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11022 – OBJECT DETECTION ALGORITHMS APPLIED ON LOW VOLTAGE GRID EQUIPMENT

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Introduction

Failures in technological systems are always bound to happen. An electric distribution box can be broken. Enedis developed a mobile application which will allow local authorities to report failures. The challenge in troubleshooting call centers is resemblance of electric equipment with other networks.

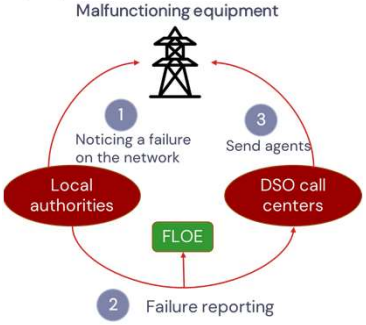

Figure 1 –Reporting of incidents

Figure 2 –resembling equipment from different networks

Data analysis

In total, more than 40,000 photos have been annotated. It should be noted that some photos can contain up to 10 equipment. We noticed that there are a lot of similarities between electric classes and non-electric ones with few examples of non-electric grid equipment to learn the specific features of these classes. Thus, we adopted a two-step :

- Object detection and image segmentation: the algorithm generates a rectangle or polygon around the detected objects.
- Classification: the algorithm assigns a class to the detected object.

Figure 3 – Approach adopted for the differentiation between electrical and non-electric equipment

Task 1 : Object detection

We decided to **merge** the electric and non-electric categories into one class due to the similarity between the two and in order to increase photos in our dataset. The metric used to evaluate the object detector is **mean Average Precision (mAP)** defined as below :

$$\text{mAP} = \frac{1}{n\_class} \sum_{i=1}^{n\_class} AP_i$$

The results show that objects with rectangular shape or large surface, such as electrical cabinets, substations or electricity meters are well detected with an overall mean average precision with **82% mAP.**

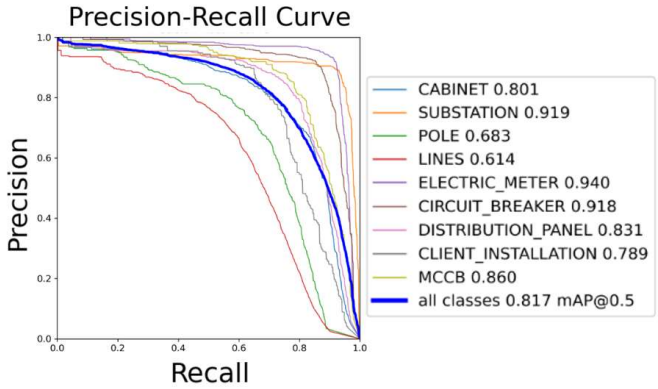

Figure 4 – Precision-recall curve of predictions on the testing set

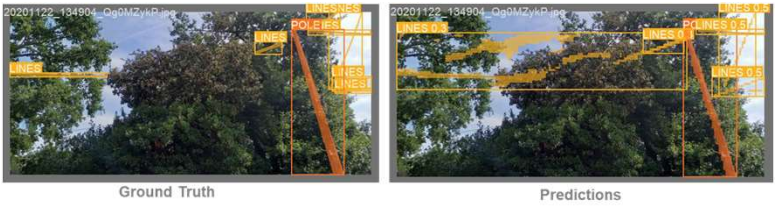

Figure 5 – Predictions on a difficult outside image of electric grid with very noisy background

Task 2 : Classifier

The metric used to evaluate the classifier is **weighted average Recall (waR)** and **weighted average Precision (waP)**.

- Cabinets : 74% waR and 74 waP
- Poles : 65% waR and 81% waP
- Lines : 65% waR and 62 waP

The classifier performs well for classifying cabinets. Nevertheless, when it comes to cables and poles it has encountered issues due to the lack of data, the low resolution, the shape and scale variation of images.

Conclusion

The upcoming photos from the mobile application called FLOE will increase the quantity and improve the quality of our dataset. This would allow to push the model performance even further.