

Detectron2 Beginner's Tutorial



Detectron2

Welcome to detectron2! This is the official colab tutorial of detectron2. Here, we will go through some basics usage of detectron2, including the following:

- Run inference on images or videos, with an existing detectron2 model
- Train a detectron2 model on a new dataset

You can make a copy of this tutorial by "File -> Open in playground mode" and make changes there. **DO NOT** request access to this tutorial.

▼ Install detectron2

```
!python -m pip install pyyaml==5.1
import sys, os, distutils.core
# Note: This is a faster way to install detectron2 in Colab, but it does not include all functionalities.
# See https://detectron2.readthedocs.io/tutorials/install.html for full installation instructions
!git clone 'https://github.com/facebookresearch/detectron2'
dist = distutils.core.run_setup("./detectron2/setup.py")
!python -m pip install {' '.join([f'"{x}"' for x in dist.install_requires])}
sys.path.insert(0, os.path.abspath('./detectron2'))

# Properly install detectron2. (Please do not install twice in both ways)
# !python -m pip install 'git+https://github.com/facebookresearch/detectron2.git'
```

Looking in indexes: <https://pypi.org/simple>, <https://us-python.pkg.dev/colab-wheels/public/simple/>
Requirement already satisfied: pyyaml==5.1 in /usr/local/lib/python3.10/dist-packages (5.1)
fatal: destination path 'detectron2' already exists and is not an empty directory.
Looking in indexes: <https://pypi.org/simple>, <https://us-python.pkg.dev/colab-wheels/public/simple/>
Requirement already satisfied: Pillow>=7.1 in /usr/local/lib/python3.10/dist-packages (8.4.0)
Requirement already satisfied: matplotlib in /usr/local/lib/python3.10/dist-packages (3.7.1)
Requirement already satisfied: pycocotools>=2.0.2 in /usr/local/lib/python3.10/dist-packages (2.0.6)
Requirement already satisfied: termcolor>=1.1 in /usr/local/lib/python3.10/dist-packages (2.3.0)
Requirement already satisfied: yacs>=0.1.8 in /usr/local/lib/python3.10/dist-packages (0.1.8)
Requirement already satisfied: tabulate in /usr/local/lib/python3.10/dist-packages (0.8.10)
Requirement already satisfied: cloudpickle in /usr/local/lib/python3.10/dist-packages (2.2.1)
Requirement already satisfied: tqdm>4.29.0 in /usr/local/lib/python3.10/dist-packages (4.65.0)
Requirement already satisfied: tensorboard in /usr/local/lib/python3.10/dist-packages (2.12.2)
Requirement already satisfied: fvc<0.1.6, >=0.1.5 in /usr/local/lib/python3.10/dist-packages (0.1.5.post20221221)
Requirement already satisfied: iopath<0.1.10, >=0.1.7 in /usr/local/lib/python3.10/dist-packages (0.1.9)
Requirement already satisfied: omegaconf>=2.1 in /usr/local/lib/python3.10/dist-packages (2.3.0)
Requirement already satisfied: hydra-core>=1.1 in /usr/local/lib/python3.10/dist-packages (1.3.2)
Requirement already satisfied: black in /usr/local/lib/python3.10/dist-packages (23.3.0)
Requirement already satisfied: packaging in /usr/local/lib/python3.10/dist-packages (23.1)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (1.0.7)
Requirement already satisfied: cycycler>=0.10 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (0.11.0)
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (4.39.3)
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (1.4.4)
Requirement already satisfied: numpy>=1.20 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (1.22.4)
Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (3.0.9)
Requirement already satisfied: python-dateutil>=2.7 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (2.8.2)
Requirement already satisfied: PyYAML in /usr/local/lib/python3.10/dist-packages (from yacs>=0.1.8) (5.1)
Requirement already satisfied: absl-py>=0.4 in /usr/local/lib/python3.10/dist-packages (from tensorboard) (1.4.0)
Requirement already satisfied: grpcio>=1.48.2 in /usr/local/lib/python3.10/dist-packages (from tensorboard) (1.54.0)
Requirement already satisfied: google-auth<3, >=1.6.3 in /usr/local/lib/python3.10/dist-packages (from tensorboard) (2.17.3)
Requirement already satisfied: google-auth-oauthlib<1.1, >=0.5 in /usr/local/lib/python3.10/dist-packages (from tensorboard) (1.0.0)
Requirement already satisfied: markdown>=2.6.8 in /usr/local/lib/python3.10/dist-packages (from tensorboard) (3.4.3)
Requirement already satisfied: protobuf>=3.19.6 in /usr/local/lib/python3.10/dist-packages (from tensorboard) (3.20.3)
Requirement already satisfied: requests<3, >=2.21.0 in /usr/local/lib/python3.10/dist-packages (from tensorboard) (2.27.1)
Requirement already satisfied: setuptools>=41.0.0 in /usr/local/lib/python3.10/dist-packages (from tensorboard) (67.7.2)
Requirement already satisfied: tensorboard-data-server<0.8.0, >=0.7.0 in /usr/local/lib/python3.10/dist-packages (from tensorboard) (0.7.0)
Requirement already satisfied: tensorboard-plugin-wit>=1.6.0 in /usr/local/lib/python3.10/dist-packages (from tensorboard) (1.8.1)
Requirement already satisfied: werkzeug>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from tensorboard) (2.3.0)
Requirement already satisfied: wheel>=0.26 in /usr/local/lib/python3.10/dist-packages (from tensorboard) (0.40.0)
Requirement already satisfied: portalocker in /usr/local/lib/python3.10/dist-packages (from iopath<0.1.10, >=0.1.7) (2.7.0)
Requirement already satisfied: antlr4-python3-runtime==4.9.* in /usr/local/lib/python3.10/dist-packages (from omegaconf>=2.1) (4.9.3)
Requirement already satisfied: click>=8.0.0 in /usr/local/lib/python3.10/dist-packages (from black) (8.1.3)
Requirement already satisfied: mypy_extensions>=0.4.3 in /usr/local/lib/python3.10/dist-packages (from black) (1.0.0)
Requirement already satisfied: pathspec>=0.9.0 in /usr/local/lib/python3.10/dist-packages (from black) (0.11.1)
Requirement already satisfied: platformdirs>=2 in /usr/local/lib/python3.10/dist-packages (from black) (3.3.0)
Requirement already satisfied: tomli>=1.1.0 in /usr/local/lib/python3.10/dist-packages (from black) (2.0.1)
Requirement already satisfied: cachetools<6.0, >=2.0.0 in /usr/local/lib/python3.10/dist-packages (from google-auth<3, >=1.6.3->ten
Requirement already satisfied: pyasn1-modules>=0.2.1 in /usr/local/lib/python3.10/dist-packages (from google-auth<3, >=1.6.3->ten
Requirement already satisfied: six>=1.9.0 in /usr/local/lib/python3.10/dist-packages (from google-auth<3, >=1.6.3->ten
Requirement already satisfied: rsa<5, >=3.1.4 in /usr/local/lib/python3.10/dist-packages (from google-auth<3, >=1.6.3->ten
Requirement already satisfied: requests-oauthlib>=0.7.0 in /usr/local/lib/python3.10/dist-packages (from google-auth-oauthlib<1.1

```

Requirement already satisfied: urllib3<1.27,>=1.21.1 in /usr/local/lib/python3.10/dist-packages (from requests<3,>=2.21.0->tensorbo
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.10/dist-packages (from requests<3,>=2.21.0->tensorboa
Requirement already satisfied: charset-normalizer~=2.0.0 in /usr/local/lib/python3.10/dist-packages (from requests<3,>=2.21.0->te
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dist-packages (from requests<3,>=2.21.0->tensorboard) (3
Requirement already satisfied: MarkupSafe>=2.1.1 in /usr/local/lib/python3.10/dist-packages (from werkzeug>=1.0.1->tensorboard) (
Requirement already satisfied: pyasn1<0.6.0,>=0.4.6 in /usr/local/lib/python3.10/dist-packages (from pyasn1-modules>=0.2.1->googl

import torch, detectron2
!nvcc --version
TORCH_VERSION = ".".join(torch.__version__.split(".")[:2])
CUDA_VERSION = torch.__version__.split("+")[-1]
print("torch: ", TORCH_VERSION, "; cuda: ", CUDA_VERSION)
print("detectron2: ", detectron2.__version__)

nvcc: NVIDIA (R) Cuda compiler driver
Copyright (c) 2005-2022 NVIDIA Corporation
Built on Wed_Sep_21_10:33:58_PDT_2022
Cuda compilation tools, release 11.8, V11.8.89
Build cuda_11.8.r11.8/compiler.31833905_0
torch:  2.0 ; cuda:  cu118
detectron2: 0.6

# Some basic setup:
# Setup detectron2 logger
import detectron2
from detectron2.utils.logger import setup_logger
setup_logger()

# import some common libraries
import numpy as np
import os, json, cv2, random
from google.colab.patches import cv2_imshow

# import some common detectron2 utilities
from detectron2 import model_zoo
from detectron2.engine import DefaultPredictor
from detectron2.config import get_cfg
from detectron2.utils.visualizer import Visualizer
from detectron2.data import MetadataCatalog, DatasetCatalog

```

▼ Run a pre-trained detectron2 model

Mount local disk and read image

```

cfg = get_cfg()
cfg.MODEL.DEVICE='cpu'
# add project-specific config (e.g., TensorMask) here if you're not running a model in detectron2's core library
cfg.merge_from_file(model_zoo.get_config_file("COCO-InstanceSegmentation/mask_rcnn_R_50_FPN_3x.yaml"))
cfg.MODEL.ROI_HEADS.SCORE_THRESH_TEST = 0.5 # set threshold for this model
# Find a model from detectron2's model zoo. You can use the https://dl.fbaipublicfiles... url as well
cfg.MODEL.WEIGHTS = model_zoo.get_checkpoint_url("COCO-InstanceSegmentation/mask_rcnn_R_50_FPN_3x.yaml")
predictor = DefaultPredictor(cfg)
# outputs = predictor(im)

[05/27 17:38:53 d2.checkpoint.detection_checkpoint]: [DetectionCheckpoint] Loading from https://dl.fbaipublicfiles.com/detectron2

from google.colab import files
uploaded = files.upload()

Choose Files No file chosen Upload widget is only available when the cell has been executed in the current browser session. Please rerun
this cell to enable.
Saving IMG_20230527_193911.jpg to IMG_20230527_193911.jpg
Saving IMG_20230527_193915.jpg to IMG_20230527_193915.jpg
Saving IMG_20230527_193919.jpg to IMG_20230527_193919.jpg
Saving IMG_20230527_193923.jpg to IMG_20230527_193923.jpg
Saving IMG_20230527_193927.jpg to IMG_20230527_193927.jpg
Saving IMG_20230527_193930.jpg to IMG_20230527_193930.jpg
Saving IMG_20230527_193935.jpg to IMG_20230527_193935.jpg
Saving IMG_20230527_193940.jpg to IMG_20230527_193940.jpg
Saving IMG_20230527_193944.jpg to IMG_20230527_193944.jpg
Saving IMG_20230527_193948.jpg to IMG_20230527_193948.jpg
Saving IMG_20230527_193952.jpg to IMG_20230527_193952.jpg

# from traitlets.traitlets import Instance
import sys
import json

```

```
def image_output_bbox(outputs_obj, fields_to_save=["pred_boxes", "scores", "pred_classes"]):
    instances = outputs_obj["instances"]
    # nof_bbox = len(instances.pred_boxes)

    tmp = {}
    for key in fields_to_save:
        if key == "pred_boxes":
            tmp[key] = eval(f'instances.{key}.tensor.cpu().numpy().tolist()')
        else:
            tmp[key] = eval(f'instances.{key}.cpu().numpy().tolist()')

    # display(tmp)
    return tmp

def save_img_output(outputs_obj, dump_fname):
    with open(dump_fname, 'w') as f:
        json.dump(image_output_bbox(outputs_obj), f)

    return dump_fname

for fname in uploaded.keys():
    print(f"parsing: {fname}")
    im = cv2.imread(fname)
    v = Visualizer(im[:, :, ::-1], MetadataCatalog.get(cfg.DATASETS.TRAIN[0])) #, scale=1.2)
    outputs = predictor(im)
    out = v.draw_instance_predictions(outputs["instances"].to("cpu"))
    cv2_imshow(out.get_image()[:, :, ::-1])
    # res_fname = save_img_output(predictor(cv2.imread(fname)), fname.replace('png', 'json'))
    display(image_output_bbox(outputs))

# eval(image_output_bbox(outputs))
```

```
parsing: IMG_20230527_193911.jpg  
/usr/local/lib/python3.10/dist-packages/torch/functional.py:504: UserWarning: torch.meshgrid: in an upcoming release, it will  
return a tuple of tensors, instead of a meshgrid object. # type: ignore[attr-defined]
```



```
{'pred_boxes': [[1664.0343017578125,  
2211.4384765625,  
1846.2711181640625,  
2449.178466796875]],  
'scores': [0.9890395402908325],  
'pred_classes': [56]}  
parsing: IMG_20230527_193915.jpg
```



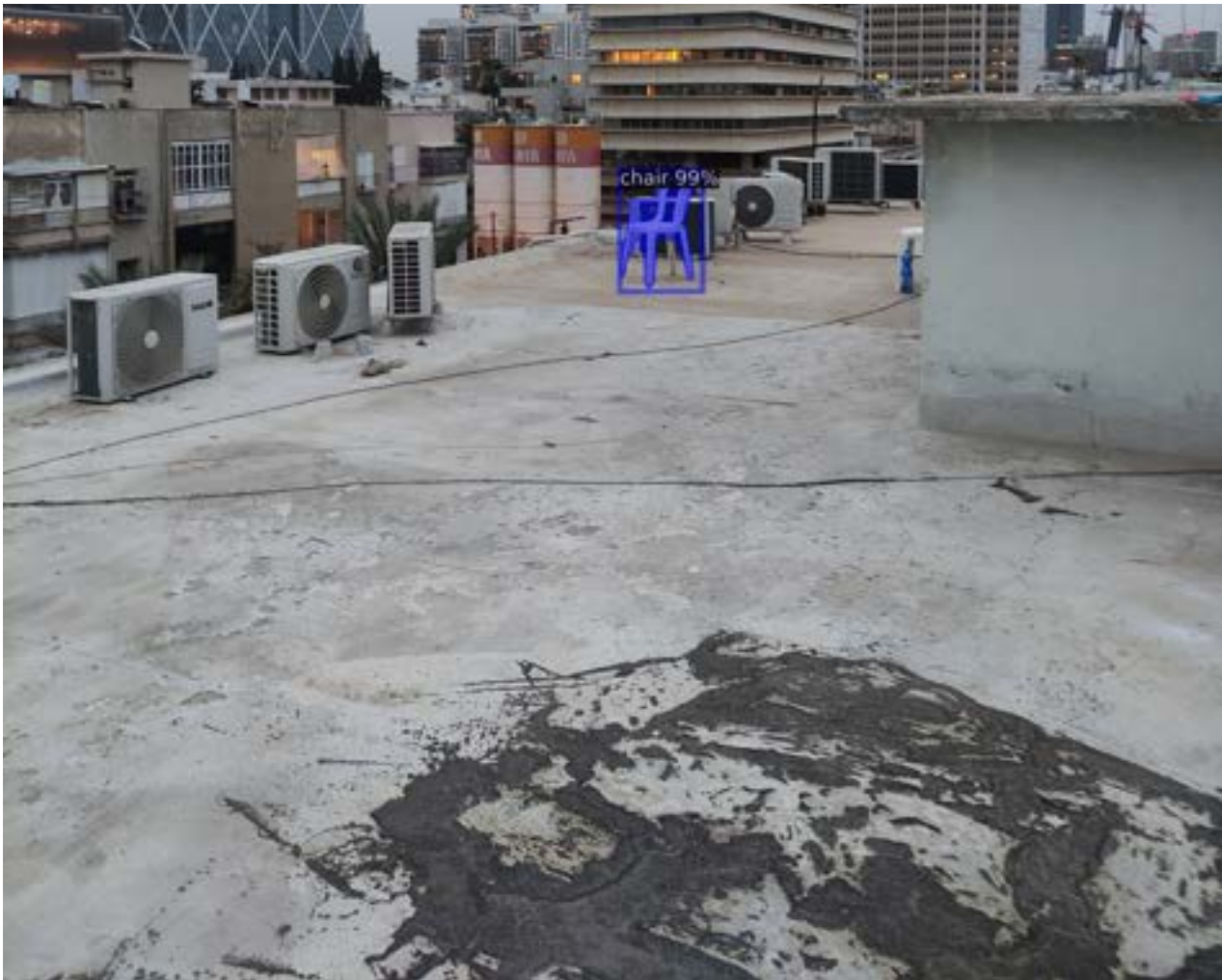

```
{ 'pred_boxes': [[1899.4244384765625,  
2256.562744140625,  
2114.703857421875,  
2517.085205078125]],  
'scores': [0.9804795980453491],  
'pred_classes': [56]}  
parsing: IMG_20230527_193919.jpg
```





```
{ 'pred_boxes': [[1958.7423095703125,
2262.435546875,
2191.429931640625,
2560.0087890625]],
'scores': [0.9931434392929077],
'pred_classes': [56]}
parsing: IMG_20230527_193923.jpg
```





```
{ 'pred_boxes': [[1757.066162109375,  
2309.724853515625,  
1992.8900146484375,  
2657.20654296875]],  
  'scores': [0.991543173789978],  
  'pred_classes': [56]}  
parsing: IMG_20230527_193927.jpg
```





```
{ 'pred_boxes': [[1552.2760009765625,
2360.260498046875,
1825.2176513671875,
2742.096923828125]],
'scores': [0.9872844219207764],
'pred_classes': [56]}
parsing: IMG_20230527_193930.jpg
```





```
{ 'pred_boxes': [[1755.489013671875,
2424.630615234375,
2066.094970703125,
2852.80419921875],
[2812.885986328125, 2686.75390625, 2872.087890625, 2879.402099609375],
[2801.908935546875, 2455.311767578125, 3090.635009765625, 2880.122314453125],
[2796.437255859375, 2450.49267578125, 3094.843994140625, 2885.57958984375]],
'scores': [0.991809070110321,
0.9573569893836975,
0.7622351050376892,
0.7526111006736755],
'pred_classes': [56, 39, 56, 13]}
parsing: IMG_20230527_193935.jpg
```





```
{'pred_boxes': [[1604.8935546875,
2376.311767578125,
1944.4326171875,
2869.37255859375],
[2813.353271484375, 2417.884033203125, 3158.966552734375, 2947.0712890625],
[3179.03564453125, 2246.33251953125, 3461.18798828125, 3021.4609375],
[2833.544189453125, 2735.57373046875, 2903.28173828125, 2936.53125],
[1952.9652099609375, 2384.35546875, 2121.34716796875, 2682.043701171875]],
'scores': [0.9925684928894043,
0.9552039504051208,
0.9451351165771484,
0.750372588634491,
0.6643755435943604],
'pred_classes': [56, 56, 56, 39, 56]}
parsing: IMG_20230527_193940.jpg
```



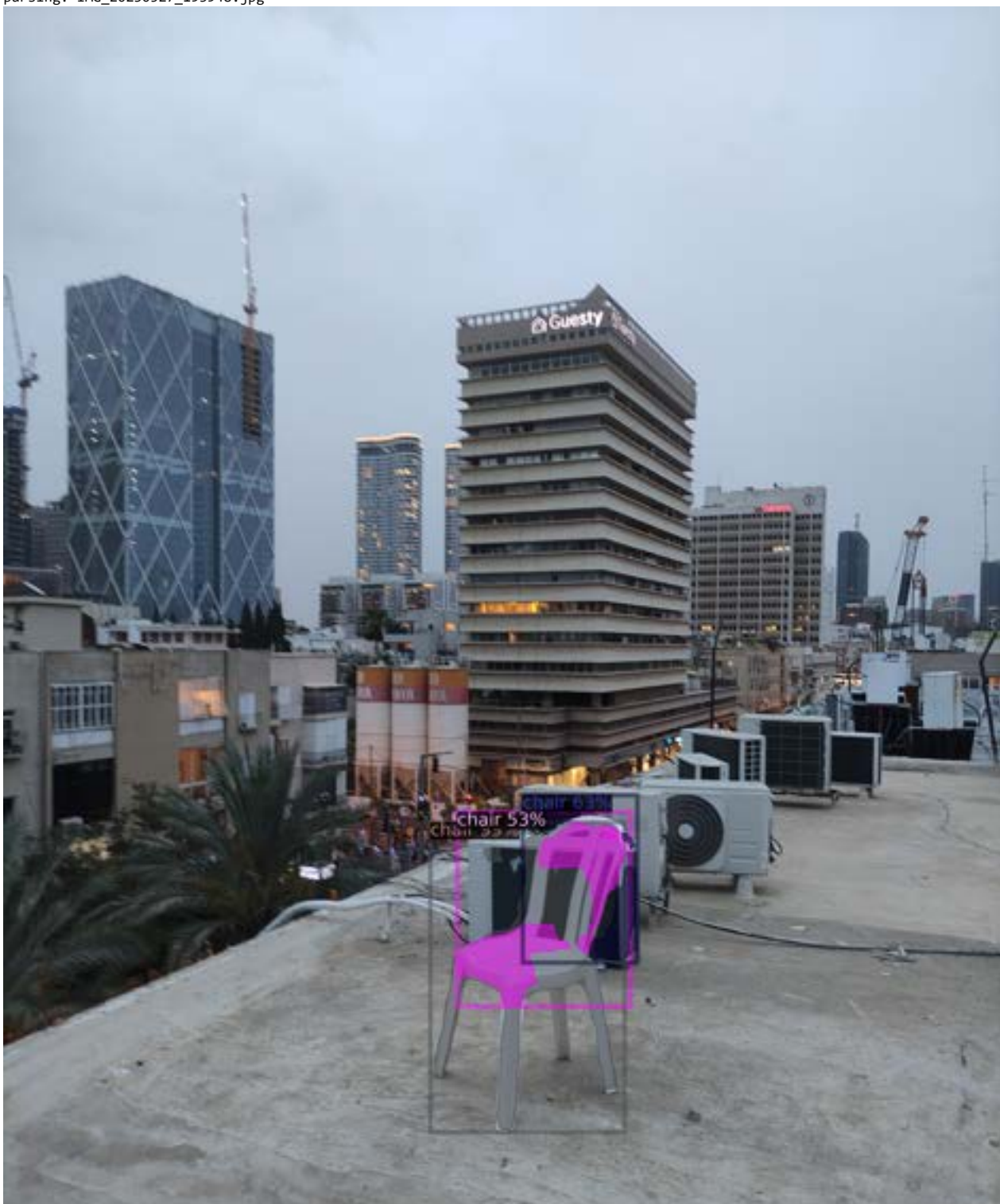


```
{
  'pred_boxes': [[1569.116943359375,
    2450.83349609375,
    1985.792724609375,
    3062.9111328125],
    [3084.09423828125, 2916.576904296875, 3163.005859375, 3169.960693359375],
    [3042.23095703125, 2504.33251953125, 3468.372802734375, 3240.8955078125],
    [1768.697265625, 2435.931884765625, 1994.697509765625, 2548.177490234375],
    [3029.844970703125, 2526.41845703125, 3470.588623046875, 3195.69287109375],
    [1754.58740234375, 2444.23974609375, 2027.9327392578125, 2848.076416015625],
    [1474.90771484375, 2466.51123046875, 1651.1029052734375, 2733.8193359375]],
  'scores': [0.9896687865257263,
    0.9462277293205261,
    0.8944146633148193,
    0.7414673566818237,
    0.6911754608154297,
    0.5923183560371399,
    0.5867781043052673],
  'pred_classes': [56, 39, 13, 56, 56, 56, 56]}
parsing: IMG_20230527_193944.jpg
```





```
{ 'pred_boxes': [[1596.1048583984375,
  2702.44384765625,
  2082.6162109375,
  3449.81787109375],
  [1894.83642578125, 2595.484130859375, 2237.17724609375, 3079.466064453125],
  [1949.61376953125, 2695.0029296875, 2163.269287109375, 3117.403076171875]],
  'scores': [0.9926437735557556, 0.6859188079833984, 0.5716659426689148],
  'pred_classes': [56, 56, 56]}
parsing: IMG_20230527_193948.jpg
```





```
{ 'pred_boxes': [[1475.8773193359375,
2818.90771484375,
2147.44287109375,
3889.684814453125],
[1795.468017578125, 2724.622802734375, 2190.55126953125, 3304.030517578125],
[1569.150634765625, 2784.452392578125, 2167.895263671875, 3454.89208984375]],
'scores': [0.9948899745941162, 0.6347652673721313, 0.5330192446708679],
'pred_classes': [56, 56, 56]}
parsing: IMG_20230527_193952.jpg
```



```
{ 'pred_boxes': [[1339.128662109375, 3047.27978515625, 2270.5, 4581.2373046875],
[562.4506225500000, 2252.716552721275, 615.2066671901699, 2202.570500042751],
[562.4506225500000, 2252.716552721275, 615.2066671901699, 2202.570500042751]],
'scores': [0.9948899745941162, 0.6347652673721313, 0.5330192446708679],
'pred_classes': [56, 56, 56]}
parsing: IMG_20230527_193952.jpg
```

```
[1388.085693359375, 2564.3076171875, 1417.1279296875, 2626.21826171875],  
[1344.3023681640625, 2705.38427734375, 1378.484130859375, 2789.075927734375],  
[999.2119140625, 2844.655517578125, 1315.4578857421875, 3136.64892578125],  
[1750.0386962890625, 2653.85009765625, 2815.148193359375, 3254.03271484375],  
[1290.4488525390625, 2838.65478515625, 1350.8436279296875, 3011.736328125]],  
'scores': [0.9967697858810425,  
0.671518862247467,  
0.6628005504608154,  
0.646913468837738,  
0.6349268555641174,  
0.5512834787368774,  
0.50490802526474],  
'pred_classes': [56, 0, 9, 9, 0, 7, 0]]
```