EO-FIN

Monitoring Solar Panel Installations

Ground truth for solar panels bounding boxes (Left) and prediction using deep learning-based object detection model (Right) using Worldview-3 images (0.3 m)over southern Germany (Source: Maxar).

Product Category

■ Land Use ☐ Natural Disaster ☐ Coast Management ☐ Earth's Surface Motion
☐ Land Cover ☐ Climate Change ☐ Marine

Financial Domain(s)

☐ **Investment management** ■ **Risk analysis** ☐ **Insurance management** ☐ **Green finance**

User requirements

UN37: Projection of risk to portfolio assets into the future

Description

VHR satellite imagery can assess the condition of solar panels, detect anomalies or defects, and evaluate the overall energy generation of the installation. By comparing historical data, it becomes possible to identify changes in performance over time and address maintenance or operational issues promptly. In addition, satellite imagery can be used to evaluate land use changes that affect the performance of solar panels such as shadows from tall buildings and vegetation cover.

Spatial Coverage Target

Asset level

Data Throughput

Rapid tasking	☐ High	■ Low
Data availability	☐ High	■ Low

Product specifications	
Main processing steps	After the acquisition and preprocessing of the optical VHR (< 0.5 m), deep learning-based object detection algorithms such as YOLO can be used to detect solar panels. First, the dataset of the VHR images would be divided into training, validation, and test datasets. Training and validation will be used to train and optimize the deep learning model, which would be used then for inference to detect solar panels in the test data (our interest). Subsequently, temporal image pairing and image registration would be applied to analyse changes in the solar panels. Then, change detection techniques should be applied to the detected solar panels to identify changes over time. In terms of monitoring vegetation cover over the solar panels, vegetation indices can be used with change detection techniques.
Input data sources	Optical: VHR based on the availability like Pleiades 1A/1B & NEO, WorldView2&3, and SPOT6/7 Radar: N.A Supporting data: Solar panel datasets for deep learning models (if any)
Accessibility	VHR imagery: commercially available on demand from EO service

Product specifications	
	providers.
Spatial resolution	Optical VHR: ≤ 0.5 m
Frequency (Temporal resolution)	Optical VHR: Daily
Latency	Daily
Geographical scale coverage	Globally
Delivery/ output format	Data type: Raster File format: GeoTIFF
Accuracies	Thematic accuracy: 80-90% Spatial accuracy: 1.5-2 pixels of input data
Constraints and limitations	▪ Cloud presence. ▪ The availability and size of solar panels dataset to train the deep learning model. ▪ Cost as balancing higher spatial resolution (to detect small panels) with broader coverage (to monitor larger installations) can be challenging due to cost constraints. ▪ The exact timing of solar panel installations might be a challenge due to cost constraints. ▪ Panels integrated into complex rooftop configurations can be harder to identify due to varying angles and orientations.
User's level of knowledge and skills to extract information and perform further analysis on the EO products.	Skills: Essential Knowledge: Essential