5 Yolov5+tensorrt acceleration(jetson)

tensorrt source code: https://github.com/wang-xinyu/tensorrtx

Official installation tutorial: https://docs.nvidia.com/deeplearning/tensorrt/install-guide/index.html

Official tutorial: https://docs.nvidia.com/deeplearning/tensorrt/developer-guide/index.html

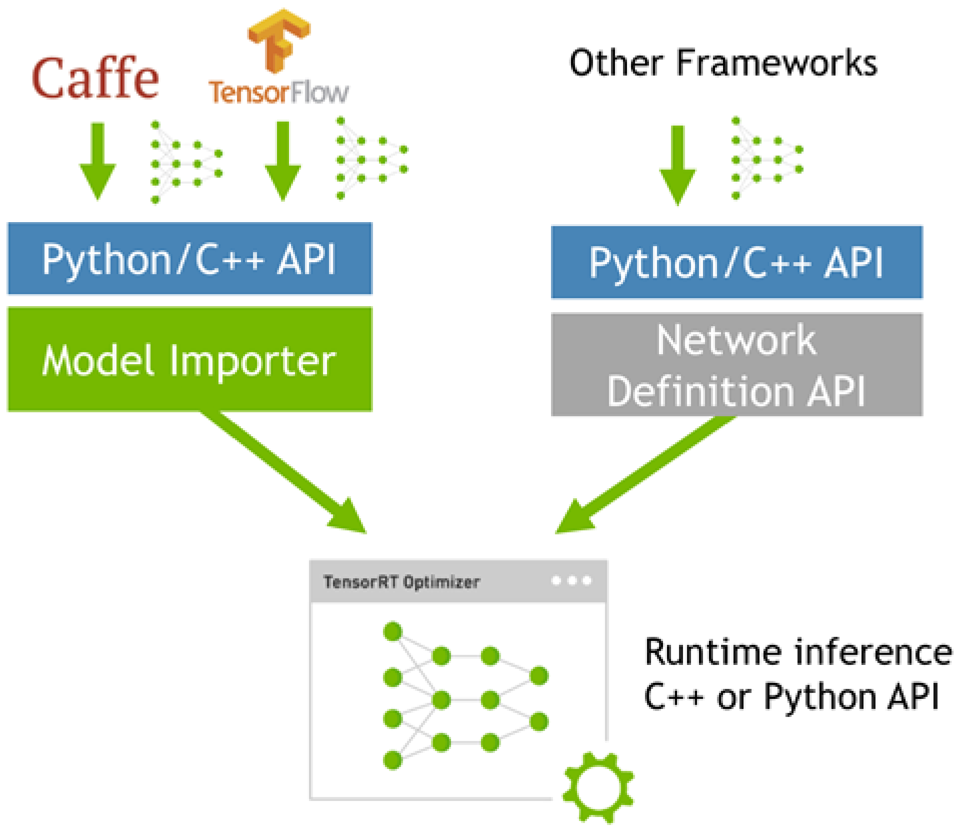
5.1 Introduction

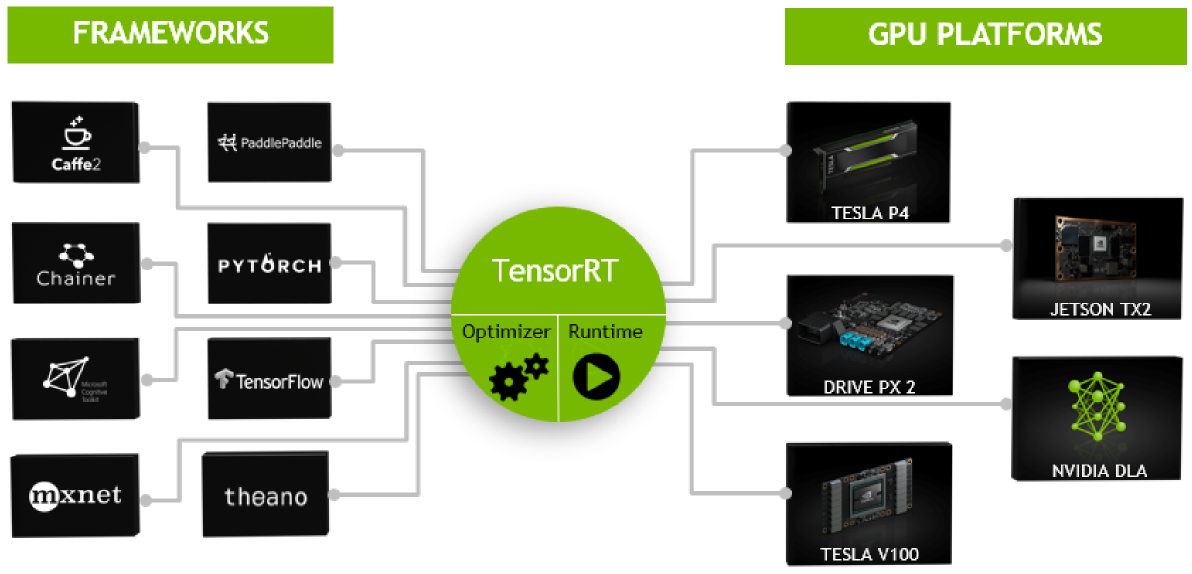
TensorRT is a high-performance deep learning inference(Inference) optimizer that provides low-latency, high-throughput deployment inference for deep learning applications. TensorRT can be used to accelerate inference in hyperscale data centers, embedded platforms, or autonomous driving platforms. TensorRT can now support almost all deep learning frameworks such as TensorFlow, Caffe, Mxnet, Pytorch, etc. The combination of TensorRT and NVIDIA GPU can perform fast and efficient deployment inference in almost all frameworks.

Can TensorRT accelerate the model?

can!According to official documents, using TensorRT, it can provide 10X or even 100X acceleration in CPU or GPU mode. TensorRT provides 20X speedup.

TensorRT is only responsible for the inference process of the model and optimizes the trained model. Generally, TensorRT is not used to train the model. tensorRT is just an inference optimizer. After your network is trained, you can directly drop the training model file into tensorRT without relying on the deep learning framework(Caffe, TensorFlow, etc.), as follows:





It can be considered that tensorRT is a deep learning framework with only forward propagation. This framework can parse the network models of Caffe and TensorFlow, and then map them one by one with the corresponding layers in tensorRT, and convert all the models of other frameworks into tensorRT. Then in tensorRT, you can implement optimization strategies for NVIDIA's own GPUs and accelerate deployment.

5.2 Use

```
roslaunch yahboomcar_yolov5 yolodetect.launch device:=nano4G display:=true
```

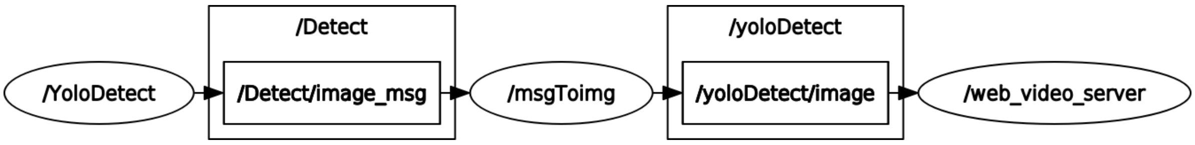
- [device] parameter: the main control device of the robot, for example: nano4G, nx, etc.
- [display] parameter: whether to enable the visual interface.

Support real-time monitoring of web pages, such as:

```
192.168.2.89:8080
```

View node information

```
rqt_graph
```



Print detection information

```
rostopic echo/DetectMsg
```

print as follows

```
data :
  -
    frame_id :  "tv"
    stamp :
      secs :  1646123012
      nsecs :  116803169
    scores :  0.754247903824
    ptx :  106.302101135
    pty :  121.952651978
    distw : 144.548706055
    disth : 90.0989227295
    centerx :  72.2743530273
    centery :  45.0494613647
```

- frame_id: Identifying name.
- scores: Identify scores.
- ptx, pty: the coordinates of the upper left corner of the recognition box.
- distw, disth: The width and height of the recognition box.
- centerx, centery: Identify the center.

5.3 tensorrt deployment process

5.3.1 Generate .wts file

For example: yolov5s.wts

Copy tensorrtx_yolov5_jetson/gen_wts.py and [yolov5-5.0/weights/yolov5s.pt] weight file(or the weight file downloaded by Baidu, take [yolov5s.pt] as an example)) to [~/software/yolov5-5.0] folder, and execute gen_wts.py in this directory to generate the .wts file.

```
python3 gen_wts.py -w yolov5s.pt
```

Copy the generated [yolov5s.wts] file to the tensorrtx_yolov5_jetson directory, and compile tensorrtx in this directory

```
mkdir build && cd build && cmake ..
```

Change CLASS_NUM in yololayer.h to yours. Because the official data set is coco, the default is 80.

Execute makeFile. (make once every time it is modified to CLASS_NUM)

```
make -j4
```

5.3.2 Generate .engine file

Generate .engine file(I use yolov5s, so end with s)

```
sudo ./yolov5 -s ../yolov5s.wts yolov5s.engine s
```

If you customize depth_multiple and width_multiple during training, just write:

```
sudo ./yolov5 -s ../yolov5.wts yolov5.engine c 0.33 0.5
```

The P6 model of yolov5 was also updated in tensorrtx 5.0

```
sudo ./yolov5 -s ../yolov5.wts yolov5.engine s6
```

5.3.3 Test

Test it with the pictures that come with it(there are two pictures in the samples)

```
sudo ./yolov5 -d yolov5s.engine ../samples
```

You can test it with a python file, you need to create a yaml file.

For example: coco.yaml

```
PLUGIN_LIBRARY : libmyplugins.so               # plugin library
engine_file_path : yolov5s.engine              # engine file path
CONF_THRESH : 0.5                              # CONF threshold
IOU_THRESHOLD : 0.4                            # IOU threshold
categories : [ "person", "bicycle", ... ...] # Identify categories
```

test

```
cd ..
python3 yolov5.py
```

5.4 ROS deployment

Copy the generated [yolov5s.engine] and [libmyplugins.so] files to the [yahboomcar_yolov5] function package [param/nano4G] folder, for example:

```
yahboomcar_yolov5
    ├──  CMakeLists.txt
    ├──  launch
    |     └──  yolodetect.launch
    ├──  package.xml
    ├──  param
    |     ├──  coco.yaml
    │     ├── nano4G
    │     │     ├── libmyplugins.so
    │     │     └── yolov5s.engine
    │     └── nx
    │         ├── libmyplugins.so
    │         └── yolov5s.engine
    └── scripts
        └── yolov5.py
```

When using, follow the operation steps of [5.2].

write yaml file

For example: coco.yaml

```
PLUGIN_LIBRARY : libmyplugins.so              # plugin library
engine_file_path : yolov5s.engine             # engine file path
CONF_THRESH : 0.5                             # CONF threshold
IOU_THRESHOLD : 0.4                           # IOU threshold
categories : [ "person", "bicycle", ... ...] # Identify categories
```

If the file name changes, you need to modify the [yolov5.py] file and open it in the file path

```
sudo vim ~/yahboomcar_ws/src/yahboomcar_yolov5/scripts/yolov5.py
```

As follows

```
class  YoloDetect :
     def __init__(self):
        rospy.on_shutdown(self.cancel)
        rospy.init_node("YoloDetect", anonymous = False)
        self.pTime  =  self.cTime  =  0
        device  =  rospy.get_param("~device", "nano4G")
        param_  =  rospkg.RosPack(). get_path("yahboomcar_yolov5")  +  '/param/'

        file_yaml  =  param_  +  'coco.yaml'
        PLUGIN_LIBRARY  =  param_  +  device  +  "/libmyplugins.so"
        engine_file_path  =  param_  +  device  +  "/yolov5s.engine"
        self.yolov5_wrapper  =  YoLov5TRT(file_yaml, PLUGIN_LIBRARY,
engine_file_path)
        self.pub_image  =  rospy.Publisher('Detect/image_msg', Image_Msg,
queue_size = 10)
        self.pub_msg  =  rospy.Publisher('DetectMsg', TargetArray, queue_size =
10)
```

The parameters of [file_yaml], [PLUGIN_LIBRARY], and [engine_file_path] should correspond one-to-one with the used names.