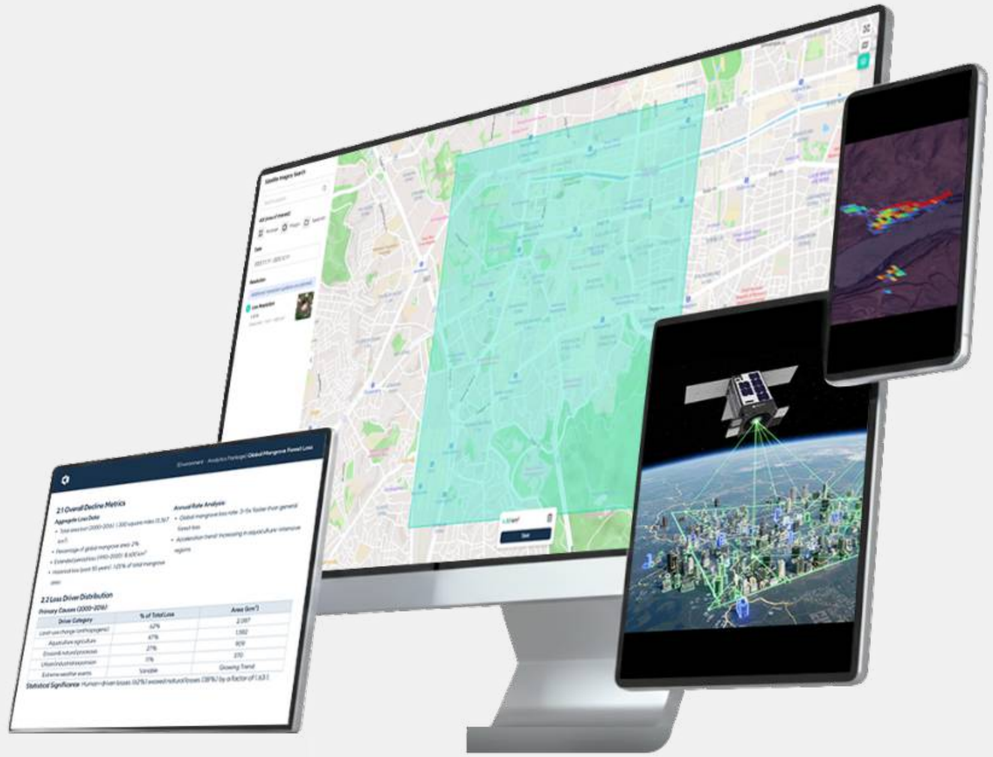
Get concise, decision-ready summaries without handling satellite data

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 Urban Management Solutions

Limitations of Existing Urban Management Solutions	Future of Urban Management with Satellite Data	
Relying on manual labor to track city-wide changes results in excessive time and labor costs.	**Remote Monitoring without Geographical Constraints**	Enables continuous and consistent monitoring of entire urban areas, including hard-to-reach locations beyond administrative reach.
Low-Resolution imagery makes difficult to detect micro-level changes such as unauthorized extensions or road damage.	**Precision Enhancement via Super Resolution (SR)**	Nara Space's proprietary SR technology increases Native imagery resolution by 3X or more for high-fidelity detailed analysis.
Delays in reporting and response times due to manual interpretation of large datasets by human analysts.	**AI-Driven Automated Object Classification & Statistics**	High-performance AI automatically detects vehicles, solar panels, and buildings in near real-time.
Environmental factors, such as shadows or seasonal color changes, are often misidentified as structural changes.	**Environment-Adaptive High-Precision Change Detection**	Extracts only actual physical changes (constructions & demolition) by filtering out effects of seasonal variations and lighting conditions.

Paradigm Shift in Urban Management Solutions

Key Applications

Surveillance on Illegal Construction & Land Use
Continuous monitoring of unauthorized development and land degradation within restricted development zone using time-series data.

Infrastructure & Construction Site Monitoring
Automated tracking of national projects and major construction sites, with remote detection of changes in urban infrastructure (roads, bridges, etc.).

Energy & Environmental Asset Management
Comprehensive surveys of solar panel installations in urban areas and management of green spaces and carbon sinks through vegetation index analysis.

Urban Activity & Economic Indicator Analysis
Estimating economic activity and population movement by analyzing night-time lights and cargo volumes at logistics hubs and ports.

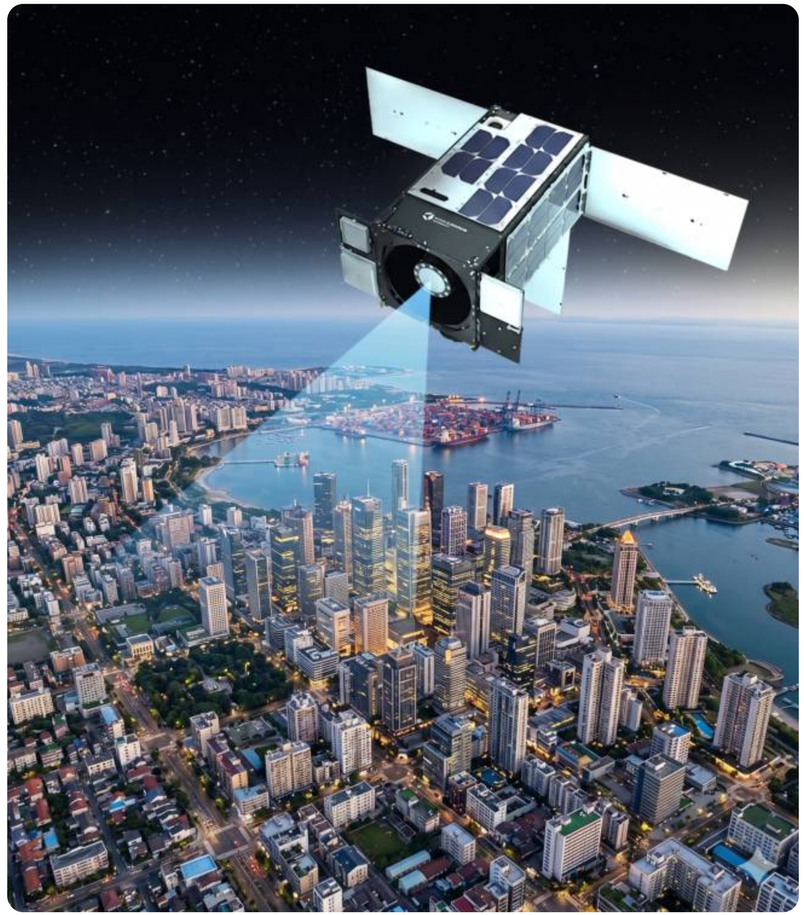
Value for Stakeholders

Addressing management manpower shortages and maximizing administrative reliability and efficiency through objective satellite-based evidence.

Simultaneous management of multiple projects without direct site visits, reducing risks and costs through data-driven progress management.

Scientific verification of energy policy compliance (including carbon neutrality) and optimization of energy self-sufficiency and environmental indicators for Smart Cities.

Supporting regional economic trend analysis and scientific policy formulation by using near real-time data which is faster than traditional statistical methods.



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Urban & Industrial Activity Monitoring

Urban Mapping & Detection

Night-time Light Analysis

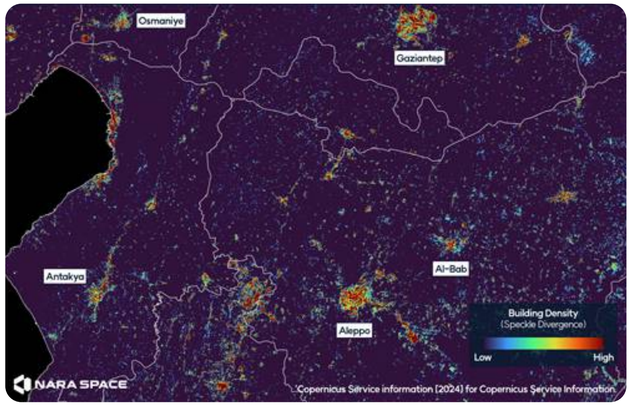
Land Cover Classification

Industrial Sites Operations Monitoring

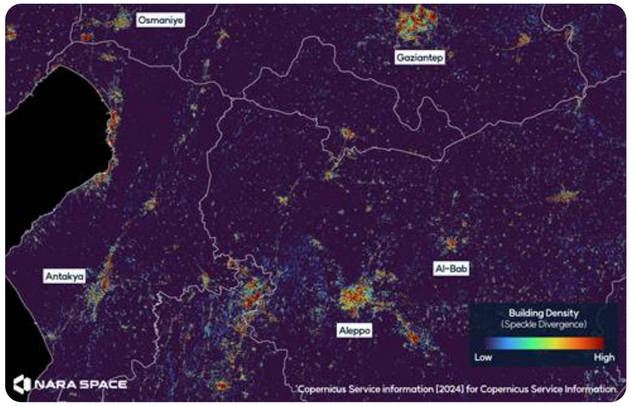
Solar Plants Monitoring

Urban Mapping & Detection

Building Density in Türkiye
Before the Earthquake (2023)



Building Density in Türkiye
After the Earthquake (2023)



SAR-based Comparison of Urban Development Status in Sindalah, Saudi Arabia

Technical Specifications

Input Data	Output Format
Dual-polarization SAR Imagery	Raster (GeoTIFF, PNG)

Key Advantages

1 Urban Sprawl Multi-Scale Spatiotemporal Analysis

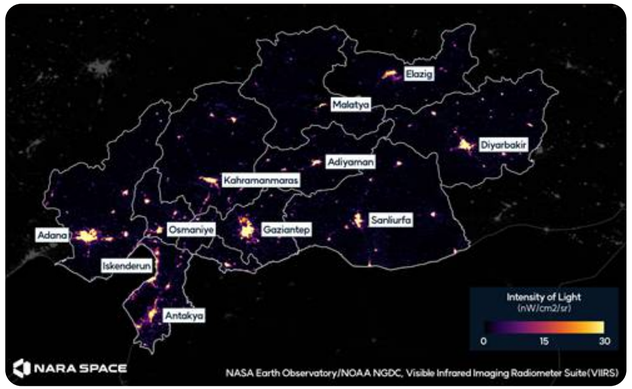
Through a scalable framework from city to national levels, enabling time-series analysis and comparison of urbanization changes across multiple spatial scales.

2 Monitoring Urban Planning Progress and Assessing Implementation Levels

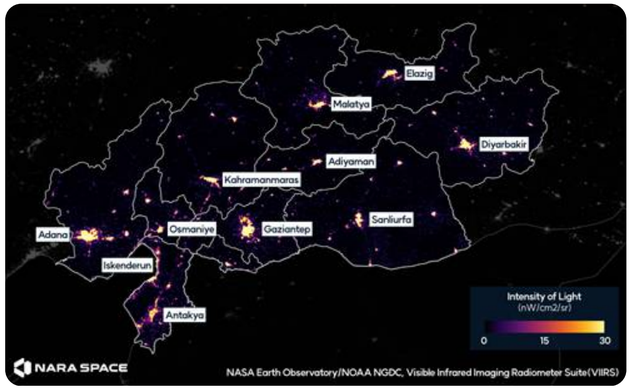
Assessing actual urbanization levels relative to planned targets, serving as foundational evidence for investment decisions and policy formulation.

Night-time Light Analysis

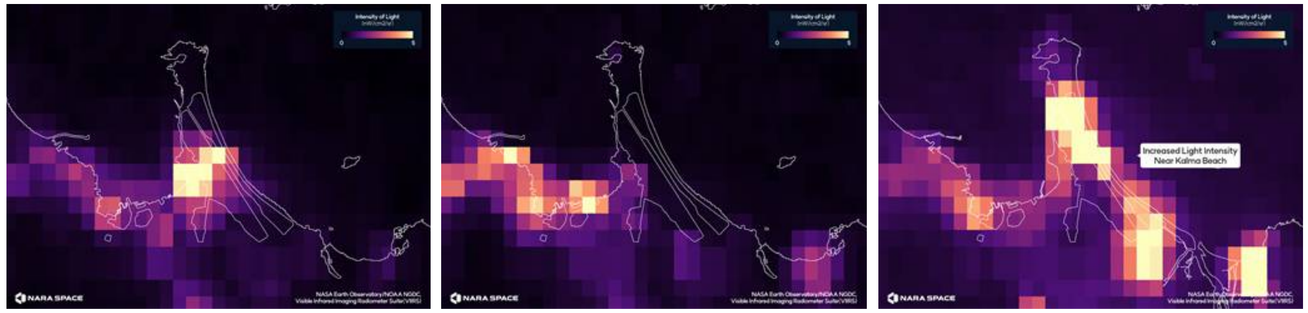
Night-time Light Intensity in Türkiye Before the Earthquake (2023)



Night-time Light Intensity in Türkiye After the Earthquake (2023)



Comparison of Night-time Light Intensity at Kalma Tourist Zone, North Korea (2014 ~ 2018)



Technical Specifications

Input Data

Red, Green, and Blue Bands Captured at Night

Output Format

Raster (GeoTIFF, PNG)

Key Advantages

1 Insights into Remote & Inaccessible Regions

Leverage satellite intelligence to assess population density and economic vitality in geographically or politically restricted regions where ground-level data is unavailable

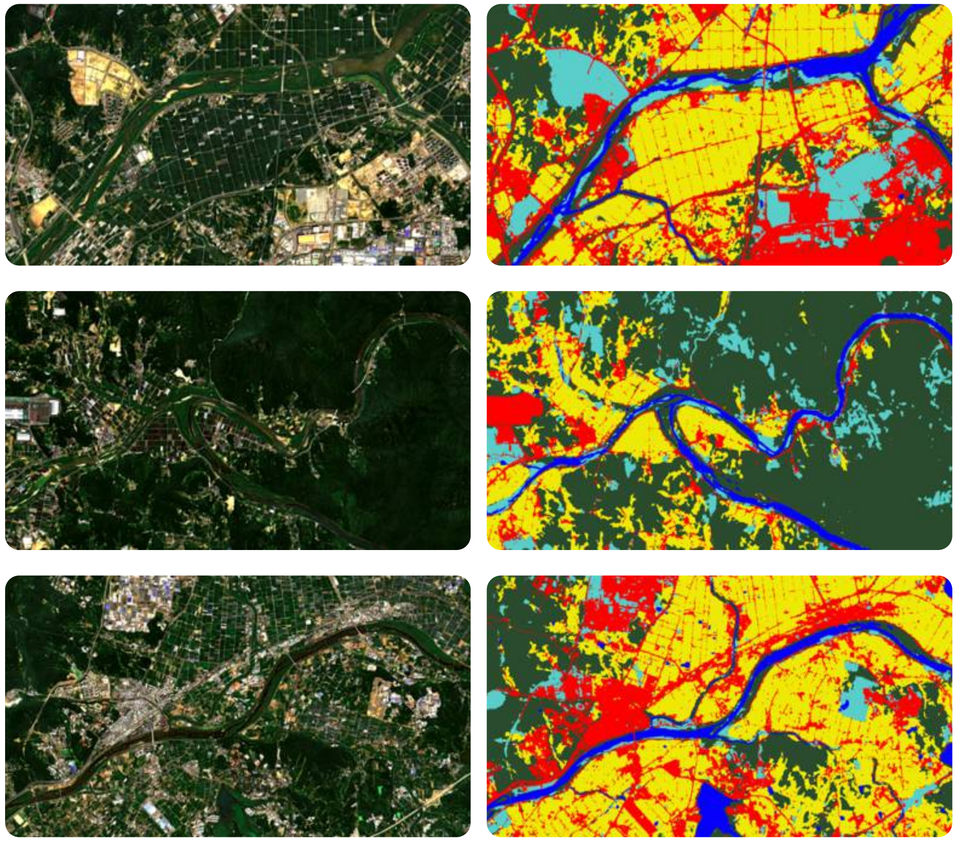
2 Targeted Night-time Activity Monitoring

Evaluate industrial productivity and regional economic health by monitoring light emissions and activity levels within manufacturing hubs and large-scale industrial zones.

Land Cover Classification

Sentinel-2
Super-Resolution Imagery

Land Cover
Classification Results



Technical Specifications

Input Data	10m resolution satellite imagery (Red, Green, Blue, NIR)
Output Format	Raster (GeoTIFF, PNG), Vector (GeoJson)
Model performance (mIoU)	0.61 (*mIoU : Mean Intersection over Union)

Key Advantages

1 High-Precision Automated Land Cover Classification

Deep learning models enable simultaneous, high-resolution classification across vast territories—automatically identifying cropland, forests, urban centers, and water bodies with unparalleled accuracy.

2 High Classification Accuracy in Complex Boundary Areas

By analyzing intricate spatial patterns, our system outperforms traditional rule-based methods, ensuring stable and reliable performance even in "mixed pixel" environments or areas with ambiguous boundaries.

3 Time-Series Based Land Use Change Detection

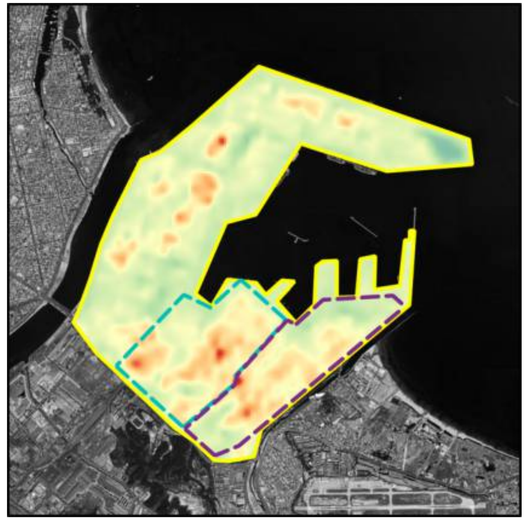
Leverages multi-temporal satellite imagery to continuously analyze land cover change trends and systematically monitor urban expansion, forest loss, and agricultural shifts.

4 Standardized Data for Policy & Environmental Intelligence

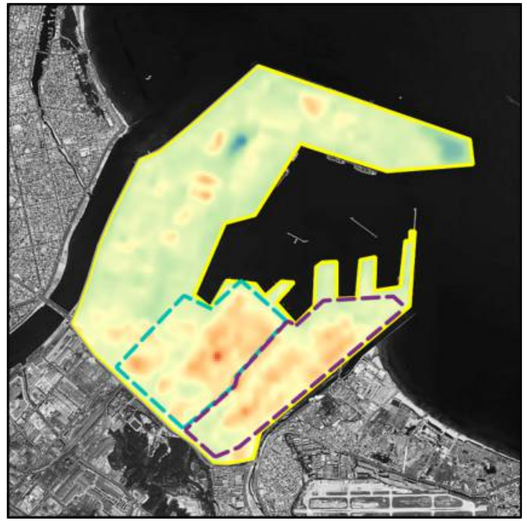
Standardized classification outputs provide a rigorous foundation for land management, policy development, and spatial statistics, streamlining workflows for administrative and research institutions.

Industrial Sites Operations Monitoring

POSCO High-Temperature Area Distribution (Jan. 2022)



Decrease in POSCO High-Temperature Areas (Jan. 2023)



- Identification of a slowdown in production activity based on the reduction of high-temperature areas compared to the previous year

Technical Specifications

Spatial Resolution	30 m
Input Data	Landsat-8
Output Format	Raster (GeoTIFF, PNG)

Key Advantages

1 Operational Monitoring via Land Surface Temperature (LST)

Periodically tracks the production activities of industrial complexes based on changes in Land Surface Temperature(LST).

2 Benchmarking Industrial Production Levels Across Regions

Our platform enables high-level comparative analysis by benchmarking current activity against historical datasets and neighboring regions. This allows stakeholders to easily visualize production trends and identify significant shifts in industrial output.

3 Intelligence Across Restricted Areas

- Remotely detect industrial and economic operations in high-security zones or denied areas- such as military installations or restricted nations - where on-site verifications are challenging.
- Determine when and where response or support is needed by identifying peak economic activity periods and locations.

Solar Plants Monitoring

Solar Panel Detection Results

Technical Specifications

Input Data	High Resolution Satellite Imagery with 50cm or above (Red, Green, Blue)
Output Format	Raster (GeoTIFF, PNG), Vector (GeoJson)
Model performance (mIoU)	0.95 (*mIoU : Mean Intersection over Union)

Key Advantages

1 Automated Wide-Area Solar Infrastructure Detection

Replace labor-intensive manual surveys with automated, high-resolution detection. Our system identifies solar assets across vast territories, providing rapid and scalable site assessments.

2 Reliable Performance across Diverse Installation Environments

Deep learning models maintain high accuracy regardless of the background environment—effectively distinguishing solar installations on urban rooftops, agricultural lands, and idle sites.

3 Lifecycle Monitoring & Change Tracking

Utilize time-series analysis to monitor the full lifecycle of solar assets. Track new deployments, expansions, and removals in real-time to maintain an up-to-date inventory of regional capacity.

4 Strategic Insights for Energy Policy & Investment

Transform detection data into actionable intelligence. We provide the foundational evidence needed to estimate power capacity, guide renewable energy policy, and validate private sector investments.

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Infrastructure Change Monitoring

Building Demolition Tracking

Structural Integrity Monitoring

Building Demolition Tracking Structural Integrity Monitoring

Case of Analysis Support Requested by Seoul National Univ.

Aerial Imagery of Bonghwa-gun before building demolition (2015)

Aerial Imagery of Bonghwa-gun after building demolition (2022)

Technical Specifications

Spatial Resolution	Sub-meter
Input Data	Aerial imagery, Satellite imagery under 1m
Output Format	Raster (GeoTIFF, PNG)

Key Advantages

1 Automated Change Detection & Demolition Tracking

Utilizing deep learning-based change detection with aerial and satellite imagery, our system automatically identifies building demolitions and newly vacant lots across scales—from individual plots to entire metropolitan regions.

2 Monitoring Urban Decline & Depopulation Trends

Continuous oversight of high-depopulation zones, identifying vacant housing and abandoned properties. Our wide-area remote sensing enables local governments to track urban shrinkage in small-to-medium cities with precision.

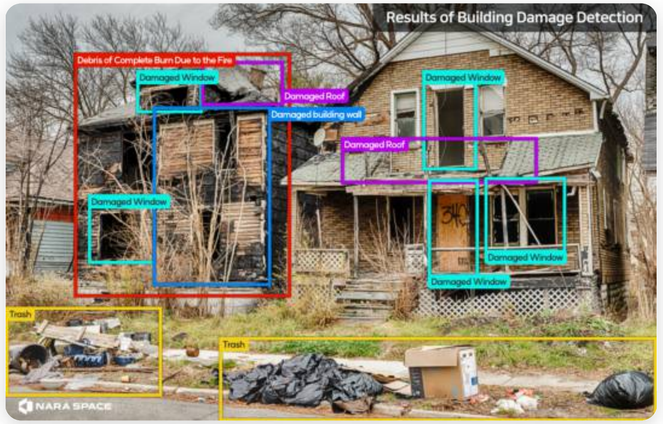
3 Data-Driven Insights for Proactive Urban Management

Identify risks such as public safety hazards, environmental degradation, and rising administrative costs. By monitoring urban vacancies ("urban perforation"), we help city planners address structural decline before it impacts the broader community.

Housing Defect Detection

Case of Analysis Support Requested by Seoul National Univ.

Roadmap-based defect detection results



Integrated fusion of building detection and defect detection results

Technical Specifications

Spatial Resolution	Sub-meter
Input Data	Roadmap data, Sub-meter Satellite imagery
Output Format	Raster (GeoTIFF, PNG)

Key Advantages

1 Extensive Building Monitoring

Image segmentation technology rapidly identifies building locations, density, and development status across vast territories. We transform high-resolution satellite imagery into actionable spatiotemporal data for efficient urban oversight.

2 Remote Structural Assessment & Damage Detection

Conduct rapid, remote evaluations of building conditions without the need for on-site inspections. Our AI-driven approach identifies structural anomalies and deterioration trends across large-scale urban environments

3 High-Fidelity Building Damage Analysis Maps

Fuse satellite geospatial data with ground-level street-view insights through deep learning. This multi-perspective analysis generates customized maps that classify building damage levels with granular, structure-specific detail.

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04

Core Analytics Technologies

Object Detection

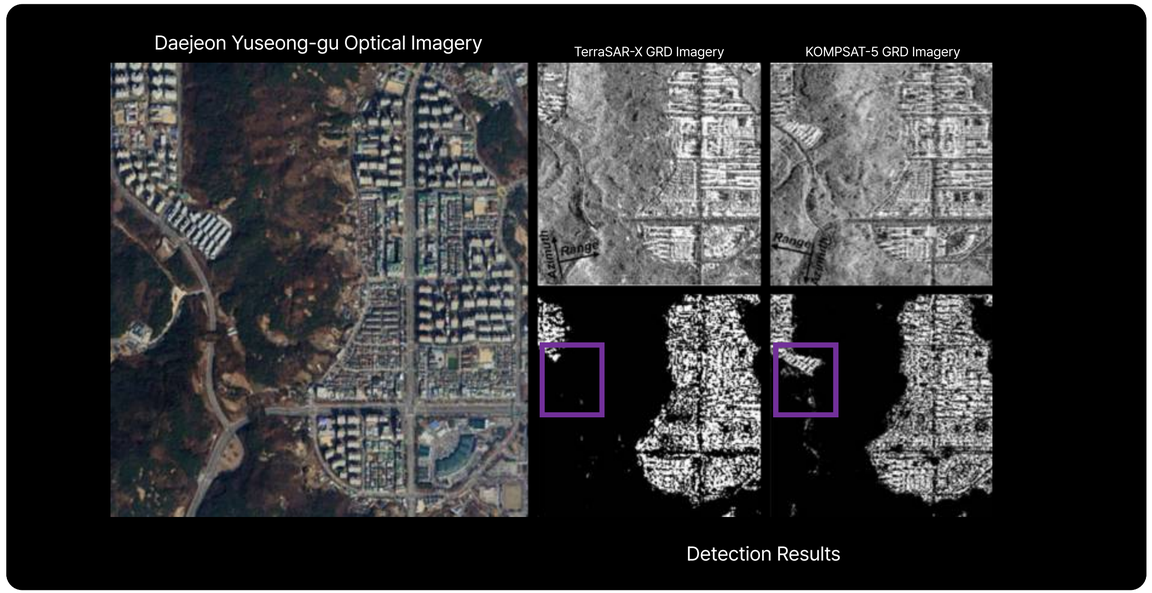
Super Resolution

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

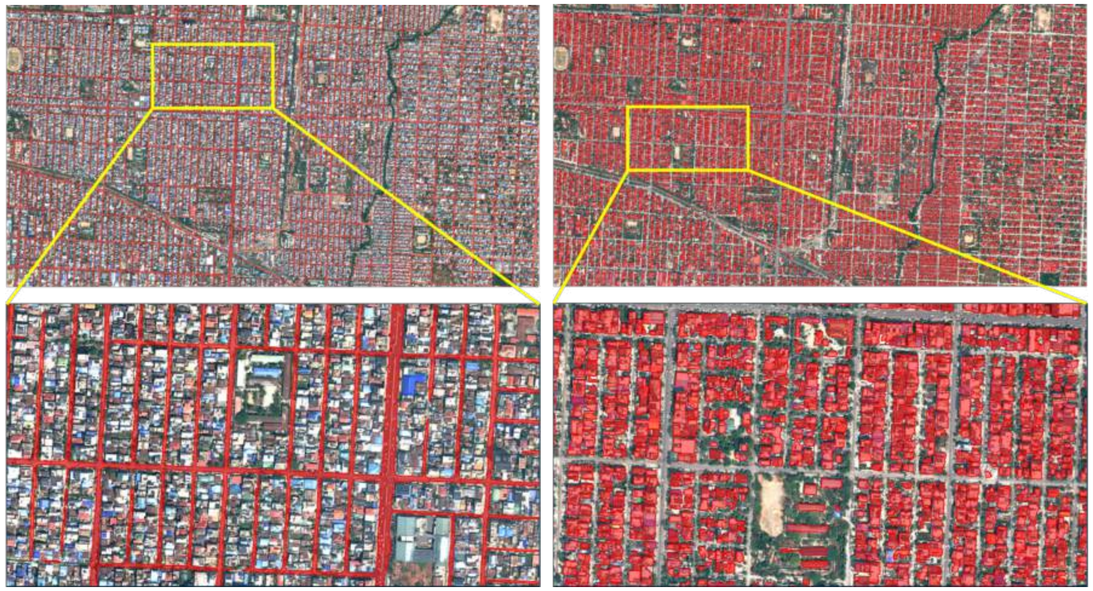
Using extracted morphological features, our solution can accurately identify densely built-up zones and urban structures, enabling valuable applications in urban planning, infrastructure monitoring, and post-disaster damage assessment.

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.

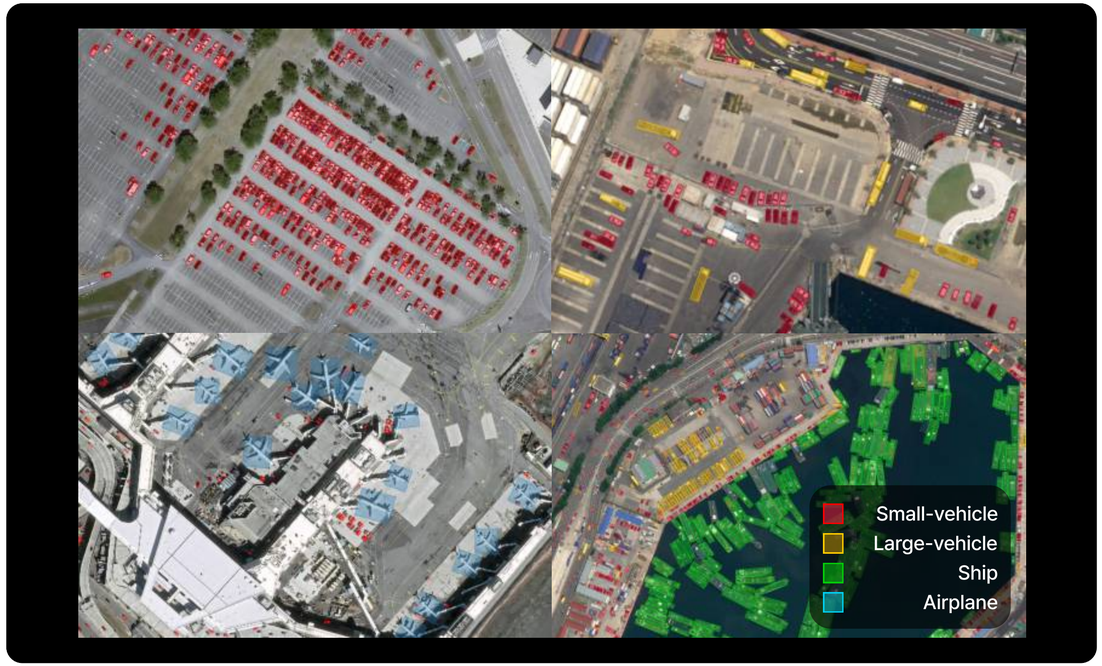
2 High-Precision Urban Area Detection through Ultra-High-Resolution Training

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



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)

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

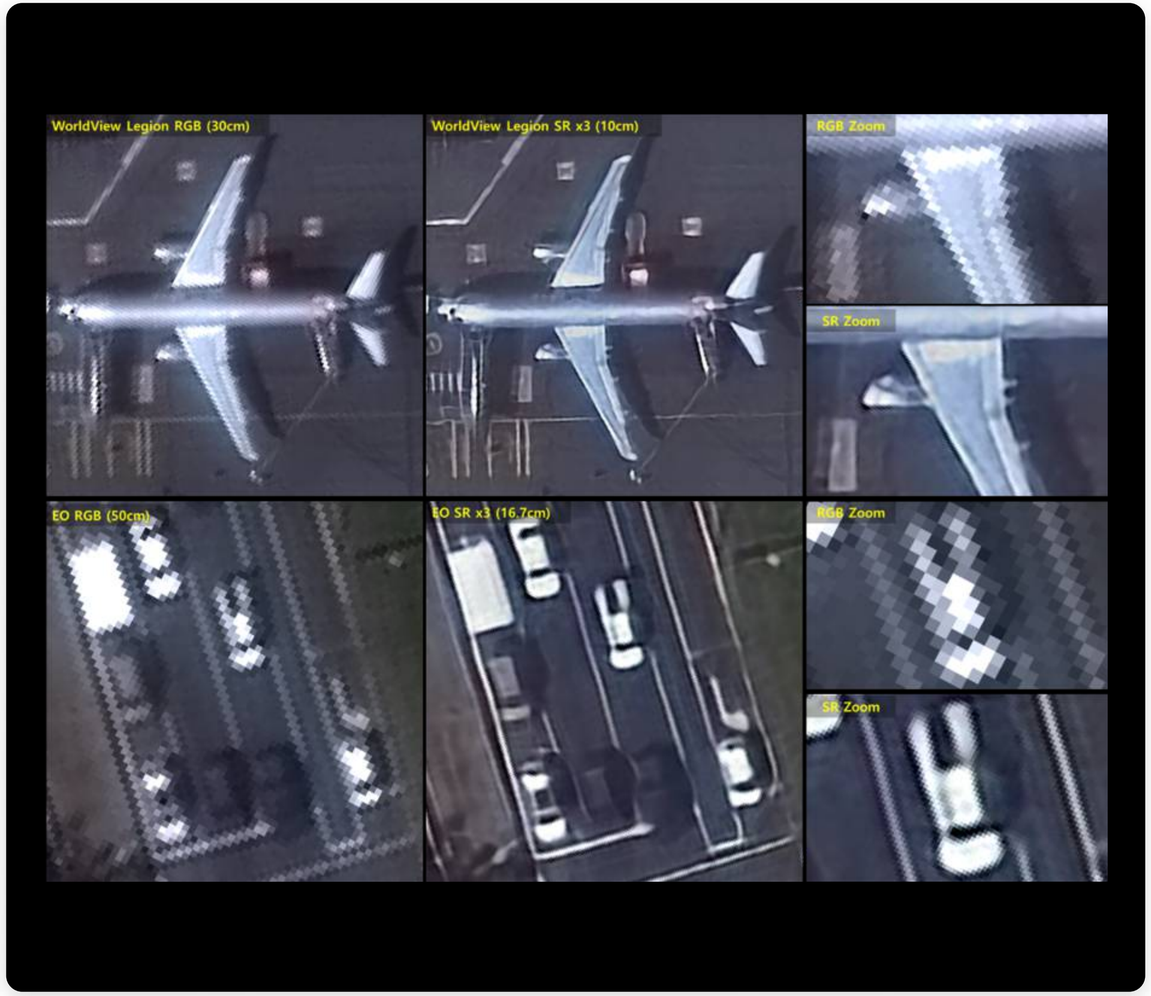
The model distinguishes multiple transportation asset types—such as fire trucks, heavy vehicles, ships, and aircraft—achieving an average recall above 0.98 accuracy across five transportation classes.

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

Super Resolution

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

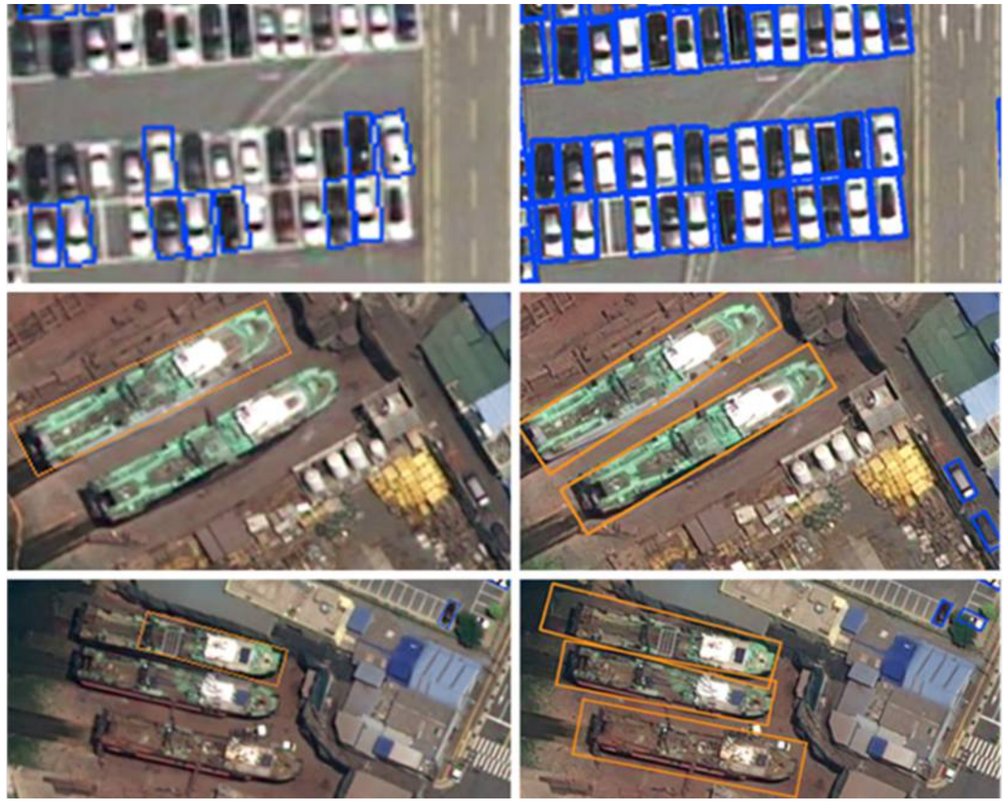
By upscaling existing low-resolution archives—such as Landsat and Sentinel—into high-resolution products, you can reduce reliance on costly high-resolution acquisitions while significantly increasing data utilization.

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.

Super Resolution

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**

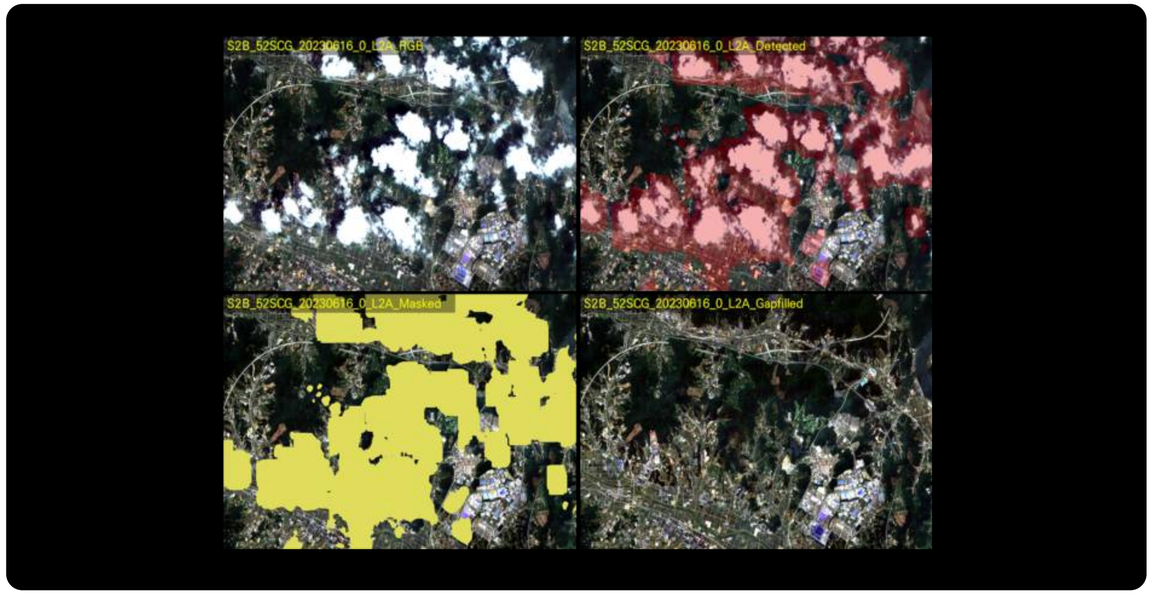
Technical Specifications

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



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)

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.

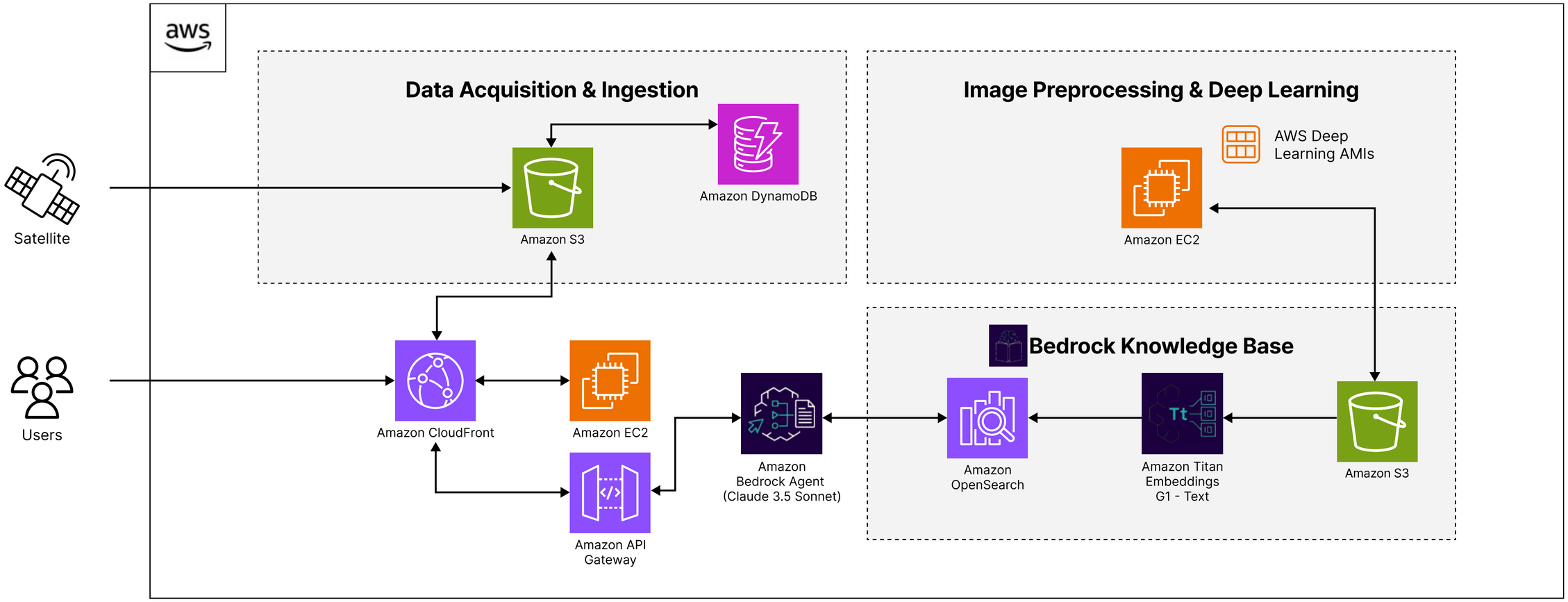
3 Seamless restoration of cloud-obscured areas

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.

Automatic Reporting Using GenAI



Key Advantages

1 Save time

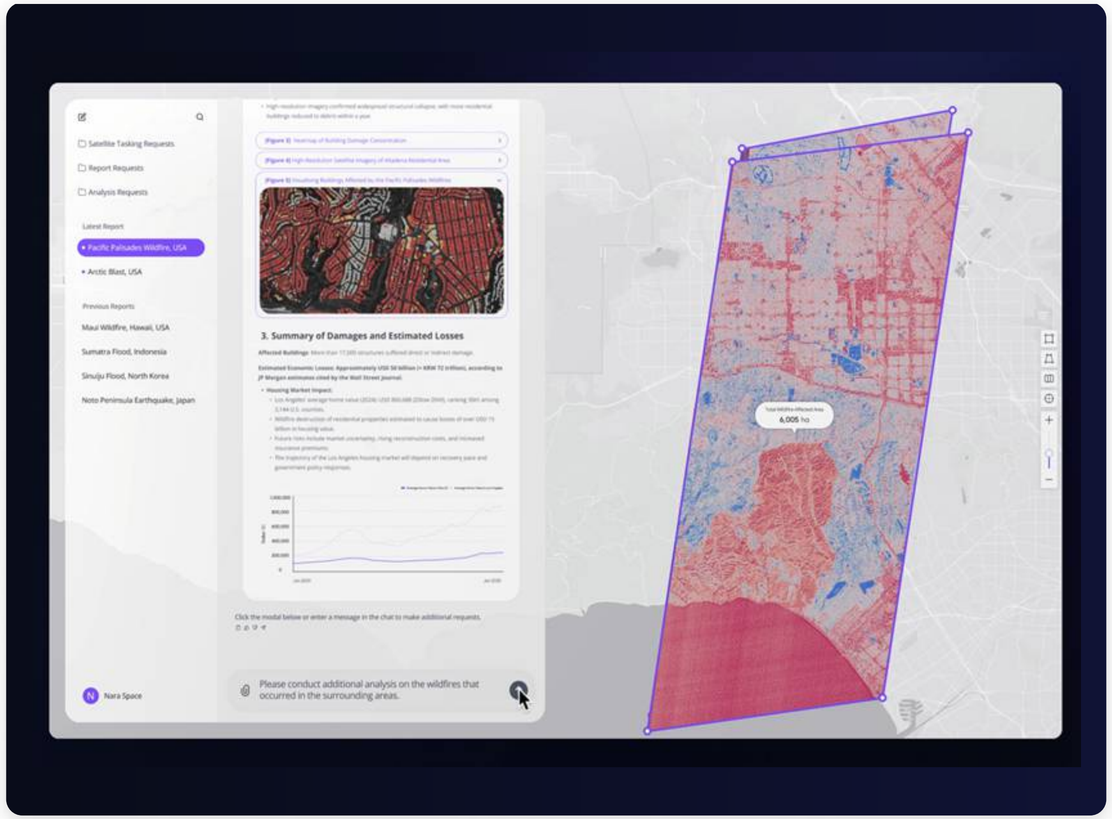
By leveraging Gen AI, report generation is dramatically reduced, enabling actionable insights in record time.

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.

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Thank you

Contact us: sales@naraspace.com