Prototype development

- **Objective:** ***use AI approaches to detect and assess the state of EDP electronic boxes***
- *What's in scope?*
  - Detection of EDP boxes from photos
  - Classification of their states
- *What's not in scope?*
  - Detection of specific instance of alterations (crack, oxidation, lock broken)

Detection of the boxes

Photos

Detection of the boxes

Photos

Labeling

CVAT YOLO output

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├── obj.data
├── obj.names
├── obj_train_data
└── train.txt
```

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0 0.450688 0.540651 0.305322 0.421997
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0 0.410495 0.507119 0.125286 0.160234
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0 0.529792 0.439717 0.321354 0.336973
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Augmentation

Data augmentation

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 # 22650 aug photos
 # train: 16987
 # valid: 5663
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Detection of the boxes

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Object detection

YOLOv4: Optimal Speed and Accuracy of Object Detection.
Alexey Bochkovskiy, Chien-Yao Wang and Hong-Yuan Mark Liao
arXiv, april 2020

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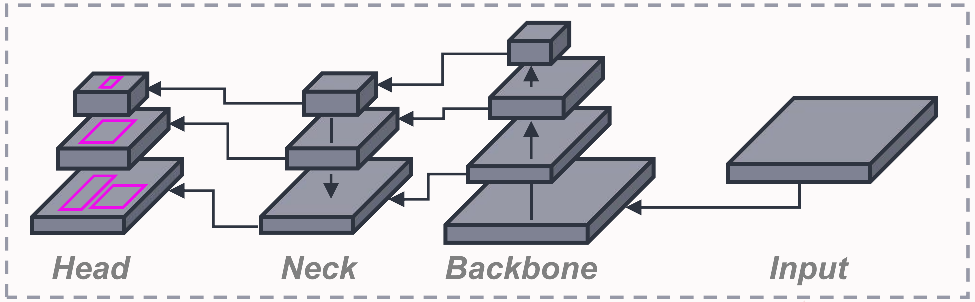
Object detection

Architecture



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Predictions & metrics

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mAP ─┐
     ├─▶ AP@50
IoU ─┘
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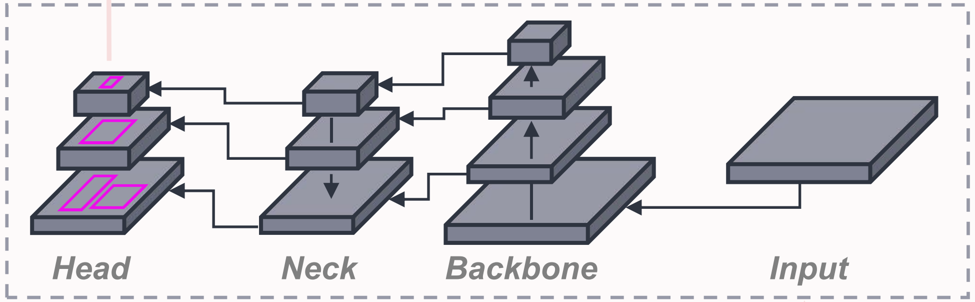

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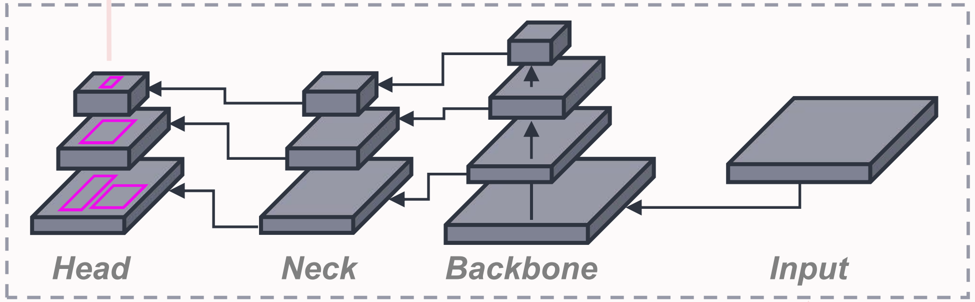

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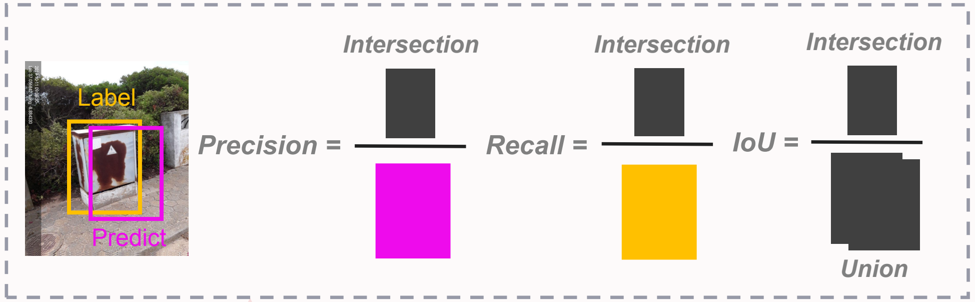

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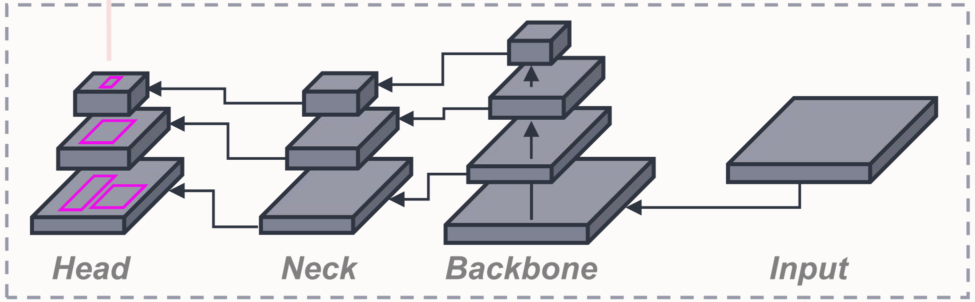

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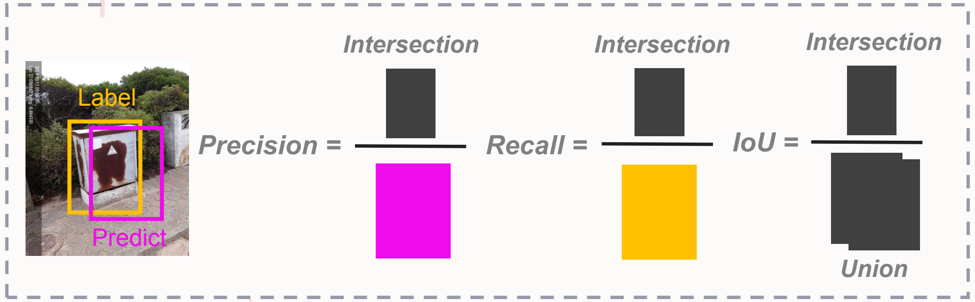

Results

```
./darknet detector map [meta] [cfg] [weigth]

class_id = 0, name = box-closed
TP = 5669, FP = 81, FN = 52
precision = 0.99, recall = 0.99, F1-score = 0.99
ap = 99.73%
average IoU   = 87.53 %
mean average precision (mAP@0.50) = 99.73 %
```

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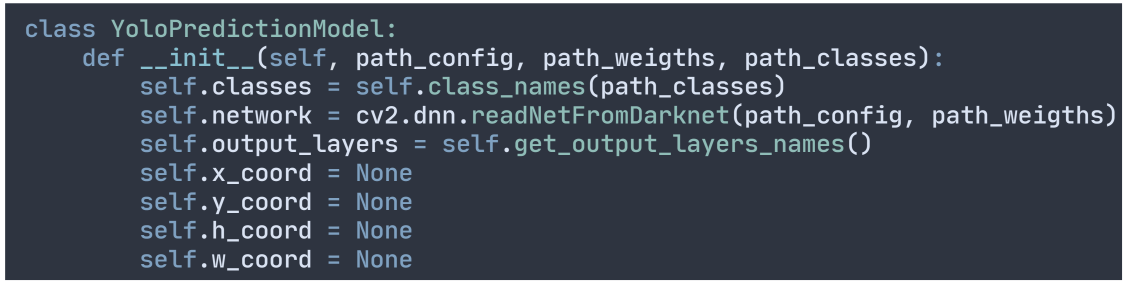
Testing the model and extracting the EDP Boxes



```
class YoloPredictionModel:
    def __init__(self, path_config, path_weigths, path_classes):
        self.classes = self.class_names(path_classes)
        self.network = cv2.dnn.readNetFromDarknet(path_config, path_weigths)
        self.output_layers = self.get_output_layers_names()
        self.x_coord = None
        self.y_coord = None
        self.h_coord = None
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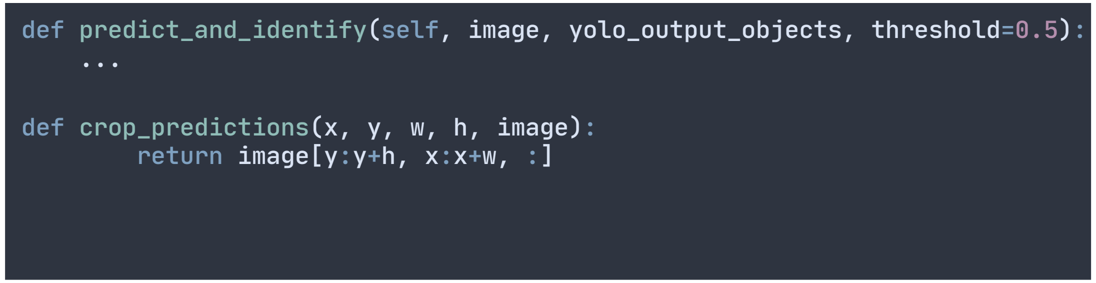

```
def predict_and_identify(self, image, yolo_output_objects, threshold=0.5):
    ...

def crop_predictions(x, y, w, h, image):
        return image[y:y+h, x:x+w, :]
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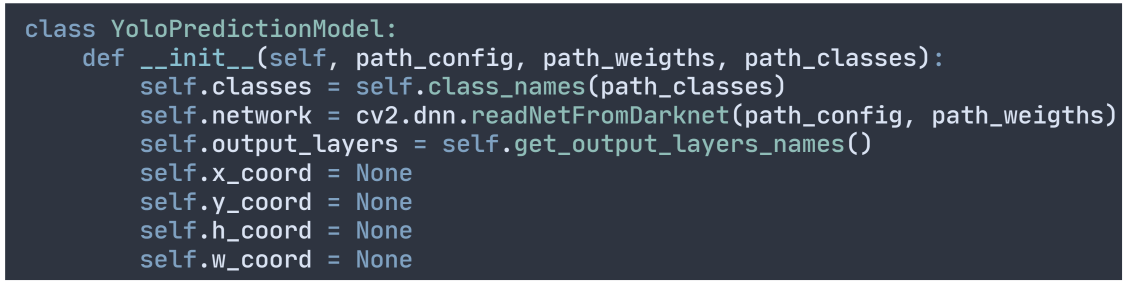
Testing the model and extracting the EDP Boxes



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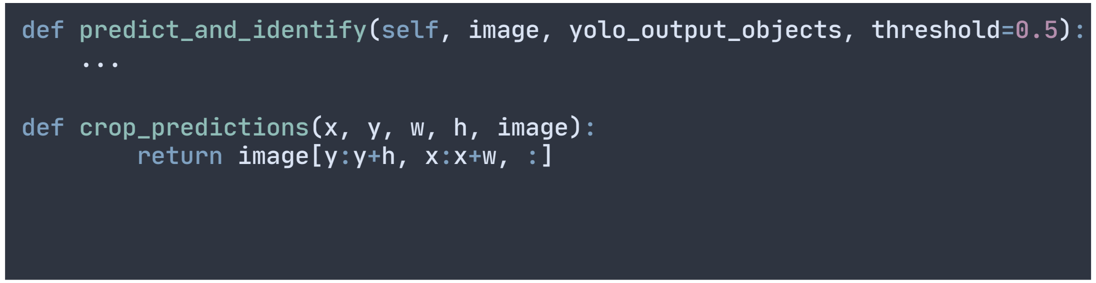

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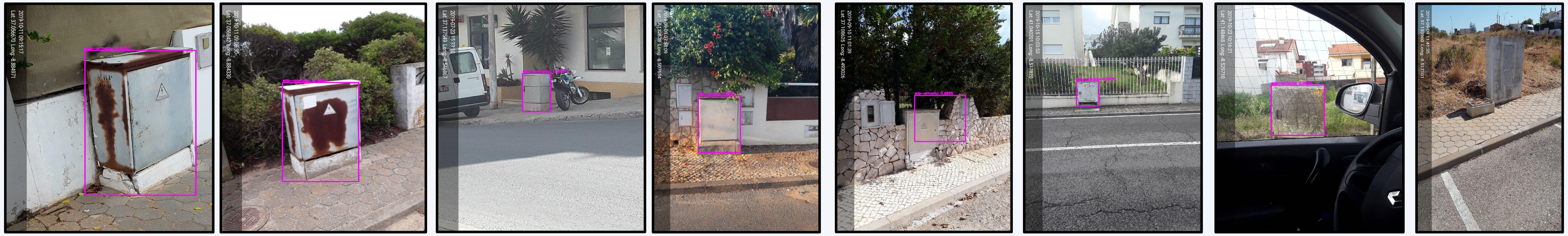

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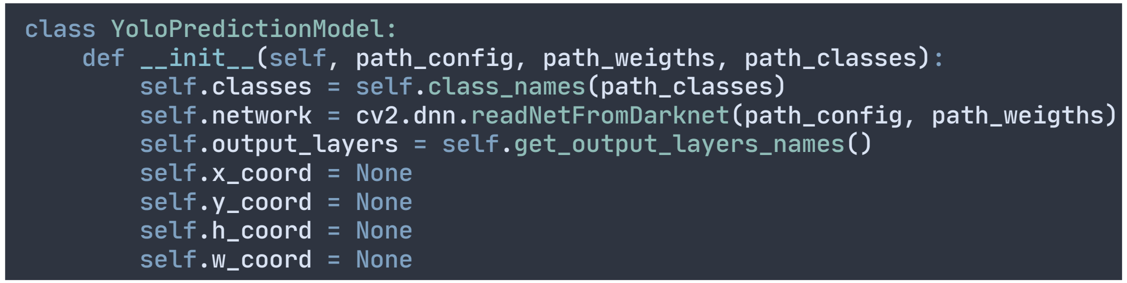

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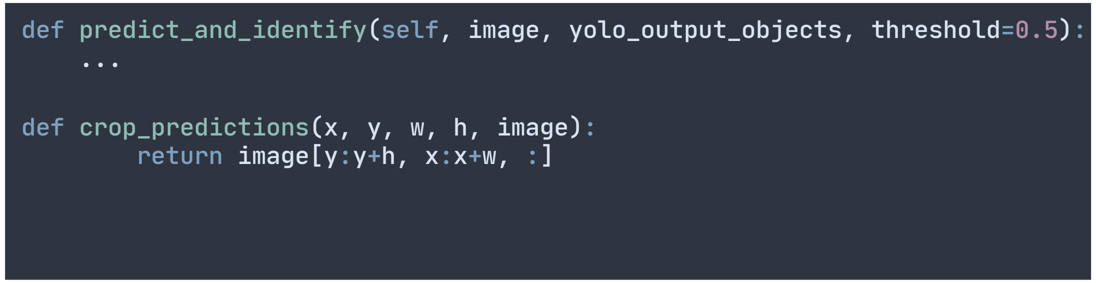

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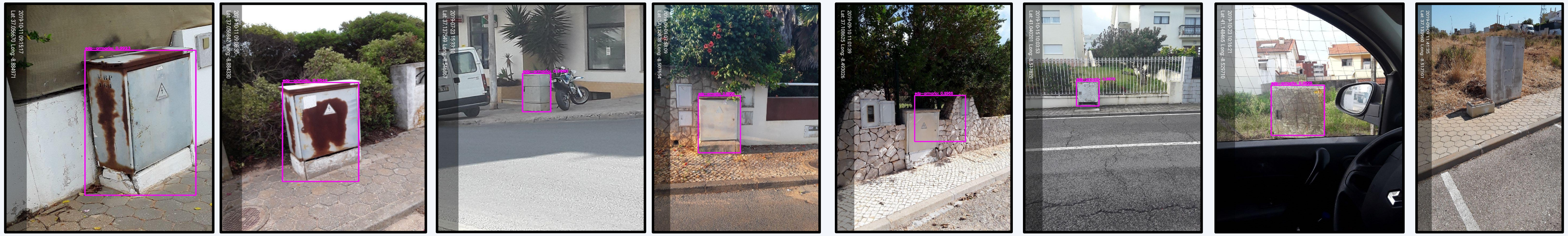

Scrapping