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exploitation of satellite images for the recognition of electrical pylons

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Objectives of data acquisition

The objective is to create annotated datasets for:

- Training and testing detection models (a few thousand samples)
- System-wide validation (a few hundred samples)

The samples consist of satellite (or aerial) imagery that include at least one RTE pylon. A significant portion of these samples should be of the Pléiades Neo type (representative of the system targeted for production).

The annotations correspond to points of interest visible to the naked eye on the pylons.

Since the goal is to detect movement and obtain 3D information about the position of the pylon, some validation samples must be available in stereo view.

The purchase of satellite acquisitions was made possible by the NoR program, via the up42 platform.

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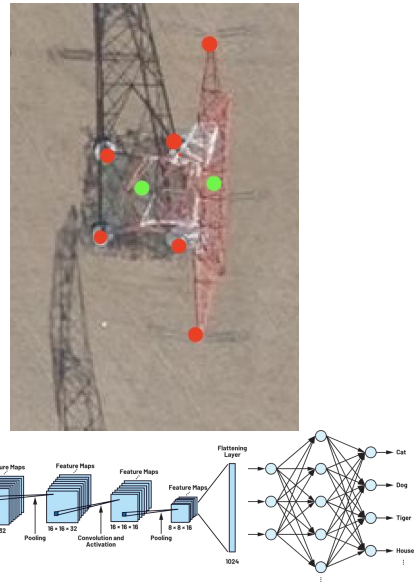
The data will be used for all project lots

pylon detection

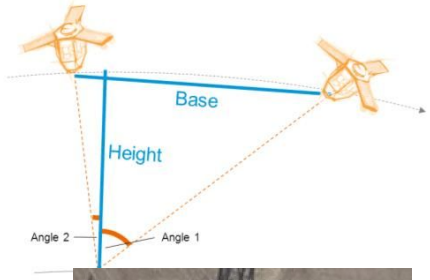


Create a representative pylon image dataset that will train a model to detect key points

temporal monitoring

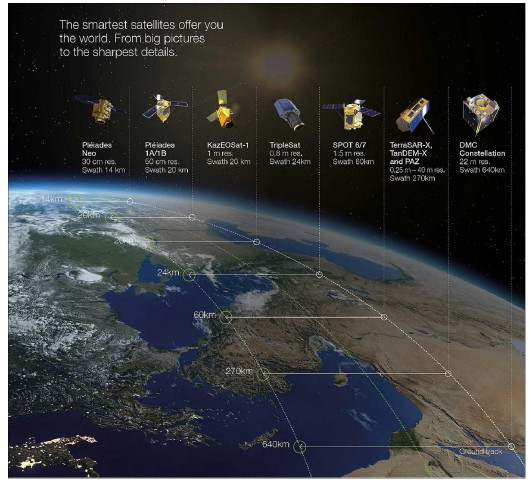
Make the link between two photos of the same pylon to try to identify a movement

3d modelisation



Use the stereo vision of satellites to represent the pylon in space

industrialisation



Set up a tasking to acquire satellite images over a given period

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Two main data sources

IGN, aerial imagery

Benefits :
- data is available across the entire territory (total coverage)
- The “orthophoto express” series allows you to occasionally have photos at different times.
- Resolution from 5cm to 50 cm / pixel
- The data is open source

Disadvantages:
- These are not the conditions of production
- No control over the date of the shooting
- RGB only
- Very limited metadata on the photo

Pleiade Neo (up42), with the help of NoR / ESA

Benefits :
- Close to real conditions
- Resolution 30 - 40 cm/pixel
- Complete shooting metadata
- Stereo possibility

Disadvantages:
- Very expensive (minimum 2EUR/pylons and 5200 EUR for stereo tasking on a few pylons) when the data exists
- Partial coverage of the territory and need to carry out tasking when data is not available
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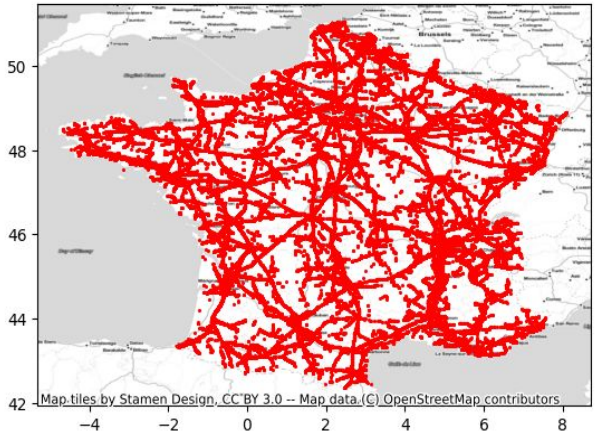
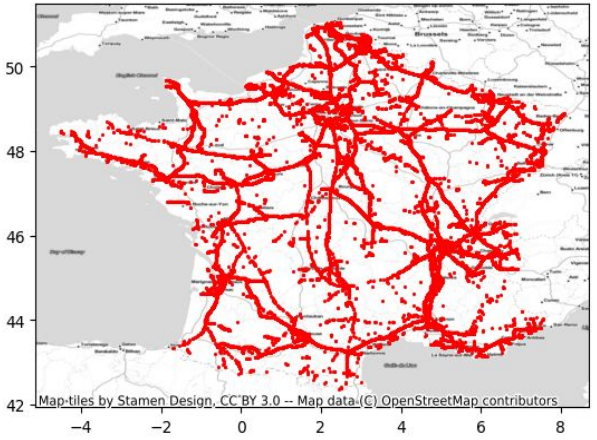
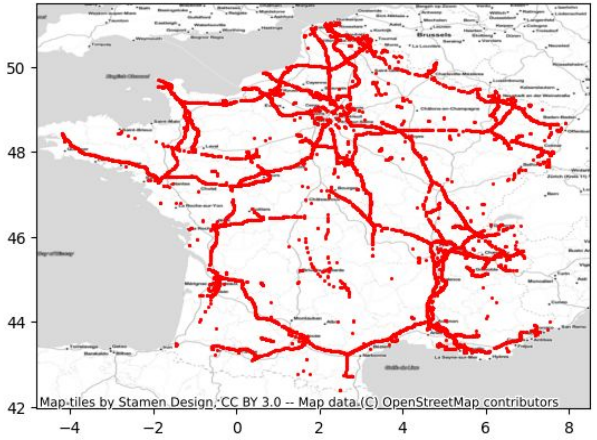
Choice of data - distribution of pylons in France



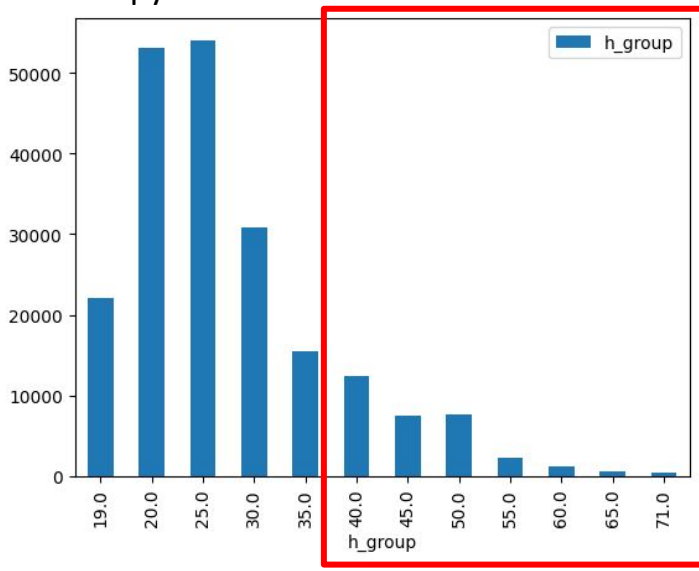
All pylons: 260k



pylons >= 40m: 30k



pylons >= 50m: 10k



The study initially focuses on pylons over 40m

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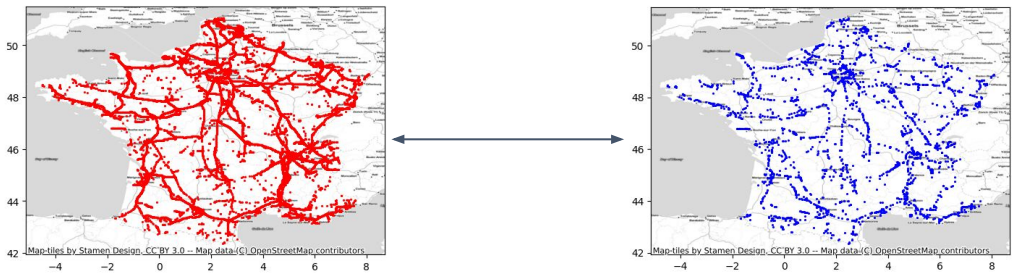
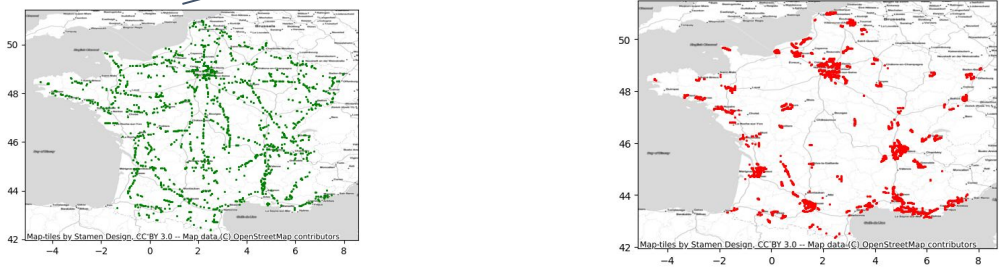
Data choice - data selection

Detection of pylons (lot 1-2)
Objective ~3,000 images (IGN & Pleiade)





Time Tracking
Including ~250 images of the same pylon at one or two other times

3d modeling
Including ~100 stereo images

Industrialization
Including (10 to be validated) pylons resulting from a tasking (mono - to be discussed)

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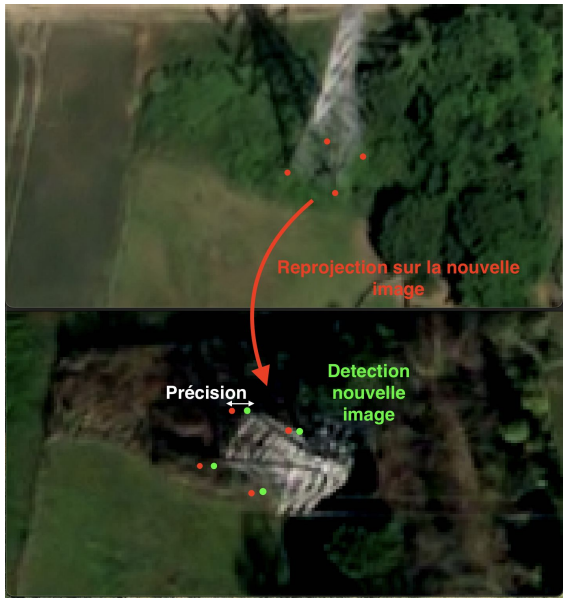
Some remarks on data accuracy

Precision of images : 30 - 40 cm/px

Precision of geo-referencing: to be evaluated



Precision of algorithms: to be evaluated

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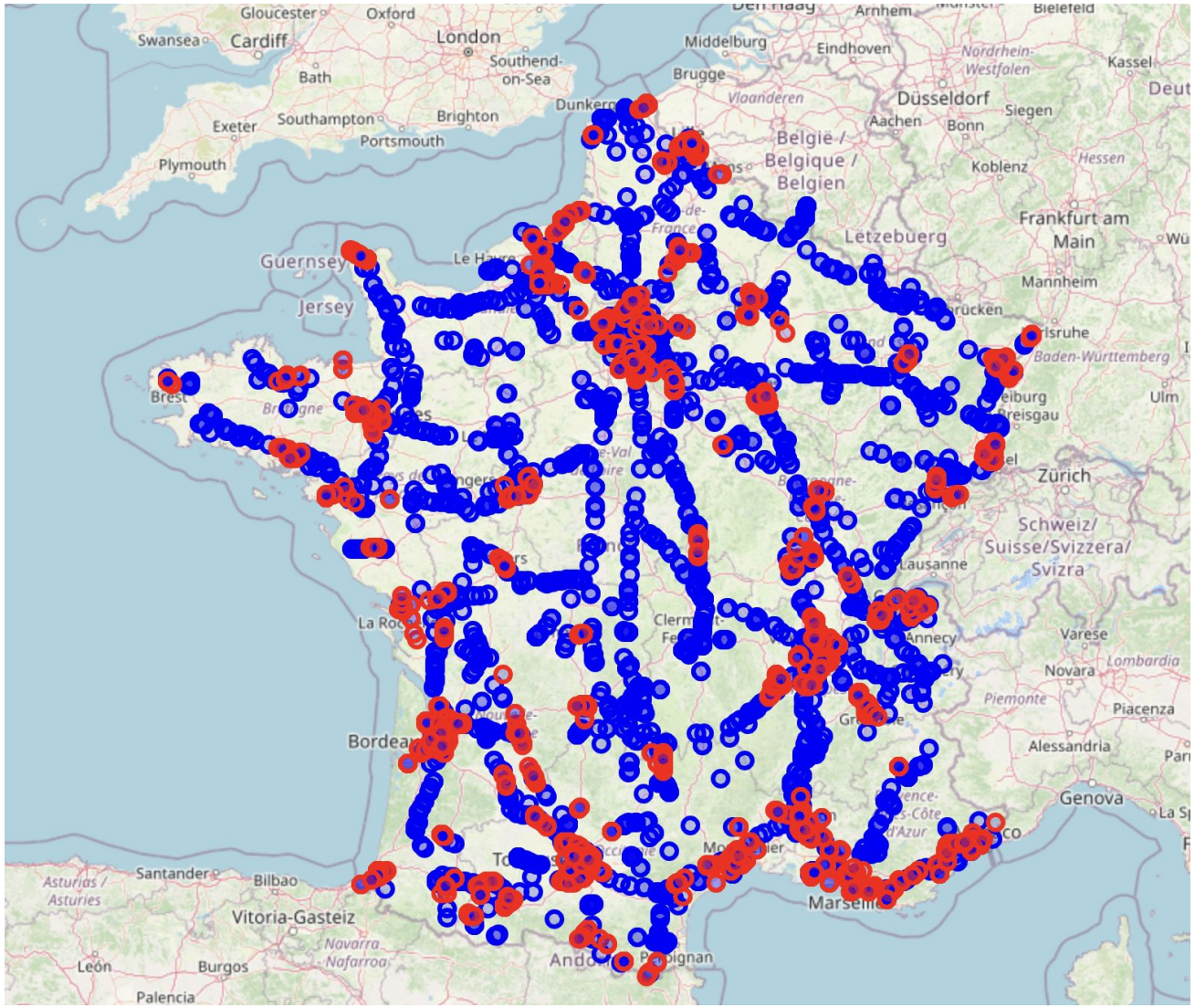
Annotated data

5 500 annotations based on aerial or satellite images of pylons spread across France



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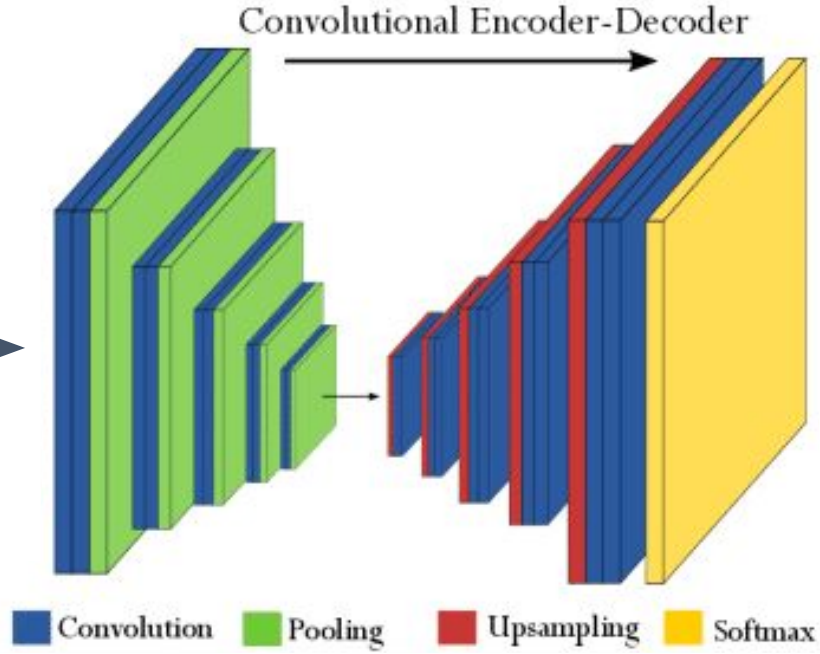
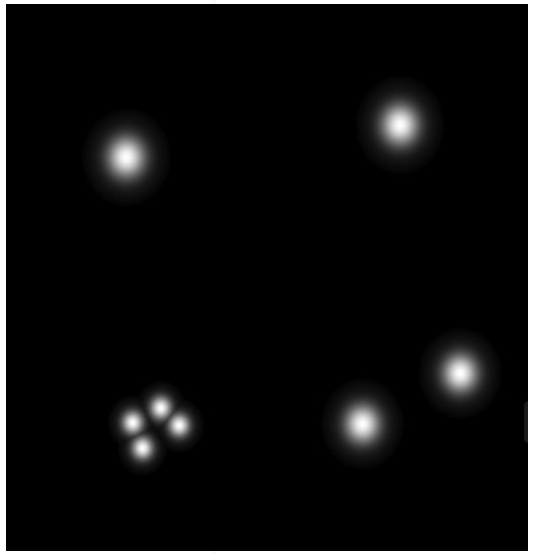
Statistical learning by neural networks - point detection

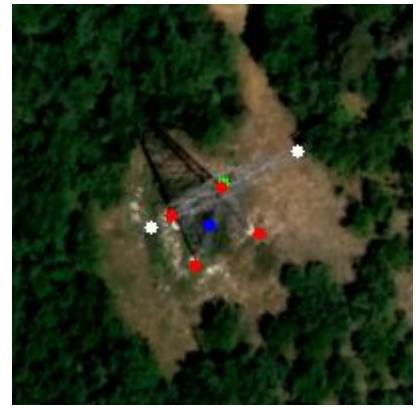
INPUT





HEAT MAPS

POST-PROCESSING



OUTPUT

Basic principles for searching for points of interest:

- passage of the image in an encoder - decoder network
- creation of heat maps: activation around points of interest
- post-processing for searching for points of interest

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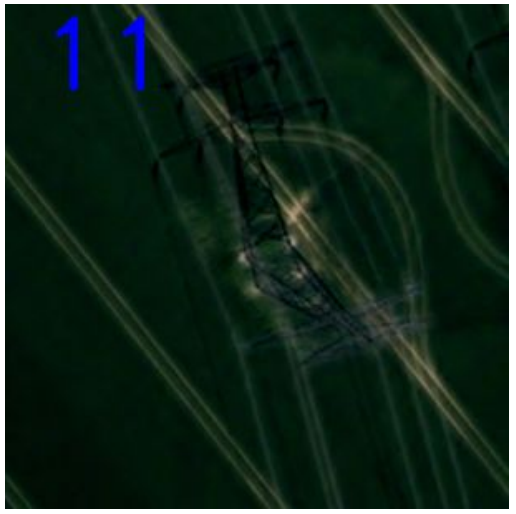
A few results

Classification - random extraction. 1st digit = calculation, 2nd digit = annotation



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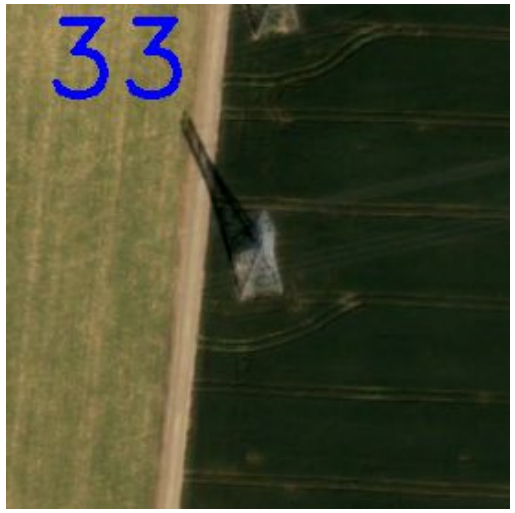
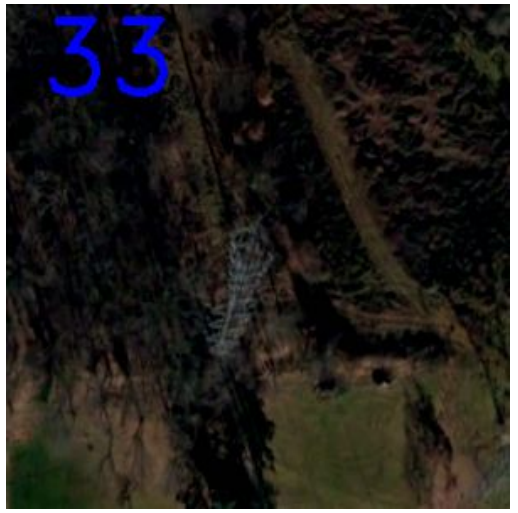
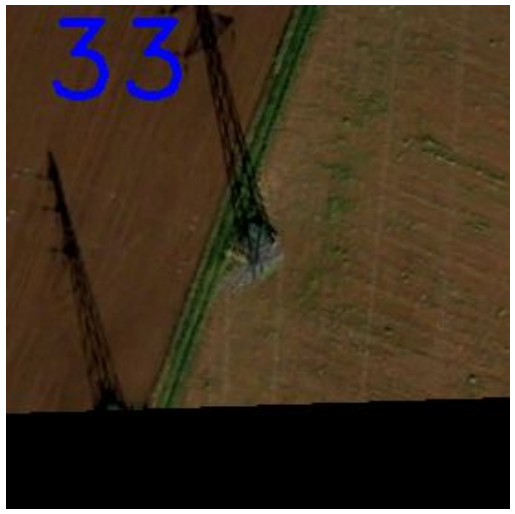
A few results







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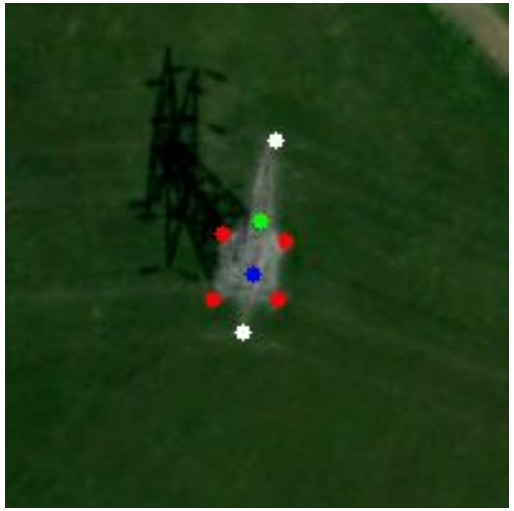
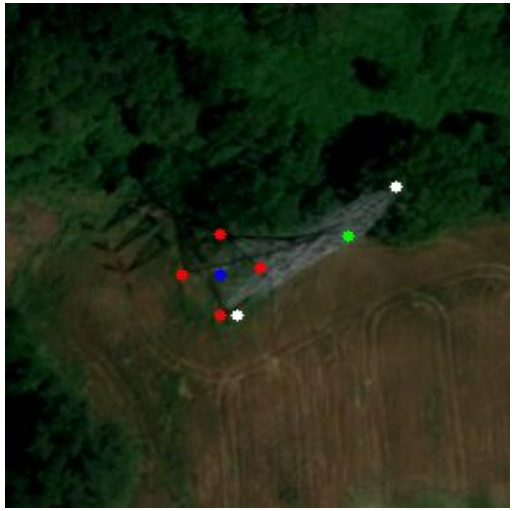
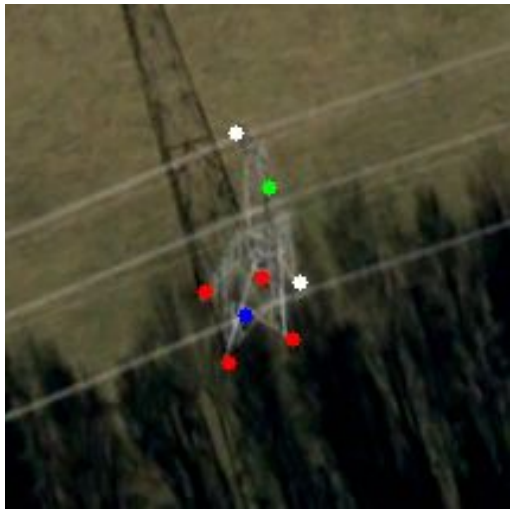
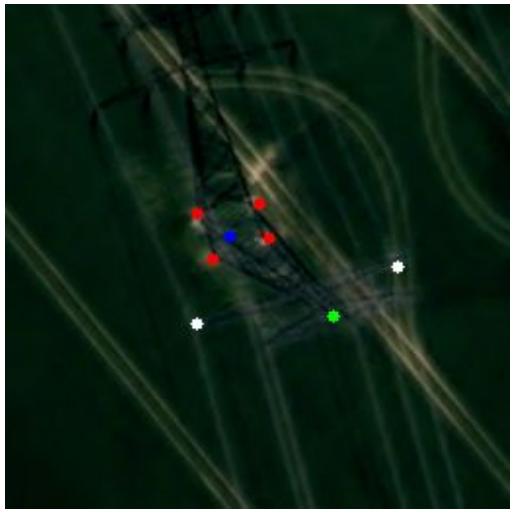
A few results

Fine detection - random extraction



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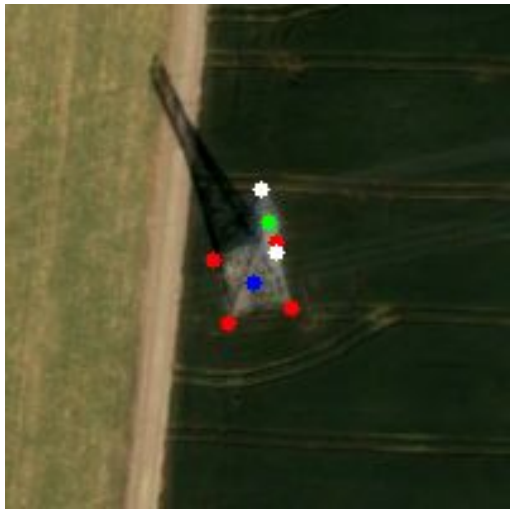
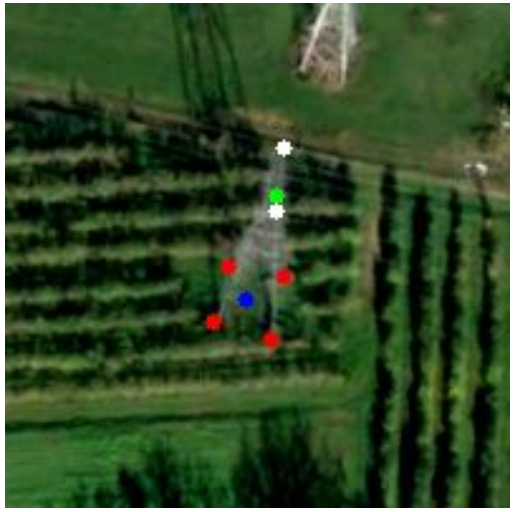
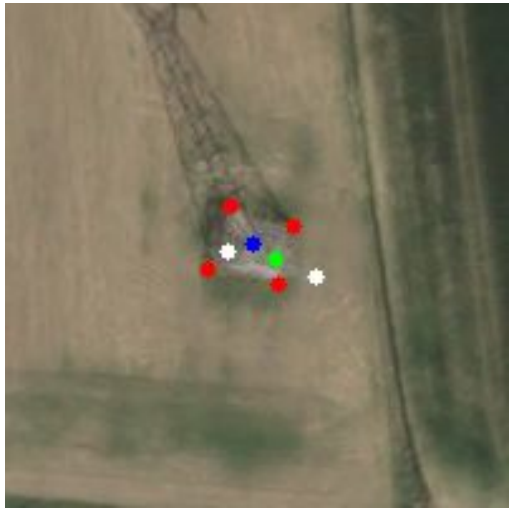
A few results



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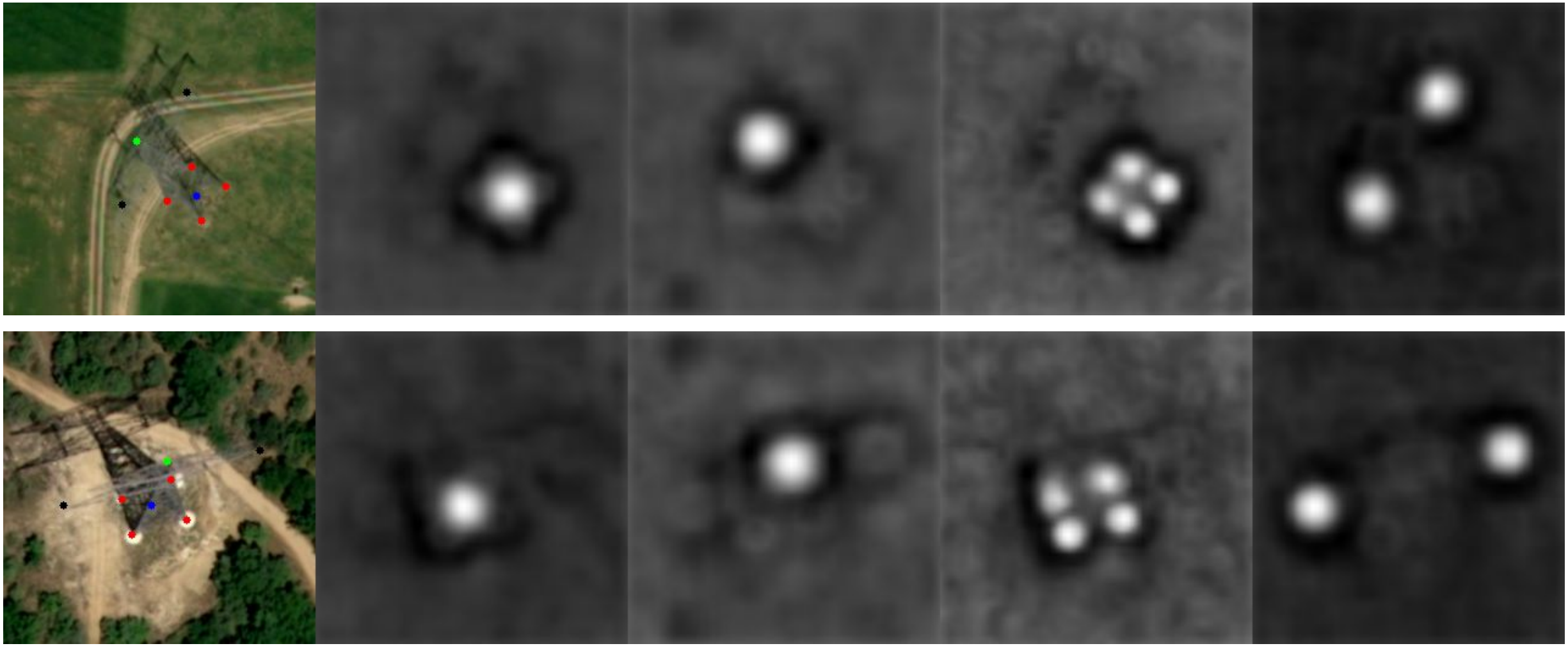
A few results

Fine detection - some examples of heat maps



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A few results