sol-aIR: Autonomous Inspection Made Easy

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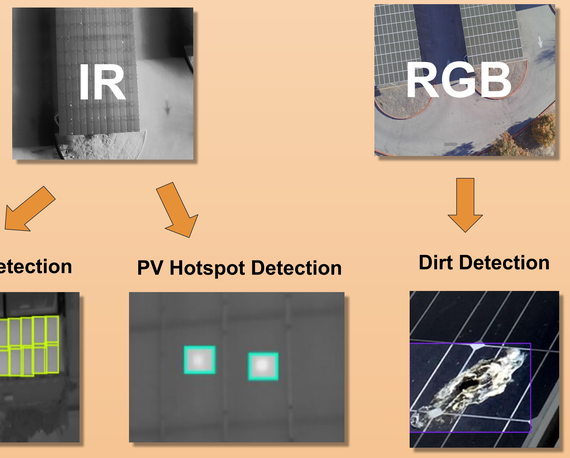
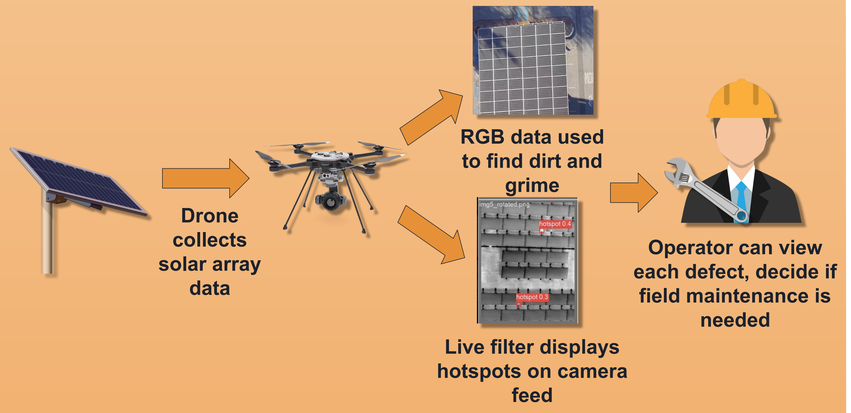
Background

Our project aims to streamline the inspection of solar panels, addressing the growing demand for solar energy and the extensive maintenance required for solar farms. Manual inspection of individual PV modules pinpoints damage, but is time-consuming due to the size of farms. We are integrating computer vision and machine learning into drones to improve the efficiency of PV module inspection.

Overview



Functional Flow Diagram



Vision of Final Product

Key Components

FLIR Boson camera

- Uncooled, long-wave IR (LWIR)
- Standard, radiometric data at 640x512
- Up to 60Hz

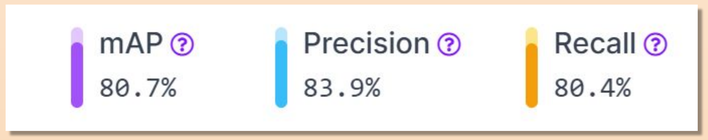
YOLOv8

- Open-source computer vision model
- Low processing power requirements
- High accuracy

FLIR ATLAS SDK

- Functions to process IR images
- Applies camera detection filters to a live video feed

IR Model Performance Metrics

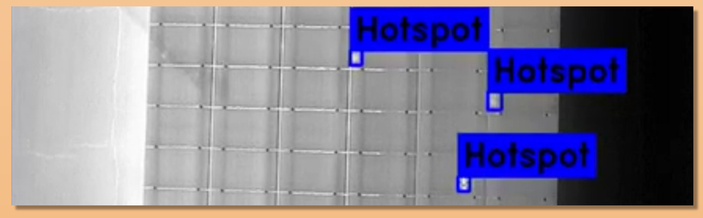


- Model does well on all metrics including precision (how often model was correct when it makes a guess), recall (how often the model was correctly identifies relevant cases) and mAP (mean Average Precision)
- Only rarely does not label PV modules toward edges of an image (false negative)

RGB Model Performance Metrics

- More challenging to improve than IR model due to huge variance in dirty module data
- Not proficient at detecting monotonous dirtiness, i.e. uniform dust/grime layer covering all the modules

Live Filtering



Simulated output of live filtering on IR finding hotspots

Simulated output of live filtering on RGB image finding dirt

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