

君正®

Magik 训练量化使用指南

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君正®

Magik训练量化

使用指南

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Release history

Date/Author	Revision	Change
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Ingenic Semiconductor Co., Ltd.

**Ingenic Headquarters, East Bldg. 14, Courtyard #10
Xibeiwang East Road, Haidian District, Beijing, China,
Tel: 86-10-56345000
Fax: 86-10-56345001
Http: //www.ingenic.com**

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1 简介

本指南主要针对使用君正处理芯的 Magik 平台的新手，这里以 pytorch 框架下的 YOLOv5s 的 person 为例，从环境搭建、数据准备、网络训练、模型转换到最终的上板运行进行全流程的详细介绍，旨在引导使用者熟悉 Magik 的使用方法，进行实现上板流程。

2 环境安装要求

- Linux
- GCC ($\geq 5.4.0$)
- Nvidia Driver
- CUDA (≥ 9.0)
- CUDNN
- Python (≥ 3.5)
- Pytorch (≥ 1.3)
- Torchvision

若上述环境均已具备(版本可不作固定要求)，同步给相关人员以适配环境编译对应的插件，拿到插件安装包之后可直接转到步骤 3.9。

3 环境安装步骤

3.1 Ubuntu

- 装机要求：Ubuntu16.04

3.2 GCC

- 版本要求：5.4.0
- 具体步骤
 1. 查看当前系统 Ubuntu16.04 的原装 GCC 版本：
`gcc -v`
 2. 下载：
<http://ftp.gnu.org/gnu/gcc>
 3. 编译安装：
`tar -zxvf gcc-5.4.0.tar.bz2`
`cd gcc-5.4.0`
`./contrib/download_prerequisites`
`cd ..`
`mkdir gcc-build-5.4.0`

```
cd gcc-build-5.4.0
../gcc-5.4.0/configure --enable-checking=release --enable-languages=
c,c++ --disable-multilib
sudo make
sudo make install
4. 检查:
再次 gcc -v 查看版本
```

3.3 Nvidia Driver

- 版本要求: ≥ 440
- 具体步骤
 1. 下载驱动程序
英伟达官网地址:
<http://www.nvidia.cn/Download/index.aspx?lang=cn>
 2. 禁用 nouveau 第三方驱动
打开编辑配置文件:
`sudo gedit /etc/modprobe.d/blacklist.conf`
在最后一行添加: `blacklist nouveau`
改好后执行命令: `sudo update-initramfs -u`
重启使之生效: `reboot`
 3. 安装驱动
执行命令: `lsmod | grep nouveau`
禁用 X 服务: `sudo /etc/init.d/lightdm stop` (或者: `sudo service lightdm stop`)
给驱动 run 文件赋予可执行权限: `sudo chmod a+x NVIDIA-Linux-x86_64-440.64.run` (下载的驱动文件名)
安装: `sudo ./NVIDIA-Linux-x86_64-440.64.run -no-opengl-files`
开启 X 服务: `sudo /etc/init.d/lightdm start` (或者: `sudo service lightdm start`)
`-no-opengl-files` 只安装驱动文件, 不安装 OpenGL 文件。这个参数最重要
`-no-x-check` 安装驱动时不检查 X 服务, `-no-nouveau-check` 安装驱动时不检查 nouveau, 后面两个参数可不加。
 4. 检查
重启, 没有问题, 输入命令: `nvidia-smi`
如果出现了驱动版本就表示安装成功了。

Tue Feb 8 17:03:49 2022

NVIDIA-SMI 440.31				Driver Version: 440.31		CUDA Version: 10.2	
GPU	Name	Persistence-M	Bus-Id	Disp.A	Volatile	Uncorr. ECC	
Fan	Temp	Perf	Pwr:Usage/Cap	Memory-Usage	GPU-Util	Compute M.	
0	GeForce GTX 108...	Off	00000000:02:00:0	Off		N/A	
0%	35C	P8	10W / 250W	0MiB / 11178MiB	0%	Default	
1	GeForce GTX 108...	Off	00000000:03:00:0	Off		N/A	
0%	50C	P2	60W / 250W	829MiB / 11178MiB	0%	Default	
2	GeForce GTX 108...	Off	00000000:03:00:0	Off		N/A	
0%	39C	P8	9W / 250W	10MiB / 11177MiB	0%	Default	
3	GeForce GTX 108...	Off	00000000:04:00:0	Off		N/A	
0%	36C	P8	10W / 250W	10MiB / 11178MiB	0%	Default	
Processes:							
GPU	PID	Type	Process name	GPU Memory Usage			

3.4 CUDA

- 版本要求: 10.0
- 具体步骤

1. 下载:

登录官网 <https://developer.nvidia.com/cuda-10.0-download-archive?>

选择 linux—x86_64—Ubuntu—16.04—runfile(local)

下载 `cuda_10.0.130_410.48_linux.run`

CUDA Toolkit 10.0 Archive

Select Target Platform ⓘ

Click on the green buttons that describe your target platform. Only supported platforms will be shown.

Operating System: Windows, Linux, Mac OSX

Architecture ⓘ: x86_64, ppc64le

Distribution: Fedora, OpenSUSE, RHEL, CentOS, SLES, Ubuntu

Version: 18.04, 16.04, 14.04

Installer Type ⓘ: runfile (local), deb (local), deb (network), cluster (local)

Download Installers for Linux Ubuntu 16.04 x86_64

The base installer is available for download below.
There is 1 patch available. This patch requires the base installer to be installed first.

Base Installer [Download (2.0 GB) ⬇]

Installation Instructions:

1. Run `sudo sh cuda_10.0.130_410.48_linux.run`
2. Follow the command-line prompts

Patch 1 (Released May 10, 2019) [Download (3.3 MB) ⬇]

In this patch we introduce new APIs for JPEG stream parsing and device and pinned memory control as well as a new hybrid decode API that decouples decoding process into pure host and device stages enabling more flexible control flow. The new APIs also support ROI decoding and 4 channel jpeg bitstreams.

2. 安装:

`sudo sh cuda_10.0.130_410.48_linux.run`

3. 查看版本:

`cat /usr/local/cuda/version.txt`

4. cuda 设置(适用于多个不同版本时):

`export PATH=/usr/local/cuda/bin:$PATH`

`export LD_LIBRARY_PATH=`

`/usr/local/cuda/lib64:$LD_LIBRARY_PATH`

3.5 CUDNN

- 版本要求: 7.6.5
- 具体步骤

1. 下载:

登陆官网: <https://developer.nvidia.com/rdp/cudnn-download>

选择 cuDNN Library for Linux: cudnn-10.0-linux-x64-v7.6.5.32.tgz

2. 解压:

```
tar -zxvf cudnn-10.0-linux-x64-v7.6.5.32.tgz
```

得到:

```
cuda/include/cudnn.h
```

```
cuda/NVIDIA_SLA_cuDNN_Support.txt
```

```
cuda/lib64/libcudnn.so
```

```
cuda/lib64/libcudnn.so.7
```

```
cuda/lib64/libcudnn.so.7.6.5
```

```
cuda/lib64/libcudnn_static.a
```

3. 拷贝:

```
sudo cp cuda/lib64/* /usr/local/cuda-10.0/lib64/
```

```
sudo cp cuda/include/* /usr/local/cuda-10.0/include/
```

4. 版本查看:

```
cat /usr/local/cuda/include/cudnn.h | grep CUDNN_MAJOR -A 2
```

得到:

```
#define CUDNN_MAJOR 7
```

```
#define CUDNN_MINOR 6
```

```
#define CUDNN_PATCHLEVEL 5
```

```
#define CUDNN_VERSION (CUDNN_MAJOR * 1000 + CUDNN_MINOR
```

```
* 100 + CUDNN_PATCHLEVEL)
```

```
#include "driver_types.h"
```

3.6 Python

- 版本要求: 3.7 (注: 系统自带的 python2.7 不要卸载或删除, 以免影响系统运行)

- 具体步骤:

1. 下载:

```
wget https://www.python.org/ftp/python/3.7.3/Python-3.7.3.tar.xz
```

2. 编译安装:

```
tar -xvJf Python-3.7.3.tar.xz
```

```
cd Python-3.7.3
```

```
./configure --prefix=/usr/local/bin/python3
```

```
sudo make
```

```
sudo make install
```

3. 创建软链接:

```
ln -s /usr/local/bin/python3/bin/python3 /usr/bin/python3
```

```
ln -s /usr/local/bin/python3/bin/pip3 /usr/bin/pip3
```

4. 版本查看:

```
python3 --version
```

3.7 Pytorch

- 版本要求: 1.3.0

- 具体步骤:

1. pip 安装: `pip3 install torch==1.3.0`

注: 这里的 pip3 是上面的 python3.7 下的, 可通过 `pip3 -V` 查看

2. 版本查看:

```
python3
```

```
>> import torch
```

```
>> print(torch.__version__)
```

3.8 Torchvision

- 版本要求: 0.4.2

- 具体步骤:

1. pip 安装: `pip3 install torchvision==0.4.2`

注: 这里的 pip3 是上面的 python3.7 下的, 可通过 `pip3 -V` 查看

2. 版本查看:

```
python3
```

```
>> import torchvision
```

```
>> print(torchvision.__version__)
```

3.9 Magik 训练插件

- 版本要求: 1.1.1

- 具体步骤:

1. 环境确认:

```
python
```

```
import torch
```

```
print(torch.__version__) #torch 的版本
```

```
print(torch.version.cuda) #对应的 cuda 版本
```

```
print(torch.backends.cudnn.version()) #对应的 cudnn 的版本
```

也可以根据自身需要设置 cuda 和 cudnn 的版本

2. 安装前根据上述环境在插件目录

magik-toolkit/TrainingKit/pytorch/magik_whl 下找到对应的安装包

pip 安装: `pip3 install magik_trainingkit_torch_130-1.1.1-py3-none-any.whl`

注：这里的 whl 安装包由我们根据客户的环境提供，如有更改，需告知相关人员同步更新。

2. 查看是否安装成功：

```
>>> from ingenic_magik_trainingkit.QuantizationTrainingPlugin.python import ops
INFO(magik): trainingkit version:1.1.1(00010101_84f712d) built:20220121-1849(5.4.0 pytorch)
>>>
```

出现上图表明导入成功，绿色的字体中有当前使用插件的版本，commit 号及编译的日期。

3.10 其他

运行 yolov5 需要一些其他的安装包：

pandas (pip install pandas)

requests (pip install requests)

cv2 (pip install opencv-python)

yaml (pip install pyyaml)

tqdm (pip install tqdm)

matplotlib (pip install matplotlib)

seaborn (pip install seaborn)

运行时如还有其他，根据提示用 pip install 进行安装，直至正常运行。

4 Yolov5s 训练流程

4.1 代码和模型的下载

yolov5 的代码地址：

<https://github.com/ultralytics/yolov5.git>

这里因为加入了插件部分，对相关算子进行了重新的封装，我们会提供一套基于原生 yolov5 改后的训练代码 yolov5s-person，其中原生的算子也有做注释保留，使用者以对比修改前后的算子了解和熟悉具体修改和使用方法。若对原生的代码感兴趣，或者想先验证一下环境是否正常，也可先跑一下原生的 yolov5 的代码。

提供的代码在 magik-toolkit/Models/T40/training/pytorch/yolov5s-person 下，以下介绍的训练和转换部分均在此目录下完成。

模型的下载地址：

链接：<https://pan.baidu.com/s/1LcE4-gLtGUaEplPrwt32rQ>

提取码：ug3k

如图，这三个模型分别是按步骤用 coco 中的 1 万 5 的单人形（person）数据训练的 32bit，8bit 和 4bit 模型，后面的测试和上板试验用的是 yolov5s-person-4bit.pt，下载放到 magik-toolkit/Models/T40/training/pytorch/yolov5s-person/runs/train 下。

yolov5s-person-4bit.pt等

订阅链接

2022-02-16 13:55

过期时间：永久有效

全部文件

☐

文件名

大小

☐

yolov5s-person-4bit.pt

95.2M

☐

yolov5s-person-8bit.pt

54.7M

☐

yolov5s-person-32bit.pt

54.5M

4.2 数据准备

1. 以 COCO2017 为例，提取出里面的 person(id: 0)部分并转换成 Yolo 训练需要的数据格式，COCO2017 数据集下载好并解压，annotation 文件的格式为.json 格式。

下载地址(用 wget 进行下载):

图片:

<http://images.cocodataset.org/zips/train2017.zip>

<http://images.cocodataset.org/zips/test2017.zip>

<http://images.cocodataset.org/zips/val2017.zip>

标注:

http://images.cocodataset.org/annotations/stuff_annotations_trainval2017.zip

http://images.cocodataset.org/annotations/image_info_test2017.zip

http://images.cocodataset.org/annotations/annotations_trainval2017.zip

2. 生成数据的脚本在 COCO_forYOLO 文件夹下:

(1)运行 `python batch_split_annotation_foryolo.py` (注意修改程序中的 coco 路径'`coco_data_dir='`)。

(2)运行完会在 coco 路径下生成 `person/data/images`、`person/data/ImageSets`、`person/data/labels` 三个文件夹，将 `ImageSets` 下的 `train2017.txt`、`val2017.txt`、`test2017.txt` 放入 `persondet/data/coco` 文件夹下，txt 文件里存储图片的绝对路径。

4.3 网络训练

1. 训练配置:

默认配置参数可参考 `models/commom.py` 中 `is_quantize`, `bitw`, `bita` 等参数:

```

bita = 32

if bita==32:
    bitw = 32
    is_quantize = 0
    clip_max_value = 6.0
    shortcut_clip_max_value = 2.0
elif bita==8:
    bitw = 8
    is_quantize = 1
    clip_max_value = 6.0
    shortcut_clip_max_value = 2.0
elif bita==4:
    bitw = 4
    is_quantize = 1
    clip_max_value = 4.0
    shortcut_clip_max_value = 1.5

weight_factor = 3.0
target_device = "T40"

```

32bit, 设置: bita = 32

8bit, 设置: bita = 8

4bit, 设置: bita = 4

其中,

is_quantize - 是否进行量化, 0-不量化, 1-量化, bita 为 32 时, 注意该值设为 0

bitw - weight 的位宽

bita - feature 的位宽

clip_max_value - feature 的截断值, 建议 8bit 设为 6.0, 4bit 设为 4.0

shortcut_clip_max_value 代表 shortcut 的 feature 的截断值, 建议 8bit 设为 2.0, 4bit 设为 1.5

2. 训练脚本 yolov5s-person/train.sh:

```
export NCCL_IB_DISABLE=1
```

```
export NCCL_DEBUG=info
```

```
GPUS=6
```

```
python3 -m torch.distributed.launch --nproc_per_node=$GPUS
```

```
--master_port=60051 train.py \
```

```
--data data/coco-person.yaml \
```

```
--cfg models/yolov5s.yaml \
```

```
--weights '' \
```

```
--batch-size 132 \
```

```
--hyp data/hyp.scratch.yaml \
```

```
--project ./runs/train/yolov5s-person-32bit \
```

```
--epochs 300 \
```

```
--device 0,1,2,3,4,5
```

(1)关于预训练

浮点训练时没有预训练模型, --weights 为 ' ', 8bit 训练时加载已得到的精度足够的 32bit 模型, 4bit 加载训练好的 8bit 作为预训练模型, 这样一步步推进, 效果更佳。

(2)关于多卡训练

训练时加入了 `torch.distributed.launch`，为多卡的分布式训练，GPUS 的值和下面 device 的总数对应，按实际情况对应修改，如果是单卡训练，直接用 `python3 train.py` 加上后面的参数即可。batch-size 是所有显卡总的 batch 数目，按实际显卡大小设置即可。

(3)关于学习率

超参数的设置在 `data/hyp.scratch.yaml` 里，lr0 设置初始学习率，其余采用默认值。train.py 里加载预训练模型有关于加载 optimizer 的部分，这里因为低 bit 模型相对于 32bit 模型不是接着训练而是类似重训，所以这里建议去掉加载 optimizer 的部分，以免影响低 bit 的训练效果。

```
# Resume
start_epoch, best_fitness = 0, 0.0
if pretrained:
    # Optimizer
    #if ckpt['optimizer'] is not None:
    #    optimizer.load_state_dict(ckpt['optimizer'])
    #    best_fitness = ckpt['best_fitness']

    # EMA
    #if use_ema and ema and ckpt.get('ema'):
    #    ema.ema.load_state_dict(ckpt['model'].float().state_dict())
    #    ema.ema.updates = ckpt['updates']

    # Epochs
    # start_epoch = ckpt['epoch'] + 1

    if resume:
        start_epoch = ckpt['epoch'] + 1
        assert start_epoch > 0, '%s training to %g epochs is finished, nothing to resume.' % (weights, epochs)
```

ema 和 epoch 也存在类似的问题，因为如图也对应做了修改。

(4)模型的保存

train.py 里 `--project` 可设置保存模型路径，在 `runs/train/project` 下，weights 下保存的有两个模型，best.pt 本次训练到目前最好的，last.pt 本次训练到目前最新的，每个 epoch 测试的结果保存在 result.txt 中，可随时查看。

(5)训练经验

针对 yolov5 系列的训练，目前总结的经验是 32bit 用 sgD 和 lr0.01，8bit 基于 32bit 的预训练用 sgD 和 lr0.01，4bit 基于 8bit 的预训练用 adam 和 lr0.001。具体命令参见 train.sh。32bit 没有预训练，收敛稍慢；8bit 有预训练且表达能力可以，收敛较快；4bit 虽有预训练但表达能力稍弱，收敛稍慢。

4.4 模型测试

1.待检测图片

通过 `python3 detect.py -h` 查看选取所需参数，通过设置 source 可检测图片或视频或图片文件夹，检测结果可设置显示(`--view-img`)或保存(`--save-img`)

- Image: `--source file.jpg``
- Video: `--source file.mp4``
- Directory: `--source dir/``

示例如下，若需要其他操作可选择相应的参数；
sh detect.sh(python detect.py --source data/images/bus.jpg \
--weights ./runs/train/yolov5s-person-4bit.pt \
--imgs 640 --device 0 - view-img)

其中，

source - 待检测图片

weights - 训练好的用于测试的模型

imgs - 测试图片的大小

device - 用第几块显卡测试

view-img - 是否画框显示检测结果

注：检测的模型配置一定要和训练时候的配置(bits)一致。

2. 测试模型精度

sh test.sh(python test.py --data data/coco-person.yaml \
--weights ./runs/train/yolov5s-person-4bit.pt \
--imgs 640 --device 0 --batch-size 40)

待测试的模型通过---weights 指定，验证集通过 data/coco-person.yaml 中的 val2017.txt 确定，其余参数根据实际需要给定。

具体测试结果如下：

640x640

	Class	Images	Targets	P	R	mAP@0.5	mAP@.5:.95
32bit:	all	5000	11004	0.771	0.615	0.700	0.422
8bit:	all	5000	11004	0.751	0.638	0.706	0.430
4bit:	all	5000	11004	0.786	0.602	0.698	0.419

models 下的 yolov5m.yaml 和 yolov5l.yaml 也分别对应原始的 yolov5m 和 yolov5l，训练流程也都同 yolov5s，有需要可以直接使用。

5 模型转换

5.1 pt 转 onnx

在上述训练的环境下生成 onnx 文件：

sh convert_onnx.sh(python convert_onnx.py \
--weights ./runs/train/yolov5s-person-4bit.pt)

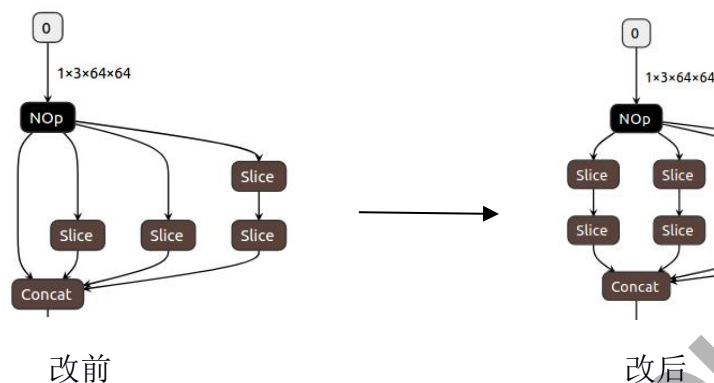
input: 指定待转模型的路径

output: .onnx，位置和.pt 在同一目录

转 onnx 时必须使用 opset9，否则会产生多余的节点导致后续转换工具不支持，如因使用 opset9 转 onnx 失败，可参见步骤 7 的疑问解答，不同版本的 torch 会有一些不同的需要注意的点。

```
def _slice(g, input, axes, starts, ends):
    assert len(starts) == len(ends)
    # if len(starts) == 1 and starts[0] == 0 and ends[0] == 9223372036854775807:
    #     return input
    return g.op("Slice", input, axes_i=axes, starts_i=starts, ends_i=ends)
```

特别地，对于 yolov5 用到了 focus 算子的转 onnx 之前需要注意修改 torch/onnx/symbolic_opset9.py 中的 _slice() 函数，如下：



转换后的 onnx 文件可用 netron 进行可视化查看。

5.2 onnx 转 bin

这一步不依赖 python，torch 及插件等环境，只需要我们的转换工具 magik-transform-tools(在 magik-toolkit/TransFormKit 下)及转换脚本 run.sh：

```
cd transform
```

```
sh run.sh
```

具体地，

```
path=../../../../../TransformKit
```

```
$path/magik-transform-tools \
```

```
--framework onnx \
```

```
--target_device T40 \
```

```
--outputpath yolov5s-person-4bit.mk.h \
```

```
--inputpath ../runs/train/yolov5s-person-4bit.onnx \
```

```
--mean 0,0,0 \
```

```
--var 255,255,255 \
```

```
--img_width 416 \
```

```
--img_height 416 \
```

```
--img_channel 3
```

其中，

inputpath - 转换的输入，上述得到的 onnx 文件

outputpath - 转换的输出，转换完成后会保存在当前目录下生成所需的.bin 文件，这时候模型的大小才会按需求位宽减小

target_device - 和训练时的设置保持一致

mean - 训练时的预处理的均值

var - 训练时的预处理的方差

img_width - 上板运行时的输入的宽(这里用的训练时的设置, 保证 32 对齐即可)

img_height - 上板运行时的输入的宽(这里用的训练时的设置, 保证 32 对齐即可)

img_channel - 上板运行时的输入的通道(和训练保持一致)

```
INFO(magik): magik-transform-tools version:1.0.0(00010000 bbb8835) cuda version:9.0.176 built:20220214-1120 GPU
2022-02-15 14:53:37.819065: W clip_model_by_nop_optimizer.cc:48-collect_remove_nodes] Multiple output NOp exists on the current pathway!
2022-02-15 14:53:37.820572: W clip_model_by_nop_optimizer.cc:48-collect_remove_nodes] Multiple output NOp exists on the current pathway!
2022-02-15 14:53:37.820625: W clip_model_by_nop_optimizer.cc:48-collect_remove_nodes] Multiple output NOp exists on the current pathway!
2022-02-15 14:53:37.820665: W clip_model_by_nop_optimizer.cc:48-collect_remove_nodes] Multiple output NOp exists on the current pathway!
2022-02-15 14:54:00.861688: W quantize_operation.cc:305-search] Not found QuantizeOperation function for Unpool2D
2022-02-15 14:54:00.875195: W quantize_operation.cc:305-search] Not found QuantizeOperation function for Unpool2D
*****
^ ^ Convert successfully, Enjoy it ^ ^
*****
```

转换后会在当前目录生成 yolov5s-person-4bit.bin 文件, 这个就是我们最终上板要用的二进制模型文件。

6 模型上板

6.1 代码编译

1. 准备工作:

(1) mips 编译过的 opencv 库下载地址:

链接: <https://pan.baidu.com/s/1Nx7yflgzNzXCJPTTbLtvJw>

提取码: 8rdl



下载之后放到 magik-toolkit/ThirdParty 下进行解压:

```
tar -xvf opencv_mips_7.2.0_2.26.tar.gz
```

(2) yolov5s-person/venus_sample_yolov5s 目录下我们还提供了上板运行需要的 inference.cpp, Makefile、测试数据, 另外我们还需要用到 venus 库及 mips 编译工具。其中,

venus 库在 magik-toolkit/InferenceKit/T40/venus 下;

mips 编译工具由方案同事提供。

2. 网络输入

这里为了用户快速实现流程, 我们在这里加入了 opencv 的库函数方便调用

imread 等函数，所以测试的时候直接传入 jpg 图即可。

3. 模型的加载

提供的实例 inference.cpp 中模型是通过参数传入的，运行前注意同步拷贝到板端对应的目录并在运行时传入。

4. 超参数的设置

```
void generateBBox(std::vector<venus::Tensor> out_res, std::vector<magik::venus::ObjBbox_t>& candidate_boxes,
float person_threshold = 0.3;
int classes = 1;
float nms_threshold = 0.6;
std::vector<float> strides = {8.0, 16.0, 32.0};
int box_num = 3;
std::vector<float> anchor = {10,13, 16,30, 33,23, 30,61, 62,45, 59,119, 116,90, 156,198, 373,326};
```

strides 和 anchor 按 yolov5 的实际使用设置，person_threshold 和 nms_threshold 分别对应原始代码中的 conf-thres（置信度阈值）和 iou-thres（iou 阈值），classes 是类别数。

5. 编译

TOPDIR - venus 库的相对目录

opencv_path - mips 编译后的 opencv 库的路径，拷贝也是从这里

libtype - 根据实际板子的需求确定是否 muclibc（这里以 muclibc 为例）

build_type - release 模式，运行得到结果，默认设置

- profile 模式，运行时网络结构可视化及网络每层运行时间及 GOPs 统计
- debug 模式，运行得到结果的同时保存每层量化 feature 的结果
- nmem 模式，统计模型运行时 nmem 内存占用情况，运行程序，内存使用情况保存在/tmp/nmem_memory.txt

直接 make 编译 inference.cpp 即可生成 venus_yolov5s_bin_uclibc_*, 即我们上板需要的可执行文件。

注意：我们同时提供了用于实际板端运行的输入为 nv12 的代码用例 inference_nv12.cpp 及输入数据 10_w1024_h714.nv12，如有需要，可修改 Makefile 进行编译及使用测试。

6.2 上板运行

注：

opencv 库在

magik-toolkit/ThirdParty/opencv_mips_7.2.0_2.26/uclibc/lib 下

venus 库在

magik-toolkit/InferenceKit/T40/venus/7.2.0/lib/uclibc 下

1. release(发布库)

编译: make build_type=release

在当前文件夹下生成 venus_yolov5s_bin_uclibc_release 可执行文件，拷贝

venus 库(libvenus.so)、opencv 库(libopencv_core.so.3.3, libopencv_highgui.so.3.3, libopencv_imgcodecs.so.3.3, libopencv_imgproc.so.3.3, libopencv_videoio.so.3.3)、可执行文件(venus_yolov5s_bin_uclibc_release)、模型文件(yolov5s-person-4bit.bin)、测试图片(bus.jpg)至开发板运行即可: ./venus_yolov5s_bin_uclibc_release yolov5s-person-4bit.bin bus.jpg
(注: 运行前添加库路径至 LD_LIBRARY_PATH:
export LD_LIBRARY_PATH=\$lib_path:\$LD_LIBRARY_PATH).
清除 make build_type=release clean

```
[root@Ingenic-uc1_1:doc_test]# ./venus_yolov5s_bin_uclibc_release yolov5s-person-4bit.bin bus.jpg
Warning : The version number is not obtained. Please upgrade the soc-nna!
INFO(magik): venus version:0.9.0(00000900_86d1804) built:20220125-1052(7.2.0 mips@ate)
w:810 h:1080
ori_image w,h: 810 ,1080
model-->416 ,416 4
input shape:
-->384 640
scale--> 0.355556
resize padding over:
resize valid_dst, w:288 h 384
padding info_top :0 bottom 0 left:176 right:176
pad_x:176 pad_y:0 scale:0.355556
box: 50 402 224 888 0.91
box: 222 401 343 857 0.89
box: 670 388 809 883 0.84
box: 0 598 74 873 0.56
```

2. debug (用于核对数据的库)

详见步骤 7.2, 输入的处理有些不同。

3. profile (网络可视化及每层运行时间统计)

编译: make build_type=profile

在当前文件夹下生成 venus_yolov5s_bin_uclibc_profile 可执行文件, 拷贝 venus 库(libvenus.p.so)、opencv 库(libopencv_core.so.3.3, libopencv_highgui.so.3.3, libopencv_imgcodecs.so.3.3, libopencv_imgproc.so.3.3, libopencv_videoio.so.3.3)、可执行文件(venus_yolov5s_bin_uclibc_profile)、模型文件(yolov5s-person-4bit.bin)、测试图片(bus.jpg)至开发板运行即可: ./venus_yolov5s_bin_uclibc_profile yolov5s-person-4bit.bin bus.jpg

注: 运行前添加库路径至 LD_LIBRARY_PATH:

export LD_LIBRARY_PATH=\$lib_path:\$LD_LIBRARY_PATH

清除 make build_type=profile clean

```

INFO(magik): venus version:0.9.0(00000900_86d1804) built:20220125-1057(7.2.0 mips@ale)
w:810 h:1080
ori_image w,h: 810 ,1080
model-->416 ,416 4
input shape:
-->384 640
scale---> 0.355556
resize padding over:
resize valid_dst, w:288 h 384
padding info top :0 bottom 0 left:176 right:176
pad_x:176 pad_y:0 scale:0.355556
box: 50 402 224 888 0.91
box: 222 401 343 857 0.89
box: 676 388 809 883 0.84
box: 0 598 74 873 0.56
[Peak: 0.000]
Timing cycle = 10
===== Detailed DispatchProfiler Summary: N/A, Exclude Swarn-ups =====
LayerName OperatorType InputShape OutputShape FilterShape Stride Pad Dila Avg(ns) Max(ns) Min(ns) Last(ns) Avg(S) Gbps Bandwidth(M)
layer_2.QuantizeFeature Convolution (1,384,640,4) (1,192,320,32) (3,3,4,32) (1,1) (1,1,1,1) (1,1) 0.594 0.612 0.567 0.5070 25.56% 0.142 2.817
layer_4.QuantizeFeature Convolution (1,192,320,32) (1,96,160,64) (3,3,32,64) (2,2) (0,1,0,1) (1,1) 2.132 2.171 2.121 2.1210 0.26% 0.566 2.831
layer_6.QuantizeFeature Convolution (1,96,160,64) (1,96,160,32) (1,1,64,32) (1,1) (0,0,0,0) (1,1) 0.681 0.714 0.671 0.7140 2.64% 0.063 1.173
layer_12.QuantizeFeature Convolution (1,96,160,32) (1,96,160,32) (1,1,32,32) (1,1) (0,0,0,0) (1,1) 0.253 0.254 0.252 0.2540 0.98% 0.031 0.469
layer_14.QuantizeFeature Convolution (1,96,160,32) (1,96,160,32) (3,3,32,32) (1,1) (1,1,1,1) (1,1) 0.190 0.191 0.190 0.1900 0.74% 0.283 0.473
layer_15.QuantizeFeature Add (1,96,160,32) (1,96,160,32) N/A N/A N/A 0.194 0.195 0.194 0.1940 0.73% 0.000 0.703
layer_8.QuantizeFeature Convolution (1,96,160,64) (1,96,160,32) (1,1,64,32) (1,1) (0,0,0,0) (1,1) 0.665 0.667 0.664 0.6670 2.58% 0.063 1.173
layer_10.QuantizeFeature Convolution (1,96,160,64) (1,96,160,64) (1,1,64,64) (1,1) (0,0,0,0) (1,1) 0.521 0.522 0.520 0.5210 2.02% 0.126 0.940
layer_17.QuantizeFeature Convolution (1,96,160,64) (1,48,80,128) (3,3,64,128) (2,2) (0,1,0,1) (1,1) 0.587 0.615 0.579 0.5790 2.27% 0.566 0.739
layer_19.QuantizeFeature Convolution (1,48,80,128) (1,48,80,64) (1,1,128,64) (1,1) (0,0,0,0) (1,1) 0.186 0.170 0.165 0.1660 0.65% 0.063 0.356
layer_25.QuantizeFeature Convolution (1,48,80,64) (1,48,80,64) (1,1,64,64) (1,1) (0,0,0,0) (1,1) 0.146 0.147 0.146 0.1460 0.57% 0.031 0.237
layer_27.QuantizeFeature Convolution (1,48,80,64) (1,48,80,64) (3,3,64,64) (1,1) (1,1,1,1) (1,1) 0.172 0.172 0.171 0.1710 0.67% 0.283 0.252
layer_28.QuantizeFeature Add (1,48,80,64) (1,48,80,64) N/A N/A N/A 0.105 0.105 0.105 0.1050 0.41% 0.000 0.352
layer_30.QuantizeFeature Convolution (1,48,80,64) (1,48,80,64) (1,1,64,64) (1,1) (0,0,0,0) (1,1) 0.152 0.154 0.150 0.1500 0.59% 0.031 0.237
layer_32.QuantizeFeature Convolution (1,48,80,64) (1,48,80,64) (3,3,64,64) (1,1) (1,1,1,1) (1,1) 0.162 0.162 0.161 0.1620 0.63% 0.283 0.252
layer_33.QuantizeFeature Add (1,48,80,64) (1,48,80,64) N/A N/A N/A 0.184 0.185 0.184 0.1840 0.40% 0.000 0.352
layer_35.QuantizeFeature Convolution (1,48,80,64) (1,48,80,64) (1,1,64,64) (1,1) (0,0,0,0) (1,1) 0.151 0.154 0.148 0.1480 0.59% 0.031 0.237
layer_37.QuantizeFeature Convolution (1,48,80,64) (1,48,80,64) (3,3,64,64) (1,1) (1,1,1,1) (1,1) 0.161 0.162 0.161 0.1610 0.63% 0.283 0.252
layer_38.QuantizeFeature Add (1,48,80,64) (1,48,80,64) N/A N/A N/A 0.184 0.185 0.184 0.1840 0.40% 0.000 0.352
layer_21.QuantizeFeature Convolution (1,48,80,128) (1,48,80,64) (1,1,128,64) (1,1) (0,0,0,0) (1,1) 0.163 0.163 0.162 0.1630 0.63% 0.063 0.356
layer_23.QuantizeFeature Convolution (1,48,80,128) (1,48,80,128) (1,1,128,128) (1,1) (0,0,0,0) (1,1) 0.268 0.262 0.257 0.2610 1.01% 0.126 0.478
layer_40.QuantizeFeature Convolution (1,48,80,128) (1,24,40,256) (3,3,128,256) (2,2) (0,1,0,1) (1,1) 0.547 0.578 0.539 0.5400 2.12% 0.566 0.494
layer_42.QuantizeFeature Convolution (1,24,40,256) (1,24,40,128) (1,1,256,128) (1,1) (0,0,0,0) (1,1) 0.093 0.100 0.090 0.0900 0.36% 0.063 0.192
layer_48.QuantizeFeature Convolution (1,24,40,128) (1,24,40,128) (1,1,128,128) (1,1) (0,0,0,0) (1,1) 0.080 0.082 0.078 0.0780 0.31% 0.031 0.126
layer_50.QuantizeFeature Convolution (1,24,40,128) (1,24,40,128) (3,3,128,128) (1,1) (1,1,1,1) (1,1) 0.174 0.176 0.173 0.1740 0.67% 0.283 0.188
layer_51.QuantizeFeature Add (1,24,40,128) (1,24,40,128) N/A N/A N/A 0.066 0.067 0.066 0.0660 0.26% 0.000 0.176
layer_53.QuantizeFeature Convolution (1,24,40,128) (1,24,40,128) (1,1,128,128) (1,1) (0,0,0,0) (1,1) 0.083 0.084 0.083 0.0830 0.32% 0.031 0.126
layer_55.QuantizeFeature Convolution (1,24,40,128) (1,24,40,128) (3,3,128,128) (1,1) (1,1,1,1) (1,1) 0.170 0.171 0.170 0.1700 0.66% 0.283 0.188
layer_56.QuantizeFeature Add (1,24,40,128) (1,24,40,128) N/A N/A N/A 0.066 0.066 0.065 0.0660 0.25% 0.000 0.176
layer_58.QuantizeFeature Convolution (1,24,40,128) (1,24,40,128) (1,1,128,128) (1,1) (0,0,0,0) (1,1) 0.082 0.082 0.081 0.0820 0.32% 0.031 0.126
layer_60.QuantizeFeature Convolution (1,24,40,128) (1,24,40,128) (3,3,128,128) (1,1) (1,1,1,1) (1,1) 0.170 0.171 0.169 0.1690 0.66% 0.283 0.188
layer_61.QuantizeFeature Add (1,24,40,128) (1,24,40,128) N/A N/A N/A 0.073 0.106 0.065 0.0650 0.28% 0.000 0.176
layer_44.QuantizeFeature Convolution (1,24,40,256) (1,24,40,128) (1,1,256,128) (1,1) (0,0,0,0) (1,1) 0.091 0.098 0.089 0.0900 0.35% 0.063 0.192
layer_46.QuantizeFeature Convolution (1,24,40,256) (1,24,40,256) (1,1,256,256) (1,1) (0,0,0,0) (1,1) 0.139 0.140 0.138 0.1390 0.54% 0.126 0.266
layer_63.QuantizeFeature Convolution (1,24,40,256) (1,12,20,512) (3,3,256,512) (2,2) (0,1,0,1) (1,1) 0.559 0.553 0.549 0.5490 2.13% 0.566 0.742
layer_65.QuantizeFeature Convolution (1,12,20,512) (1,12,20,256) (1,1,512,256) (1,1) (0,0,0,0) (1,1) 0.076 0.077 0.076 0.0760 0.30% 0.063 0.152
518 Pooling (1,12,20,256) (1,12,20,256) (5,5) (1,1) (1,1,1,1) (1,1) 0.391 0.391 0.390 0.3910 1.17% 0.032 0.952

```

4. nmem 模式（用于统计网络运行时 nmem 占用情况，保存在 /tmp/nmem_memory.txt）

编译: make build_type=nmem

在当前文件夹下生成 venus_yolov5s_bin_uclibc_nmem 可执行文件，拷贝 venus 库(libvenus.m.so)、opencv 库(libopencv_core.so.3.3

,libopencv_highgui.so.3.3,libopencv_imgcodecs.so.3.3,libopencv_imgproc.so.3.

3,libopencv_videoio.so.3.3)、可执行文件(venus_yolov5s_bin_uclibc_nmem)、

模型文件(yolov5s-person-4bit.bin)、测试图片(bus.jpg)至开发板运行即可: ./venus_yolov5s_bin_uclibc_nmem yolov5s-person-4bit.bin bus.jpg

注: 运行前添加库路径至 LD_LIBRARY_PATH:

export LD_LIBRARY_PATH=\$lib_path:\$LD_LIBRARY_PATH

清除 make build_type=nmem clean

```

[root@Ingenic-uc1_1:doc_test]# ./venus_yolov5s_bin_uclibc_nmem yolov5s-person-4bit.bin bus.jpg
Warning : The version number is not obtained. Please upgrade the soc-nna!
INFO(magik): venus version:0.9.0(00000900_86d1804) built:20220125-1045(7.2.0 mips@ale)
w:810 h:1080
ori_image w,h: 810 ,1080
model-->416 ,416 4
input shape:
-->384 640
scale---> 0.355556
resize padding over:
resize valid_dst, w:288 h 384
padding info top :0 bottom 0 left:176 right:176
pad_x:176 pad_y:0 scale:0.355556
box: 50 402 224 888 0.91
box: 222 401 343 857 0.89
box: 676 388 809 883 0.84
box: 0 598 74 873 0.56
[root@Ingenic-uc1_1:doc_test]# cat /tmp/nmem_memory.txt
nmem total = 131072K
nmem used = 13024K
nmem free = 118048K
#### %9.94 ####

```

7 数据核对

验证 PC 端和板端的数据是否能对齐，可按如下操作:

1. PC 端

步骤 4.4-1 测试单张图片加入环境变量 `MAGIK_TRAININGKIT_DUMP=1` 可保存每层量化结果到 `/tmp/trainingkit_data/feature` 下，也可通过设置环境变量 `MAGIK_TRAININGKIT_PATH` 指定保存的目录，具体运行命令为：

`MAGIK_TRAININGKIT_DUMP=1`

`MAGIK_TRAININGKIT_PATH="" python detect.py \`

`--source data/images/bus.jpg \`

`--weights ./runs/train/yolov5s-person-4bit.pt \`

`--imgs 640 --device 0`

这里的 `bus.jpg` 原始分辨率是 `1080*810`，测试时加入了目标 `imgs` 为 `640`，按 `yolov5` 代码的缩放原则（长边 `640`，短边等比缩放再填充至 `32` 的倍数），最后进入测试的分辨率为 `640*480`，最终保存 `./trainingkit_data/feature` 下（具体见下图），可见输入层有保存为 `input_data_shape_1_640_480_3.bin`，后面的 `shape` 命名的规则是 `n,h,w,c`，即高为 `640`，宽为 `480`，最后面是三个输出层；

参数 `imgs`、`conf-thres`、`iou-thres` 的设置也是为了和 `c` 代码(详见 6.1-3)保持一致，以保证比对条件一致；

```
input_data_shape_1_640_480_3.bin layer_44_QuantizeFeature.bin
layer_101_QuantizeFeature.bin layer_46_QuantizeFeature.bin
layer_103_QuantizeFeature.bin layer_48_QuantizeFeature.bin
layer_106_QuantizeFeature.bin layer_4_QuantizeFeature.bin
layer_108_QuantizeFeature.bin layer_50_QuantizeFeature.bin
layer_10_QuantizeFeature.bin layer_51_QuantizeFeature.bin
layer_110_QuantizeFeature.bin layer_53_QuantizeFeature.bin
layer_112_QuantizeFeature.bin layer_55_QuantizeFeature.bin
layer_114_QuantizeFeature.bin layer_56_QuantizeFeature.bin
layer_116_QuantizeFeature.bin layer_58_QuantizeFeature.bin
layer_119_QuantizeFeature.bin layer_60_QuantizeFeature.bin
layer_121_QuantizeFeature.bin layer_61_QuantizeFeature.bin
layer_123_QuantizeFeature.bin layer_63_QuantizeFeature.bin
layer_125_QuantizeFeature.bin layer_65_QuantizeFeature.bin
layer_127_QuantizeFeature.bin layer_67_QuantizeFeature.bin
layer_129_QuantizeFeature.bin layer_69_QuantizeFeature.bin
layer_12_QuantizeFeature.bin layer_6_QuantizeFeature.bin
layer_14_QuantizeFeature.bin layer_71_QuantizeFeature.bin
layer_15_QuantizeFeature.bin layer_73_QuantizeFeature.bin
layer_17_QuantizeFeature.bin layer_75_QuantizeFeature.bin
layer_19_QuantizeFeature.bin layer_77_QuantizeFeature.bin
layer_21_QuantizeFeature.bin layer_80_QuantizeFeature.bin
layer_23_QuantizeFeature.bin layer_82_QuantizeFeature.bin
layer_25_QuantizeFeature.bin layer_84_QuantizeFeature.bin
layer_27_QuantizeFeature.bin layer_86_QuantizeFeature.bin
layer_28_QuantizeFeature.bin layer_88_QuantizeFeature.bin
layer_2_QuantizeFeature.bin layer_8_QuantizeFeature.bin
layer_30_QuantizeFeature.bin layer_90_QuantizeFeature.bin
layer_32_QuantizeFeature.bin layer_93_QuantizeFeature.bin
layer_33_QuantizeFeature.bin layer_95_QuantizeFeature.bin
layer_35_QuantizeFeature.bin layer_97_QuantizeFeature.bin
layer_37_QuantizeFeature.bin layer_99_QuantizeFeature.bin
layer_38_QuantizeFeature.bin output_index_1_shape_1_80_60_18.bin
layer_40_QuantizeFeature.bin output_index_2_shape_1_40_30_18.bin
layer_42_QuantizeFeature.bin output_index_3_shape_1_20_15_18.bin
```

2. 板端

(1)板端需要的输入数据为 4 通道，对于上面 `pc` 端测试的 `bus.jpg`，我们用运行时保存的输入 `input_data_shape_1_640_480_3.bin` 处理成 `.h` 之后拿来板端的测试，以保证二者的输入完全一致，可先做线下处理(脚本在 `yolov5s-person/venus_sample_yolov5s/generate_img_input.py`):

`python generate_img_input.py bin_path w h c bin`

`bin_path` -- 要转换的 `bin` 文件，即 `pc` 端运行保存的输入 `bin`

`w, h` -- `bin` 文件对应的宽和高，`bin` 文件名字里有对应，分别是 `1_h_w_c`

`bin` -- `flag` 标志，表示由 `bin` 文件转头文件，还有一种是 `img` 转头文件

说明：用 bin 的话可以完全保证两边的输入一致，方便对数据。

(2)提供的实例中模型是通过参数传入的(argv[1])，运行时注意同步拷贝到板端对应的目录，运行时按需传入。宽(w)、高(h)也要从外部传入，具体值同(1)中。

(3)编译 c 代码：编译之前最好先将之前编译过的模式做一下 clean(make build_type=release/profile/nmem clean), 不然可能出现 opencv 的链接库失败的错误，之后 make build_type=debug，在当前文件夹下生成 venus_yolov5s_bin_uclibc_debug 可执行文件，拷贝 venus 库(libvenus.d.so)、可执行文件(venus_yolov5s_bin_uclibc_debug)、模型文件(yolov5s-person-4bit.bin)至开发板运行：

./venus_test_bin_uclibc_t40 yolov5s-person-4bit.bin 480 640

其中，480 对应为 w，640 对应 h，运行的时候就会自动保存每层的输出及其他信息（如下图）：

```
layer_116_QuantizeFeature_bt.bin layer_27_QuantizeFeature_out.bin layer_53_QuantizeFeature_weight.bin
layer_116_QuantizeFeature_out.bin layer_27_QuantizeFeature_weight.bin layer_55_QuantizeFeature_bt.bin
layer_116_QuantizeFeature_weight.bin layer_28_QuantizeFeature_out.bin layer_55_QuantizeFeature_out.bin
layer_119_QuantizeFeature_bt.bin layer_2_QuantizeFeature_bt.bin layer_55_QuantizeFeature_weight.bin
layer_119_QuantizeFeature_out.bin layer_2_QuantizeFeature_out.bin layer_56_QuantizeFeature_out.bin
layer_119_QuantizeFeature_weight.bin layer_2_QuantizeFeature_weight.bin layer_58_QuantizeFeature_bt.bin
layer_121_QuantizeFeature_bt.bin layer_30_QuantizeFeature_bt.bin layer_58_QuantizeFeature_out.bin
layer_121_QuantizeFeature_out.bin layer_30_QuantizeFeature_out.bin layer_58_QuantizeFeature_weight.bin
layer_121_QuantizeFeature_weight.bin layer_30_QuantizeFeature_weight.bin layer_60_QuantizeFeature_bt.bin
layer_123_QuantizeFeature_bt.bin layer_32_QuantizeFeature_bt.bin layer_60_QuantizeFeature_out.bin
layer_123_QuantizeFeature_out.bin layer_32_QuantizeFeature_out.bin layer_60_QuantizeFeature_weight.bin
layer_123_QuantizeFeature_weight.bin layer_32_QuantizeFeature_weight.bin layer_61_QuantizeFeature_out.bin
layer_125_QuantizeFeature_bt.bin layer_33_QuantizeFeature_out.bin layer_63_QuantizeFeature_bt.bin
layer_125_QuantizeFeature_out.bin layer_35_QuantizeFeature_bt.bin layer_63_QuantizeFeature_out.bin
layer_125_QuantizeFeature_weight.bin layer_35_QuantizeFeature_out.bin layer_63_QuantizeFeature_weight.bin
layer_127_QuantizeFeature_bt.bin layer_35_QuantizeFeature_weight.bin layer_65_QuantizeFeature_bt.bin
layer_127_QuantizeFeature_out.bin layer_37_QuantizeFeature_bt.bin layer_65_QuantizeFeature_out.bin
layer_127_QuantizeFeature_weight.bin layer_37_QuantizeFeature_out.bin layer_65_QuantizeFeature_weight.bin
layer_129_QuantizeFeature_bt.bin layer_37_QuantizeFeature_weight.bin layer_67_QuantizeFeature_bt.bin
layer_129_QuantizeFeature_out.bin layer_38_QuantizeFeature_out.bin layer_67_QuantizeFeature_out.bin
layer_129_QuantizeFeature_weight.bin layer_40_QuantizeFeature_bt.bin layer_67_QuantizeFeature_weight.bin
layer_12_QuantizeFeature_bt.bin layer_40_QuantizeFeature_out.bin layer_69_QuantizeFeature_bt.bin
layer_12_QuantizeFeature_out.bin layer_40_QuantizeFeature_weight.bin layer_69_QuantizeFeature_out.bin
layer_12_QuantizeFeature_weight.bin layer_42_QuantizeFeature_bt.bin layer_69_QuantizeFeature_weight.bin
layer_14_QuantizeFeature_bt.bin layer_42_QuantizeFeature_out.bin layer_6_QuantizeFeature_bt.bin
layer_14_QuantizeFeature_out.bin layer_42_QuantizeFeature_weight.bin layer_6_QuantizeFeature_out.bin
layer_14_QuantizeFeature_weight.bin layer_44_QuantizeFeature_bt.bin layer_6_QuantizeFeature_weight.bin
layer_15_QuantizeFeature_out.bin layer_44_QuantizeFeature_out.bin layer_71_QuantizeFeature_bt.bin
layer_17_QuantizeFeature_bt.bin layer_44_QuantizeFeature_weight.bin layer_71_QuantizeFeature_out.bin
layer_17_QuantizeFeature_out.bin layer_46_QuantizeFeature_bt.bin layer_71_QuantizeFeature_weight.bin
layer_17_QuantizeFeature_weight.bin layer_46_QuantizeFeature_out.bin layer_73_QuantizeFeature_bt.bin
layer_19_QuantizeFeature_bt.bin layer_46_QuantizeFeature_weight.bin layer_73_QuantizeFeature_out.bin
layer_19_QuantizeFeature_out.bin layer_48_QuantizeFeature_bt.bin layer_73_QuantizeFeature_weight.bin
layer_19_QuantizeFeature_weight.bin layer_48_QuantizeFeature_out.bin layer_75_QuantizeFeature_bt.bin
layer_21_QuantizeFeature_bt.bin layer_48_QuantizeFeature_weight.bin layer_75_QuantizeFeature_out.bin
layer_21_QuantizeFeature_out.bin layer_4_QuantizeFeature_bt.bin layer_75_QuantizeFeature_weight.bin
layer_21_QuantizeFeature_weight.bin layer_4_QuantizeFeature_out.bin layer_77_QuantizeFeature_bt.bin
layer_23_QuantizeFeature_bt.bin layer_4_QuantizeFeature_weight.bin layer_77_QuantizeFeature_out.bin
layer_23_QuantizeFeature_out.bin layer_50_QuantizeFeature_bt.bin layer_77_QuantizeFeature_weight.bin
layer_23_QuantizeFeature_weight.bin layer_50_QuantizeFeature_out.bin layer_80_QuantizeFeature_bt.bin
layer_25_QuantizeFeature_bt.bin layer_50_QuantizeFeature_weight.bin layer_80_QuantizeFeature_out.bin
layer_25_QuantizeFeature_out.bin layer_51_QuantizeFeature_out.bin layer_80_QuantizeFeature_weight.bin
layer_25_QuantizeFeature_weight.bin layer_53_QuantizeFeature_bt.bin layer_82_QuantizeFeature_bt.bin
layer_27_QuantizeFeature_bt.bin layer_53_QuantizeFeature_out.bin layer_82_QuantizeFeature_out.bin
```

其中 layer_*_QuantizeFeature_out.bin 和 PC 端运行时保存在 /tmp/trainingkit_data/feature 下的 layer_*_QuantizeFeature.bin 是一一对应的，直接核对 md5 值是否一致即可，在保证输入完全一致的情况下中间有层不对应及时反馈。

```
86859cb6efb8cfd932dbb57e32a260e3 /tmp/trainingkit_data/feature/layer_2_QuantizeFeature.bin
6e2c04cf0e560cbd3b76860a23132053 /tmp/trainingkit_data/feature/layer_129_QuantizeFeature.bin

[root@Ingenic-uc1_1:doc_test]# md5sum layer_2_QuantizeFeature_out.bin
86859cb6efb8cfd932dbb57e32a260e3 layer_2_QuantizeFeature_out.bin
[root@Ingenic-uc1_1:doc_test]# md5sum layer_129_QuantizeFeature_out.bin
6e2c04cf0e560cbd3b76860a23132053 layer_129_QuantizeFeature_out.bin
```

debug 模式这里只核对网络结果，没有加后处理部分，因此无结果打印。

8 常见疑问解答

1. 问：为什么 release 运行 810*1080 的 bus.jpg 的分辨率是 640*384，debug 的时候是 480*640？

答：当我们设置目标分辨率为 640 时，板端的缩放规则是按等比缩放之后 w 填充至 640（因为实际的视频流大都是 w>h），这里 640 是 w，384 是 h；而 yolov5 代码里的规则是按长边 640 等比缩放再将短边填充至 32 的倍数，所以这里 h 是 640,480 是 w，debug 是和 pc 端保持一致的，实际使用按需设置即可。

2. 问：导入 magik 包出现 “undefined symbol: _ZN6caffe28TypeMeta21_typeMetaDataInstanceIN3c108BFloat16EEEEPKNS_6detail12TypeMetaDataEv” 类似错误？

答：当前环境下 torch 的版本和 magik 包的不对应。

3. 问：“importError: version ‘libcudart.so.10.1’ not found”？

答：当前 cuda 版本和插件编译时的版本不对应

4. 问：加插件之后的网络是否可以加载原生 torch 模型做预训练？

答：理论可以，层对应好就行，不过基于原生 float 的 32bit 模型还是要再微调训练一下，不建议直接加载原生的跑 8bit。

5. 问：训练出现 “RuntimeError: Address already in use”？

答：在 python -m torch.distributed.launch 后指定一个未被使用的端口——master_port=60053

6. 问：训练出现 “expected scalar type Float but found Half”？

答：torch 中用了 amp.autocast 进行半精度训练加速,但量化暂不支持半精度训练，注掉这块即可。另，原生 v5 在保存模型时按 half() 存的，目前发现量化这样操作最后存的模型的精度会有损失，建议去掉。

7. 问：torch 转 onnx 出现 “step!=1 is currently not supported”？

答：yolov5 slice 转换遇到的问题, 1.6 及之前版本可以可以, 1.7 以后变成 error 了，torch/onnx/symbolic_opset9.py 对应报错的行 if + raise RuntimeError 注掉即可。

8. 问：torch 转 onnx 出错 “RuntimeError:input_shape_value== reshape_value || input_shape_value==1 || reshape_value == 1 INTERNAL ASSERT FAILED ……”？

答：1.9 版本之后的错，torch/onnx/utils.py 中 635 行 _export() 最后一个参数的 onnx_shape_inference=True 改为 onnx_shape_inference=False；torch1.10 是在 677 行。不同版本找这个函数相应修改即可。

9. 问：torch1.8/torch1.9 版本转换 onnx 会出现 “Warning: Unsupported operator NOp. No schema registered for this operator.” 等？

答：warning 不用管,不影响结果。

10. 问：转 bin 出现 “After checking the input dimension, the input of concat cannot be concatenated!” ？

答：slice 的问题（参见 5.1），将 torch/onnx/symbolic_opset9.py 中 _slice 函数中的 if+return 这两句去掉，可视化 onnx 的 slice 正常。

11. 问：c 代码编译出现 “error: 'constexpr bool std::isinf(double)' conflicts with a previous declaration” 等一系列冲突错误？

答：mips 的编译器和 x86 自带的出现冲突，将环境变量 CPLUS_INCLUDE_PATH 中关于/usr/include/x86_64-linux-gnu 的部分去掉。

12. 问：c 端编译出现 “make: mips-linux-gnu-g++: Command not found” ？

答：未指定 mips 编译器，通过 export 设置。

13. 问：板端精度和 PC 端精度损失有多少？

答：理论上损失很小，1 个点以内，若出现较大差距，可检查输入是否一致，训练和验证的数据是 BGR/RGB，阈值的设置，也可对比网络输出结果看看输出是否一致，具体见步骤 7。

14. 问：转 onnx 的分辨率，转换工具的分辨率以及板端测试的分辨率需要保持一致吗？

答：最好保持一致，尤其后两者，本例中没有保持一致是因为对这个没有影响，对于其他非全卷积网络可能导致转换出来的模型有影响，所以测试验证集精度时建议输入数据统一线下处理到同一大小再做 PC 端和板端的比较。