

License Plate Detection

Download the Dataset

Download the Vehicle registration plate

Download the Vehicle Registration Plate dataset from [here](#) and unzip it.

We will have the following directory structure:

```
Dataset
└── train
    └── Vehicle registration plate
        └── Label
└── validation
    └── Vehicle registration plate
        └── Label
```

Unzipping the file will give you a directory `Dataset`. This directory has two folder `train` and `validation`. Each train and validation folder has `Vehicle registration plate` folder with `.jpg` images and a folder `Labels`. `Labels` folder has bounding box data for the images.

For example, For image: `Dataset/train/Vehicle registration plate/bf4689922cdfd532.jpg` Label file is `Dataset/train/Vehicle registration plate/Label/bf4689922cdfd532.txt`

There are one or more lines in each `.txt` file. Each line represents one bounding box. For example,

```
Vehicle registration plate 385.28 445.15 618.24 514.225
Vehicle registration plate 839.68 266.066462 874.24 289.091462
```

We have a single class detection (`Vehicle registration plate detection`) problem. So bounding box details start from the fourth column in each row.

Representation is in `xmin`, `ymin`, `xmax`, and `ymax` format.

It has 5308 training and 386 validation dataset.

Data is downloaded from [Open Images Dataset](#)

1. Plot Ground Truth Bounding Boxes

You have to show three images from validation data with the bounding boxes.

The plotted images should be similar to the following:



In [1]:

```
from google.colab import drive
drive.mount('/content/drive')
```

Mounted at /content/drive

```
In [2]: %cd /content/drive/MyDrive/'OpenCV Class 3 Project 3'
```

```
/content/drive/MyDrive/OpenCV Class 3 Project 3
```

```
In [ ]: !apt-get install tree
```

```
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  tree
0 upgraded, 1 newly installed, 0 to remove and 37 not upgraded.
Need to get 40.7 kB of archives.
After this operation, 105 kB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu bionic/universe amd64 tree amd64 1.7.0-5 [40.7 kB]
Fetched 40.7 kB in 0s (111 kB/s)
Selecting previously unselected package tree.
(Reading database ... 155047 files and directories currently installed.)
Preparing to unpack .../tree_1.7.0-5_amd64.deb ...
Unpacking tree (1.7.0-5) ...
Setting up tree (1.7.0-5) ...
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
```

```
In [ ]: !tree -d ./Dataset
```

```
./Dataset
└── train
    └── Vehicle registration plate
        └── Label
└── validation
    └── Vehicle registration plate
        └── Label
```

```
6 directories
```

Install PyCocoTools

```
In [3]: !pip install -U 'git+https://github.com/cocodataset/cocoapi.git#subdirectory=PythonAPI'
```

```
Collecting git+https://github.com/cocodataset/cocoapi.git#subdirectory=PythonAPI
  Cloning https://github.com/cocodataset/cocoapi.git to /tmp/pip-req-build-gec75dzn
    Running command git clone -q https://github.com/cocodataset/cocoapi.git /tmp/pip-req-build-gec75dzn
Requirement already satisfied: setuptools>=18.0 in /usr/local/lib/python3.7/dist-packages (from pycocotools==2.0) (5.7.4.0)
Requirement already satisfied: cython>=0.27.3 in /usr/local/lib/python3.7/dist-packages (from pycocotools==2.0) (0.29.24)
Requirement already satisfied: matplotlib>=2.1.0 in /usr/local/lib/python3.7/dist-packages (from pycocotools==2.0) (3.2.2)
Requirement already satisfied: python-dateutil>=2.1 in /usr/local/lib/python3.7/dist-packages (from matplotlib>=2.1.0->pycocotools==2.0) (2.8.2)
Requirement already satisfied: numpy>=1.11 in /usr/local/lib/python3.7/dist-packages (from matplotlib>=2.1.0->pycocotools==2.0) (1.19.5)
Requirement already satisfied: pyparsing!=2.0.4,!!=2.1.2,!!=2.1.6,>=2.0.1 in /usr/local/lib/python3.7/dist-packages (from matplotlib>=2.1.0->pycocotools==2.0) (3.0.6)
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.7/dist-packages (from matplotlib>=2.1.0->pycocotools==2.0) (1.3.2)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.7/dist-packages (from matplotlib>=2.1.0->pycocotools==2.0) (0.11.0)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/dist-packages (from python-dateutil>=2.1->matplotlib>=2.1.0->pycocotools==2.0) (1.15.0)
Building wheels for collected packages: pycocotools
  Building wheel for pycocotools (setup.py) ... done
    Created wheel for pycocotools: filename=pycocotools-2.0-cp37-cp37m-linux_x86_64.whl size=263918 sha256=66212bbb7ec201e3398f83d06100e7404b7c9112e8a79b456c99f4e14ef421a9
      Stored in directory: /tmp/pip-ephem-wheel-cache-tr4kx5ta/wheels/e2/6b/1d/344ac773c7495ea0b85eb228bc66daec7400a143a92d36b7b1
Successfully built pycocotools
Installing collected packages: pycocotools
  Attempting uninstall: pycocotools
    Found existing installation: pycocotools 2.0.2
    Uninstalling pycocotools-2.0.2:
      Successfully uninstalled pycocotools-2.0.2
Successfully installed pycocotools-2.0
```

Install Detectron2

In [4]:

```
!python -m pip install 'git+https://github.com/facebookresearch/detectron2.git'
```

```
Collecting git+https://github.com/facebookresearch/detectron2.git
  Cloning https://github.com/facebookresearch/detectron2.git to /tmp/pip-req-build-9fuddf0y
    Running command git clone -q https://github.com/facebookresearch/detectron2.git /tmp/pip-req-build-9fuddf0y
Requirement already satisfied: Pillow>=7.1 in /usr/local/lib/python3.7/dist-packages (from detectron2==0.6) (7.1.2)
Requirement already satisfied: matplotlib in /usr/local/lib/python3.7/dist-packages (from detectron2==0.6) (3.2.2)
Collecting pycocotools>=2.0.2
  Downloading pycocotools-2.0.2.tar.gz (23 kB)
Requirement already satisfied: termcolor>=1.1 in /usr/local/lib/python3.7/dist-packages (from detectron2==0.6) (1.1.0)
Collecting yacs>=0.1.8
  Downloading yacs-0.1.8-py3-none-any.whl (14 kB)
Requirement already satisfied: tabulate in /usr/local/lib/python3.7/dist-packages (from detectron2==0.6) (0.8.9)
Requirement already satisfied:云pickle in /usr/local/lib/python3.7/dist-packages (from detectron2==0.6) (1.3.0)
Requirement already satisfied: tqdm>4.29.0 in /usr/local/lib/python3.7/dist-packages (from detectron2==0.6) (4.62.3)
Requirement already satisfied: tensorboard in /usr/local/lib/python3.7/dist-packages (from detectron2==0.6) (2.7.0)
Collecting fvcore<0.1.6,>=0.1.5
  Downloading fvcore-0.1.5.post20211023.tar.gz (49 kB)
|██████████| 49 kB 4.5 MB/s
Collecting iopath<0.1.10,>=0.1.7
  Downloading iopath-0.1.9-py3-none-any.whl (27 kB)
Requirement already satisfied: future in /usr/local/lib/python3.7/dist-packages (from detectron2==0.6) (0.16.0)
Requirement already satisfied: pydot in /usr/local/lib/python3.7/dist-packages (from detectron2==0.6) (1.3.0)
Collecting omegaconf>=2.1
  Downloading omegaconf-2.1.1-py3-none-any.whl (74 kB)
|██████████| 74 kB 3.5 MB/s
Collecting hydra-core>=1.1
  Downloading hydra_core-1.1.1-py3-none-any.whl (145 kB)
|██████████| 145 kB 29.0 MB/s
Collecting black==21.4b2
  Downloading black-21.4b2-py3-none-any.whl (130 kB)
|██████████| 130 kB 63.6 MB/s
Requirement already satisfied: typing-extensions>=3.7.4 in /usr/local/lib/python3.7/dist-packages (from black==21.4b2->detectron2==0.6) (3.10.0.2)
Collecting regex>=2020.1.8
  Downloading regex-2021.11.10-cp37-cp37m-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (749 kB)
|██████████| 749 kB 55.7 MB/s
Requirement already satisfied: appdirs in /usr/local/lib/python3.7/dist-packages (from black==21.4b2->detectron2==0.6) (1.4.4)
Collecting mypy-extensions>=0.4.3
  Downloading mypy_extensions-0.4.3-py2.py3-none-any.whl (4.5 kB)
Collecting typed-ast>=1.4.2
  Downloading typed_ast-1.5.0-cp37-cp37m-manylinux_2_5_x86_64.manylinux1_x86_64.manylinux_2_12_x86_64.manylinux2010_x86_64.whl (843 kB)
|██████████| 843 kB 37.3 MB/s
Requirement already satisfied: toml>=0.10.1 in /usr/local/lib/python3.7/dist-packages (from black==21.4b2->detectron2==0.6) (0.10.2)
Collecting pathspec<1,>=0.8.1
  Downloading pathspec-0.9.0-py2.py3-none-any.whl (31 kB)
Requirement already satisfied: click>=7.1.2 in /usr/local/lib/python3.7/dist-packages (from black==21.4b2->detectron2==0.6) (7.1.2)
Requirement already satisfied: numpy in /usr/local/lib/python3.7/dist-packages (from fvcore<0.1.6,>=0.1.5->detectron2==0.6) (1.19.5)
Collecting pyyaml>=5.1
  Downloading PyYAML-6.0-cp37-cp37m-manylinux_2_5_x86_64.manylinux1_x86_64.manylinux_2_12_x86_64.manylinux2010_x86_64.whl (596 kB)
|██████████| 596 kB 72.3 MB/s
Requirement already satisfied: importlib-resources in /usr/local/lib/python3.7/dist-packages (from hydra-core>=1.1->detectron2==0.6) (5.4.0)
Collecting antlr4-python3-runtime==4.8
  Downloading antlr4-python3-runtime-4.8.tar.gz (112 kB)
|██████████| 112 kB 78.1 MB/s
Collecting portalocker
  Downloading portalocker-2.3.2-py2.py3-none-any.whl (15 kB)
Requirement already satisfied: setuptools>=18.0 in /usr/local/lib/python3.7/dist-packages (from pycocotools>=2.0.2->detectron2==0.6) (57.4.0)
Requirement already satisfied: cython>=0.27.3 in /usr/local/lib/python3.7/dist-packages (from pycocotools>=2.0.2->detectron2==0.6) (0.29.24)
Requirement already satisfied: pyparsing!=2.0.4,!>=2.1.2,!>=2.1.6,>=2.0.1 in /usr/local/lib/python3.7/dist-packages (from matplotlib->detectron2==0.6) (3.0.6)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.7/dist-packages (from matplotlib->detectron2==0.6) (0.11.0)
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.7/dist-packages (from matplotlib->detectron2==0.6) (1.3.2)
Requirement already satisfied: python-dateutil>=2.1 in /usr/local/lib/python3.7/dist-packages (from matplotlib->detectron2==0.6) (2.8.2)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/dist-packages (from python-dateutil>=2.1->matplotlib->detectron2==0.6) (1.15.0)
```

```
Requirement already satisfied: zipp>=3.1.0 in /usr/local/lib/python3.7/dist-packages (from importlib-resources->hydr
a-core>=1.1->detectron2==0.6) (3.6.0)
Requirement already satisfied: absl-py>=0.4 in /usr/local/lib/python3.7/dist-packages (from tensorboard->detectron2=
=0.6) (0.12.0)
Requirement already satisfied: tensorboard-plugin-wit>=1.6.0 in /usr/local/lib/python3.7/dist-packages (from tensorb
oard->detectron2==0.6) (1.8.0)
Requirement already satisfied: grpcio>=1.24.3 in /usr/local/lib/python3.7/dist-packages (from tensorboard->detectron
2==0.6) (1.42.0)
Requirement already satisfied: tensorboard-data-server<0.7.0,>=0.6.0 in /usr/local/lib/python3.7/dist-packages (from
tensorboard->detectron2==0.6) (0.6.1)
Requirement already satisfied: google-auth<3,>=1.6.3 in /usr/local/lib/python3.7/dist-packages (from tensorboard->de
tectron2==0.6) (1.35.0)
Requirement already satisfied: requests<3,>=2.21.0 in /usr/local/lib/python3.7/dist-packages (from tensorboard->dete
ctron2==0.6) (2.23.0)
Requirement already satisfied: markdown>=2.6.8 in /usr/local/lib/python3.7/dist-packages (from tensorboard->detectro
n2==0.6) (3.3.6)
Requirement already satisfied: google-auth-oauthlib<0.5,>=0.4.1 in /usr/local/lib/python3.7/dist-packages (from tens
orboard->detectron2==0.6) (0.4.6)
Requirement already satisfied: wheel>=0.26 in /usr/local/lib/python3.7/dist-packages (from tensorboard->detectron2==
0.6) (0.37.0)
Requirement already satisfied: protobuf>=3.6.0 in /usr/local/lib/python3.7/dist-packages (from tensorboard->detectro
n2==0.6) (3.17.3)
Requirement already satisfied: werkzeug>=0.11.15 in /usr/local/lib/python3.7/dist-packages (from tensorboard->detect
ron2==0.6) (1.0.1)
Requirement already satisfied: cachetools<5.0,>=2.0.0 in /usr/local/lib/python3.7/dist-packages (from google-auth<3,
>=1.6.3->tensorboard->detectron2==0.6) (4.2.4)
Requirement already satisfied: rsa<5,>=3.1.4 in /usr/local/lib/python3.7/dist-packages (from google-auth<3,>=1.6.3->
tensorboard->detectron2==0.6) (4.7.2)
Requirement already satisfied: pyasn1-modules>=0.2.1 in /usr/local/lib/python3.7/dist-packages (from google-auth<3,>
=1.6.3->tensorboard->detectron2==0.6) (0.2.8)
Requirement already satisfied: requests-oauthlib>=0.7.0 in /usr/local/lib/python3.7/dist-packages (from google-auth-
oauthlib<0.5,>=0.4.1->tensorboard->detectron2==0.6) (1.3.0)
Requirement already satisfied: importlib-metadata>=4.4 in /usr/local/lib/python3.7/dist-packages (from markdown>=2.
6.8->tensorboard->detectron2==0.6) (4.8.2)
Requirement already satisfied: pyasn1<0.5.0,>=0.4.6 in /usr/local/lib/python3.7/dist-packages (from pyasn1-modules>=
0.2.1->google-auth<3,>=1.6.3->tensorboard->detectron2==0.6) (0.4.8)
Requirement already satisfied: idna<3,>=2.5 in /usr/local/lib/python3.7/dist-packages (from requests<3,>=2.21.0->t
ensorboard->detectron2==0.6) (2.10)
Requirement already satisfied: urllib3!=1.25.0,!>1.25.1,<1.26,>=1.21.1 in /usr/local/lib/python3.7/dist-packages (fr
om requests<3,>=2.21.0->tensorboard->detectron2==0.6) (1.24.3)
Requirement already satisfied: chardet<4,>=3.0.2 in /usr/local/lib/python3.7/dist-packages (from requests<3,>=2.21.0
->tensorboard->detectron2==0.6) (3.0.4)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.7/dist-packages (from requests<3,>=2.21.
0->tensorboard->detectron2==0.6) (2021.10.8)
Requirement already satisfied: oauthlib>=3.0.0 in /usr/local/lib/python3.7/dist-packages (from requests-oauthlib>=0.
7.0->google-auth-oauthlib<0.5,>=0.4.1->tensorboard->detectron2==0.6) (3.1.1)
Building wheels for collected packages: detectron2, fvcore, antlr4-python3-runtime, pycocotools
  Building wheel for detectron2 (setup.py) ... done
  Created wheel for detectron2: filename=detectron2-0.6-cp37-cp37m-linux_x86_64.whl size=5731482 sha256=1e01ab013645
7950779f0bcf9e4048423695e79145646a78599e28e4e8787e17
  Stored in directory: /tmp/pip-ephem-wheel-cache-4ebp3pl9/wheels/07/dc/32/0322cb484dbe fab8b9366bfedba ff5060ac7d149d
69c27ca5d
  Building wheel for fvcore (setup.py) ... done
  Created wheel for fvcore: filename=fvcore-0.1.5.post20211023-py3-none-any.whl size=60947 sha256=ad364e0713931eff7a
82aaee3c1ddba332556b899049746ee0b80c0ea2fcff2da
  Stored in directory: /root/.cache/pip/wheels/16/98/fc/252d62cab6263c719120e06b28f3378af59b52ce7a20e81852
  Building wheel for antlr4-python3-runtime (setup.py) ... done
  Created wheel for antlr4-python3-runtime: filename=antlr4_python3_runtime-4.8-py3-none-any.whl size=141230 sha256=
8a343f5a3b88c350f5238a838662d6e238ae96169b7b547f75cf579a2b9a53d5
  Stored in directory: /root/.cache/pip/wheels/ca/33/b7/336836125fc9bb4ceaa4376d8abca10ca8bc84ddc824baea6c
  Building wheel for pycocotools (setup.py) ... done
  Created wheel for pycocotools: filename=pycocotools-2.0.2-cp37-cp37m-linux_x86_64.whl size=264002 sha256=8ed8d5e09
4cb01b2381ddfdc14f94966b87ec3e128d96f7e925ealde315b8ab6
  Stored in directory: /root/.cache/pip/wheels/bc/cf/1b/e95c99c5f9d1648be3f500ca55e7ce55f24818b0f48336adaf
Successfully built detectron2 fvcore antlr4-python3-runtime pycocotools
Installing collected packages: pyyaml, portalocker, antlr4-python3-runtime, yacs, typed-ast, regex, pathspec, omegaconf, mypy-extensions, iopath, pycocotools, hydra-core, fvcore, black, detectron2
  Attempting uninstall: pyyaml
    Found existing installation: PyYAML 3.13
    Uninstalling PyYAML-3.13:
      Successfully uninstalled PyYAML-3.13
  Attempting uninstall: regex
    Found existing installation: regex 2019.12.20
    Uninstalling regex-2019.12.20:
      Successfully uninstalled regex-2019.12.20
  Attempting uninstall: pycocotools
    Found existing installation: pycocotools 2.0
    Uninstalling pycocotools-2.0:
      Successfully uninstalled pycocotools-2.0
Successfully installed antlr4-python3-runtime-4.8 black-21.4b2 detectron2-0.6 fvcore-0.1.5.post20211023 hydra-core-
1.1.1 iopath-0.1.9 mypy-extensions-0.4.3 omegaconf-2.1.1 pathspec-0.9.0 portalocker-2.3.2 pycocotools-2.0.2 pyyaml-
```

```
In [ ]: !nvcc --version
```

```
nvcc: NVIDIA (R) Cuda compiler driver
Copyright (c) 2005-2020 NVIDIA Corporation
Built on Mon_Oct_12_20:09:46_PDT_2020
Cuda compilation tools, release 11.1, V11.1.105
Build cuda_11.1.TC455_06.29190527_0
```

```
In [5]: import torch
print(torch.__version__, torch.cuda.is_available())
1.10.0+cu111 True
```

```
In [6]: print(torch.cuda.is_available())
print(torch.cuda.current_device())
print(torch.cuda.get_device_name(0))
True
0
Tesla P100-PCIE-16GB
```

```
In [7]: import detectron2
from detectron2.utils.logger import setup_logger
setup_logger()

# import some common libraries
import torch
import numpy as np
import cv2
import random
import os
import matplotlib.pyplot as plt

# model_zoo has lots of pre-trained models
from detectron2 import model_zoo

# DefaultTrainer is a class for training object detector
from detectron2.engine import DefaultTrainer
# DefaultPredictor is class for inference
from detectron2.engine import DefaultPredictor

# detectron2 has its configuration format
from detectron2.config import get_cfg
# detectron2 has implemented Visualizer of object detection
from detectron2.utils.visualizer import Visualizer

# from DatasetCatalog, detectron2 gets dataset and from MetadataCatalog it gets metadata of the dataset
from detectron2.data import DatasetCatalog, MetadataCatalog

# BoxMode supports bounding boxes in different format
from detectron2.structures import BoxMode

# COCOEvaluator based on COCO evaluation metric, inference_on_dataset is used for evaluation for a given metric
from detectron2.evaluation import COCOEvaluator, inference_on_dataset

# build_detection_test_loader, used to create test loader for evaluation
from detectron2.data import build_detection_test_loader
```

```
In [8]: %matplotlib inline
```

Format Data for Detectron2

```
In [9]: train_data_root = '/Dataset/train/Vehicle registration plate'
val_data_root = '/Dataset/validation/Vehicle registration plate'
ext = '.jpg'

train_data_name = 'Vehicle_registration_train'
test_data_name = 'Vehicle_registration_test'
```

Register Dataset

In [10]:

```
train_data_root = './Dataset/train/Vehicle registration plate'
val_data_root = './Dataset/validation/Vehicle registration plate'

train_data_name = 'license_plate_train'
val_data_name = 'license_plate_validation'

thing_classes = ['license-plates']

output_dir = 'outputs'

def count_files(data_root):
    count = 0
    for filename in os.listdir(data_root):
        if filename.endswith('.jpg'):
            count = count + 1
    return count

train_img_count = count_files(train_data_root)
print(train_img_count)
```

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```
In [11]: def get_license_plate_dicts(data_root):
    dataset_dicts = []
    filenames = []
    count = 0

    ext = '.jpg'

    for filename in os.listdir(data_root):
        if filename.endswith(ext):
            filenames.append(filename)

    for idx, filename in enumerate(filenames):
        record = {}

        image_path = os.path.join(data_root, filename)
        print(image_path)

        height, width = cv2.imread(image_path).shape[:2]
        count = count + 1
        print("Height: {}, Width: {}. Filename: {}, Count: {}".format(height, width, filename, count))

        record['file_name'] = image_path
        record['image_id'] = idx
        record['height'] = height
        record['width'] = width

        image_filename = os.path.basename(filename)
        image_name_split = filename.split('.')[0]
        image_name = image_name_split.split(' ')[0]
        annotation_path = os.path.join(data_root, 'Label', '{}.txt'.format(image_name))
        annotation_rows = []

        with open(annotation_path, "r") as f:
            for line in f:
                temp = line.rstrip().split(" ")
                annotation_rows.append(temp)

        objs = []
        for row in annotation_rows:
            #xcentre = int(float(row[3]))
            #ycentre = int(float(row[4]))
            #bwidth = int(float(row[5]))
            #bheight = int(float(row[6]))

            x1 = int(float(row[3]))
            x2 = int(float(row[4]))
            y1 = int(float(row[5]))
            y2 = int(float(row[6]))

            #xmin = int(xcentre - bwidth/2)
            #ymin = int(ycentre - bheight/2)
            #xmax = xmin + bwidth
            #ymax = ymin + bheight

            obj = {
                #'bbox': [xmin, ymin, xmax, ymax],
                'bbox': [x1, x2, y1, y2],
                'bbox_mode': BoxMode.XYXY_ABS,
                # alternatively, we can use bbox_mode = BoxMode.XYWH_ABS
                # 'bbox': [xmin, ymin, bwidth, bheight],
                # 'bbox_mode': BoxMode.XYWH_ABS,
                'category_id': int(0),
                'iscrowd': 0
            }

            objs.append(obj)
        record['annotations'] = objs
        dataset_dicts.append(record)
    return dataset_dicts
```

In [12]:

```
# register test data
DatasetCatalog.register(name=train_data_name,
    func=lambda: get_license_plate_dicts(train_data_root))
train_metadata = MetadataCatalog.get(train_data_name).set(thing_classes=thing_classes)

# register validation data
DatasetCatalog.register(name=val_data_name,
    func=lambda: get_license_plate_dicts(val_data_root))
val_metadata = MetadataCatalog.get(val_data_name).set(thing_classes=thing_classes)
```

Visualize Data

In [24]:

```
val_data_dict = get_license_plate_dicts(val_data_root)

for d in random.sample(val_data_dict, 3):
    img = cv2.imread(d["file_name"])
    visualizer = Visualizer(img[:, :, ::-1],
                           metadata=train_metadata,
                           scale=0.5)
    vis = visualizer.draw_dataset_dict(d)
    plt.figure(figsize = (12,12))
    plt.imshow(vis.get_image())
    plt.show()

./Dataset/validation/Vehicle registration plate/f73b754cdb1ab677.jpg
Height: 683, Width: 1024. Filename: f73b754cdb1ab677.jpg, Count: 1
./Dataset/validation/Vehicle registration plate/315aeadd7766727b8.jpg
Height: 768, Width: 819. Filename: 315aeadd7766727b8.jpg, Count: 2
./Dataset/validation/Vehicle registration plate/affd16c51644a893.jpg
Height: 768, Width: 1024. Filename: affd16c51644a893.jpg, Count: 3
./Dataset/validation/Vehicle registration plate/c650ff8d3e8e75b3.jpg
Height: 635, Width: 1024. Filename: c650ff8d3e8e75b3.jpg, Count: 4
./Dataset/validation/Vehicle registration plate/944281d0485869f0.jpg
Height: 682, Width: 1024. Filename: 944281d0485869f0.jpg, Count: 5
./Dataset/validation/Vehicle registration plate/6a0ef049e5ec4b16.jpg
Height: 683, Width: 1024. Filename: 6a0ef049e5ec4b16.jpg, Count: 6
./Dataset/validation/Vehicle registration plate/cb8c75fc1c7ccf73.jpg
Height: 1024, Width: 1024. Filename: cb8c75fc1c7ccf73.jpg, Count: 7
./Dataset/validation/Vehicle registration plate/7f56adf4b9306ac9.jpg
Height: 683, Width: 1024. Filename: 7f56adf4b9306ac9.jpg, Count: 8
./Dataset/validation/Vehicle registration plate/09453a7c716a9ef3.jpg
Height: 768, Width: 1024. Filename: 09453a7c716a9ef3.jpg, Count: 9
./Dataset/validation/Vehicle registration plate/d8f6c135ec5486ff.jpg
Height: 680, Width: 1024. Filename: d8f6c135ec5486ff.jpg, Count: 10
./Dataset/validation/Vehicle registration plate/895d440e05b2a8d8.jpg
Height: 751, Width: 1024. Filename: 895d440e05b2a8d8.jpg, Count: 11
./Dataset/validation/Vehicle registration plate/62bb93bbd270dd9a.jpg
Height: 684, Width: 1024. Filename: 62bb93bbd270dd9a.jpg, Count: 12
./Dataset/validation/Vehicle registration plate/c50d184afad1a9dc.jpg
Height: 768, Width: 1024. Filename: c50d184afad1a9dc.jpg, Count: 13
./Dataset/validation/Vehicle registration plate/ccc1a2d44a290368.jpg
Height: 681, Width: 1024. Filename: ccc1a2d44a290368.jpg, Count: 14
./Dataset/validation/Vehicle registration plate/e79f6777f2fc08b2.jpg
Height: 683, Width: 1024. Filename: e79f6777f2fc08b2.jpg, Count: 15
./Dataset/validation/Vehicle registration plate/90596bf3313e72e3.jpg
Height: 515, Width: 1024. Filename: 90596bf3313e72e3.jpg, Count: 16
./Dataset/validation/Vehicle registration plate/64de505bd2bac82b.jpg
Height: 768, Width: 1024. Filename: 64de505bd2bac82b.jpg, Count: 17
./Dataset/validation/Vehicle registration plate/182268e1f8c6525f.jpg
Height: 683, Width: 1024. Filename: 182268e1f8c6525f.jpg, Count: 18
./Dataset/validation/Vehicle registration plate/2fe1f00b77a110a0.jpg
Height: 683, Width: 1024. Filename: 2fe1f00b77a110a0.jpg, Count: 19
./Dataset/validation/Vehicle registration plate/f53243c2bb551b8a.jpg
Height: 683, Width: 1024. Filename: f53243c2bb551b8a.jpg, Count: 20
./Dataset/validation/Vehicle registration plate/52ceb1fc30b413e5.jpg
Height: 768, Width: 1024. Filename: 52ceb1fc30b413e5.jpg, Count: 21
./Dataset/validation/Vehicle registration plate/e82f13b4a2fe69f3.jpg
Height: 768, Width: 1024. Filename: e82f13b4a2fe69f3.jpg, Count: 22
./Dataset/validation/Vehicle registration plate/1545c73bdecbb3e2f.jpg
Height: 523, Width: 1024. Filename: 1545c73bdecbb3e2f.jpg, Count: 23
./Dataset/validation/Vehicle registration plate/4148b2126f0986a4.jpg
Height: 1024, Width: 1024. Filename: 4148b2126f0986a4.jpg, Count: 24
./Dataset/validation/Vehicle registration plate/0673b967f8c68eec.jpg
Height: 742, Width: 1024. Filename: 0673b967f8c68eec.jpg, Count: 25
./Dataset/validation/Vehicle registration plate/2b97f5bf137ee8d1.jpg
Height: 683, Width: 1024. Filename: 2b97f5bf137ee8d1.jpg, Count: 26
./Dataset/validation/Vehicle registration plate/5df8816356fc2b29.jpg
Height: 478, Width: 1024. Filename: 5df8816356fc2b29.jpg, Count: 27
```

./Dataset/validation/Vehicle registration plate/003a5aaaf6d17c917.jpg
Height: 683, Width: 1024. Filename: 003a5aaaf6d17c917.jpg, Count: 28
./Dataset/validation/Vehicle registration plate/25d5c2fb8b99662.jpg
Height: 571, Width: 1024. Filename: 25d5c2fb8b99662.jpg, Count: 29
./Dataset/validation/Vehicle registration plate/f3814f4a6121838d.jpg
Height: 512, Width: 1024. Filename: f3814f4a6121838d.jpg, Count: 30
./Dataset/validation/Vehicle registration plate/43b1b0028dd2db8d.jpg
Height: 768, Width: 1024. Filename: 43b1b0028dd2db8d.jpg, Count: 31
./Dataset/validation/Vehicle registration plate/b8a3f2ea385e45b3.jpg
Height: 576, Width: 1024. Filename: b8a3f2ea385e45b3.jpg, Count: 32
./Dataset/validation/Vehicle registration plate/d59b7a0ff294e3be.jpg
Height: 872, Width: 1024. Filename: d59b7a0ff294e3be.jpg, Count: 33
./Dataset/validation/Vehicle registration plate/29f7991e696e6e3f.jpg
Height: 683, Width: 1024. Filename: 29f7991e696e6e3f.jpg, Count: 34
./Dataset/validation/Vehicle registration plate/c1d8b110186e095a.jpg
Height: 768, Width: 1024. Filename: c1d8b110186e095a.jpg, Count: 35
./Dataset/validation/Vehicle registration plate/4e593c88022ff6b1.jpg
Height: 768, Width: 1024. Filename: 4e593c88022ff6b1.jpg, Count: 36
./Dataset/validation/Vehicle registration plate/8cdcb833ef1ef049.jpg
Height: 768, Width: 1024. Filename: 8cdcb833ef1ef049.jpg, Count: 37
./Dataset/validation/Vehicle registration plate/2e95d7a799e23e11.jpg
Height: 558, Width: 1024. Filename: 2e95d7a799e23e11.jpg, Count: 38
./Dataset/validation/Vehicle registration plate/4793138df3c05610.jpg
Height: 521, Width: 1024. Filename: 4793138df3c05610.jpg, Count: 39
./Dataset/validation/Vehicle registration plate/593e594137f374ab.jpg
Height: 681, Width: 1024. Filename: 593e594137f374ab.jpg, Count: 40
./Dataset/validation/Vehicle registration plate/017527da8bfeb97d.jpg
Height: 683, Width: 1024. Filename: 017527da8bfeb97d.jpg, Count: 41
./Dataset/validation/Vehicle registration plate/be654a7eabe0e891.jpg
Height: 768, Width: 1024. Filename: be654a7eabe0e891.jpg, Count: 42
./Dataset/validation/Vehicle registration plate/bf0aac0878b0a3d2.jpg
Height: 776, Width: 1024. Filename: bf0aac0878b0a3d2.jpg, Count: 43
./Dataset/validation/Vehicle registration plate/0727983dd5f9e4e6.jpg
Height: 768, Width: 1024. Filename: 0727983dd5f9e4e6.jpg, Count: 44
./Dataset/validation/Vehicle registration plate/63d3df798bc8840f.jpg
Height: 1024, Width: 1024. Filename: 63d3df798bc8840f.jpg, Count: 45
./Dataset/validation/Vehicle registration plate/299f0363ae21d1c3.jpg
Height: 683, Width: 1024. Filename: 299f0363ae21d1c3.jpg, Count: 46
./Dataset/validation/Vehicle registration plate/e8b36c888a75d742.jpg
Height: 768, Width: 1024. Filename: e8b36c888a75d742.jpg, Count: 47
./Dataset/validation/Vehicle registration plate/fd07d2db70cf53d5.jpg
Height: 768, Width: 1024. Filename: fd07d2db70cf53d5.jpg, Count: 48
./Dataset/validation/Vehicle registration plate/1ca1155083156d72.jpg
Height: 683, Width: 1024. Filename: 1ca1155083156d72.jpg, Count: 49
./Dataset/validation/Vehicle registration plate/955a8e4c8ba8116e.jpg
Height: 768, Width: 1024. Filename: 955a8e4c8ba8116e.jpg, Count: 50
./Dataset/validation/Vehicle registration plate/67945cf7a6beccdf.jpg
Height: 576, Width: 1024. Filename: 67945cf7a6beccdf.jpg, Count: 51
./Dataset/validation/Vehicle registration plate/5373ec295ea62c47.jpg
Height: 683, Width: 1024. Filename: 5373ec295ea62c47.jpg, Count: 52
./Dataset/validation/Vehicle registration plate/1db3793d7c84fa1.jpg
Height: 768, Width: 1024. Filename: 1db3793d7c84fa1.jpg, Count: 53
./Dataset/validation/Vehicle registration plate/4cb48c8bf41b70a4.jpg
Height: 768, Width: 1024. Filename: 4cb48c8bf41b70a4.jpg, Count: 54
./Dataset/validation/Vehicle registration plate/f9170e8c13a99991.jpg
Height: 823, Width: 1024. Filename: f9170e8c13a99991.jpg, Count: 55
./Dataset/validation/Vehicle registration plate/9286a99f243b359a.jpg
Height: 769, Width: 1024. Filename: 9286a99f243b359a.jpg, Count: 56
./Dataset/validation/Vehicle registration plate/73467682c5995b65.jpg
Height: 771, Width: 1024. Filename: 73467682c5995b65.jpg, Count: 57
./Dataset/validation/Vehicle registration plate/9498d0aff8f9ff8c.jpg
Height: 599, Width: 1024. Filename: 9498d0aff8f9ff8c.jpg, Count: 58
./Dataset/validation/Vehicle registration plate/b1096bc91a89b0cf.jpg
Height: 712, Width: 1024. Filename: b1096bc91a89b0cf.jpg, Count: 59
./Dataset/validation/Vehicle registration plate/343326e127297379.jpg
Height: 683, Width: 1024. Filename: 343326e127297379.jpg, Count: 60
./Dataset/validation/Vehicle registration plate/de2b5afb7eda96cf.jpg
Height: 682, Width: 1024. Filename: de2b5afb7eda96cf.jpg, Count: 61
./Dataset/validation/Vehicle registration plate/0c756c9366a8cb10.jpg
Height: 768, Width: 1024. Filename: 0c756c9366a8cb10.jpg, Count: 62
./Dataset/validation/Vehicle registration plate/140e8d10ff02e7e7.jpg
Height: 683, Width: 1024. Filename: 140e8d10ff02e7e7.jpg, Count: 63
./Dataset/validation/Vehicle registration plate/be9fd0014b5a4f2a.jpg
Height: 689, Width: 1024. Filename: be9fd0014b5a4f2a.jpg, Count: 64
./Dataset/validation/Vehicle registration plate/488722909dd9c0ac.jpg
Height: 768, Width: 1024. Filename: 488722909dd9c0ac.jpg, Count: 65
./Dataset/validation/Vehicle registration plate/30b6cfb60bf44533.jpg
Height: 1024, Width: 1024. Filename: 30b6cfb60bf44533.jpg, Count: 66
./Dataset/validation/Vehicle registration plate/044417ca6134604f.jpg
Height: 683, Width: 1024. Filename: 044417ca6134604f.jpg, Count: 67
./Dataset/validation/Vehicle registration plate/fb55b73f241bf50a.jpg

./Dataset/validation/Vehicle registration plate/e5edf93b7c9f5edb.jpg
Height: 759, Width: 1024. Filename: e5edf93b7c9f5edb.jpg, Count: 352
./Dataset/validation/Vehicle registration plate/50631041f74001aa.jpg
Height: 685, Width: 1024. Filename: 50631041f74001aa.jpg, Count: 353
./Dataset/validation/Vehicle registration plate/daac3a6c64a79bea.jpg
Height: 1024, Width: 780. Filename: daac3a6c64a79bea.jpg, Count: 354
./Dataset/validation/Vehicle registration plate/50c37aeaf19acd5b.jpg
Height: 683, Width: 1024. Filename: 50c37aeaf19acd5b.jpg, Count: 355
./Dataset/validation/Vehicle registration plate/2bd26c63ebf598b7.jpg
Height: 683, Width: 1024. Filename: 2bd26c63ebf598b7.jpg, Count: 356
./Dataset/validation/Vehicle registration plate/19eba8ac64eed194.jpg
Height: 768, Width: 1024. Filename: 19eba8ac64eed194.jpg, Count: 357
./Dataset/validation/Vehicle registration plate/8c63cf76166c3bd7.jpg
Height: 773, Width: 1024. Filename: 8c63cf76166c3bd7.jpg, Count: 358
./Dataset/validation/Vehicle registration plate/d5058059dc0ce0ad.jpg
Height: 768, Width: 1024. Filename: d5058059dc0ce0ad.jpg, Count: 359
./Dataset/validation/Vehicle registration plate/d9fa2abf3719a4bd.jpg
Height: 768, Width: 1024. Filename: d9fa2abf3719a4bd.jpg, Count: 360
./Dataset/validation/Vehicle registration plate/53925df03b471f5d.jpg
Height: 768, Width: 1024. Filename: 53925df03b471f5d.jpg, Count: 361
./Dataset/validation/Vehicle registration plate/1f0e643b125f00ec.jpg
Height: 682, Width: 1024. Filename: 1f0e643b125f00ec.jpg, Count: 362
./Dataset/validation/Vehicle registration plate/9ebba4d1f8d6e7b.jpg
Height: 528, Width: 1024. Filename: 9ebba4d1f8d6e7b.jpg, Count: 363
./Dataset/validation/Vehicle registration plate/edecf3a6d569b7c9.jpg
Height: 1024, Width: 683. Filename: edecf3a6d569b7c9.jpg, Count: 364
./Dataset/validation/Vehicle registration plate/415d64bf8cfe82f2.jpg
Height: 683, Width: 1024. Filename: 415d64bf8cfe82f2.jpg, Count: 365
./Dataset/validation/Vehicle registration plate/9034927e7438bdd6.jpg
Height: 1024, Width: 737. Filename: 9034927e7438bdd6.jpg, Count: 366
./Dataset/validation/Vehicle registration plate/b3b61da98e22cd4a.jpg
Height: 768, Width: 1024. Filename: b3b61da98e22cd4a.jpg, Count: 367
./Dataset/validation/Vehicle registration plate/69450fa183d57a7b.jpg
Height: 604, Width: 1024. Filename: 69450fa183d57a7b.jpg, Count: 368
./Dataset/validation/Vehicle registration plate/fa897478280a2758.jpg
Height: 768, Width: 1024. Filename: fa897478280a2758.jpg, Count: 369
./Dataset/validation/Vehicle registration plate/6b113b3edbadfe5d.jpg
Height: 768, Width: 1024. Filename: 6b113b3edbadfe5d.jpg, Count: 370
./Dataset/validation/Vehicle registration plate/67c834b73882a9f9.jpg
Height: 717, Width: 1024. Filename: 67c834b73882a9f9.jpg, Count: 371
./Dataset/validation/Vehicle registration plate/0fbdb85fc01d2ae.jpg
Height: 615, Width: 1024. Filename: 0fbdb85fc01d2ae.jpg, Count: 372
./Dataset/validation/Vehicle registration plate/b101900b26128253.jpg
Height: 768, Width: 1024. Filename: b101900b26128253.jpg, Count: 373
./Dataset/validation/Vehicle registration plate/53ad98b12752ad16.jpg
Height: 768, Width: 1024. Filename: 53ad98b12752ad16.jpg, Count: 374
./Dataset/validation/Vehicle registration plate/f5d1729aa333b284.jpg
Height: 768, Width: 1024. Filename: f5d1729aa333b284.jpg, Count: 375
./Dataset/validation/Vehicle registration plate/d027c6e32db60e3c.jpg
Height: 768, Width: 1024. Filename: d027c6e32db60e3c.jpg, Count: 376
./Dataset/validation/Vehicle registration plate/302d636c896c263f.jpg
Height: 683, Width: 1024. Filename: 302d636c896c263f.jpg, Count: 377
./Dataset/validation/Vehicle registration plate/54ebca2064066a49.jpg
Height: 683, Width: 1024. Filename: 54ebca2064066a49.jpg, Count: 378
./Dataset/validation/Vehicle registration plate/a774a6f81fea258b.jpg
Height: 768, Width: 1024. Filename: a774a6f81fea258b.jpg, Count: 379
./Dataset/validation/Vehicle registration plate/f1131b93a33cef9.jpg
Height: 683, Width: 1024. Filename: f1131b93a33cef9.jpg, Count: 380
./Dataset/validation/Vehicle registration plate/844adfe06e003c09.jpg
Height: 768, Width: 1024. Filename: 844adfe06e003c09.jpg, Count: 381
./Dataset/validation/Vehicle registration plate/2619ec27a314e69c.jpg
Height: 768, Width: 1024. Filename: 2619ec27a314e69c.jpg, Count: 382
./Dataset/validation/Vehicle registration plate/f38265abb22a00e4.jpg
Height: 694, Width: 1024. Filename: f38265abb22a00e4.jpg, Count: 383
./Dataset/validation/Vehicle registration plate/2f90aaa72744452d.jpg
Height: 768, Width: 1024. Filename: 2f90aaa72744452d.jpg, Count: 384
./Dataset/validation/Vehicle registration plate/82b53fe7f9147c96.jpg
Height: 685, Width: 1024. Filename: 82b53fe7f9147c96.jpg, Count: 385



2. Training

- Share the loss plot of your training using tensorboard.dev.

Detectron2 Configuration

In [13]:

```
# Default configuration
cfg = get_cfg()

# Update configuration with RetinaNet configuration
cfg.merge_from_file(model_zoo.get_config_file("COCO-Detection/retinanet_R_50_FPN_3x.yaml"))

# Replace Detectron2 default train dataset with our train dataset
cfg.DATASETS.TRAIN = (train_data_name,)

# Update cfg.DATASET.TEST with empty tuple
cfg.DATASETS.TEST = ()
```

Loading config /usr/local/lib/python3.7/dist-packages/detectron2/model_zoo/configs/COCO-Detection/..../Base-RetinaNet.yaml with yaml.unsafe_load. Your machine may be at risk if the file contains malicious content.

In [14]:

```
# Data loader configuration
cfg.DATALOADER.NUM_WORKERS = 4
```

In [15]:

```
# Update model URL in Detectron2 config file
cfg.MODEL.WEIGHTS = model_zoo.get_checkpoint_url("COCO-Detection/retinanet_R_50_FPN_3x.yaml")
```

Solver Configuration

In [17]:

```
# batch size
cfg.SOLVER.IMS_PER_BATCH = 4

# learning rate
cfg.SOLVER.BASE_LR = 0.001

# define iterations
epoch = 2
max_iter = int(epoch * train_img_count / cfg.SOLVER.IMS_PER_BATCH)
#max_iter = 500

cfg.SOLVER.MAX_ITER = max_iter
print(max_iter)
```

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In [18]:

```
# number of output class - only one - License Plate
cfg.MODEL.RETINANET.NUM_CLASSES = len(thing_classes)
```

In [19]:

```
# update create output directory
cfg.OUTPUT_DIR = output_dir
os.makedirs(cfg.OUTPUT_DIR, exist_ok=True)
```

Set Up Tensorboard

In [27]:

```
%load_ext tensorboard

%tensorboard --logdir outputs
```

The tensorboard extension is already loaded. To reload it, use:

```
%reload_ext tensorboard
Reusing TensorBoard on port 6006 (pid 679), started 2:46:14 ago. (Use '!kill 679' to kill it.)
```

In [44]:

```
%reload_ext tensorboard

%tensorboard --logdir outputs
```

Reusing TensorBoard on port 6006 (pid 679), started 3:41:19 ago. (Use '!kill 679' to kill it.)

Tensorboard Experiment:

<https://tensorboard.dev/experiment/CoBkEkE1SQOaxJee1qaCww/#scalars>

In [43]:

```
!tensorboard dev upload --logdir ./outputs \
--name "Project 3 Object Detection" \
--description "License Plate Detection w/ Detectron2" \
--one_shot

***** TensorBoard Uploader *****

This will upload your TensorBoard logs to https://tensorboard.dev/ from
the following directory:

./outputs

This TensorBoard will be visible to everyone. Do not upload sensitive
data.

Your use of this service is subject to Google's Terms of Service
<https://policies.google.com/terms> and Privacy Policy
<https://policies.google.com/privacy>, and TensorBoard.dev's Terms of Service
<https://tensorboard.dev/policy/terms/>.

This notice will not be shown again while you are logged into the uploader.
To log out, run `tensorboard dev auth revoke`.
```

Continue? (yes/NO) yes

```
Please visit this URL to authorize this application: https://accounts.google.com/o/oauth2/auth?response_type=code&client_id=373649185512-8v619h5kft3814456nm2dj4ubeqsrh6.apps.googleusercontent.com&redirect_uri=urn%3Aietf%3Awg%3Aoauth%3A2.0%3Aoob&scope=openid+https%3A%2F%2Fwww.googleapis.com%2Fauth%2Fuserinfo.email&state=mJLJjs4lQUVBD90q9T1DTHqy3J8sPX&prompt=consent&access_type=offline
Enter the authorization code: 4/1AX4XfWjbktb7g0_wbVC9MjfmnsiNrFtEgASTinNv9ZcgWTplM8aLtEylAxI
```

New experiment created. View your TensorBoard at: <https://tensorboard.dev/experiment/CoBkEkE1SQOaxJee1qaCww/>

```
[2021-11-22T20:13:58] Started scanning logdir.
[2021-11-22T20:13:59] Total uploaded: 1872 scalars, 0 tensors, 0 binary objects
[2021-11-22T20:13:59] Done scanning logdir.
```

Done. View your TensorBoard at <https://tensorboard.dev/experiment/CoBkEkE1SQOaxJee1qaCww/>

Training

In [21]:

```
# Create a trainer instance with the configuration
trainer = DefaultTrainer(cfg)

# if resume=False, because we don't have trained model yet.
trainer.resume_or_load(resume=False)

# start training
trainer.train()
```

```
Streaming output truncated to the last 5000 lines.
Height: 577, Width: 1024. Filename: 171cf18f57cf0e3a.jpg, Count: 2832
./Dataset/train/Vehicle registration plate/9de855abf6dc972d.jpg
Height: 683, Width: 1024. Filename: 9de855abf6dc972d.jpg, Count: 2833
./Dataset/train/Vehicle registration plate/4080d6d6081fceff.jpg
Height: 768, Width: 1024. Filename: 4080d6d6081fceff.jpg, Count: 2834
./Dataset/train/Vehicle registration plate/1c583f5f87eeea30.jpg
Height: 640, Width: 1024. Filename: 1c583f5f87eeea30.jpg, Count: 2835
./Dataset/train/Vehicle registration plate/828b7a2bf9e52690.jpg
Height: 768, Width: 1024. Filename: 828b7a2bf9e52690.jpg, Count: 2836
./Dataset/train/Vehicle registration plate/047efe4a7f176cca.jpg
Height: 684, Width: 1024. Filename: 047efe4a7f176cca.jpg, Count: 2837
./Dataset/train/Vehicle registration plate/5dfe9be278d26861.jpg
Height: 1024, Width: 768. Filename: 5dfe9be278d26861.jpg, Count: 2838
./Dataset/train/Vehicle registration plate/bda2907a6cc27817.jpg
Height: 768, Width: 1024. Filename: bda2907a6cc27817.jpg, Count: 2839
./Dataset/train/Vehicle registration plate/01121f7b33853547.jpg
Height: 768, Width: 1024. Filename: 01121f7b33853547.jpg, Count: 2840
./Dataset/train/Vehicle registration plate/a6d807e56dfc614c.jpg
Height: 768, Width: 1024. Filename: a6d807e56dfc614c.jpg, Count: 2841
./Dataset/train/Vehicle registration plate/628563cc032bcc83.jpg
```

Height: 751, Width: 1024. Filename: 628563cc032bcc83.jpg, Count: 2842
./Dataset/train/Vehicle registration plate/be9430a477de4e57.jpg
Height: 768, Width: 1024. Filename: be9430a477de4e57.jpg, Count: 2843
./Dataset/train/Vehicle registration plate/ef544ed16f5e66b5.jpg
Height: 768, Width: 1024. Filename: ef544ed16f5e66b5.jpg, Count: 2844
./Dataset/train/Vehicle registration plate/b5c442ad1fd57366.jpg
Height: 683, Width: 1024. Filename: b5c442ad1fd57366.jpg, Count: 2845
./Dataset/train/Vehicle registration plate/c4b79ee255e53c50.jpg
Height: 768, Width: 1024. Filename: c4b79ee255e53c50.jpg, Count: 2846
./Dataset/train/Vehicle registration plate/70c262fa51c5f85f.jpg
Height: 547, Width: 1024. Filename: 70c262fa51c5f85f.jpg, Count: 2847
./Dataset/train/Vehicle registration plate/f26eaac6cec7010d.jpg
Height: 683, Width: 1024. Filename: f26eaac6cec7010d.jpg, Count: 2848
./Dataset/train/Vehicle registration plate/6904af7d1461f553.jpg
Height: 687, Width: 1024. Filename: 6904af7d1461f553.jpg, Count: 2849
./Dataset/train/Vehicle registration plate/4c9def12b33c6e73.jpg
Height: 768, Width: 1024. Filename: 4c9def12b33c6e73.jpg, Count: 2850
./Dataset/train/Vehicle registration plate/0ade5dbc0d8e78de.jpg
Height: 685, Width: 1024. Filename: 0ade5dbc0d8e78de.jpg, Count: 2851
./Dataset/train/Vehicle registration plate/9a32b564317ddfa3.jpg
Height: 790, Width: 1024. Filename: 9a32b564317ddfa3.jpg, Count: 2852
./Dataset/train/Vehicle registration plate/7546744f4a3a7754.jpg
Height: 768, Width: 1024. Filename: 7546744f4a3a7754.jpg, Count: 2853
./Dataset/train/Vehicle registration plate/0016bd822c0a9511.jpg
Height: 768, Width: 1024. Filename: 0016bd822c0a9511.jpg, Count: 2854
./Dataset/train/Vehicle registration plate/1db732bf9563795e.jpg
Height: 768, Width: 1024. Filename: 1db732bf9563795e.jpg, Count: 2855
./Dataset/train/Vehicle registration plate/1a5b2739b4e289ea.jpg
Height: 492, Width: 1024. Filename: 1a5b2739b4e289ea.jpg, Count: 2856
./Dataset/train/Vehicle registration plate/1191454739a48d88.jpg
Height: 1024, Width: 614. Filename: 1191454739a48d88.jpg, Count: 2857
./Dataset/train/Vehicle registration plate/59d19a8436bbaba8.jpg
Height: 573, Width: 1024. Filename: 59d19a8436bbaba8.jpg, Count: 2858
./Dataset/train/Vehicle registration plate/19de167e69af5115.jpg
Height: 683, Width: 1024. Filename: 19de167e69af5115.jpg, Count: 2859
./Dataset/train/Vehicle registration plate/c409373c5b2dc796.jpg
Height: 1024, Width: 768. Filename: c409373c5b2dc796.jpg, Count: 2860
./Dataset/train/Vehicle registration plate/9aa27bf68c418619.jpg
Height: 1024, Width: 683. Filename: 9aa27bf68c418619.jpg, Count: 2861
./Dataset/train/Vehicle registration plate/3eb002372e0db95b.jpg
Height: 768, Width: 1024. Filename: 3eb002372e0db95b.jpg, Count: 2862
./Dataset/train/Vehicle registration plate/9149d679d83e5266.jpg
Height: 576, Width: 1024. Filename: 9149d679d83e5266.jpg, Count: 2863
./Dataset/train/Vehicle registration plate/f99543be4ac9c607.jpg
Height: 683, Width: 1024. Filename: f99543be4ac9c607.jpg, Count: 2864
./Dataset/train/Vehicle registration plate/06281410c3ae590d.jpg
Height: 646, Width: 1024. Filename: 06281410c3ae590d.jpg, Count: 2865
./Dataset/train/Vehicle registration plate/778446cf6ae411d8.jpg
Height: 798, Width: 1024. Filename: 778446cf6ae411d8.jpg, Count: 2866
./Dataset/train/Vehicle registration plate/00f220d92e7681e7.jpg
Height: 741, Width: 1024. Filename: 00f220d92e7681e7.jpg, Count: 2867
./Dataset/train/Vehicle registration plate/0061db4fbe34adad.jpg
Height: 640, Width: 1024. Filename: 0061db4fbe34adad.jpg, Count: 2868
./Dataset/train/Vehicle registration plate/1b55621372668519.jpg
Height: 683, Width: 1024. Filename: 1b55621372668519.jpg, Count: 2869
./Dataset/train/Vehicle registration plate/c78e400cbd1f8f48.jpg
Height: 768, Width: 1024. Filename: c78e400cbd1f8f48.jpg, Count: 2870
./Dataset/train/Vehicle registration plate/681fc4b687215a76.jpg
Height: 787, Width: 1024. Filename: 681fc4b687215a76.jpg, Count: 2871
./Dataset/train/Vehicle registration plate/82b9679c3d214108.jpg
Height: 768, Width: 1024. Filename: 82b9679c3d214108.jpg, Count: 2872
./Dataset/train/Vehicle registration plate/fcccd499be630ca52.jpg
Height: 768, Width: 1024. Filename: fcccd499be630ca52.jpg, Count: 2873
./Dataset/train/Vehicle registration plate/4d470b52bb9e758e.jpg
Height: 681, Width: 1024. Filename: 4d470b52bb9e758e.jpg, Count: 2874
./Dataset/train/Vehicle registration plate/4255fe1e007d2915.jpg
Height: 768, Width: 1024. Filename: 4255fe1e007d2915.jpg, Count: 2875
./Dataset/train/Vehicle registration plate/0a314340d4d2873f.jpg
Height: 768, Width: 1024. Filename: 0a314340d4d2873f.jpg, Count: 2876
./Dataset/train/Vehicle registration plate/46bd46306ba4f22e (1).jpg
Height: 768, Width: 1024. Filename: 46bd46306ba4f22e (1).jpg, Count: 2877
./Dataset/train/Vehicle registration plate/ee03b12cc889bcc1.jpg
Height: 768, Width: 1024. Filename: ee03b12cc889bcc1.jpg, Count: 2878
./Dataset/train/Vehicle registration plate/b63ca3779c1ad21a.jpg
Height: 768, Width: 1024. Filename: b63ca3779c1ad21a.jpg, Count: 2879
./Dataset/train/Vehicle registration plate/c044849d7c171e4a.jpg
Height: 681, Width: 1024. Filename: c044849d7c171e4a.jpg, Count: 2880
./Dataset/train/Vehicle registration plate/46bd46306ba4f22e.jpg
Height: 768, Width: 1024. Filename: 46bd46306ba4f22e.jpg, Count: 2881
./Dataset/train/Vehicle registration plate/ab5f3da08d0fa8ee.jpg
Height: 681, Width: 1024. Filename: ab5f3da08d0fa8ee.jpg, Count: 2882

```
./Dataset/train/Vehicle registration plate/41ce67021d8dc21b.jpg
Height: 683, Width: 1024. Filename: 41ce67021d8dc21b.jpg, Count: 5313
./Dataset/train/Vehicle registration plate/00749e86d631cba0.jpg
Height: 683, Width: 1024. Filename: 00749e86d631cba0.jpg, Count: 5314
./Dataset/train/Vehicle registration plate/07ed6078ba96d0c5.jpg
Height: 768, Width: 1024. Filename: 07ed6078ba96d0c5.jpg, Count: 5315
./Dataset/train/Vehicle registration plate/3cd3406c658e54d6.jpg
Height: 708, Width: 1024. Filename: 3cd3406c658e54d6.jpg, Count: 5316
./Dataset/train/Vehicle registration plate/c410643d74cedf61.jpg
Height: 683, Width: 1024. Filename: c410643d74cedf61.jpg, Count: 5317
./Dataset/train/Vehicle registration plate/f0db45fa5cd0efe7.jpg
Height: 683, Width: 1024. Filename: f0db45fa5cd0efe7.jpg, Count: 5318
./Dataset/train/Vehicle registration plate/001679a19bb6fd3f.jpg
Height: 768, Width: 1024. Filename: 001679a19bb6fd3f.jpg, Count: 5319
./Dataset/train/Vehicle registration plate/50fdbccbefc1736a.jpg
Height: 1024, Width: 1024. Filename: 50fdbccbefc1736a.jpg, Count: 5320
./Dataset/train/Vehicle registration plate/lea9085bc91d402b.jpg
Height: 768, Width: 1024. Filename: lea9085bc91d402b.jpg, Count: 5321
./Dataset/train/Vehicle registration plate/f3913942c822443d.jpg
Height: 768, Width: 1024. Filename: f3913942c822443d.jpg, Count: 5322
./Dataset/train/Vehicle registration plate/ae0bfed53edcb4cb.jpg
Height: 681, Width: 1024. Filename: ae0bfed53edcb4cb.jpg, Count: 5323
./Dataset/train/Vehicle registration plate/23dede11cdalcd96.jpg
Height: 1024, Width: 1024. Filename: 23dede11cdalcd96.jpg, Count: 5324
./Dataset/train/Vehicle registration plate/491a9b0bf4797514.jpg
Height: 654, Width: 1024. Filename: 491a9b0bf4797514.jpg, Count: 5325

/usr/local/lib/python3.7/dist-packages/torch/utils/data/dataloader.py:481: UserWarning: This DataLoader will create
4 worker processes in total. Our suggested max number of worker in current system is 2, which is smaller than what t
his DataLoader is going to create. Please be aware that excessive worker creation might get DataLoader running slow
or even freeze, lower the worker number to avoid potential slowness/freeze if necessary.

    cpuset_checked))

model_final_5bd44e.pkl: 152MB [00:14, 10.6MB/s]
Skip loading parameter 'head.cls_score.weight' to the model due to incompatible shapes: (720, 256, 3, 3) in the chec
kpoint but (9, 256, 3, 3) in the model! You might want to double check if this is expected.
Skip loading parameter 'head.cls_score.bias' to the model due to incompatible shapes: (720,) in the checkpoint but
(9,) in the model! You might want to double check if this is expected.
Some model parameters or buffers are not found in the checkpoint:
head.cls_score.{bias, weight}

The checkpoint state_dict contains keys that are not used by the model:
    pixel_mean
    pixel_std
[11/22 18:46:32 d2.engine.train_loop]: Starting training from iteration 0

/usr/local/lib/python3.7/dist-packages/torch/utils/data/dataloader.py:481: UserWarning: This DataLoader will create
4 worker processes in total. Our suggested max number of worker in current system is 2, which is smaller than what t
his DataLoader is going to create. Please be aware that excessive worker creation might get DataLoader running slow
or even freeze, lower the worker number to avoid potential slowness/freeze if necessary.

    cpuset_checked))

/usr/local/lib/python3.7/dist-packages/torch/functional.py:445: UserWarning: torch.meshgrid: in an upcoming release,
it will be required to pass the indexing argument. (Triggered internally at  ../../aten/src/ATen/native/TensorShape.cp
p:2157.)
    return _VF.meshgrid(tensors, **kwargs) # type: ignore[attr-defined]
[11/22 18:46:54 d2.utils.events]: eta: 0:49:03 iter: 19 total_loss: 1.313 loss_cls: 0.9465 loss_box_reg: 0.4159
time: 1.1264 data_time: 0.0454 lr: 1.9981e-05 max_mem: 3309M
[11/22 18:47:07 d2.utils.events]: eta: 0:45:44 iter: 39 total_loss: 1.536 loss_cls: 1.062 loss_box_reg: 0.4742
time: 0.8460 data_time: 0.0322 lr: 3.9961e-05 max_mem: 3309M
[11/22 18:47:17 d2.utils.events]: eta: 0:24:23 iter: 59 total_loss: 1.335 loss_cls: 0.9298 loss_box_reg: 0.3314
time: 0.7274 data_time: 0.0225 lr: 5.9941e-05 max_mem: 3309M
[11/22 18:47:27 d2.utils.events]: eta: 0:22:50 iter: 79 total_loss: 1.016 loss_cls: 0.7654 loss_box_reg: 0.2832
time: 0.6712 data_time: 0.0182 lr: 7.9921e-05 max_mem: 3309M
[11/22 18:47:38 d2.utils.events]: eta: 0:22:41 iter: 99 total_loss: 0.8018 loss_cls: 0.5681 loss_box_reg: 0.292
8 time: 0.6416 data_time: 0.0283 lr: 9.9901e-05 max_mem: 3309M
[11/22 18:47:48 d2.utils.events]: eta: 0:22:20 iter: 119 total_loss: 0.7519 loss_cls: 0.4219 loss_box_reg: 0.33
94 time: 0.6202 data_time: 0.0235 lr: 0.00011988 max_mem: 3309M
[11/22 18:47:58 d2.utils.events]: eta: 0:21:57 iter: 139 total_loss: 0.6003 loss_cls: 0.3676 loss_box_reg: 0.24
87 time: 0.6048 data_time: 0.0261 lr: 0.00013986 max_mem: 3309M
[11/22 18:48:09 d2.utils.events]: eta: 0:21:52 iter: 159 total_loss: 0.6938 loss_cls: 0.3561 loss_box_reg: 0.29
54 time: 0.5957 data_time: 0.0252 lr: 0.00015984 max_mem: 3309M
[11/22 18:48:19 d2.utils.events]: eta: 0:21:31 iter: 179 total_loss: 0.3852 loss_cls: 0.1894 loss_box_reg: 0.18
03 time: 0.5861 data_time: 0.0239 lr: 0.00017982 max_mem: 3309M
[11/22 18:48:30 d2.utils.events]: eta: 0:21:28 iter: 199 total_loss: 0.4876 loss_cls: 0.2348 loss_box_reg: 0.23
7 time: 0.5820 data_time: 0.0324 lr: 0.0001998 max_mem: 3419M
[11/22 18:48:41 d2.utils.events]: eta: 0:21:25 iter: 219 total_loss: 0.5006 loss_cls: 0.2419 loss_box_reg: 0.20
54 time: 0.5771 data_time: 0.0266 lr: 0.00021978 max_mem: 3419M
[11/22 18:48:51 d2.utils.events]: eta: 0:21:14 iter: 239 total_loss: 1.075 loss_cls: 0.8545 loss_box_reg: 0.225
8 time: 0.5725 data_time: 0.0224 lr: 0.00023976 max_mem: 3419M
[11/22 18:49:02 d2.utils.events]: eta: 0:20:58 iter: 259 total_loss: 0.6395 loss_cls: 0.3924 loss_box_reg: 0.26
33 time: 0.5683 data_time: 0.0313 lr: 0.00025974 max_mem: 3419M
[11/22 18:49:12 d2.utils.events]: eta: 0:20:46 iter: 279 total_loss: 0.5502 loss_cls: 0.272 loss_box_reg: 0.277
2 time: 0.5644 data_time: 0.0230 lr: 0.00027972 max_mem: 3419M
[11/22 18:49:22 d2.utils.events]: eta: 0:20:36 iter: 299 total_loss: 0.528 loss_cls: 0.2749 loss_box_reg: 0.248
```

```

135 time: 0.5268 data_time: 0.0242 lr: 0.001 max_mem: 3419M
[11/22 19:03:36 d2.utils.events]: eta: 0:06:11 iter: 1939 total_loss: 0.2877 loss_cls: 0.0944 loss_box_reg: 0.1
899 time: 0.5265 data_time: 0.0216 lr: 0.001 max_mem: 3419M
[11/22 19:03:46 d2.utils.events]: eta: 0:06:01 iter: 1959 total_loss: 0.3744 loss_cls: 0.1213 loss_box_reg: 0.2
554 time: 0.5265 data_time: 0.0287 lr: 0.001 max_mem: 3419M
[11/22 19:03:57 d2.utils.events]: eta: 0:05:51 iter: 1979 total_loss: 0.2955 loss_cls: 0.09671 loss_box_reg: 0.
1846 time: 0.5265 data_time: 0.0275 lr: 0.001 max_mem: 3419M
[11/22 19:04:07 d2.utils.events]: eta: 0:05:41 iter: 1999 total_loss: 0.2654 loss_cls: 0.08701 loss_box_reg: 0.
1839 time: 0.5264 data_time: 0.0205 lr: 0.001 max_mem: 3419M
[11/22 19:04:18 d2.utils.events]: eta: 0:05:31 iter: 2019 total_loss: 0.3672 loss_cls: 0.1395 loss_box_reg: 0.2
194 time: 0.5263 data_time: 0.0309 lr: 0.001 max_mem: 3419M
[11/22 19:04:28 d2.utils.events]: eta: 0:05:21 iter: 2039 total_loss: 0.3402 loss_cls: 0.1145 loss_box_reg: 0.2
259 time: 0.5263 data_time: 0.0255 lr: 0.001 max_mem: 3419M
[11/22 19:04:39 d2.utils.events]: eta: 0:05:10 iter: 2059 total_loss: 0.3773 loss_cls: 0.1431 loss_box_reg: 0.2
293 time: 0.5262 data_time: 0.0245 lr: 0.001 max_mem: 3419M
[11/22 19:04:49 d2.utils.events]: eta: 0:05:00 iter: 2079 total_loss: 0.2754 loss_cls: 0.1023 loss_box_reg: 0.2
005 time: 0.5262 data_time: 0.0203 lr: 0.001 max_mem: 3419M
[11/22 19:04:59 d2.utils.events]: eta: 0:04:49 iter: 2099 total_loss: 0.3464 loss_cls: 0.131 loss_box_reg: 0.22
39 time: 0.5261 data_time: 0.0241 lr: 0.001 max_mem: 3419M
[11/22 19:05:10 d2.utils.events]: eta: 0:04:39 iter: 2119 total_loss: 0.2927 loss_cls: 0.1108 loss_box_reg: 0.1
889 time: 0.5262 data_time: 0.0292 lr: 0.001 max_mem: 3419M
[11/22 19:05:21 d2.utils.events]: eta: 0:04:29 iter: 2139 total_loss: 0.3028 loss_cls: 0.1062 loss_box_reg: 0.2
08 time: 0.5262 data_time: 0.0266 lr: 0.001 max_mem: 3419M
[11/22 19:05:31 d2.utils.events]: eta: 0:04:18 iter: 2159 total_loss: 0.3829 loss_cls: 0.1254 loss_box_reg: 0.2
616 time: 0.5261 data_time: 0.0261 lr: 0.001 max_mem: 3419M
[11/22 19:05:41 d2.utils.events]: eta: 0:04:08 iter: 2179 total_loss: 0.3453 loss_cls: 0.115 loss_box_reg: 0.23
57 time: 0.5260 data_time: 0.0240 lr: 0.001 max_mem: 3419M
[11/22 19:05:51 d2.utils.events]: eta: 0:03:58 iter: 2199 total_loss: 0.3628 loss_cls: 0.1283 loss_box_reg: 0.2
545 time: 0.5258 data_time: 0.0254 lr: 0.001 max_mem: 3419M
[11/22 19:06:02 d2.utils.events]: eta: 0:03:47 iter: 2219 total_loss: 0.4882 loss_cls: 0.1725 loss_box_reg: 0.3
027 time: 0.5258 data_time: 0.0209 lr: 0.001 max_mem: 3419M
[11/22 19:06:13 d2.utils.events]: eta: 0:03:37 iter: 2239 total_loss: 0.395 loss_cls: 0.148 loss_box_reg: 0.262
time: 0.5259 data_time: 0.0308 lr: 0.001 max_mem: 3419M
[11/22 19:06:23 d2.utils.events]: eta: 0:03:27 iter: 2259 total_loss: 0.3757 loss_cls: 0.1286 loss_box_reg: 0.2
102 time: 0.5259 data_time: 0.0317 lr: 0.001 max_mem: 3419M
[11/22 19:06:33 d2.utils.events]: eta: 0:03:17 iter: 2279 total_loss: 0.3964 loss_cls: 0.188 loss_box_reg: 0.24
69 time: 0.5258 data_time: 0.0176 lr: 0.001 max_mem: 3419M
[11/22 19:06:44 d2.utils.events]: eta: 0:03:07 iter: 2299 total_loss: 0.3858 loss_cls: 0.1641 loss_box_reg: 0.2
294 time: 0.5258 data_time: 0.0298 lr: 0.001 max_mem: 3419M
[11/22 19:06:54 d2.utils.events]: eta: 0:02:56 iter: 2319 total_loss: 0.3603 loss_cls: 0.1399 loss_box_reg: 0.1
98 time: 0.5258 data_time: 0.0257 lr: 0.001 max_mem: 3419M
[11/22 19:07:05 d2.utils.events]: eta: 0:02:46 iter: 2339 total_loss: 0.367 loss_cls: 0.1289 loss_box_reg: 0.23
8 time: 0.5256 data_time: 0.0216 lr: 0.001 max_mem: 3419M
[11/22 19:07:15 d2.utils.events]: eta: 0:02:36 iter: 2359 total_loss: 0.3929 loss_cls: 0.1634 loss_box_reg: 0.1
916 time: 0.5257 data_time: 0.0325 lr: 0.001 max_mem: 3419M
[11/22 19:07:26 d2.utils.events]: eta: 0:02:26 iter: 2379 total_loss: 0.4248 loss_cls: 0.1591 loss_box_reg: 0.2
506 time: 0.5257 data_time: 0.0230 lr: 0.001 max_mem: 3419M
[11/22 19:07:36 d2.utils.events]: eta: 0:02:15 iter: 2399 total_loss: 0.4367 loss_cls: 0.1815 loss_box_reg: 0.2
795 time: 0.5255 data_time: 0.0214 lr: 0.001 max_mem: 3419M
[11/22 19:07:46 d2.utils.events]: eta: 0:02:05 iter: 2419 total_loss: 0.3789 loss_cls: 0.1453 loss_box_reg: 0.2
151 time: 0.5254 data_time: 0.0218 lr: 0.001 max_mem: 3419M
[11/22 19:07:57 d2.utils.events]: eta: 0:01:54 iter: 2439 total_loss: 0.4183 loss_cls: 0.1426 loss_box_reg: 0.2
54 time: 0.5254 data_time: 0.0252 lr: 0.001 max_mem: 3419M
[11/22 19:08:07 d2.utils.events]: eta: 0:01:44 iter: 2459 total_loss: 0.3074 loss_cls: 0.1121 loss_box_reg: 0.2
127 time: 0.5253 data_time: 0.0263 lr: 0.001 max_mem: 3419M
[11/22 19:08:17 d2.utils.events]: eta: 0:01:34 iter: 2479 total_loss: 0.3823 loss_cls: 0.1094 loss_box_reg: 0.2
417 time: 0.5253 data_time: 0.0214 lr: 0.001 max_mem: 3419M
[11/22 19:08:28 d2.utils.events]: eta: 0:01:24 iter: 2499 total_loss: 0.4 loss_cls: 0.153 loss_box_reg: 0.2506
time: 0.5253 data_time: 0.0216 lr: 0.001 max_mem: 3419M
[11/22 19:08:39 d2.utils.events]: eta: 0:01:13 iter: 2519 total_loss: 0.3282 loss_cls: 0.1221 loss_box_reg: 0.2
164 time: 0.5253 data_time: 0.0203 lr: 0.001 max_mem: 3419M
[11/22 19:08:49 d2.utils.events]: eta: 0:01:03 iter: 2539 total_loss: 0.2898 loss_cls: 0.1314 loss_box_reg: 0.1
692 time: 0.5253 data_time: 0.0292 lr: 0.001 max_mem: 3419M
[11/22 19:08:59 d2.utils.events]: eta: 0:00:53 iter: 2559 total_loss: 0.3554 loss_cls: 0.1388 loss_box_reg: 0.2
169 time: 0.5252 data_time: 0.0252 lr: 0.001 max_mem: 3419M
[11/22 19:09:10 d2.utils.events]: eta: 0:00:42 iter: 2579 total_loss: 0.3962 loss_cls: 0.1444 loss_box_reg: 0.2
402 time: 0.5253 data_time: 0.0264 lr: 0.001 max_mem: 3419M
[11/22 19:09:21 d2.utils.events]: eta: 0:00:32 iter: 2599 total_loss: 0.3192 loss_cls: 0.1175 loss_box_reg: 0.2
005 time: 0.5253 data_time: 0.0235 lr: 0.001 max_mem: 3419M
[11/22 19:09:31 d2.utils.events]: eta: 0:00:22 iter: 2619 total_loss: 0.5006 loss_cls: 0.1595 loss_box_reg: 0.2
797 time: 0.5254 data_time: 0.0282 lr: 0.001 max_mem: 3419M
[11/22 19:09:42 d2.utils.events]: eta: 0:00:11 iter: 2639 total_loss: 0.397 loss_cls: 0.142 loss_box_reg: 0.253
3 time: 0.5253 data_time: 0.0230 lr: 0.001 max_mem: 3419M
[11/22 19:09:52 d2.utils.events]: eta: 0:00:01 iter: 2659 total_loss: 0.38 loss_cls: 0.1275 loss_box_reg: 0.217
7 time: 0.5253 data_time: 0.0294 lr: 0.001 max_mem: 3419M
[11/22 19:10:02 d2.utils.events]: eta: 0:00:00 iter: 2662 total_loss: 0.3422 loss_cls: 0.121 loss_box_reg: 0.21
54 time: 0.5253 data_time: 0.0322 lr: 0.001 max_mem: 3419M
[11/22 19:10:02 d2.engine.hooks]: Overall training speed: 2661 iterations in 0:23:17 (0.5253 s / it)

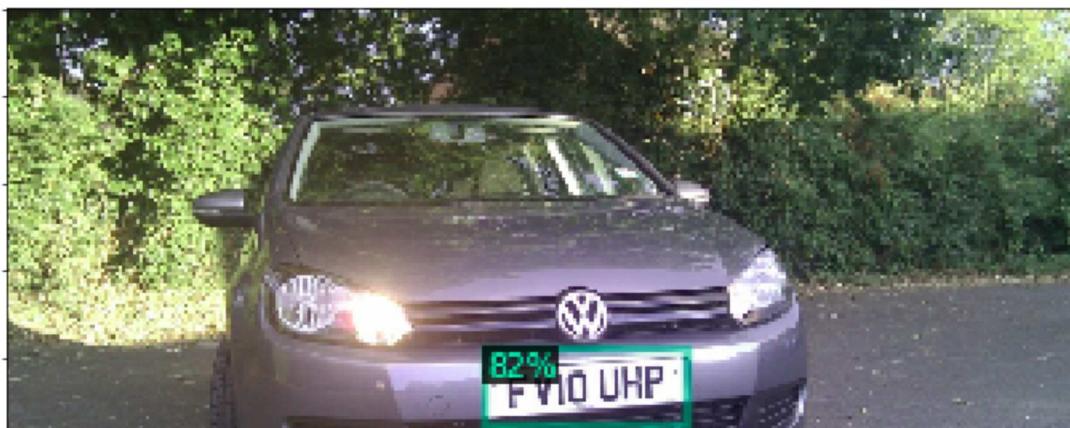
```

3. Inference

Make predictions from your trained model on three images from the validation dataset.

The plotted images should be similar to the following:





In [29]:

```
# inference on our fine-tuned model

# By default detectron2 save the model with name model_final.pth
# update the model path in configuration that will be used to load the model
cfg.MODEL.WEIGHTS = os.path.join(cfg.OUTPUT_DIR, "model_final.pth")

# update RetinaNet score threshold
cfg.MODEL.RETINANET.SCORE_THRESH_TEST = 0.5

cfg.DATASETS.TEST = (val_data_name,)

# create a predictor instance with the configuration (it has our fine-tuned model)
# this predictor does prediction on a single image
predictor = DefaultPredictor(cfg)
```

In [30]:

```
for d in random.sample(val_data_dict, 3):
    print(d["file_name"])
    im = cv2.imread(d["file_name"])
    outputs = predictor(im)
    print(outputs)
    v = Visualizer(im[:, :, ::-1],
                   metadata=val_metadata,
                   scale=0.8
    )
    v = v.draw_instance_predictions(outputs["instances"].to("cpu"))
    plt.figure(figsize = (12, 12))
    plt.imshow(v.get_image())
    plt.show()

./Dataset/validation/Vehicle registration plate/6846c275ded01f85.jpg
{'instances': Instances(num_instances=1, image_height=1024, image_width=1024, fields=[pred_boxes: Boxes(tensor([[61.6.2277, 526.9174, 867.6112, 651.6702]]), device='cuda:0')), scores: tensor([0.6560], device='cuda:0'), pred_classes: tensor([0], device='cuda:0'))}
```



```
./Dataset/validation/Vehicle registration plate/27798906120ea394.jpg
{'instances': Instances(num_instances=3, image_height=724, image_width=1024, fields=[pred_boxes: Boxes(tensor([[180.
6140, 400.3203, 346.9027, 484.8778],
[891.3699, 177.9257, 966.2171, 197.1682],
[289.8699, 233.7426, 321.6644, 254.8244]], device='cuda:0')), scores: tensor([0.9159, 0.7635, 0.7608], devic
e='cuda:0'), pred_classes: tensor([0, 0, 0], device='cuda:0'))]}
```



```
./Dataset/validation/Vehicle registration plate/008637722500f239.jpg
```

```
{'instances': Instances(num_instances=2, image_height=768, image_width=1024, fields=[pred_boxes: Boxes(tensor([[817.9381, 252.3293, 873.8712, 282.2318], [247.0691, 394.4139, 349.1277, 451.5660]]), device='cuda:0')), scores: tensor([0.8307, 0.8052], device='cuda:0')). pred classes: tensor([0. 01. device='cuda:0'])})
```



4. COCO Detection Evaluation

You have to evaluate your detection model on COCO detection evaluation metric.

For your reference here is the coco evaluation metric chart:

Average Precision (AP):

AP	% AP at IoU=.50:.95 (primary challenge metric)
AP ^{IoU=.50}	% AP at IoU=.50 (PASCAL VOC metric)
AP ^{IoU=.75}	% AP at IoU=.75 (strict metric)

AP Across Scales:

AP ^{small}	% AP for small objects: area < 32 ²
AP ^{medium}	% AP for medium objects: 32 ² < area < 96 ²
AP ^{large}	% AP for large objects: area > 96 ²

Average Recall (AR):

AR ^{max=1}	% AR given 1 detection per image
AR ^{max=10}	% AR given 10 detections per image
AR ^{max=100}	% AR given 100 detections per image

AR Across Scales:

AR ^{small}	% AR for small objects: area < 32 ²
AR ^{medium}	% AR for medium objects: 32 ² < area < 96 ²
AR ^{large}	% AR for large objects: area > 96 ²

The expected *AP* (primary challenge metric) is more than 0.5.

The expected output should look similar to the following:

```
Average Precision (AP) @[ IoU=0.50:0.95 | area= all | maxDets=100 ] = 0.550
Average Precision (AP) @[ IoU=0.50 | area= all | maxDets=100 ] = 0.886
Average Precision (AP) @[ IoU=0.75 | area= all | maxDets=100 ] = 0.629
Average Precision (AP) @[ IoU=0.50:0.95 | area= small | maxDets=100 ] = 0.256
Average Precision (AP) @[ IoU=0.50:0.95 | area=medium | maxDets=100 ] = 0.653
Average Precision (AP) @[ IoU=0.50:0.95 | area= large | maxDets=100 ] = 0.627
Average Recall (AR) @[ IoU=0.50:0.95 | area= all | maxDets= 1 ] = 0.504
Average Recall (AR) @[ IoU=0.50:0.95 | area= all | maxDets= 10 ] = 0.629
Average Recall (AR) @[ IoU=0.50:0.95 | area= all | maxDets=100 ] = 0.633
Average Recall (AR) @[ IoU=0.50:0.95 | area= small | maxDets=100 ] = 0.380
Average Recall (AR) @[ IoU=0.50:0.95 | area=medium | maxDets=100 ] = 0.722
Average Recall (AR) @[ IoU=0.50:0.95 | area= large | maxDets=100 ] = 0.704
```

In [31]:

```
# create directory for evaluation
eval_dir = os.path.join(cfg.OUTPUT_DIR, 'coco_eval')
os.makedirs(eval_dir, exist_ok=True)

# create evaluator instance with coco evaluator
evaluator = COCOEvaluator(dataset_name=val_data_name,
                           tasks=cfg,
                           distributed=False,
                           output_dir=eval_dir)

# create validation data loader
val_loader = build_detection_test_loader(cfg, val_data_name)

# start validation
inference_on_dataset(trainer.model, val_loader, evaluator)
```

WARNING [11/22 19:23:54 d2.evaluation.coco_evaluation]: COCO Evaluator instantiated using config, this is deprecated behavior. Please pass in explicit arguments instead.

[11/22 19:23:54 d2.evaluation.coco_evaluation]: Trying to convert 'license_plate_validation' to COCO format ...

WARNING [11/22 19:23:54 d2.data.datasets.coco]: Using previously cached COCO format annotations at 'outputs/coco_eval/license_plate_validation_coco_format.json'. You need to clear the cache file if your dataset has been modified.

./Dataset/validation/Vehicle registration plate/f73b754cdb1ab677.jpg
Height: 683, Width: 1024. Filename: f73b754cdb1ab677.jpg, Count: 1
./Dataset/validation/Vehicle registration plate/315aeadd7766727b8.jpg
Height: 768, Width: 819. Filename: 315aeadd7766727b8.jpg, Count: 2
./Dataset/validation/Vehicle registration plate/affd16c51644a893.jpg
Height: 768, Width: 1024. Filename: affd16c51644a893.jpg, Count: 3
./Dataset/validation/Vehicle registration plate/c650ff8d3e8e75b3.jpg
Height: 635, Width: 1024. Filename: c650ff8d3e8e75b3.jpg, Count: 4
./Dataset/validation/Vehicle registration plate/944281d0485869f0.jpg
Height: 682, Width: 1024. Filename: 944281d0485869f0.jpg, Count: 5
./Dataset/validation/Vehicle registration plate/6a0ef049e5ec4b16.jpg
Height: 683, Width: 1024. Filename: 6a0ef049e5ec4b16.jpg, Count: 6
./Dataset/validation/Vehicle registration plate/cb8c75fc1c7ccf73.jpg
Height: 1024, Width: 1024. Filename: cb8c75fc1c7ccf73.jpg, Count: 7
./Dataset/validation/Vehicle registration plate/7f56adf4b9306ac9.jpg
Height: 683, Width: 1024. Filename: 7f56adf4b9306ac9.jpg, Count: 8
./Dataset/validation/Vehicle registration plate/09453a7c716a9ef3.jpg
Height: 768, Width: 1024. Filename: 09453a7c716a9ef3.jpg, Count: 9
./Dataset/validation/Vehicle registration plate/d8f6c135ec5486ff.jpg
Height: 680, Width: 1024. Filename: d8f6c135ec5486ff.jpg, Count: 10
./Dataset/validation/Vehicle registration plate/895d440e05b2a8d8.jpg
Height: 751, Width: 1024. Filename: 895d440e05b2a8d8.jpg, Count: 11
./Dataset/validation/Vehicle registration plate/62bb93bbd270dd9a.jpg
Height: 684, Width: 1024. Filename: 62bb93bbd270dd9a.jpg, Count: 12
./Dataset/validation/Vehicle registration plate/c50d184afad1a9dc.jpg
Height: 768, Width: 1024. Filename: c50d184afad1a9dc.jpg, Count: 13
./Dataset/validation/Vehicle registration plate/cc1la2d44a290368.jpg
Height: 681, Width: 1024. Filename: cc1la2d44a290368.jpg, Count: 14
./Dataset/validation/Vehicle registration plate/e79f6777f2fc08b2.jpg
Height: 683, Width: 1024. Filename: e79f6777f2fc08b2.jpg, Count: 15
./Dataset/validation/Vehicle registration plate/90596bf3313e72e3.jpg
Height: 515, Width: 1024. Filename: 90596bf3313e72e3.jpg, Count: 16
./Dataset/validation/Vehicle registration plate/64de505bd2bac82b.jpg
Height: 768, Width: 1024. Filename: 64de505bd2bac82b.jpg, Count: 17
./Dataset/validation/Vehicle registration plate/182268e1f8c6525f.jpg
Height: 683, Width: 1024. Filename: 182268e1f8c6525f.jpg, Count: 18
./Dataset/validation/Vehicle registration plate/2fe1f00b77a110a0.jpg
Height: 683, Width: 1024. Filename: 2fe1f00b77a110a0.jpg, Count: 19
./Dataset/validation/Vehicle registration plate/f53243c2bb551b8a.jpg
Height: 683, Width: 1024. Filename: f53243c2bb551b8a.jpg, Count: 20
./Dataset/validation/Vehicle registration plate/52ceb1fc30b413e5.jpg
Height: 768, Width: 1024. Filename: 52ceb1fc30b413e5.jpg, Count: 21
./Dataset/validation/Vehicle registration plate/e82f13b4a2fe69f3.jpg
Height: 768, Width: 1024. Filename: e82f13b4a2fe69f3.jpg, Count: 22
./Dataset/validation/Vehicle registration plate/1545c73bdec3e2f.jpg
Height: 523, Width: 1024. Filename: 1545c73bdec3e2f.jpg, Count: 23
./Dataset/validation/Vehicle registration plate/4148b2126f0986a4.jpg
Height: 1024, Width: 1024. Filename: 4148b2126f0986a4.jpg, Count: 24
./Dataset/validation/Vehicle registration plate/0673b967f8c68eec.jpg
Height: 742, Width: 1024. Filename: 0673b967f8c68eec.jpg, Count: 25
./Dataset/validation/Vehicle registration plate/2b97f5bf137ee8d1.jpg
Height: 683, Width: 1024. Filename: 2b97f5bf137ee8d1.jpg, Count: 26
./Dataset/validation/Vehicle registration plate/5df8816356fc2b29.jpg
Height: 478, Width: 1024. Filename: 5df8816356fc2b29.jpg, Count: 27
./Dataset/validation/Vehicle registration plate/003a5aaaf6d17c917.jpg
Height: 683, Width: 1024. Filename: 003a5aaaf6d17c917.jpg, Count: 28
./Dataset/validation/Vehicle registration plate/25d5c2fb8b99662.jpg
Height: 571, Width: 1024. Filename: 25d5c2fb8b99662.jpg, Count: 29

./Dataset/validation/Vehicle registration plate/f3814f4a6121838d.jpg
Height: 512, Width: 1024. Filename: f3814f4a6121838d.jpg, Count: 30
./Dataset/validation/Vehicle registration plate/43b1b0028dd2db8d.jpg
Height: 768, Width: 1024. Filename: 43b1b0028dd2db8d.jpg, Count: 31
./Dataset/validation/Vehicle registration plate/b8a3f2ea385e45b3.jpg
Height: 576, Width: 1024. Filename: b8a3f2ea385e45b3.jpg, Count: 32
./Dataset/validation/Vehicle registration plate/d59b7a0ff294e3be.jpg
Height: 872, Width: 1024. Filename: d59b7a0ff294e3be.jpg, Count: 33
./Dataset/validation/Vehicle registration plate/29f7991e696e6e3f.jpg
Height: 683, Width: 1024. Filename: 29f7991e696e6e3f.jpg, Count: 34
./Dataset/validation/Vehicle registration plate/c1d8b110186e095a.jpg
Height: 768, Width: 1024. Filename: c1d8b110186e095a.jpg, Count: 35
./Dataset/validation/Vehicle registration plate/4e593c88022ff6b1.jpg
Height: 768, Width: 1024. Filename: 4e593c88022ff6b1.jpg, Count: 36
./Dataset/validation/Vehicle registration plate/8cdcb833ef1ef049.jpg
Height: 768, Width: 1024. Filename: 8cdcb833ef1ef049.jpg, Count: 37
./Dataset/validation/Vehicle registration plate/2e95d7a799e23e11.jpg
Height: 558, Width: 1024. Filename: 2e95d7a799e23e11.jpg, Count: 38
./Dataset/validation/Vehicle registration plate/4793138df3c05610.jpg
Height: 521, Width: 1024. Filename: 4793138df3c05610.jpg, Count: 39
./Dataset/validation/Vehicle registration plate/593e594137f374ab.jpg
Height: 681, Width: 1024. Filename: 593e594137f374ab.jpg, Count: 40
./Dataset/validation/Vehicle registration plate/017527da8bfeb97d.jpg
Height: 683, Width: 1024. Filename: 017527da8bfeb97d.jpg, Count: 41
./Dataset/validation/Vehicle registration plate/be654a7eabe0e891.jpg
Height: 768, Width: 1024. Filename: be654a7eabe0e891.jpg, Count: 42
./Dataset/validation/Vehicle registration plate/bf0aac0878b0a3d2.jpg
Height: 776, Width: 1024. Filename: bf0aac0878b0a3d2.jpg, Count: 43
./Dataset/validation/Vehicle registration plate/0727983dd5f9e4e6.jpg
Height: 768, Width: 1024. Filename: 0727983dd5f9e4e6.jpg, Count: 44
./Dataset/validation/Vehicle registration plate/63d3df798bc8840f.jpg
Height: 1024, Width: 1024. Filename: 63d3df798bc8840f.jpg, Count: 45
./Dataset/validation/Vehicle registration plate/299f0363ae21d1c3.jpg
Height: 683, Width: 1024. Filename: 299f0363ae21d1c3.jpg, Count: 46
./Dataset/validation/Vehicle registration plate/e8b36c888a75d742.jpg
Height: 768, Width: 1024. Filename: e8b36c888a75d742.jpg, Count: 47
./Dataset/validation/Vehicle registration plate/fd07d2db70cf53d5.jpg
Height: 768, Width: 1024. Filename: fd07d2db70cf53d5.jpg, Count: 48
./Dataset/validation/Vehicle registration plate/1ca1155083156d72.jpg
Height: 683, Width: 1024. Filename: 1ca1155083156d72.jpg, Count: 49
./Dataset/validation/Vehicle registration plate/955a8e4c8ba8116e.jpg
Height: 768, Width: 1024. Filename: 955a8e4c8ba8116e.jpg, Count: 50
./Dataset/validation/Vehicle registration plate/67945cf7a6beccdf.jpg
Height: 576, Width: 1024. Filename: 67945cf7a6beccdf.jpg, Count: 51
./Dataset/validation/Vehicle registration plate/5373ec295ea62c47.jpg
Height: 683, Width: 1024. Filename: 5373ec295ea62c47.jpg, Count: 52
./Dataset/validation/Vehicle registration plate/1db3793d7c84fa1.jpg
Height: 768, Width: 1024. Filename: 1db3793d7c84fa1.jpg, Count: 53
./Dataset/validation/Vehicle registration plate/4cb48c8bf41b70a4.jpg
Height: 768, Width: 1024. Filename: 4cb48c8bf41b70a4.jpg, Count: 54
./Dataset/validation/Vehicle registration plate/f9170e8c13a99991.jpg
Height: 823, Width: 1024. Filename: f9170e8c13a99991.jpg, Count: 55
./Dataset/validation/Vehicle registration plate/9286a99f243b359a.jpg
Height: 769, Width: 1024. Filename: 9286a99f243b359a.jpg, Count: 56
./Dataset/validation/Vehicle registration plate/73467682c5995b65.jpg
Height: 771, Width: 1024. Filename: 73467682c5995b65.jpg, Count: 57
./Dataset/validation/Vehicle registration plate/9498d0aff8f9ff8c.jpg
Height: 599, Width: 1024. Filename: 9498d0aff8f9ff8c.jpg, Count: 58
./Dataset/validation/Vehicle registration plate/b1096bc91a89b0cf.jpg
Height: 712, Width: 1024. Filename: b1096bc91a89b0cf.jpg, Count: 59
./Dataset/validation/Vehicle registration plate/343326e127297379.jpg
Height: 683, Width: 1024. Filename: 343326e127297379.jpg, Count: 60
./Dataset/validation/Vehicle registration plate/de2b5afb7eda96cf.jpg
Height: 682, Width: 1024. Filename: de2b5afb7eda96cf.jpg, Count: 61
./Dataset/validation/Vehicle registration plate/0c756c9366a8cb10.jpg
Height: 768, Width: 1024. Filename: 0c756c9366a8cb10.jpg, Count: 62
./Dataset/validation/Vehicle registration plate/140e8d10ff02e7e7.jpg
Height: 683, Width: 1024. Filename: 140e8d10ff02e7e7.jpg, Count: 63
./Dataset/validation/Vehicle registration plate/be9fd0014b5a4f2a.jpg
Height: 689, Width: 1024. Filename: be9fd0014b5a4f2a.jpg, Count: 64
./Dataset/validation/Vehicle registration plate/488722909dd9c0ac.jpg
Height: 768, Width: 1024. Filename: 488722909dd9c0ac.jpg, Count: 65
./Dataset/validation/Vehicle registration plate/30b6cfb60bf44533.jpg
Height: 1024, Width: 1024. Filename: 30b6cfb60bf44533.jpg, Count: 66
./Dataset/validation/Vehicle registration plate/044417ca6134604f.jpg
Height: 683, Width: 1024. Filename: 044417ca6134604f.jpg, Count: 67
./Dataset/validation/Vehicle registration plate/fb55b73f241bf50a.jpg
Height: 693, Width: 1024. Filename: fb55b73f241bf50a.jpg, Count: 68
./Dataset/validation/Vehicle registration plate/35875c388efcddf0.jpg
Height: 768, Width: 1024. Filename: 35875c388efcddf0.jpg, Count: 69
./Dataset/validation/Vehicle registration plate/d44c0b2252bf8a92.jpg

```

./Dataset/validation/Vehicle registration plate/daac3a6c64a79bea.jpg
Height: 1024, Width: 780. Filename: daac3a6c64a79bea.jpg, Count: 354
./Dataset/validation/Vehicle registration plate/50c37aeaf19acd5b.jpg
Height: 683, Width: 1024. Filename: 50c37aeaf19acd5b.jpg, Count: 355
./Dataset/validation/Vehicle registration plate/2bd26c63ebf598b7.jpg
Height: 683, Width: 1024. Filename: 2bd26c63ebf598b7.jpg, Count: 356
./Dataset/validation/Vehicle registration plate/19eba8ac64eed194.jpg
Height: 768, Width: 1024. Filename: 19eba8ac64eed194.jpg, Count: 357
./Dataset/validation/Vehicle registration plate/8c63cf76166c3bd7.jpg
Height: 773, Width: 1024. Filename: 8c63cf76166c3bd7.jpg, Count: 358
./Dataset/validation/Vehicle registration plate/d5058059dc0ce0ad.jpg
Height: 768, Width: 1024. Filename: d5058059dc0ce0ad.jpg, Count: 359
./Dataset/validation/Vehicle registration plate/d9fa2abf3719a4bd.jpg
Height: 768, Width: 1024. Filename: d9fa2abf3719a4bd.jpg, Count: 360
./Dataset/validation/Vehicle registration plate/53925df03b471f5d.jpg
Height: 768, Width: 1024. Filename: 53925df03b471f5d.jpg, Count: 361
./Dataset/validation/Vehicle registration plate/1f0e643b125f00ec.jpg
Height: 682, Width: 1024. Filename: 1f0e643b125f00ec.jpg, Count: 362
./Dataset/validation/Vehicle registration plate/9ebba4d1f8d6e7b.jpg
Height: 528, Width: 1024. Filename: 9ebba4d1f8d6e7b.jpg, Count: 363
./Dataset/validation/Vehicle registration plate/edecf3a6d569b7c9.jpg
Height: 1024, Width: 683. Filename: edecf3a6d569b7c9.jpg, Count: 364
./Dataset/validation/Vehicle registration plate/415d64bf8cfe82f2.jpg
Height: 683, Width: 1024. Filename: 415d64bf8cfe82f2.jpg, Count: 365
./Dataset/validation/Vehicle registration plate/9034927e7438bdd6.jpg
Height: 1024, Width: 737. Filename: 9034927e7438bdd6.jpg, Count: 366
./Dataset/validation/Vehicle registration plate/b3b61da98e22cd4a.jpg
Height: 768, Width: 1024. Filename: b3b61da98e22cd4a.jpg, Count: 367
./Dataset/validation/Vehicle registration plate/69450fa183d57a7b.jpg
Height: 604, Width: 1024. Filename: 69450fa183d57a7b.jpg, Count: 368
./Dataset/validation/Vehicle registration plate/fa897478280a2758.jpg
Height: 768, Width: 1024. Filename: fa897478280a2758.jpg, Count: 369
./Dataset/validation/Vehicle registration plate/6b113b3edbadfe5d.jpg
Height: 768, Width: 1024. Filename: 6b113b3edbadfe5d.jpg, Count: 370
./Dataset/validation/Vehicle registration plate/67c834b73882a9f9.jpg
Height: 717, Width: 1024. Filename: 67c834b73882a9f9.jpg, Count: 371
./Dataset/validation/Vehicle registration plate/0fbdb1b85fc01d2ae.jpg
Height: 615, Width: 1024. Filename: 0fbdb1b85fc01d2ae.jpg, Count: 372
./Dataset/validation/Vehicle registration plate/b101900b26128253.jpg
Height: 768, Width: 1024. Filename: b101900b26128253.jpg, Count: 373
./Dataset/validation/Vehicle registration plate/53ad98b12752ad16.jpg
Height: 768, Width: 1024. Filename: 53ad98b12752ad16.jpg, Count: 374
./Dataset/validation/Vehicle registration plate/f5d1729aa333b284.jpg
Height: 768, Width: 1024. Filename: f5d1729aa333b284.jpg, Count: 375
./Dataset/validation/Vehicle registration plate/d027c6e32db60e3c.jpg
Height: 768, Width: 1024. Filename: d027c6e32db60e3c.jpg, Count: 376
./Dataset/validation/Vehicle registration plate/302d636c896c263f.jpg
Height: 683, Width: 1024. Filename: 302d636c896c263f.jpg, Count: 377
./Dataset/validation/Vehicle registration plate/54ebca2064066a49.jpg
Height: 683, Width: 1024. Filename: 54ebca2064066a49.jpg, Count: 378
./Dataset/validation/Vehicle registration plate/a774a6f81fea258b.jpg
Height: 768, Width: 1024. Filename: a774a6f81fea258b.jpg, Count: 379
./Dataset/validation/Vehicle registration plate/f1131b93a33cefb9.jpg
Height: 683, Width: 1024. Filename: f1131b93a33cefb9.jpg, Count: 380
./Dataset/validation/Vehicle registration plate/844adfe06e003c09.jpg
Height: 768, Width: 1024. Filename: 844adfe06e003c09.jpg, Count: 381
./Dataset/validation/Vehicle registration plate/2619ec27a314e69c.jpg
Height: 768, Width: 1024. Filename: 2619ec27a314e69c.jpg, Count: 382
./Dataset/validation/Vehicle registration plate/f38265abb22a00e4.jpg
Height: 694, Width: 1024. Filename: f38265abb22a00e4.jpg, Count: 383
./Dataset/validation/Vehicle registration plate/2f90aaa72744452d.jpg
Height: 768, Width: 1024. Filename: 2f90aaa72744452d.jpg, Count: 384
./Dataset/validation/Vehicle registration plate/82b53fe7f9147c96.jpg
Height: 685, Width: 1024. Filename: 82b53fe7f9147c96.jpg, Count: 385
./Dataset/validation/Vehicle registration plate/4c04b488ddc48225.jpg
Height: 607, Width: 1024. Filename: 4c04b488ddc48225.jpg, Count: 386

```

[11/22 19:24:01 d2.data.build]: Distribution of instances among all 1 categories:

category	#instances
license-pla..	512

[11/22 19:24:01 d2.data.dataset_mapper]: [DatasetMapper] Augmentations used in inference: [ResizeShortestEdge(short_edge_length=(800, 800), max_size=1333, sample_style='choice')]

/usr/local/lib/python3.7/dist-packages/torch/utils/data/dataloader.py:481: UserWarning: This DataLoader will create 4 worker processes in total. Our suggested max number of worker in current system is 2, which is smaller than what his DataLoader is going to create. Please be aware that excessive worker creation might get DataLoader running slow or even freeze, lower the worker number to avoid potential slowness/freeze if necessary.

cpuset_checked)

[11/22 19:24:03 d2.evaluation.evaluator]: Inference done 11/386. Dataloading: 0.0043 s/iter. Inference: 0.0635 s/ite
r. Eval: 0.0003 s/iter. Total: 0.0681 s/iter. ETA=0:00:25

```

[11/22 19:24:08 d2.evaluation.evaluator]: Inference done 89/386. Dataloading: 0.0032 s/iter. Inference: 0.0613 s/ite
r. Eval: 0.0003 s/iter. Total: 0.0649 s/iter. ETA=0:00:19
[11/22 19:24:13 d2.evaluation.evaluator]: Inference done 166/386. Dataloading: 0.0032 s/iter. Inference: 0.0614 s/it
er. Eval: 0.0003 s/iter. Total: 0.0651 s/iter. ETA=0:00:14
[11/22 19:24:18 d2.evaluation.evaluator]: Inference done 236/386. Dataloading: 0.0047 s/iter. Inference: 0.0618 s/it
er. Eval: 0.0003 s/iter. Total: 0.0670 s/iter. ETA=0:00:10
[11/22 19:24:23 d2.evaluation.evaluator]: Inference done 314/386. Dataloading: 0.0042 s/iter. Inference: 0.0618 s/it
er. Eval: 0.0003 s/iter. Total: 0.0664 s/iter. ETA=0:00:04
[11/22 19:24:27 d2.evaluation.evaluator]: Total inference time: 0:00:25.337004 (0.066501 s / iter per device, on 1 d
evices)
[11/22 19:24:27 d2.evaluation.evaluator]: Total inference pure compute time: 0:00:23 (0.061840 s / iter per device,
on 1 devices)
[11/22 19:24:28 d2.evaluation.coco_evaluation]: Preparing results for COCO format ...
[11/22 19:24:28 d2.evaluation.coco_evaluation]: Saving results to outputs/coco_eval/coco_instances_results.json
[11/22 19:24:29 d2.evaluation.coco_evaluation]: Evaluating predictions with unofficial COCO API...
Loading and preparing results...
DONE (t=0.25s)
creating index...
index created!
[11/22 19:24:29 d2.evaluation.fast_eval_api]: Evaluate annotation type *bbox*
[11/22 19:24:29 d2.evaluation.fast_eval_api]: COCOeval_opt.evaluate() finished in 0.11 seconds.
[11/22 19:24:29 d2.evaluation.fast_eval_api]: Accumulating evaluation results...
[11/22 19:24:29 d2.evaluation.fast_eval_api]: COCOeval_opt.accumulate() finished in 0.03 seconds.
Average Precision (AP) @[ IoU=0.50:0.95 | area= all | maxDets=100 ] = 0.577
Average Precision (AP) @[ IoU=0.50 | area= all | maxDets=100 ] = 0.882
Average Precision (AP) @[ IoU=0.75 | area= all | maxDets=100 ] = 0.677
Average Precision (AP) @[ IoU=0.50:0.95 | area= small | maxDets=100 ] = 0.256
Average Precision (AP) @[ IoU=0.50:0.95 | area=medium | maxDets=100 ] = 0.682
Average Precision (AP) @[ IoU=0.50:0.95 | area= large | maxDets=100 ] = 0.660
Average Recall (AR) @[ IoU=0.50:0.95 | area= all | maxDets= 1 ] = 0.535
Average Recall (AR) @[ IoU=0.50:0.95 | area= all | maxDets= 10 ] = 0.657
Average Recall (AR) @[ IoU=0.50:0.95 | area= all | maxDets=100 ] = 0.667
Average Recall (AR) @[ IoU=0.50:0.95 | area= small | maxDets=100 ] = 0.420
Average Recall (AR) @[ IoU=0.50:0.95 | area=medium | maxDets=100 ] = 0.754
Average Recall (AR) @[ IoU=0.50:0.95 | area= large | maxDets=100 ] = 0.734
[11/22 19:24:29 d2.evaluation.coco_evaluation]: Evaluation results for bbox:
| AP | AP50 | AP75 | APs | APm | APl |
| :----: | :----: | :----: | :----: | :----: | :----: |
OrderedDict([('bbox',
    {'AP': 57.747133552055395,
     'AP50': 88.16172099481642,
     'AP75': 67.70828579584585,
     'APl': 65.98845871229642,
     'APm': 68.159558016245,
     'APs': 25.562044556902602})))

```

Out[31]:

```

{'AP': 57.747133552055395,
 'AP50': 88.16172099481642,
 'AP75': 67.70828579584585,
 'APl': 65.98845871229642,
 'APm': 68.159558016245,
 'APs': 25.562044556902602})

```

5. Run Inference on a Video

[Download the Input Video](#)

Run inference on a video.

Upload the output video on youtube and share the link. Do not upload the video in the lab.

In []:

```

from IPython.display import YouTubeVideo, display
video = YouTubeVideo("18HWHCevFdU", width=640, height=360)
display(video)

```

Your output video should have a bounding box around the vehicle registration plate.

```
In [ ]: video = YouTubeVideo("5SgCuee7AMs", width=640, height=360)
display(video)
```

You can use the following sample code to read and write a video.

```
In [33]: def video_read_write(video_path):
    """
    Read video frames one-by-one, flip it, and write in the other video.
    video_path (str): path/to/video
    """
    video = cv2.VideoCapture(video_path)

    output_frames = []

    # Check if camera opened successfully
    if not video.isOpened():
        print("Error opening video file")
        return

    # create video writer
    width = int(video.get(cv2.CAP_PROP_FRAME_WIDTH))
    height = int(video.get(cv2.CAP_PROP_FRAME_HEIGHT))
    frames_per_second = video.get(cv2.CAP_PROP_FPS)
    num_frames = int(video.get(cv2.CAP_PROP_FRAME_COUNT))

    output_fname = '{}_out.mp4'.format(os.path.splitext(video_path)[0])

    output_file = cv2.VideoWriter(
        filename=output_fname,
        # some installation of opencv may not support x264 (due to its license),
        # you can try other format (e.g. MPEG)
        fourcc=cv2.VideoWriter_fourcc(*"mp4v"), # x264
        fps=float(frames_per_second),
        frameSize=(width, height),
        isColor=True,
    )

    i = 0
    while video.isOpened():
        ret, frame = video.read()
        if ret:
            #im = cv2.imread(frame)
            outputs = predictor(frame)
            #print(outputs)
            v = Visualizer(frame[:, :, ::-1],
                           metadata=val_metadata,
                           scale=1)
            v = v.draw_instance_predictions(outputs["instances"].to("cpu"))
            plt.imshow(v.get_image())
            plt.show()
            output_frames.append(v.get_image()[:, :, ::-1]) # changed 'write' to 'append'
            #cv2.imwrite('apnd_out/frame_{}.png'.format(str(i).zfill(3)), frame[:, ::-1, :])
            i += 1
        else:
            break

    for i in range(len(output_frames)):
        output_file.write(output_frames[i])

    video.release()
    output_file.release()

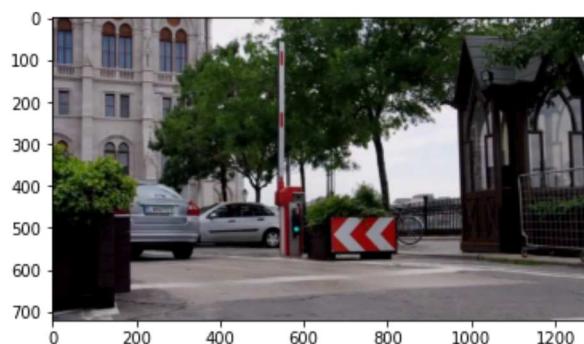
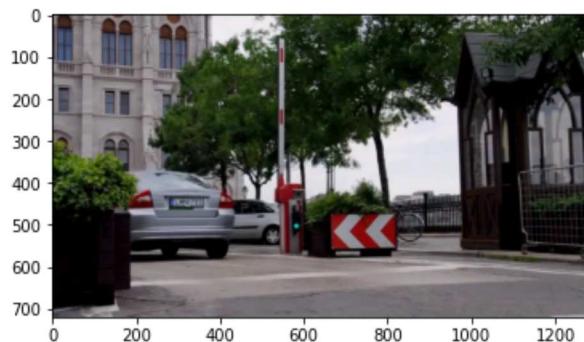
    return
```

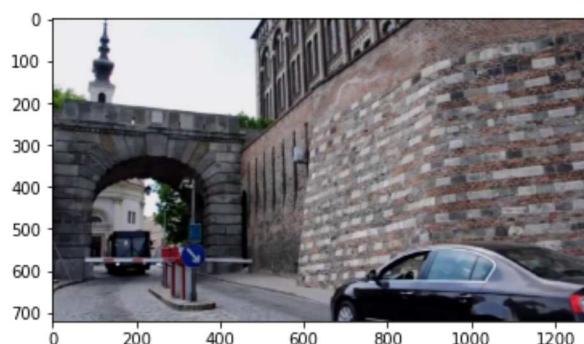
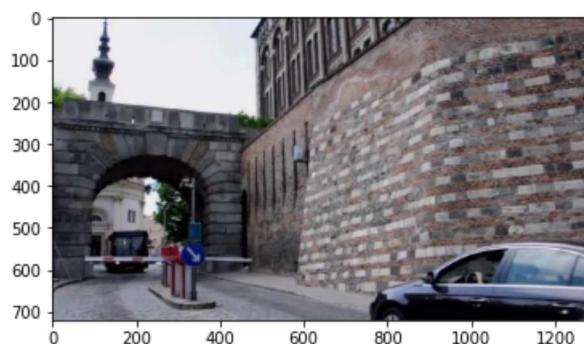
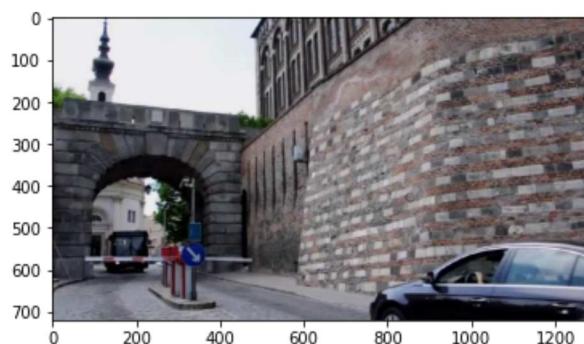
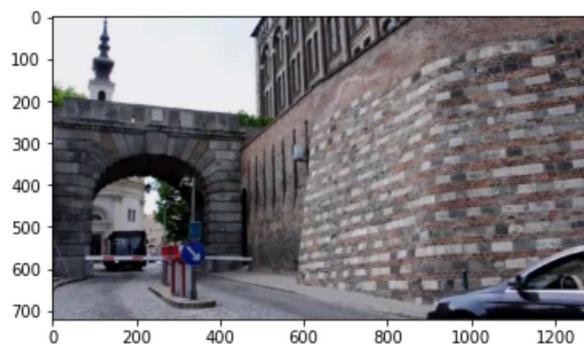
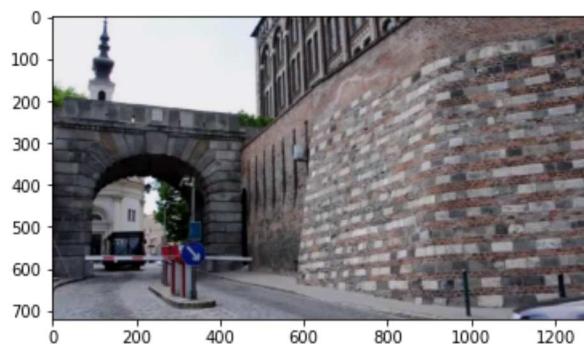
```
In [34]: video_read_write('project3-input-video.mp4')
```

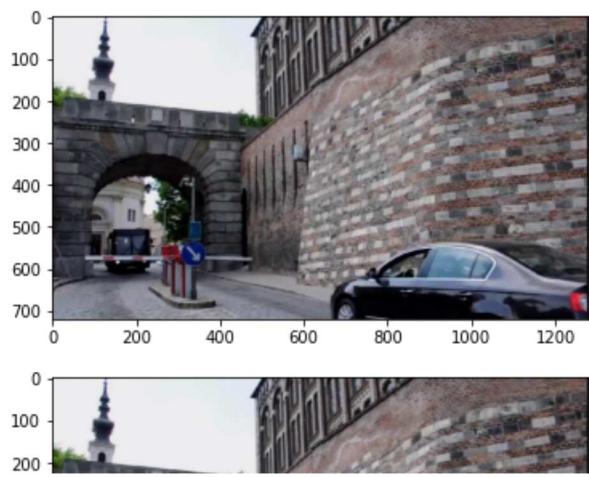












Video Link:

<https://youtu.be/KfyDvN3TSpl>