4、yolov5 model training

yolov5 official tutorial: https://github.com/ultralytics/yolov5/blob/master/tutorial.ipynb

yolov5 official source code: https://github.com/ultralytics/yolov5

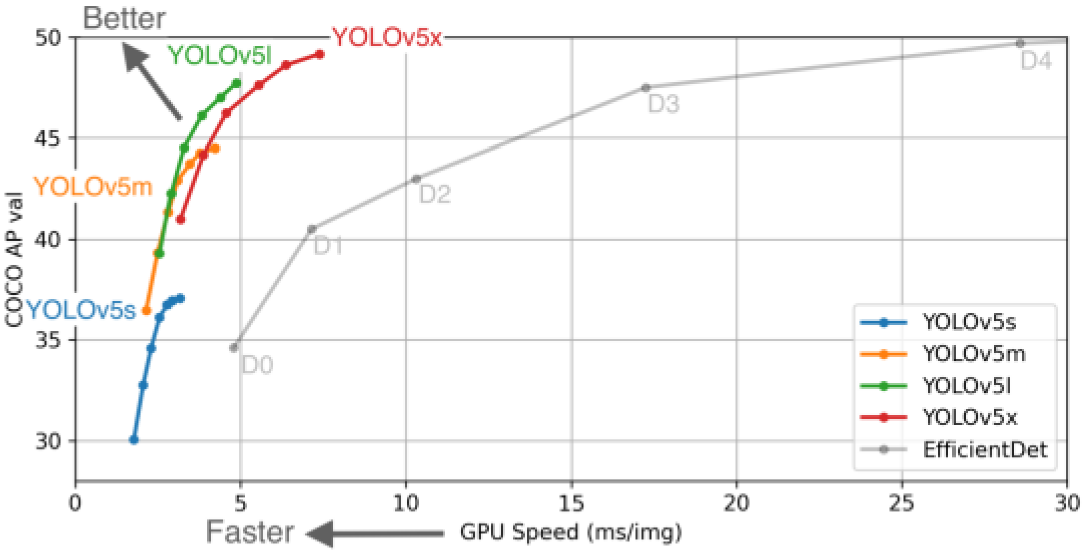
yolov5 weight file: https://github.com/ultralytics/yolov5/releases

4.1. yolov5 introduction

In February 2020, Joseph Redmon, the father of YOLO, announced his withdrawal from the field of computer vision research. YOLOv4 was released on April 23, 2020, and YOLOv5 was released on June 10, 2020. The developer of YOLOv5 claims that YOLOv5 can achieve a fast detection of 140 FPS on Tesla P100; while the detection speed of YOLOv4 is 50 FPS. Not only that, the size of YOLOv5 is only 27 MB. YOLOv4 is 244 MB. YOLOv5 is nearly 90% smaller than YOLOv4. In terms of accuracy metrics, YOLOv5 is comparable to YOLOv4.

As a result, YOLOv5 is very fast, has a very lightweight model size, and is as accurate as the YOLOv4 baseline.

Yolov5 author’s algorithm performance test chart:



Video test official case

```
cd ~/software/yolov5
python3 detect.py --source 0
```

Important folder description:

- data：stores the yaml files that need to be loaded during training
- garbage：stores the data set generation program and garbage identification related files, including the generated training data set (train/images)
- models：stores some training configuration files, such as yolov5s.yaml
- runs：storage of trained data model (train) and prediction result output folder (detect)

4.2. Environmental requirements

The factory image has been configured and no installation is required.

```
# YOLOv5 馃殌 requirements
# Usage: pip install -r requirements.txt

# Base ------------------------------------------------------------------------
gitpython
ipython  # interactive notebook
matplotlib>=3.2.2
numpy>=1.18.5
#opencv-python>=4.1.1
Pillow>=7.1.2
psutil  # system resources
PyYAML>=5.3.1
requests>=2.23.0
scipy>=1.4.1
thop>=0.1.1  # FLOPs computation
#torch>=1.7.0  # see https://pytorch.org/get-started/locally (recommended)
#torchvision>=0.8.1
tqdm>=4.64.0
# protobuf<=3.20.1  # https://github.com/ultralytics/yolov5/issues/8012

# Logging ---------------------------------------------------------------------
tensorboard>=2.4.1
# clearml>=1.2.0
# comet

# Plotting --------------------------------------------------------------------
pandas>=1.1.4
seaborn>=0.11.0

# Export ----------------------------------------------------------------------
# coremltools>=6.0  # CoreML export
# onnx>=1.9.0  # ONNX export
# onnx-simplifier>=0.4.1  # ONNX simplifier
# nvidia-pyindex  # TensorRT export
# nvidia-tensorrt  # TensorRT export
# scikit-learn<=1.1.2  # CoreML quantization
# tensorflow>=2.4.1  # TF exports (-cpu, -aarch64, -macos)
# tensorflowjs>=3.9.0  # TF.js export
# openvino-dev  # OpenVINO export
# Deploy ----------------------------------------------------------------------
# tritonclient[all]~=2.24.0

# Extras ----------------------------------------------------------------------
# mss  # screenshots
# albumentations>=1.0.3
# pycocotools>=2.0  # COCO mAP
# roboflow
# ultralytics  # HUB https://hub.ultralytics.com
```

Installation example

```
pip install imgaug
```

4.3. Usage process

- After completing the configuration according to the above process
- Under the path [garbage/texture], fill in more background images ([more])
- Run the [Get_garbageData.py] file to obtain the data set (you need to modify the number of types in line 120 and the number of generated data sets in line 156 [more])

  ```
  for i in range(0, 10):
      index = np.random.randint(0, 16)
      readimg = cv.imread('./image/' + str(index) + '.png')
      readimg = cv.resize(readimg, (200, 200))
      overlay = random_augment(readimg)
      h, w = overlay.shape[:2]
      x = np.random.randint(0, 416 - h)
      y = np.random.randint(0, 416 - w)
      if checkOverlap(rectangles, (y, x, y + w, x + h)): continue
      hsv = cv.cvtColor(overlay, cv.COLOR_BGR2HSV)
      lowerb = (35, 43, 36)
      upperb = (77, 255, 255)
      dst = cv.inRange(hsv, lowerb, upperb)
      ...............
  ```

  16 represents the number of types, which should be modified according to the actual number of recognized types.

```
def generateImage():
    rootdir = './texture'
    # List all directories and files in a folder
    # List all directories and files in a folder
    list = os.listdir(rootdir)
    for i in range(0, 100):
        index = np.random.randint(0, len(list))
        txt_path = os.path.join(rootdir, list[index])
        overlay, label = transparentOverlay(txt_path)
        cv.imwrite("./train/images/" + str(i) + ".jpg", overlay)
        with open("./train/labels/" + str(i) + ".txt", "w") as wf:
            wf.write(label)
            wf.flush()
```

100 means generating 100 training images.

- Run the [train.py] file to start training
- Run [detect.py] for image prediction

4.4. Custom training data set

4.4.1. Collect data sets

First go to Baidu to download or use other methods. Under the path [garbage/texture], fill in more background images ([more])

Run the [Get_garbageData.py] file to obtain the data set

```
cd ~/software/yolov5/garbage
python3 Get_garbageData.py
```

4.4.2. Create yaml file

For example garbage.yaml:

```
train: /home/jetson/software/yolov5/garbage/train/images  # train images Path to
generate training data set
val: /home/jetson/software/yolov5/garbage/train/images  # val images Path to
generate training data set
names:
  0: Zip_top_can
  1: Old_school_bag
  2: Newspaper
  3: Book
  4: Toilet_paper
  5: Peach_pit
  6: Cigarette_butts
  7: Disposable_chopsticks
  8: Egg_shell
  9: Apple_core
  10: Watermelon_rind
  11: Fish_bone
  12: Expired_tablets
  13: Expired_cosmetics
  14: Used_batteries
  15: Syringe
```

4.5.3. Modify train.py

```
parser.add_argument('--weights', type=str, default=ROOT / 'yolov5s.pt', help='initial weights path') # Pre-trained weights
parser.add_argument('--data', type=str, default=ROOT / 'data/garbage.yaml', help='dataset.yaml path')        #Custom training files
parser.add_argument('--epochs', type=int, default=100, help='total training epochs')                                    # Customize training epochs, how many rounds of training
parser.add_argument('--batch-size', type=int, default=-1, help='total batch size for all GPUs, -1 for autobatch')        # Total batch size across all GPUs
parser.add_argument('--imgsz', '--img', '--img-size', type=int, default=640, help='train, val image size (pixels)')  # Image size
parser.add_argument('--device', default='cpu', help='cuda device, i.e. 0 or 0,1,2,3 or cpu')            # Choose CPU or GPU
parser.add_argument('--project', default=ROOT / 'runs/train', help='save to project/name')                  # Training result output folder
```

Other places are based on your own needs.

4.5.4. Modify model configuration file

Modify the second line of the yaml file of the yolov5 neural network and use which weight file to modify the corresponding yaml file.

Here we are using yolov5s.yaml, so just modify the second line of the models/yolov5s.yaml file.

```
nc: 16  # number of classes
```

4.5.5. Modify detect.py

It's almost the same place that needs to be modified in the [train.py] file.

```
parser.add_argument('--weights', nargs='+', type=str, default=ROOT / 'best.pt', help='model path or triton URL') #Pre-trained weights
parser.add_argument('--source', type=str, default=ROOT / 'data/images', help='file/dir/URL/glob/screen/0(webcam)') # Enter predicted image
parser.add_argument('--imgsz', '--img', '--img-size', nargs='+', type=int, default=[640], help='inference size h,w')                     # Image size
parser.add_argument('--device', default='', help='cuda device, i.e. 0 or 0,1,2,3 or cpu')            # Choose CPU or GPU
parser.add_argument('--project', default=ROOT / 'runs/detect', help='save results to project/name')            #Prediction result output folder
```

Other places are based on your own needs.

4.5.6. Training and prediction

```
cd ~/software/yolov5
python3 train.py
```

Train the model. After training, the final model will be produced in the [runs/train] folder. By default, the folder with the exp prefix is generated, and the latest one is generated.

Video real-time monitoring requires modifying the model path.

```
python3 detect.py --source 0
```