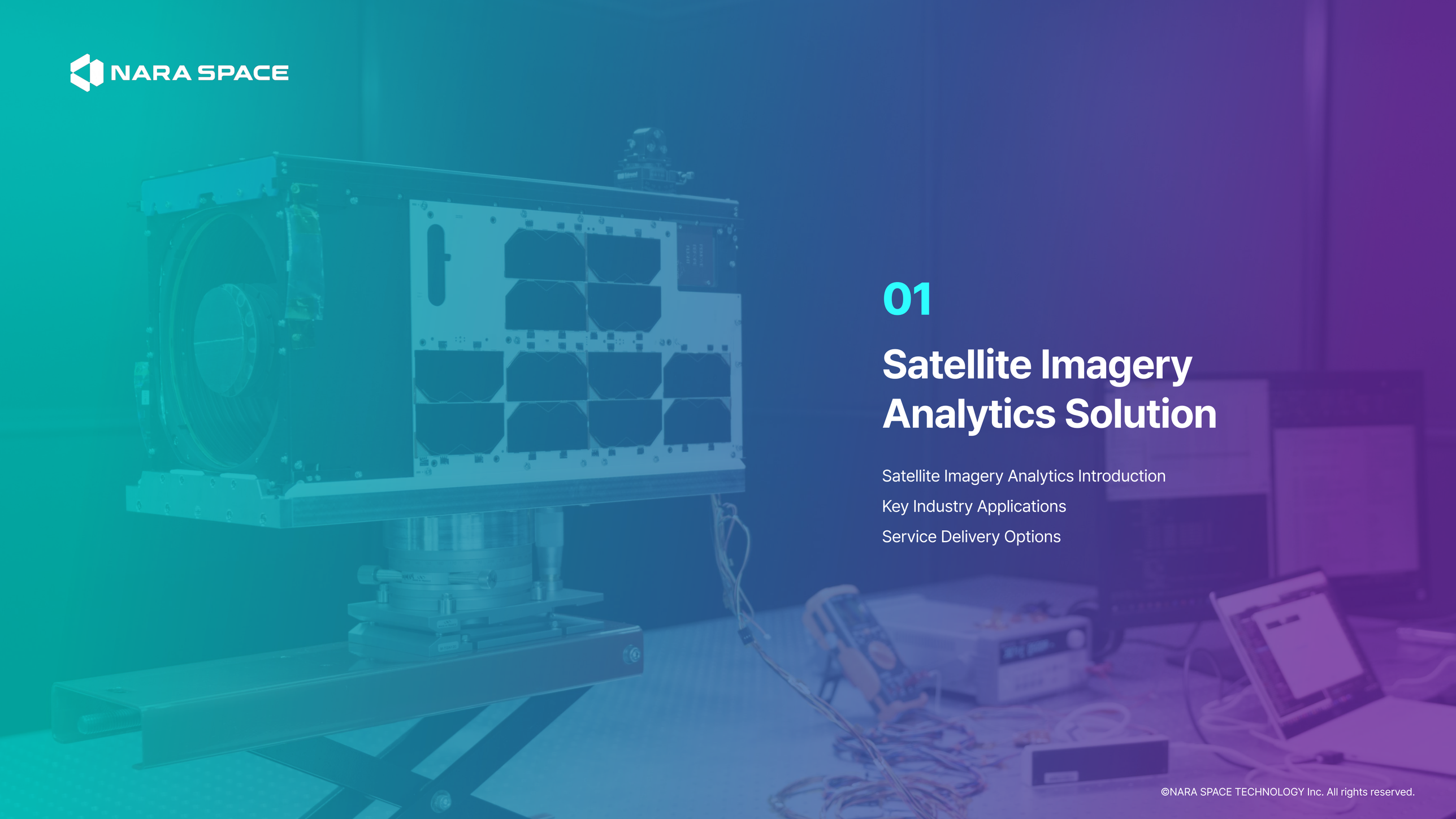
Nara Space Satellite Imagery Analytics Solution

Agriculture Management Solution

NARA SPACE

NARA SPACE



01

Satellite Imagery Analytics Solution

Satellite Imagery Analytics Introduction

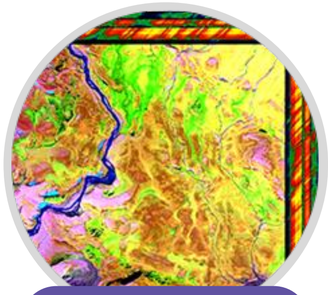
Key Industry Applications

Service Delivery Options

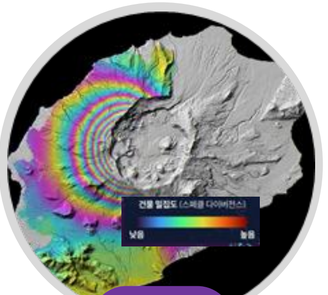
Nara Space Satellite Imagery Analytics Solution

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

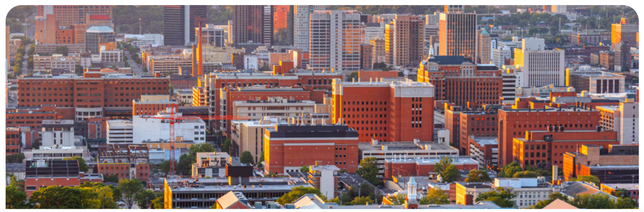
- Yield Prediction
- Corn
- Soybean
- Wheat

Environment

- Tree Detection
- Land Classification
- Water Quality Assessment

Defense

- Super-Resolution Imaging
- Object Detection
- Object Segmentation
- Change Detection



Urban

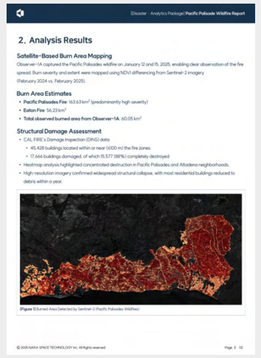
- Urban Management
- Smart City Strategy Development
- Land Use & Construction Monitoring

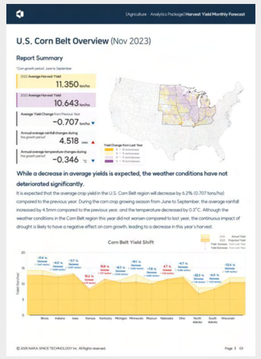
Service Delivery Options

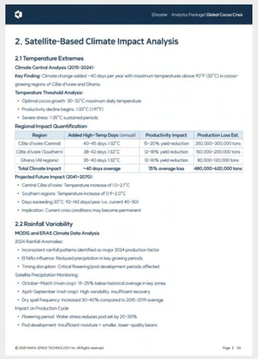
On-Demand Insight Reports

Get concise, decision-ready summaries without handling satellite data

Examples

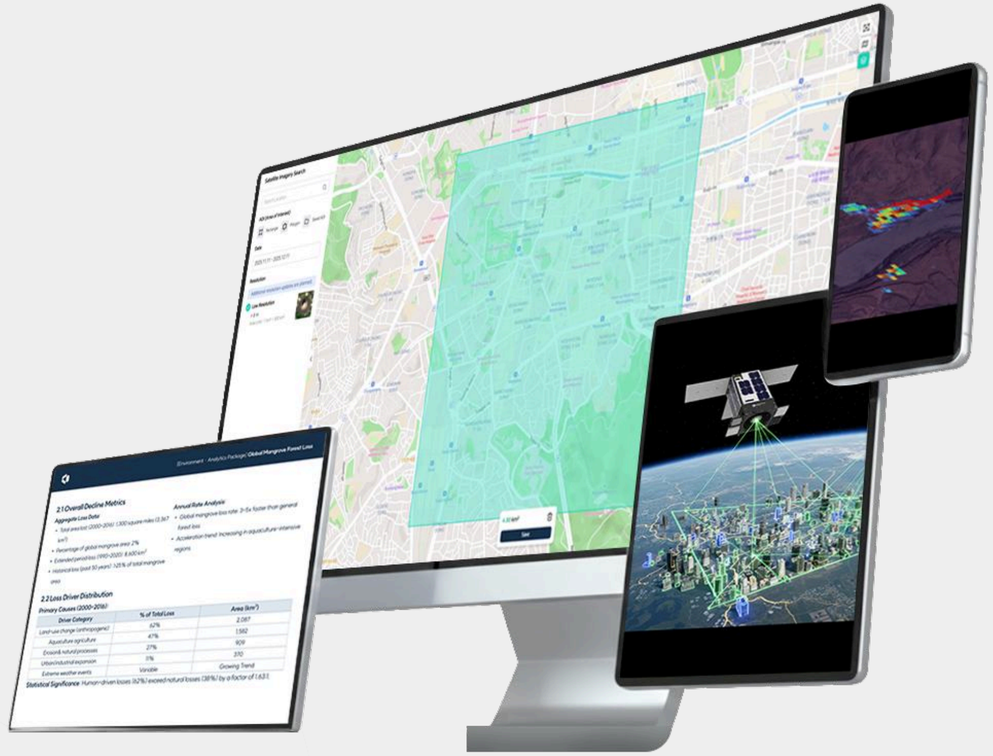






Custom Web Platform

A dedicated platform tailored for your organization



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

NARA SPACE

02

Crop Yield Prediction & Health Monitoring

Corn / Soybean / Wheat / Barley / Potato / Rice

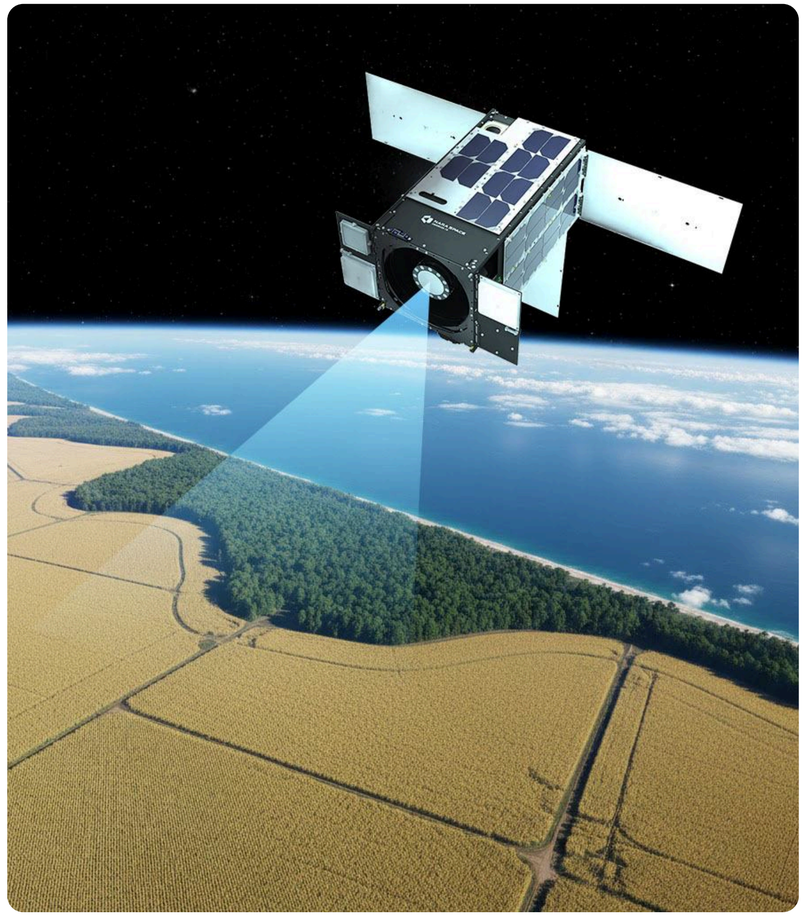
Palm Trees / Seaweed (Kelp) Farms

Why the Agriculture Sector Uses Satellite Data

Challenges in Modern Agriculture	What Satellite Data Provides
Climate change causing unpredictable yields	**Large-Scale Monitoring** | Continuous observation of millions of hectares at once
Farmers & traders rely on inaccurate or delayed reports	**High-Frequency Updates** | Near real-time crop growth and stress detection
Difficult to monitor vast and remote farmlands consistently	**Predictive Analytics** | AI models forecast yields (corn, wheat, soybean, rice, etc.)
Limited visibility into crop health, soil moisture, and pests	**Cost Efficiency** | Reduces need for expensive field surveys

Why the Agriculture Sector Uses Satellite Data

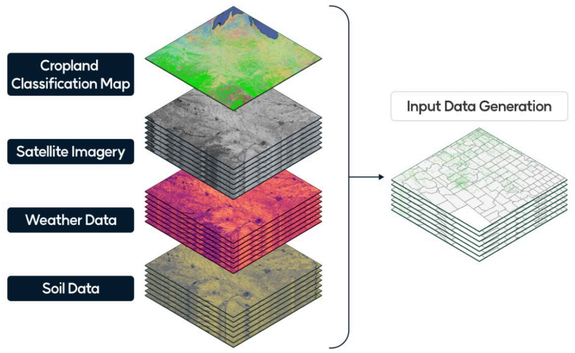
Key Applications	Value for Disaster Stakeholders
Yield Prediction Forecast supply & support global food security	**Boost productivity through precision farming**
Crop Health Monitoring Detect drought stress, pests, or disease outbreaks early	**Reduce losses with early warnings on risks**
Soil & Water Management Optimize irrigation and fertilizer use	**Support sustainability by optimizing land and water usage**
Commodity Trading Support Provide reliable insights for traders and insurers	**Strengthen food security at national and global scales**



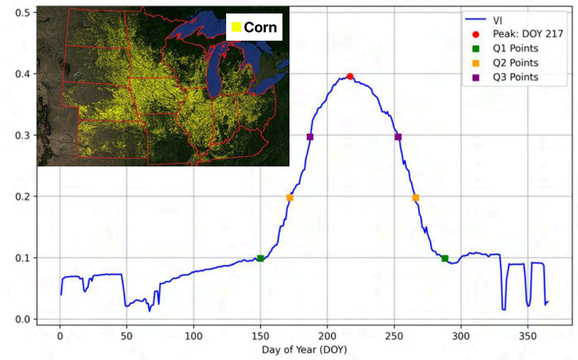
Corn Yield Prediction

Key Performance Indicator **4.7 %** | RMSPE Error Rate

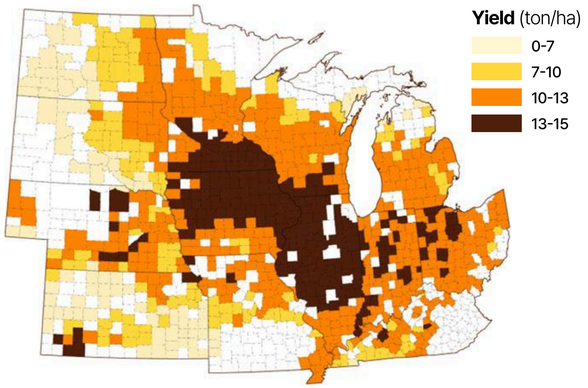
Crop Yield Prediction Model Input Data



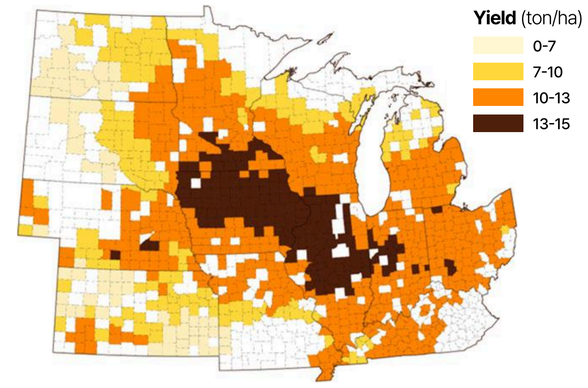
Analysis Results of the Growth Cycle for the U.S Corn Belt Cultivation Areas



Actual Corn Yield of the U.S. Corn Belt



U.S. Corn Belt Corn Yield Forecast



Technical Specifications

Input Data

Satellite-based Vegetation Index, Meteorological Data, Soil Data
Land Cover Map,
Yield Information

Output Format

Text (CSV), Report (PDF)

Key Advantages

1 Precise Crop Yield Forecast Aligned with the Crop Growth Cycle

Developing highly accurate crop models at the administrative district level by deriving optimal growth cycles considering crop seasonality by region and location.

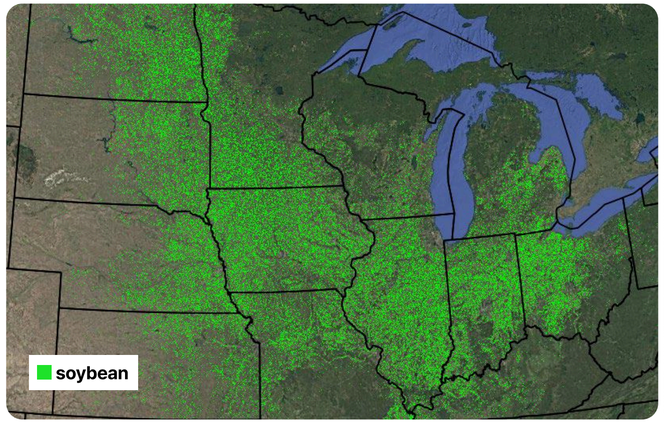
2 3D Analysis through Spatio-Temporal Resolution Matching of Multi-Source Data

Implementing a 3D dataset suitable for yield forecasting and efficiently generating models by standardizing data with different spatio-temporal resolutions.

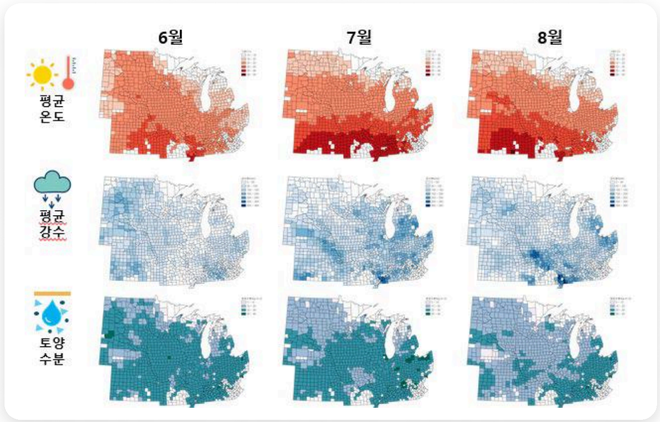
Soybean Yield Prediction

Key Performance Indicator **5.5 %** | RMSPE Error Rate

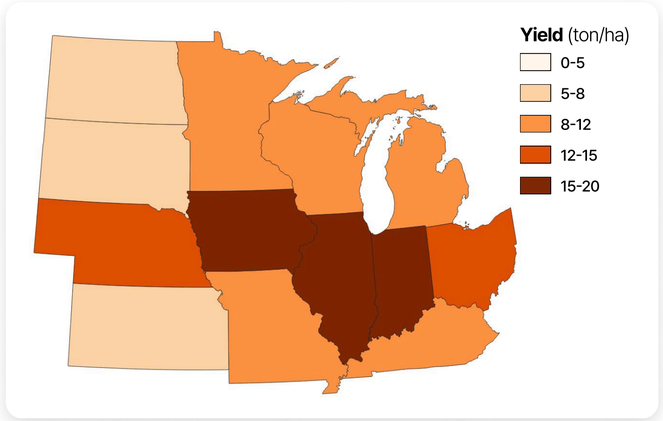
U.S. Corn Belt Soybean Production Area



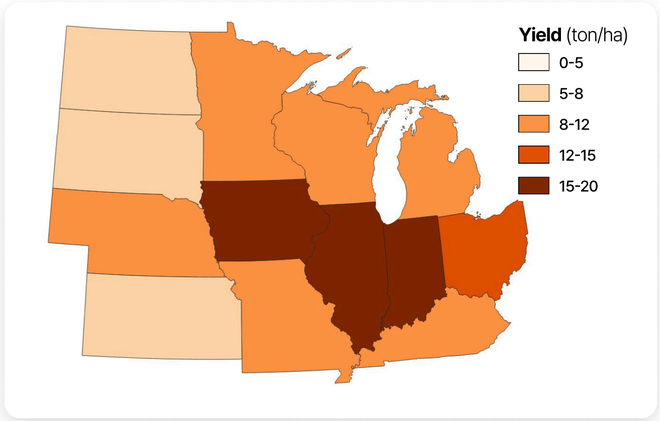
Analysis of Monthly Changes in Weather and Soil Environment



Actual Soybean Yield



Soybean Yield Forecast



Technical Specifications

Input Data

Satellite-based Vegetation Index,
Meteorological Data, Soil Data
Land Cover Map,
Yield Information

Output Format

Text (CSV), Report (PDF)

Key Advantages

1 Precise Crop Yield Forecast Aligned with the Crop Growth Cycle

Developing highly accurate crop models at the administrative district level by deriving optimal growth cycles considering crop seasonality by region and location.

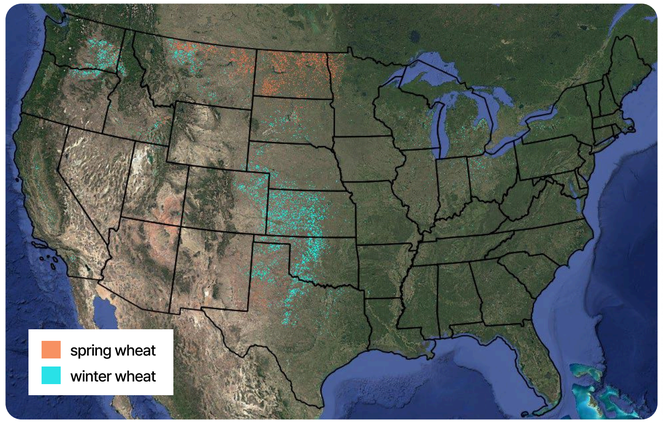
2 Prediction Model Considering Annually Changing Cultivation Areas

Achieving high-accuracy forecasts by reducing error rates in rotational farming zones, including soybean cultivation areas cultivated through crop rotation practices similar to corn, using our internally developed crop classification map.

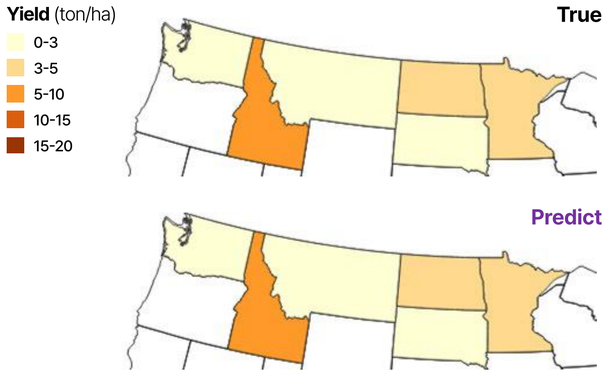
Wheat Yield Prediction

Key Performance Indicator **9.8 %** | RMSPE Error Rate

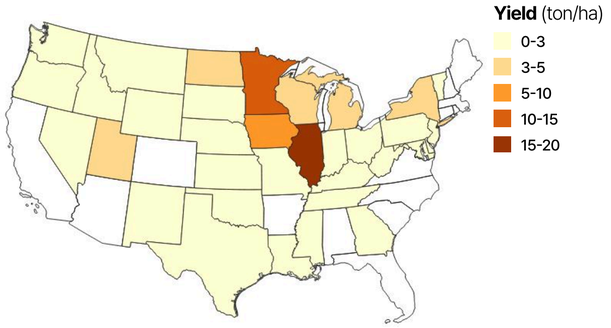
Wheat Cultivation Map



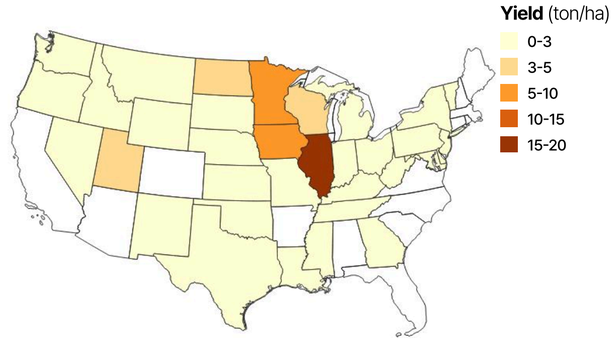
Actual / Forecasted Spring Wheat Yield



Actual Winter Wheat Yield



Winter Wheat Yield Forecast



Technical Specifications

Input Data

Satellite-based Vegetation Index,
Meteorological Data, Soil Data
Land Cover Map,
Yield Information

Output Format

Text (CSV), Report (PDF)

Key Advantages

1 **Precise Crop Yield Forecast Aligned with the Crop Growth Cycle**

Developing highly accurate crop models at the administrative district level by deriving optimal growth cycles considering crop seasonality by region and location.

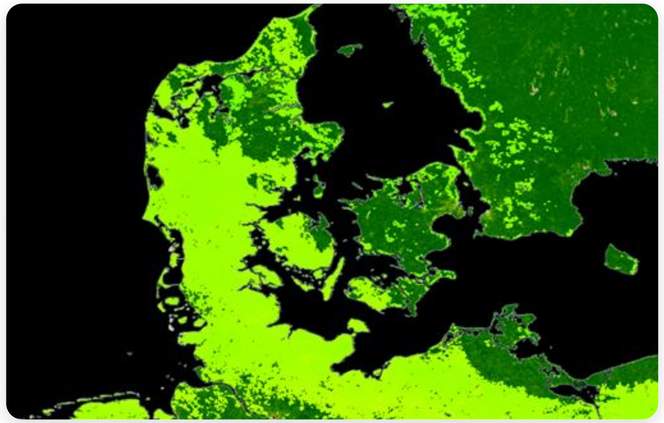
2 **Nationwide Analytical Capability Across the U.S. CONUS**

Executing high-speed, large-scale image processing and constructing extensive datasets through a cloud-based processing infrastructure.

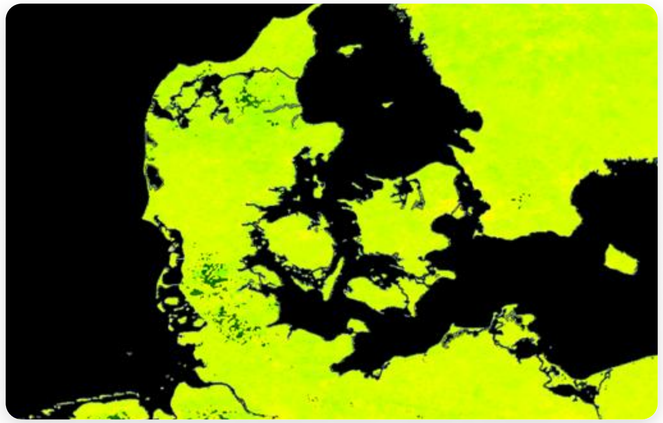
Barley Yield Prediction

Key Performance Indicator **13.8 %** | RMSPE Error Rate

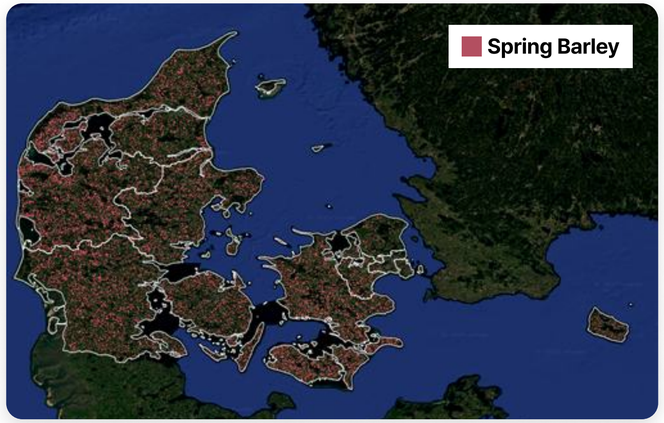
Denmark's Daily Average Temperature



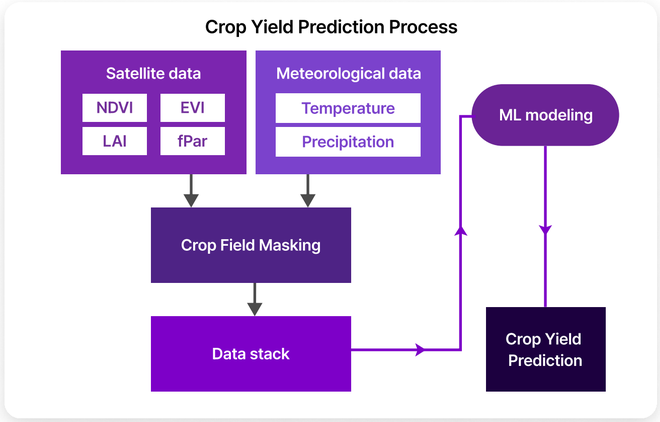
Denmark's 8-Day Average Temperature



Barley Cultivation Map



Crop Yield Prediction Model Generation Process



Technical Specifications

Input Data

Satellite-based Vegetation Index,
Meteorological Data, Soil Data
Land Cover Map,
Yield Information

Output Format

Text (CSV), Report (PDF)

Key Advantages

1 Precise Crop Yield Forecast Aligned with the Crop Growth Cycle

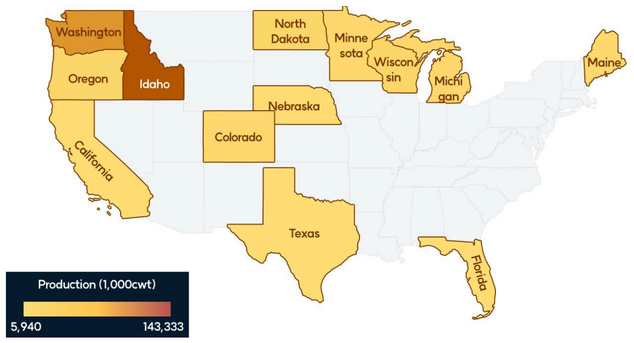
Developing highly accurate crop models at the administrative district level by deriving optimal growth cycles considering crop seasonality by region and location.

2 A Method Well-Suited for Cultivation Environments Dispersed Across Large Areas

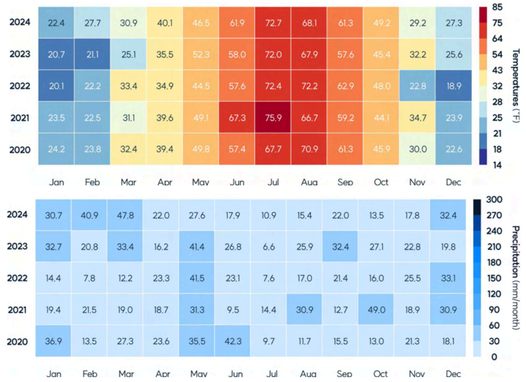
In Denmark, where agricultural lands are extensive and farms are widely distributed, this approach enables efficient monitoring of crop growth and provides more reliable total production forecasts compared to traditional field-based surveys.

Potato Yield Prediction

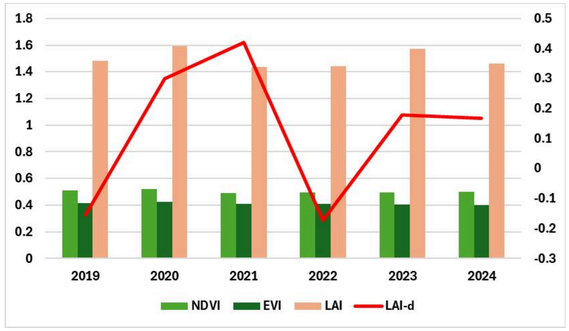
Major Potato Producing States in the U.S.



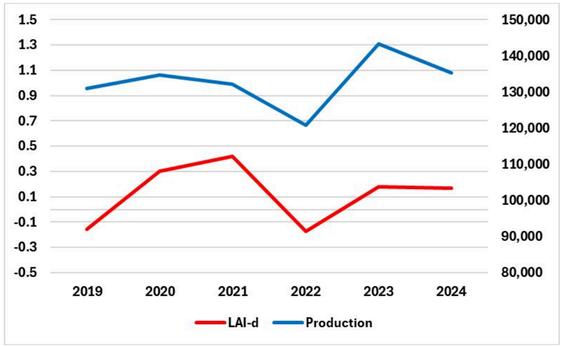
Monthly Average Temperature and Monthly Cumulative Precipitation



Comparative Analysis of Vegetation Indices in Potato Areas



Comparison of Potato Production and Vegetation Difference Value



Technical Specifications

Input Data

Bands such as Red, Green, Blue, NIR, and Meteorological Data

Output Format

Raster (GeoTIFF, PNG)

Key Advantages

1 Highly Reliable Crop Yield Forecast Combining Meteorological and Growth Indicators

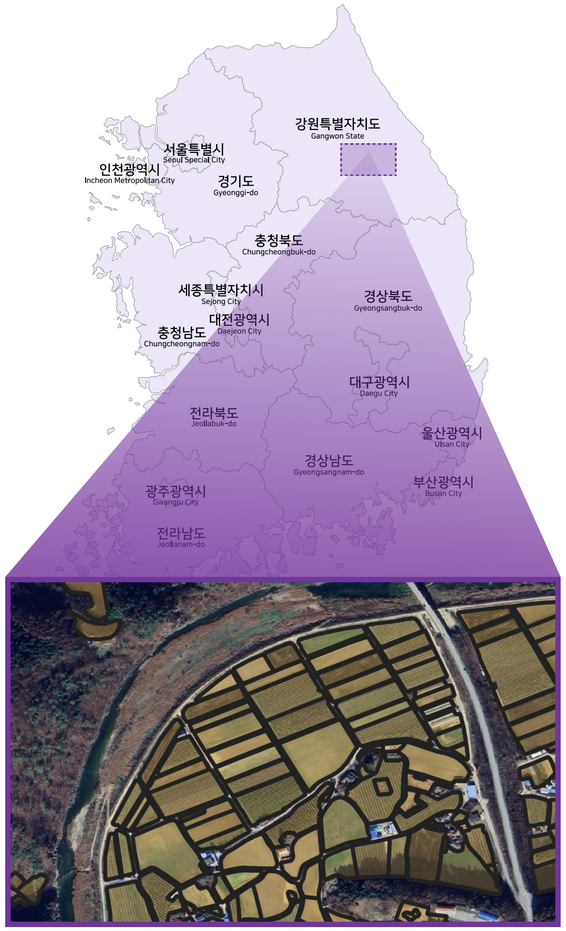
Predicting stable yield variation by jointly incorporating climate factors and vegetation indices that directly reflect crop growth conditions.

2 Faster Access to Key Insights Compared to USDA Reports

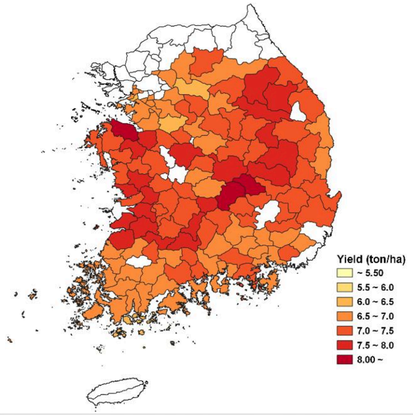
Achieving high-sensitivity potato yield forecasts through targeted analysis of critical growth stages, enabling predictions earlier than government reports typically released in September.

Rice Yield Prediction

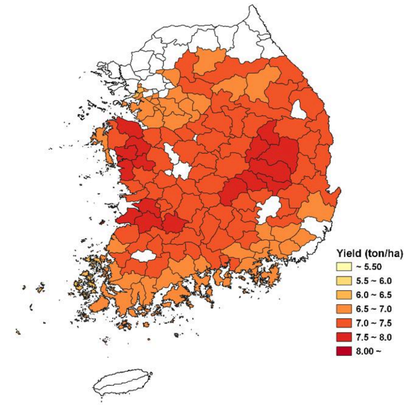
South Korea Rice Cultivation Map



Actual Rice Yield



Rice Yield Forecast



Technical Specifications

Input Data

Bands such as Red, Green, Blue, NIR, and Meteorological Data

Output Format

Raster (GeoTIFF, PNG)

Key Advantages

1 Highly Reliable Crop Yield Forecast Combining Meteorological and Growth Indicators

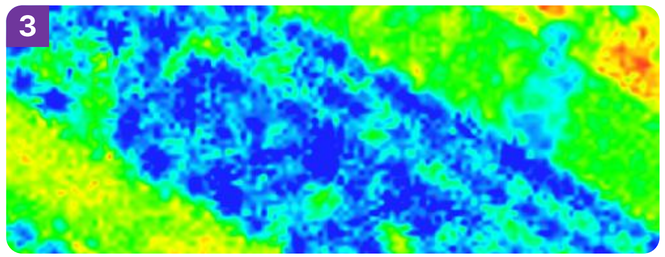
Developing highly accurate, district-level crop yield models by identifying the optimal growth cycle using vegetation indices that directly reflect the crop growth conditions.

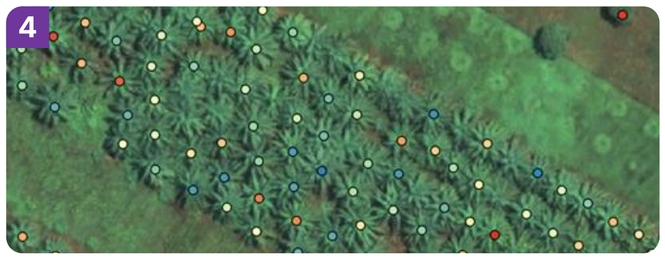
2 Application of High-Precision Rice Cultivation Map

Forecasting rice yield at the city/county administrative district level using Farm Map-based rice cultivation data provided by the Ministry of Agriculture, Food and Rural Affairs (MAFRA) and the Korea Agency of Education, Promotion and Information Service in Food, Agriculture, Forestry and Fisheries (EPIS).

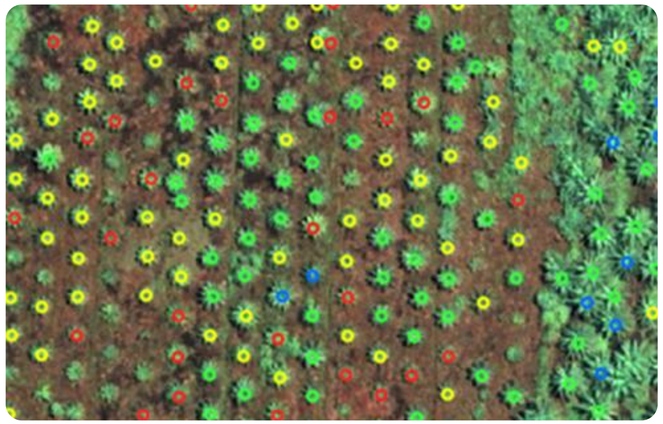
Palm Tree Detection

Key Performance Indicator **0.84** | mAP accuracy

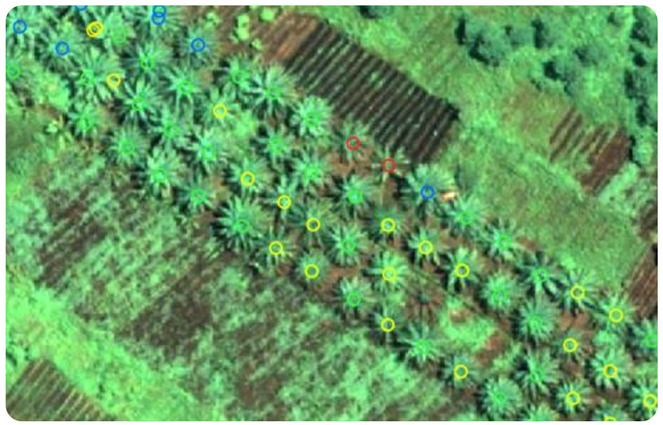




Palm Tree Detection Result 1



Palm Tree Detection Result 2



Technical Specifications

Available Resolution	30 cm and Above
Input Data	Red, Green, Blue, NIR, Red Edge
Output Format	Raster (GeoTIFF, PNG), Vector (GeoJson)

Key Advantages

1 Achieving location accuracy at the individual tree level

Previously, detection was performed at the cluster level, but the object detection model now enables the detection of the location of each individual palm tree.

2 Monitoring based on a health index enables early detection of abnormalities

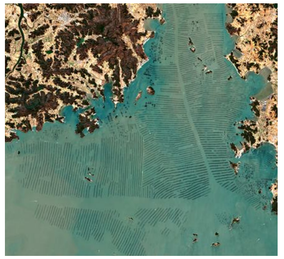
By integrating spectral information, the system can sensitively detect early signs of growth decline, enabling the identification of abnormal conditions before they become visible to the naked eye.

3 Enabling customized management and efficient resource allocation

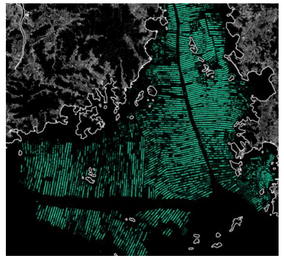
By leveraging health information at the individual-tree level, resources can be directed precisely where they are needed, supporting the development of a targeted and strategic management plan.

Seaweed Farm Detection

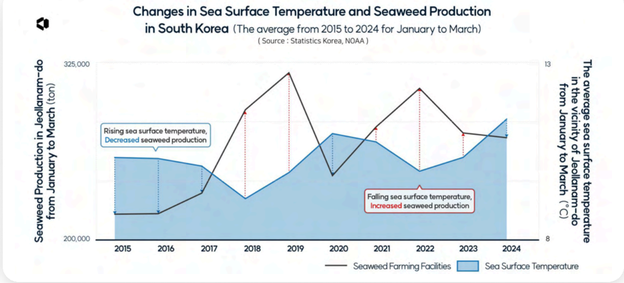
RGB Image



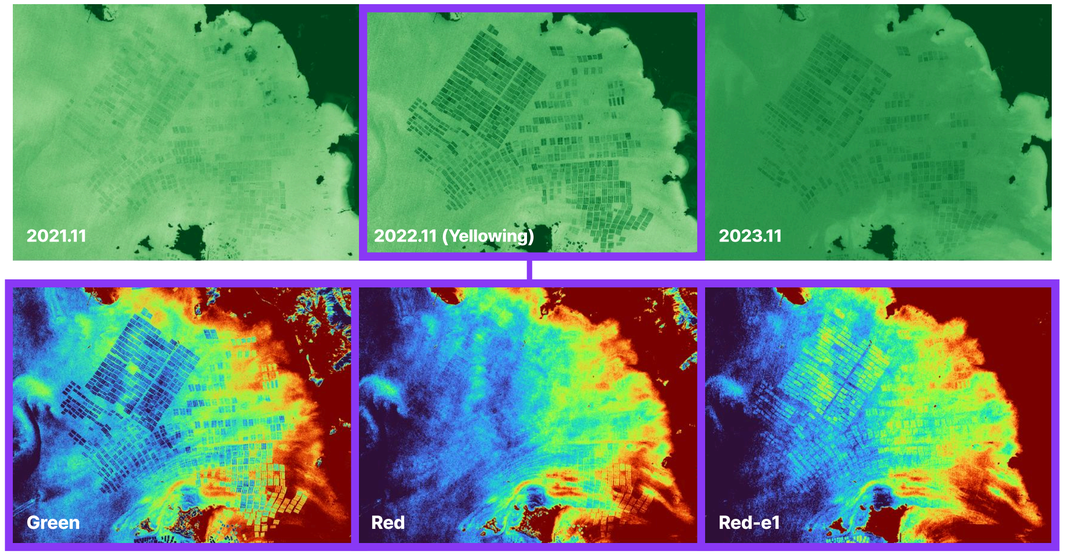
Laver Farm Detection Results



Changes in Sea Surface Temperature in South Korea



Laver Farm Yellowing Detection and Analysis Results



Technical Specifications

Available Resolution	10 m and Above
Input Data	Red, Green, Blue, NIR, Red Edge, SWIR, etc.
Output Format	Raster (GeoTIFF, PNG), Vector (GeoJson)

Key Advantages

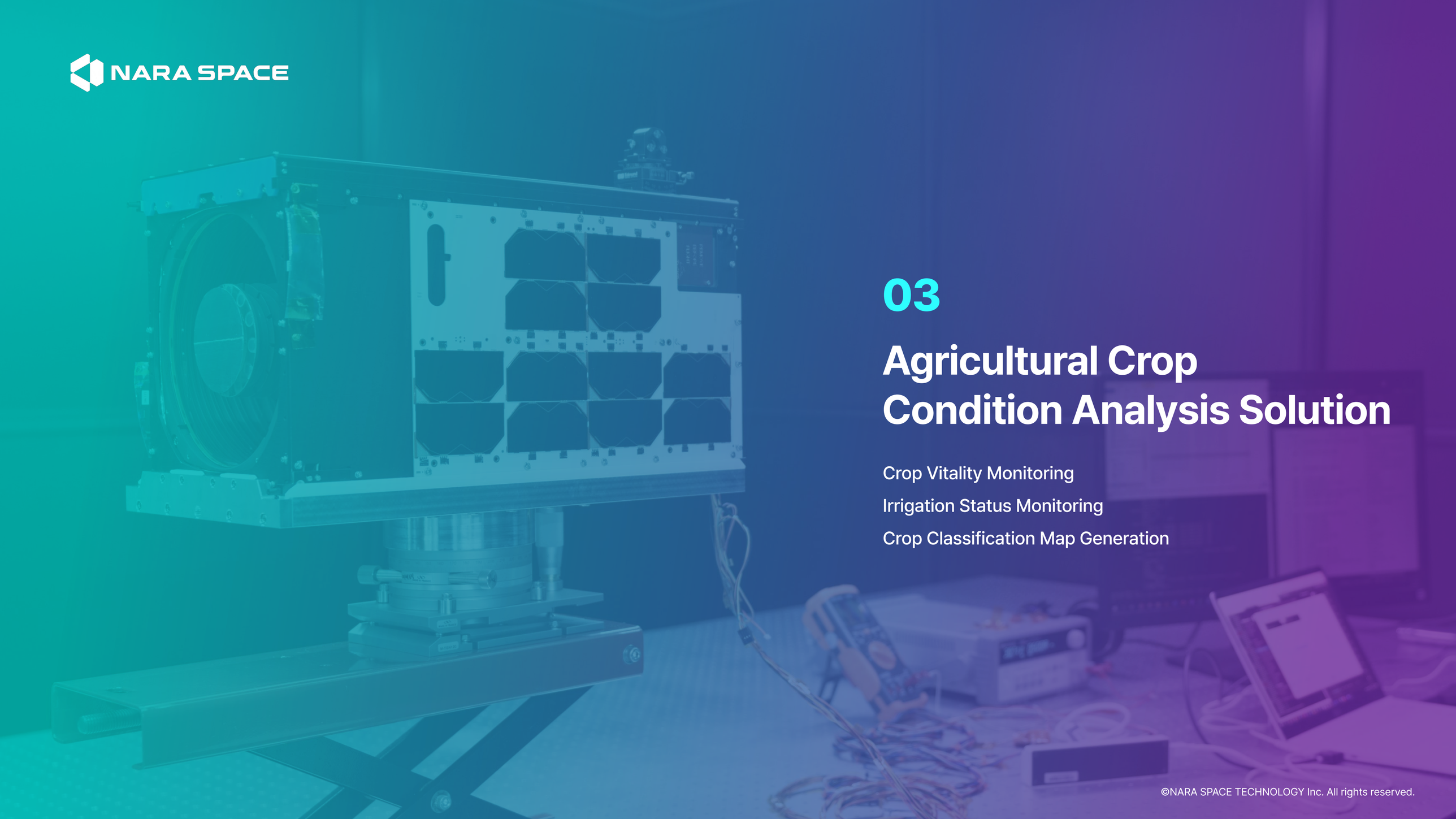
1 Enhancing Accuracy Through Multi-Source Data Fusion

By using satellite imagery to detect the location, size, and condition of seaweed farms and integrating these observations with marine environmental and statistical data—such as sea surface temperature—it becomes possible to develop a comprehensive understanding of overall farm health status.

2 The Power of Time-Series

By analyzing multi-year patterns, it becomes feasible to identify historical trends and environmental change dynamics. These insights can be used to detect farms at risk of production decline and to support optimized adjustments to farming schedules.

NARA SPACE



03

Agricultural Crop Condition Analysis Solution

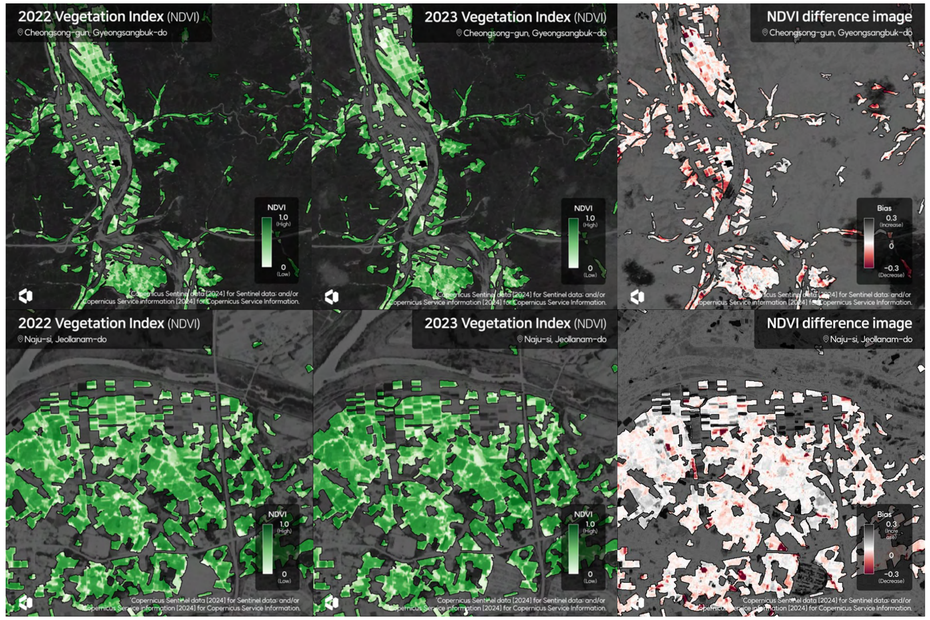
Crop Vitality Monitoring

Irrigation Status Monitoring

Crop Classification Map Generation

Crop Vitality Monitoring

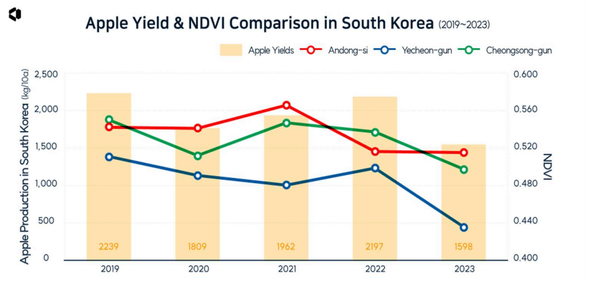
Annual Vegetation Index and Difference Images for Cheongsong Apples and Naju Pears

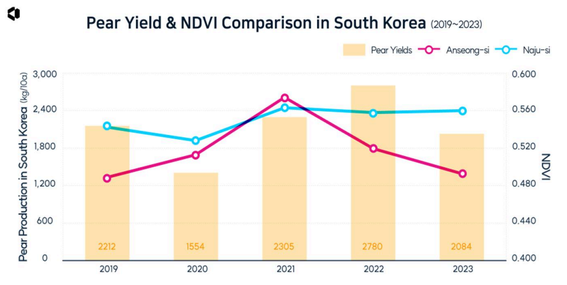


Technical Specifications

Available Resolution	30 cm - 1 km (Possible based on the area)
Input Data	Red, Green, Blue, NIR, SWIR bands, etc.
Output Format	Raster (GeoTIFF, PNG)

Comparison Graph of Annual Vegetation Index and Yield for Cheongsong Apples and Naju Pears





Key Advantages

1 Remote Sensing-based Wide-Area Monitoring

Crop vitality can be evaluated across broad regions simultaneously, enabling non-contact and non-destructive monitoring at scale.

2 Providing Quantitative and objective indicators

Scientific, data-driven metrics replace subjective human visual assessments, enabling objective and evidence-based decision-making.

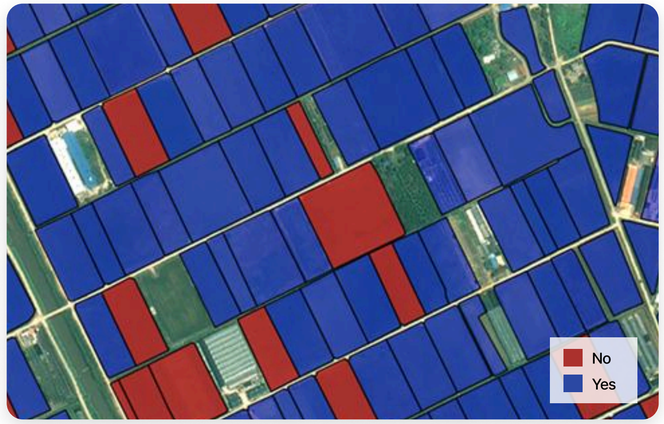
3 Early warning and Broader Application through Time-Series Analysis

By tracking changes in key indices, early detection of abnormal conditions—such as disease, water stress, or nutrient deficiency—is possible. These insights can support diverse policy and industry applications, including agricultural productivity monitoring and climate adaptation strategies.

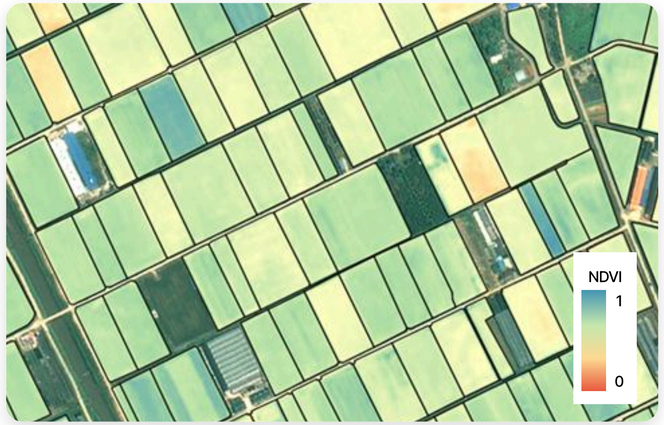
Irrigation Status Monitoring

RGB Imagery (2025-06-18, Pleiades)

Irrigation Presence Mask



Analysis Results Based on the Vegetation Index (NDVI)



Analysis Results Based on the Water Index (NDWI)

Technical Specifications

Available Resolution	10 m and Above (Sentinel-2, Pleiades, PNEO, etc.)
Input Data	Red, Green, NIR, and SWIR Bands Before and After Irrigation
Output Format	Raster (GeoTIFF, PNG), Vector (GeoJson)

Key Advantages

1 Precise Detection of Irrigation Presence and Irrigation Rate per Field Parcel

Satellite data enables simultaneous observation of large rice-growing regions and allows accurate evaluation of irrigation status for individual or multiple field parcels.

2 Detection of Abnormal Conditions not Visible to the Naked Eye

By applying remote sensing–based vegetation and water indices, it becomes possible to sensitively identify poorly irrigated rice paddies that are difficult to assess through visual inspection alone.

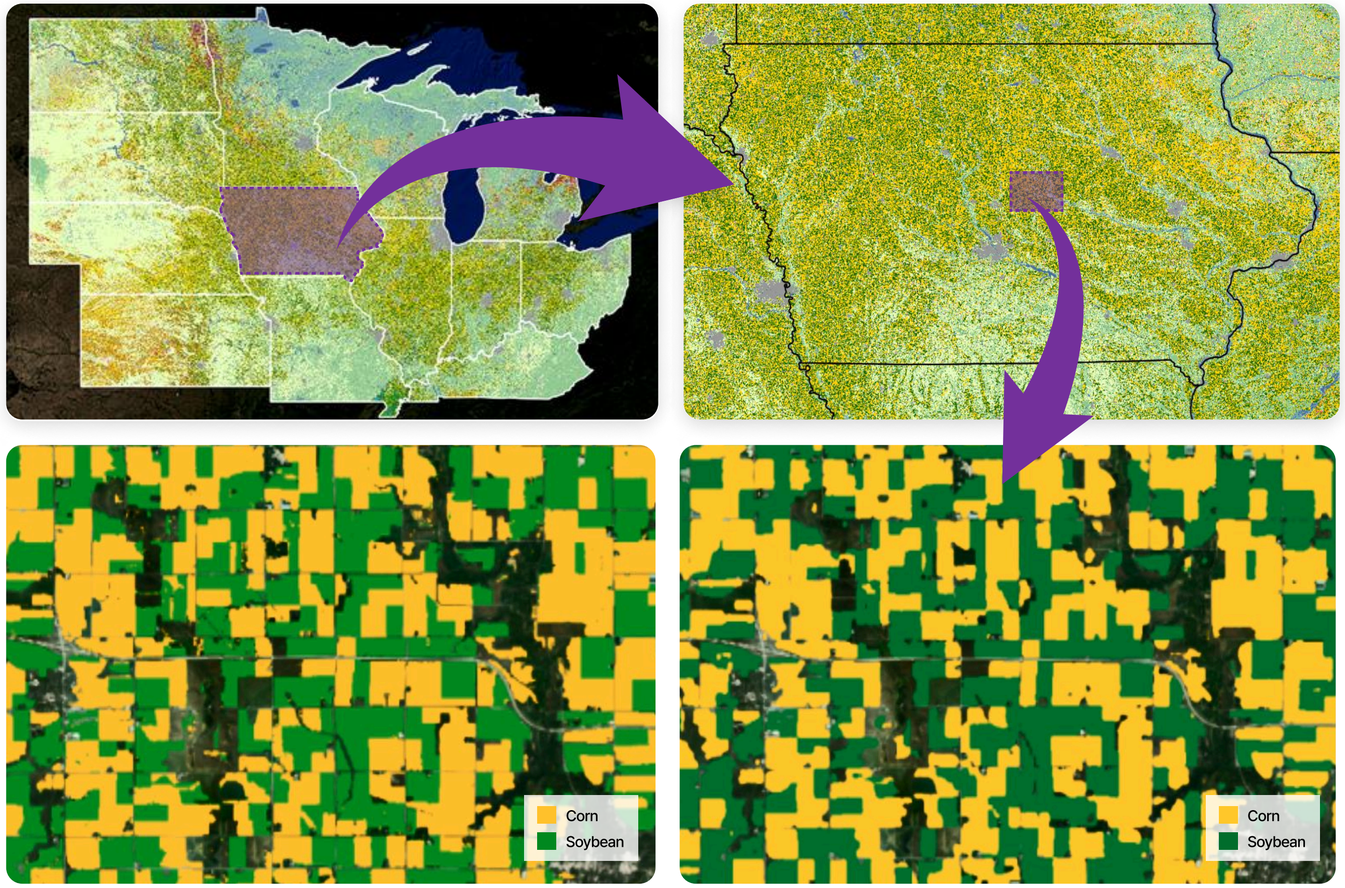
3 Proactive Water Resource Management for Rice Farming

Near real-time monitoring of irrigation status during periods of expected water scarcity supports the development of proactive and data-driven mitigation strategies.

Crop Classification Map (Corn / Soybean)

Key Performance Indicator

0.8 (0.787)	mIoU accuracy
0.9 (0.878)	mF-score accuracy



U.S. Department of Agriculture (USDA) Crop Classification Map

Nara Space Crop Classification Map

Technical Specifications

Available Resolution	30 m
Input Data	Coastal, R, G, B, NIR, SWIR1, SWIR2
Output Format	Raster (GeoTIFF, PNG)

Key Advantages

1 Possible to Update Periodically at a Faster Cycle than Existing Announcements

While the U.S. Department of Agriculture (USDA) releases crop classification data annually—typically at the beginning of the following year—this technology enables the creation of the current year's crop classification map before harvest.

2 Classification Optimized for the Crop Environment while Maintaining a High Accuracy

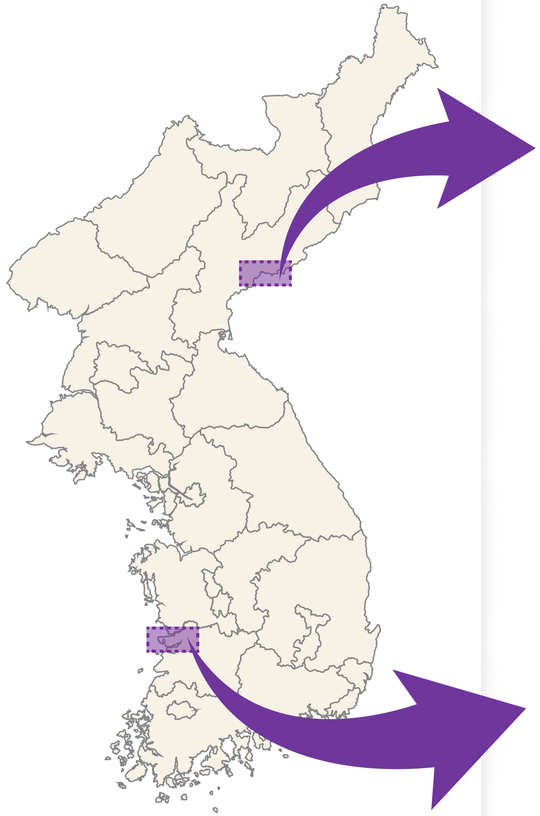
Capable of generating crop-specific maps that accurately reflect the characteristics and growing conditions of major U.S. crops.

3 Utilization of Data for Crop Yield Prediction

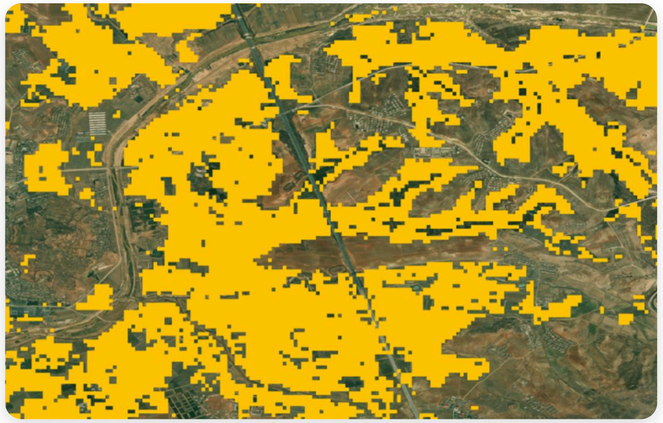
Because crop types can be identified with high precision, this information can be seamlessly integrated into crop yield prediction models, enabling earlier and more accurate assessments of harvest yields and production levels.

Crop Classification Map Generation (Rice)

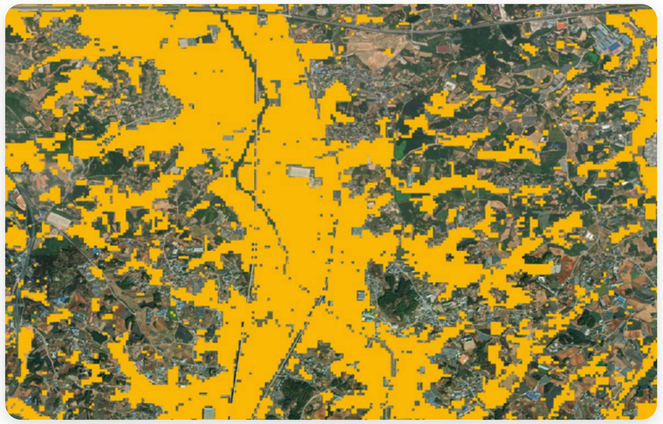
Korean Peninsula Crop Classification Map



Detection Results of North Korean Rice Cultivation Areas



Detection Results of South Korean Rice Cultivation Areas



Technical Specifications

Available Resolution	30 m
Input Data	Coastal, R, G, B, NIR, SWIR1, SWIR2
Output Format	Raster (GeoTIFF, PG)

Key Advantages

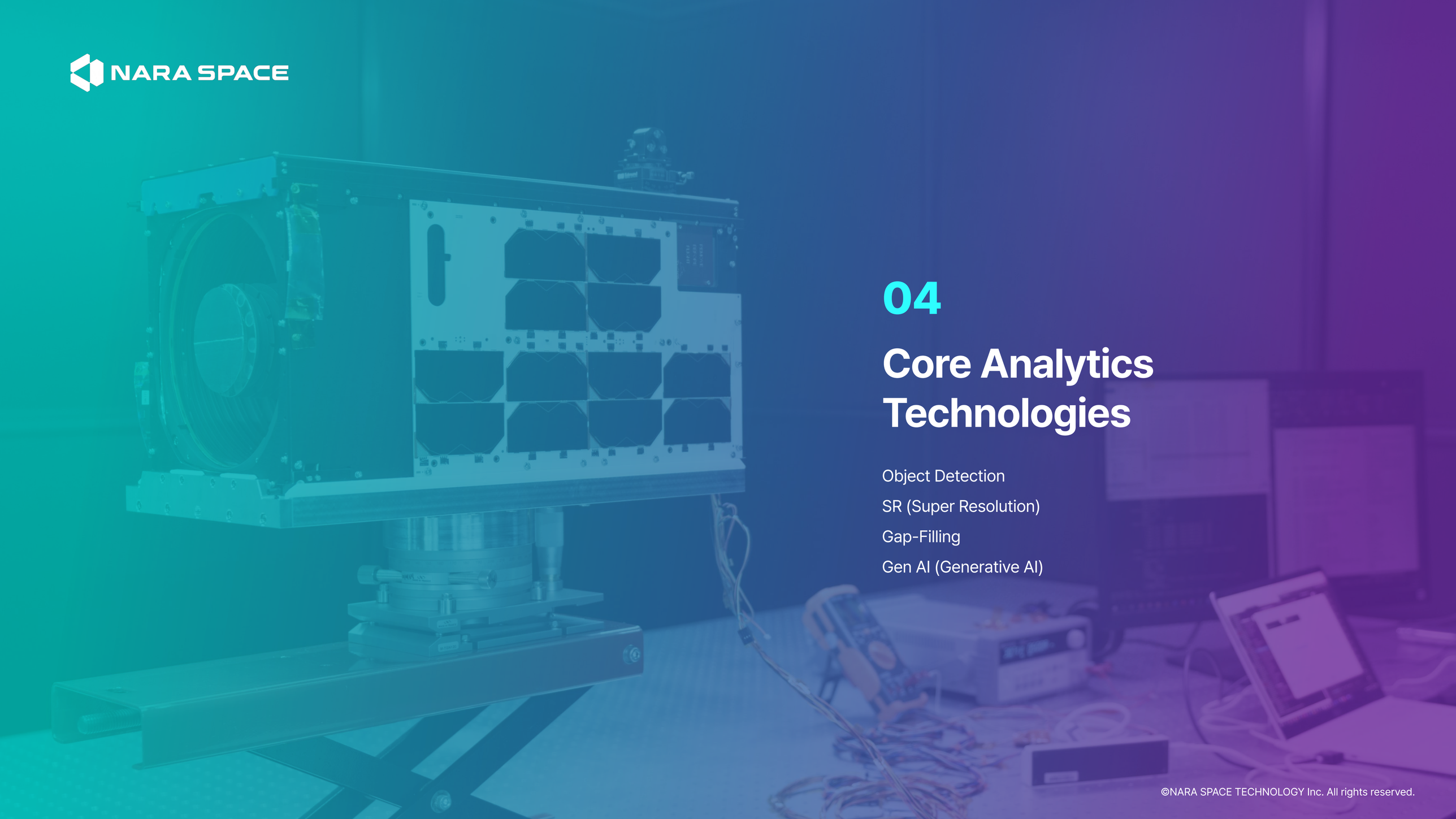
1 Deep Learning-Based Crop Classification Model

By using both the visible and infrared bands of satellite imagery, a deep learning model that captures crop-specific characteristics is developed, enabling the precise estimation of crop classification maps.

2 Estimation of Rice Cultivation Areas in North Korea

By applying a deep learning model trained on South Korean rice cultivation data to the North Korean region, it becomes possible to automatically identify and extract rice cultivation areas across the entire country.

NARA SPACE



04

Core Analytics Technologies

Object Detection

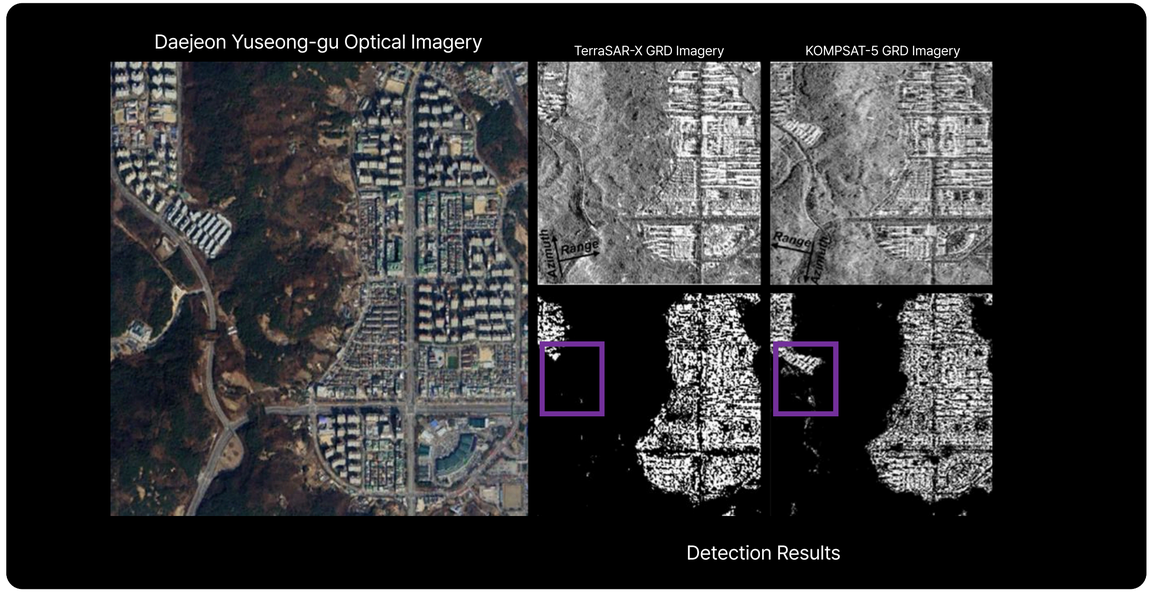
SR (Super Resolution)

Gap-Filling

Gen AI (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

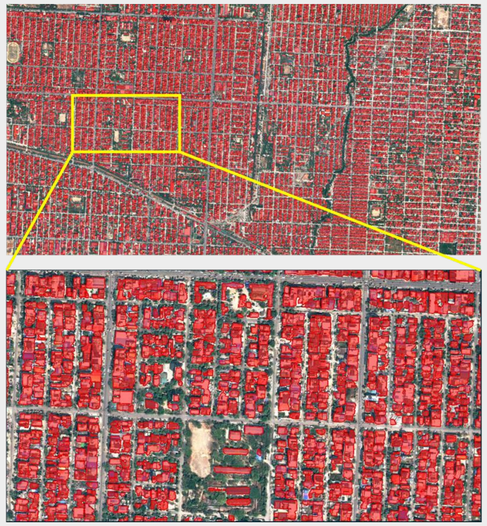
Using extracted morphological features, our solution can accurately identify densely built-up zones and urban structures, enabling valuable applications in urban planning, infrastructure monitoring, and post-disaster damage assessment.

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 Detection

Mandalay, Myanmar



0.84

mIoU accuracy on test data with resolution under 1 meter

Technical Specifications

Recommended Resolution	~ 1 m
Input Data	RGB band
Output Format	Raster (GeoTIFF, PNG), Vector (GeoJson)

Key Advantages

1 Robust model trained on diverse global datasets

Trained on diverse domestic and international datasets, ensuring stable detection performance regardless of regional or environmental characteristics.

2 Train on ultra-high-resolution satellite and aerial imagery (Spatial resolution of less than 1 m)

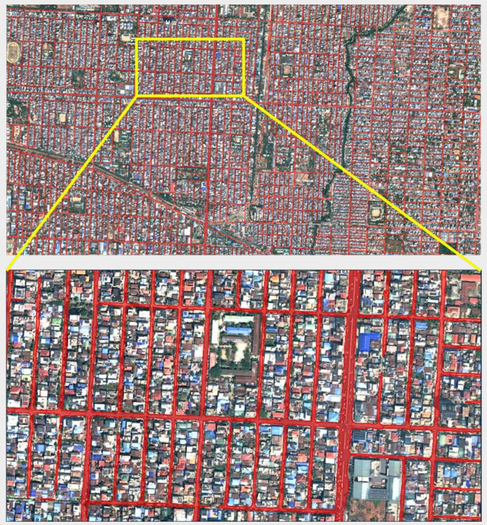
Achieves precise building boundary detection with a high accuracy of mIoU 0.84 on 1-meter resolution imagery.

3 High-speed inference through the deployment of efficient inference models

With an inference time of approximately 13 seconds for 1000 × 1000 pixel inputs, the model enables rapid and accurate detection across extensive spatial areas.

Object Detection : Optical Image-Based Road Detection

Mandalay, Myanmar



0.84

mIoU accuracy on test data with resolution under 1 meter

Technical Specifications

Recommended Resolution	~ 1 m
Input Data	RGB band
Output Format	Raster (GeoTIFF, PNG), Vector (GeoJson)

Key Advantages

1 Robust model trained on diverse global datasets

Trained on diverse domestic and international datasets, ensuring stable detection performance regardless of regional or environmental characteristics.

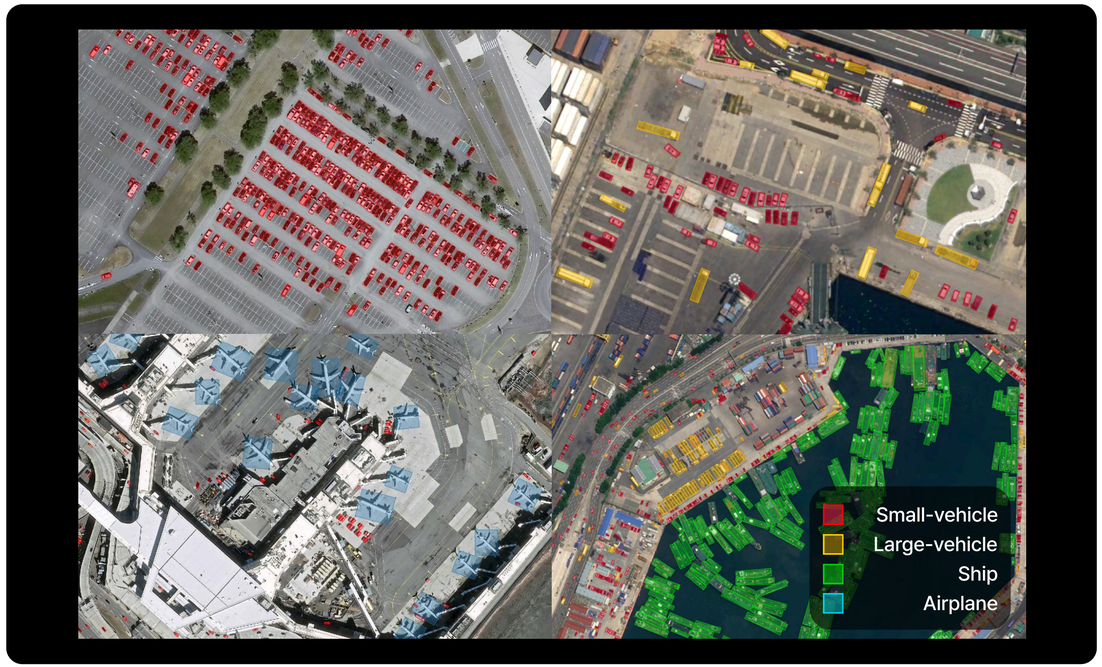
2 Train on ultra-high-resolution satellite and aerial imagery (Spatial resolution of less than 1 m)

Achieves precise building boundary detection with a high accuracy of mIoU 0.84 on 1-meter resolution imagery.

3 High-speed inference through the deployment of efficient inference models

With an inference time of approximately 13 seconds for 1000 × 1000 pixel inputs, the model enables rapid and accurate detection across extensive 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

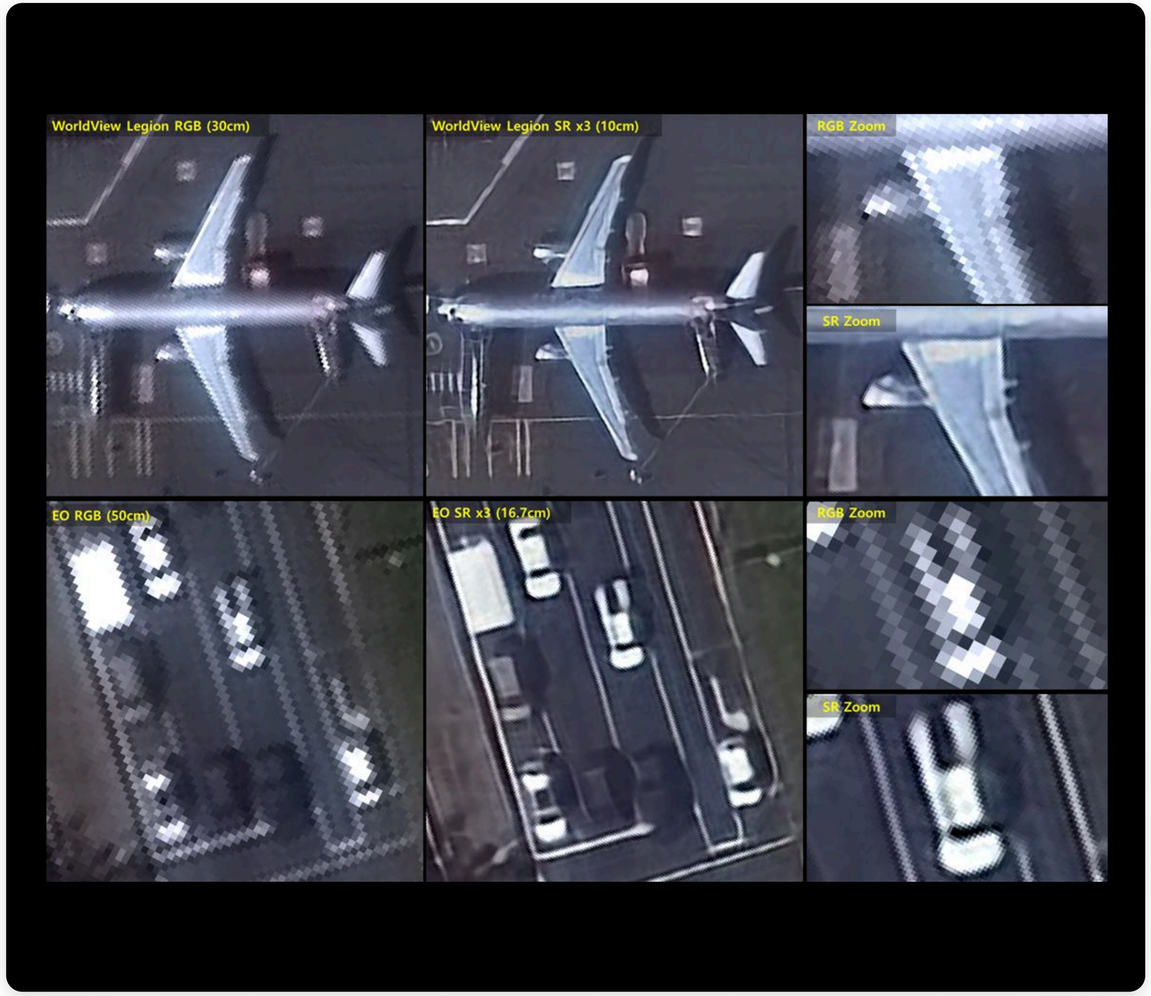
The model distinguishes multiple transportation asset types—such as fire trucks, heavy vehicles, ships, and aircraft—achieving an average recall above 0.98 accuracy across five transportation classes.

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

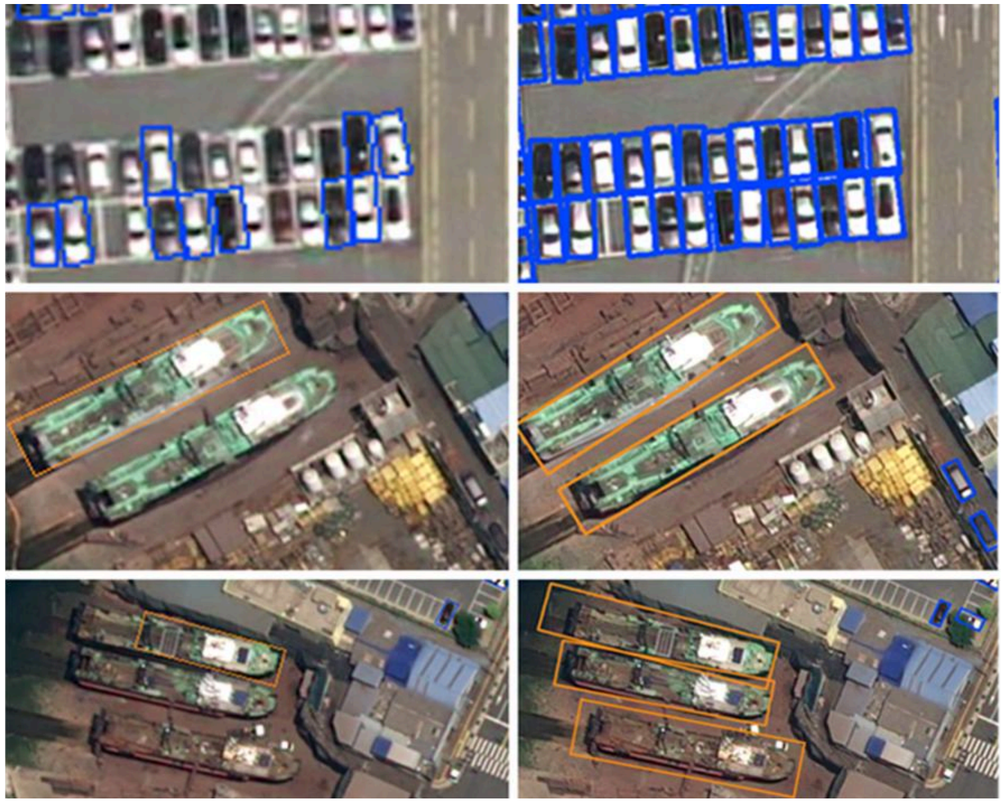
By upscaling existing low-resolution archives—such as Landsat and Sentinel—into high-resolution products, you can reduce reliance on costly high-resolution acquisitions while significantly increasing data utilization.

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**

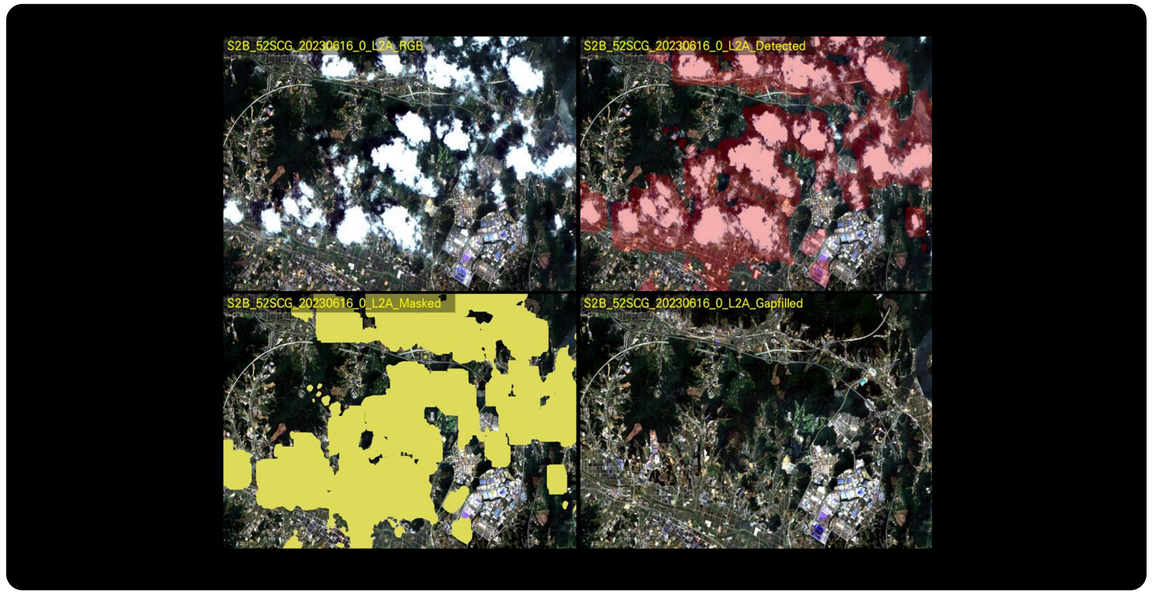
Technical Specifications

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 , 16bit)

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.

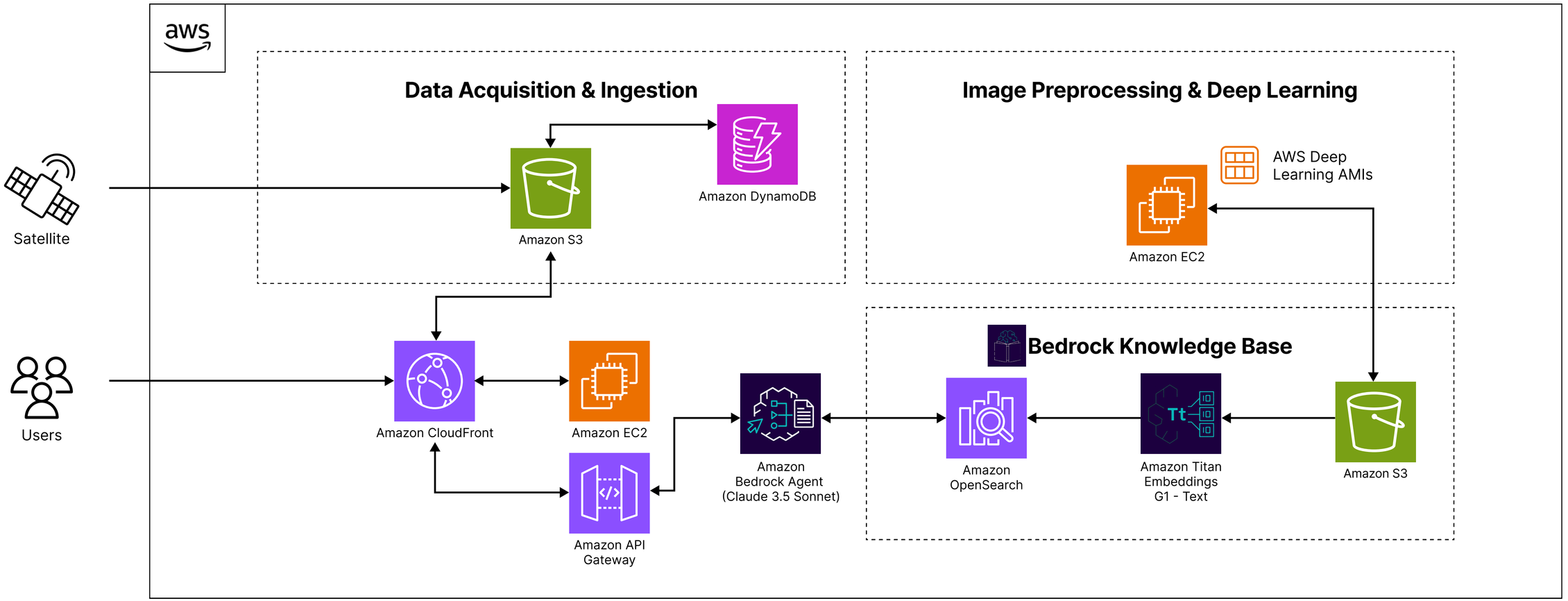
3 Seamless restoration of cloud-obscured areas

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 Gen AI



Key Advantages

1 Save time

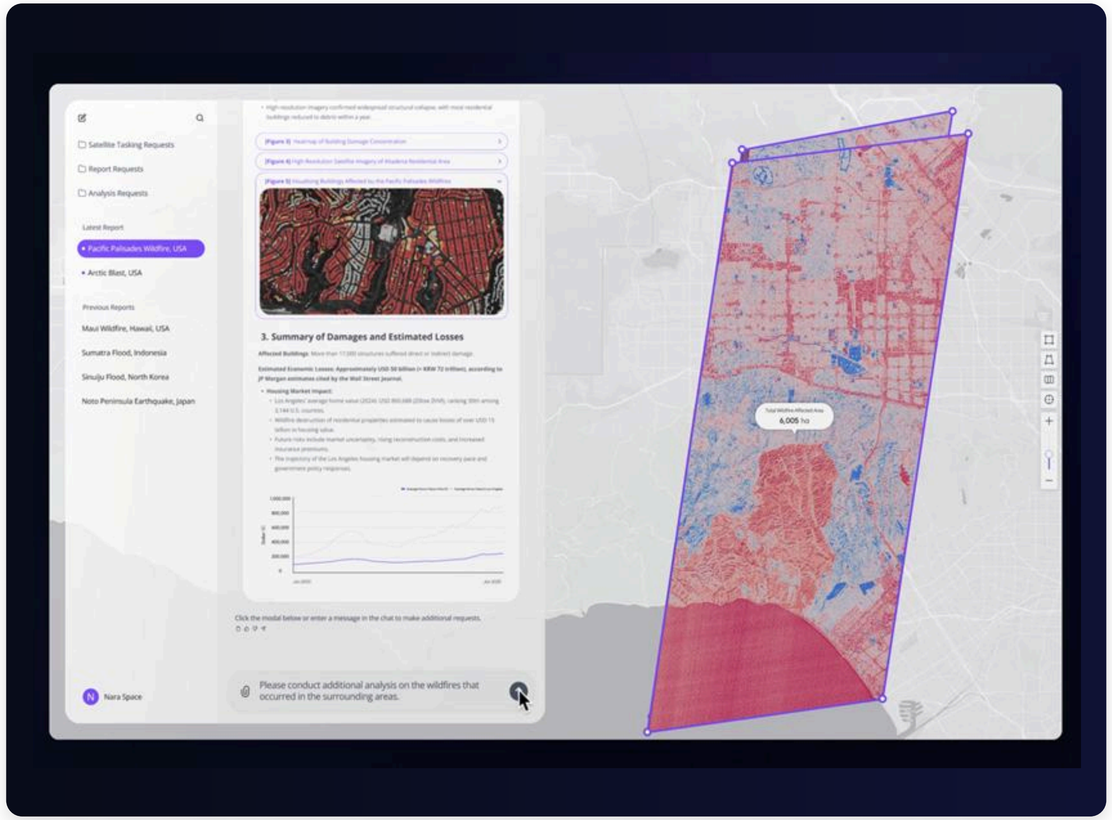
By leveraging Gen AI, report generation is dramatically reduced, enabling actionable insights in record time.

2 Minimized Hallucinations

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

Gen AI-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.

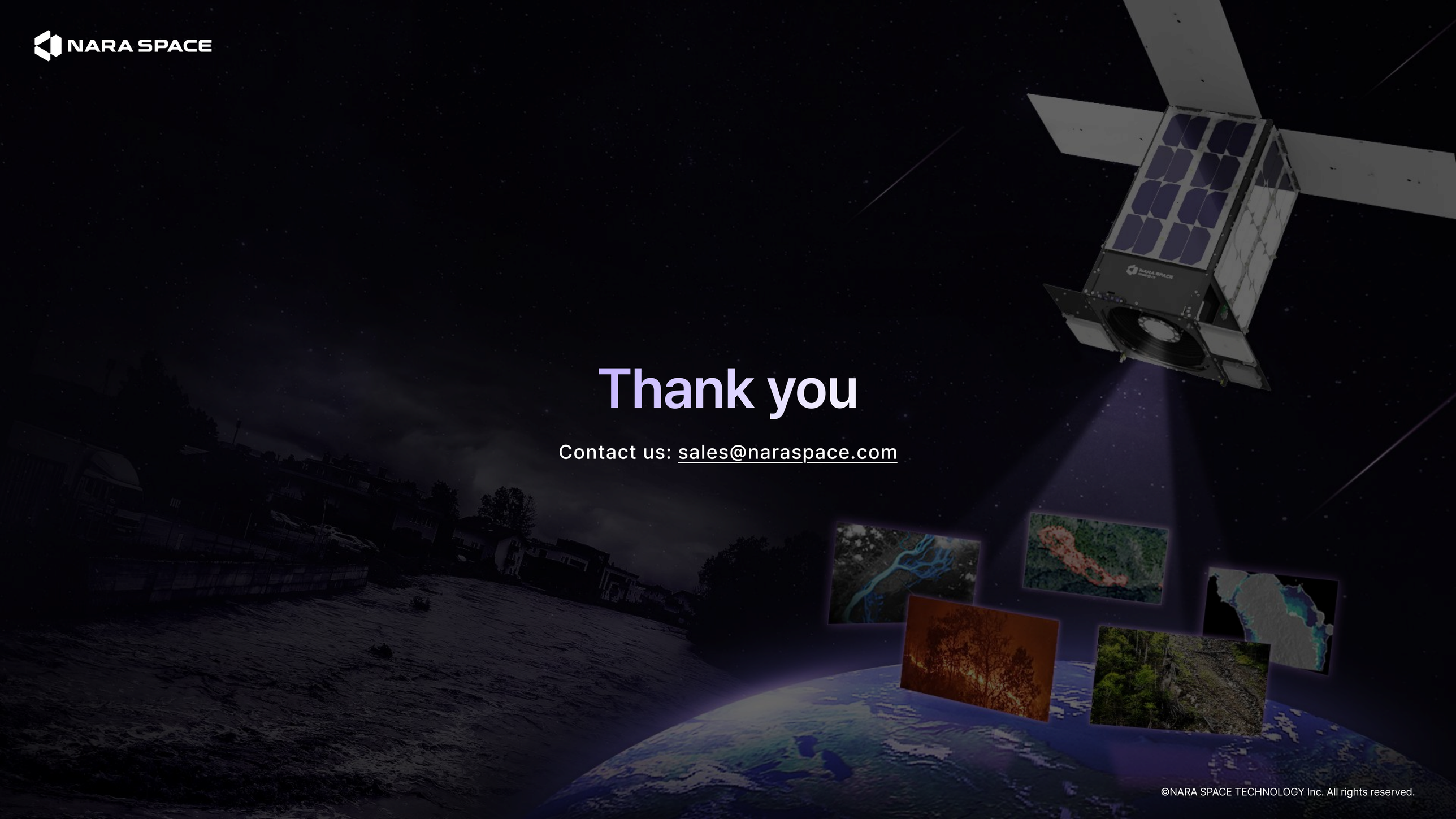
3 On-demand, deeper analysis

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.

NARA SPACE



Thank you

Contact us: sales@naraspace.com