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RKNN SDK 快速上手指南

(技术部，图形计算平台中心)

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1 主要说明

此文档向零基础用户详细介绍如何快速在 ROCKCHIP 芯片的 EVB 板子上使用 RKNN-Toolkit2 和 RKNPU2 工具转换 yolov5s.onnx 模型为 yolov5s.rknn 模型并进行板端推理。

支持的平台：RK3566、RK3568、RK3588、RK3588S

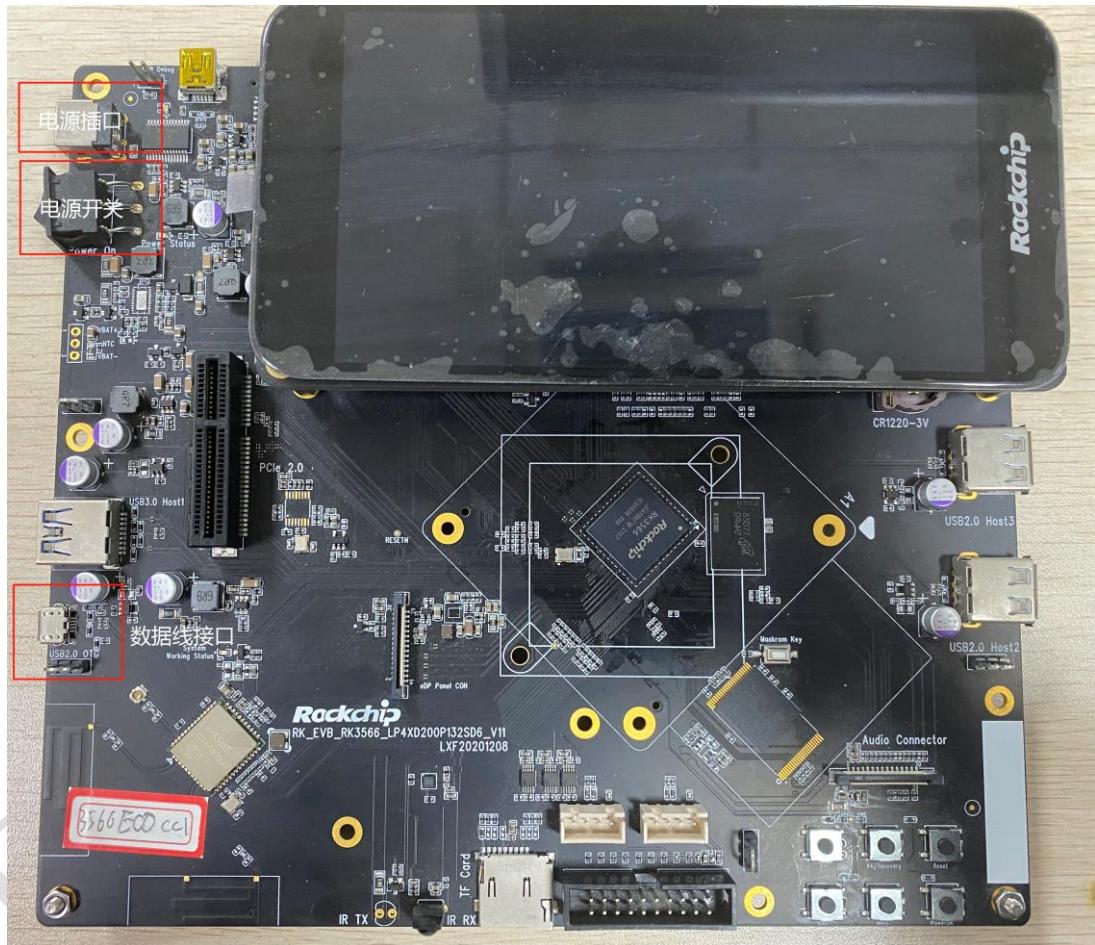
RKNPU2 工程下载地址：<https://github.com/rockchip-linux/rknpu2>

RKNN-Toolkit2 工程下载地址：<https://github.com/rockchip-linux/rknn-toolkit2>

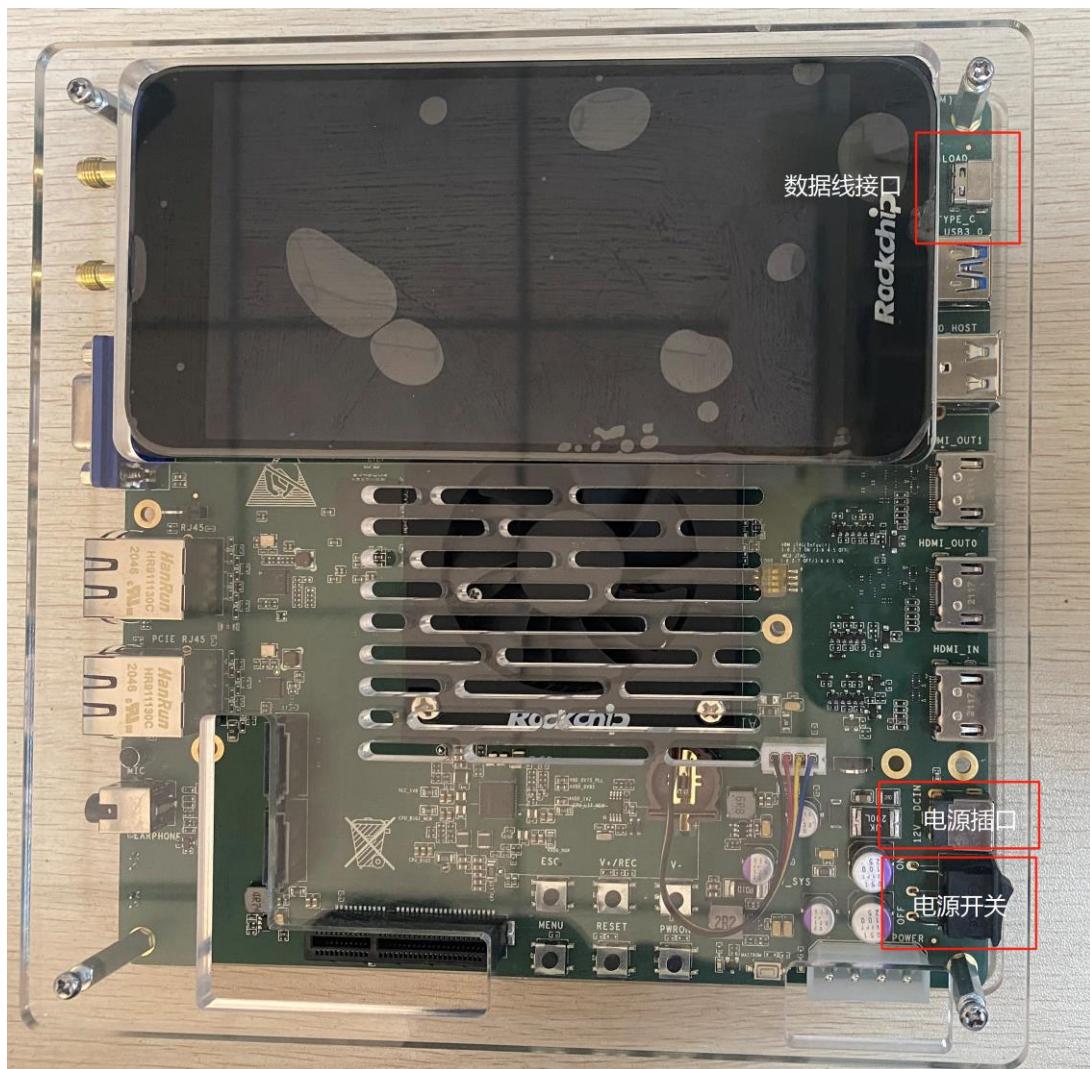
2 准备工具

1. 一台操作系统 Ubuntu18.04 的电脑
2. 一块 EVB 板子（RK3566、RK3568、RK3588、RK3588S）

RK3566



RK3588



3. 一条连接板子和电脑的数据线

RK356X: USB-A——Micro USB



RK3588: USB-A——USB-C



4. 一个电源适配器

RK356X: 输出 12V-2A



RK3588: 输出 12V-3A



3 快速入门使用 RKNN-Toolkit2 和 RKNPU2

3.1 安装 RKNN-Toolkit2

本章节介绍两种安装使用 RKNN-Toolkit2 的方法，“通过 pip install 安装”和“通过 Docker 镜像安装”，用户可自行选择安装方式。如果不是 Ubuntu18.04 系统的电脑推荐使用“通过 Docker 镜像安装”方式，已集成所有所需的安装包依赖，简单可靠。

3.1.1 通过 Docker 镜像安装并推理

1. 电 脑 若 没 有 安 装 Docker 工 具 ， 请 先 按 照 此 安 装 教 程 (<https://mirrors.tuna.tsinghua.edu.cn/help/docker-ce/>) 安装 Docker 工具,再进行下一步。
2. 打开一个终端命令行窗口，cd 进入 RKNN-Toolkit2 工程的 docker 文件夹，根据工程的保存路径修改 cd 命令中的路径

cd <输入 RKNN-Toolkit2 工程其中 docker 文件夹的路径>
命令：

```
cd ~/Projects/rknn-toolkit2-1.2.0/docker  
ls
```

查看到当前目录下有一个 docker 镜像文件 rknn-toolkit2-1.2.0-cp36-docker.tar.gz。

```
xdc@xdc-HP-ProDesk-480-G7-PCI-Microtower-PC:~$ cd ~/Projects/rknn-toolkit2-1.2.0/docker  
xdc@xdc-HP-ProDesk-480-G7-PCI-Microtower-PC:~/Projects/rknn-toolkit2-1.2.0/docker$ ls  
rknn-toolkit2-1.2.0-cp36-docker.tar.gz
```

3. 加载 docker 镜像

```
docker load --input rknn-toolkit2-1.2.0-cp36-docker.tar.gz
```

```
xdc@xdc-HP-ProDesk-480-G7-PCI-Microtower-PC:~/Projects/rknn-toolkit2-1.2.0/docker$ docker load --input rknn-toolkit2-1.2.0-cp36-docker.tar.gz
4545ab880984: Loading layer [=====] 3.772GB/3.772GB
4c0684488808: Loading layer [=====] 96.88MB/96.88MB
dbc74bd091c2: Loading layer [=====] 96.76MB/96.76MB
4825335a4f29: Loading layer [=====] 96.76MB/96.76MB
a2e0cbd69e91: Loading layer [=====] 96.82MB/96.82MB
7847922741cd: Loading layer [=====] 96.82MB/96.82MB
52b702757ce5: Loading layer [=====] 96.82MB/96.82MB
a5d5c752150a: Loading layer [=====] 96.82MB/96.82MB
7839d6b86597: Loading layer [=====] 96.82MB/96.82MB
f4d99da867e3: Loading layer [=====] 96.82MB/96.82MB
7bd0f2baa256: Loading layer [=====] 101.1MB/101.1MB
b1130d33011e: Loading layer [=====] 96.83MB/96.83MB
2a403abe6293: Loading layer [=====] 96.86MB/96.86MB
f3043fffe6a8: Loading layer [=====] 89.74MB/89.74MB
c11071cf2459: Loading layer [=====] 89.74MB/89.74MB
Loaded image: rknn-toolkit2:1.2.0-cp36
```

4. 查看当前所有的 docker 镜像

命令：

```
docker images

xdc@xdc-HP-ProDesk-480-G7-PCI-Microtower-PC:~$ docker images
REPOSITORY          TAG      IMAGE ID      CREATED       SIZE
rknn-toolkit2        1.2.0-cp36  e0b1de68a73a  8 hours ago  5.81GB
```

查看到镜像 rknn-toolkit2:1.2.0-cp36 已加载成功。

5. 运行 docker 容器

命令：

```
docker run -t -i --privileged -v /dev/bus/usb:/dev/bus/usb \
-v ~/Projects/rknn-toolkit2-1.2.0/examples/onnx/yolov5:/rknn_yolov5_demo \
rknn-toolkit2:1.2.0-cp36 /bin/bash
```

将目录映射进 Docker 环境可通过附加 “-v <host src folder>:<image dst folder>” 。

绿色部分为 RKNN-Toolkit2 工程中 examples/onnx/yolov5 本地文件夹路径（根据本机路径修改）映射到 docker 容器中/rknn_yolov5_demo 文件夹。

成功进入 docker 容器后，命令 ls 查看到文件夹 rknn_yolov5_demo 映射成功。

```
xdc@xdc-HP-ProDesk-480-G7-PCI-Microtower-PC:~/Projects/rknn-toolkit2-1.2.0/docker$ docker run -t -i --privileged -v
/dev/bus/usb:/dev/bus/usb -v ~/Projects/rknn-toolkit2-1.2.0/examples/onnx/yolov5:/rknn_yolov5_demo rknn-toolkit2:1.2
.0-cp36 /bin/bash
root@7f6c4bc2d065:/# ls
bin  dev  home  lib64  mnt  packages  rknn_yolov5_demo  run  srv  tmp  var
boot  etc  lib  media  opt  proc  root  sbin  sys  usr
```

6. 在 docker 容器中进入 rknn_yolov5_demo 目录

命令：

```
cd rknn_yolov5_demo
```

```
root@f6e58b87f3a8:/# cd rknn_yolov5_demo/  
root@f6e58b87f3a8:/rknn_yolov5_demo# ls  
bus.jpg dataset.txt test.py yolov5s.onnx
```

7. 转换 yolov5s.onnx 为 rknn 模型并行推理图片

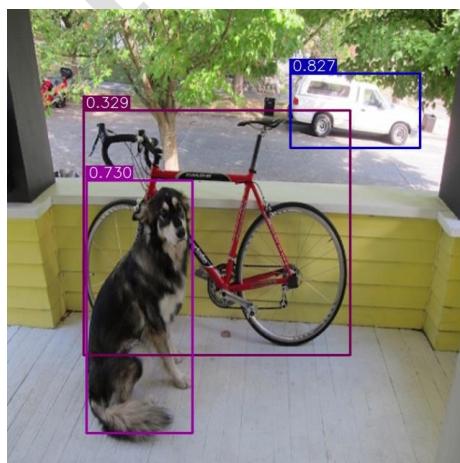
```
python3 ./test.py
```

```
root@4da66f8c2824:/rknn_yolov5_demo# python3 test.py
```

```
I rknn buiding done  
done  
--> Export rknn model  
done  
--> Init runtime environment  
Preparing :  0%|                                     | 0/163 [00:00<  
Preparing :  6%|███████████| 9/163 [00:00<00:03, 4  
Preparing : 60%|███████████████| 98/163 [00:00<00:01, 5  
Preparing : 100%|████████████████| 163/163 [00:00<00:00, 44  
0.32it/s]  
W init_runtime: target is None, use simulator!  
done  
--> Running model  
W inference: The dims of input(ndarray) shape (640, 640, 3) is wrong, expect dims is 4! Try  
expand dims to (1, 640, 640, 3)!  
done  
class: person, score: 0.9983320832252502  
box coordinate left,top,right,down: [474.55716973543167, 256.9547041654587, 561.31746405363  
08, 516.4103471040726]  
class: person, score: 0.9965435862541199  
box coordinate left,top,right,down: [110.08729419112206, 230.1465458869934, 220.96309033036  
232, 532.0092158317566]  
class: person, score: 0.9758545756340027  
box coordinate left,top,right,down: [210.40820306539536, 245.37266218662262, 288.3529663681  
984, 507.16560685634613]  
class: bus , score: 0.9926542043685913  
box coordinate left,top,right,down: [73.90917986631393, 140.49429368972778, 567.08477765321  
73, 442.35696363449097]
```

此脚本是在 PC 模拟器上运行，若需要连板调试请参考[章节 3.2](#)。

转换模型和推理脚本 test.py 运行成功，转换后的模型默认保存路径为 /rknn-toolkit2-1.2.0/examples/onnix/yolov5/yolov5s-640-640.rknn，推理的图片结果保存在 /rknn-toolkit2-1.2.0/examples/onnix/yolov5/result.jpg。



3.1.2 通过 pip install 安装并推理

1. 打开一个终端命令行窗口，安装 Python3.6 和 pip3

命令：

```
sudo apt-get install python3 python3-dev python3-pip
```

2. 安装所需的依赖包

命令：

```
sudo apt-get install libxslt1-dev zlib1g-dev libglib2.0 libsm6 \
libgl1-mesa-glx libprotobuf-dev gcc
```

3. 进入 Toolkit2 工程文件夹，根据工程的保存路径修改 cd 命令中的路径

cd <输入 Toolkit2 工程的路径>

命令：

```
cd ~/rknn-toolkit2-1.2.0
```

4. 安装必要相应版本的依赖包

命令：

```
pip3 install -r doc/requirements-1.2.0.txt
```

```
ubuntu1804@ubuntu1804:~/rknn-toolkit2-1.2.0$ pip3 install -r doc/requirements_cp
36-1.2.0.txt
```

备注：

1) 若在安装过程中出现“匹配不到 XX 版本”的错误，可能由于是 pip 版本太低造成。

可先执行以下升级 pip 版本命令，pip 升级至版本 21.3.1，再执行重新执行上述安装命令。

```
python3 -m pip install --upgrade pip
```

```
ubuntu1804@ubuntu1804:~/Projects/rknn-toolkit2-1.1.0$ python3 -m pip install --upgrade pip
Collecting pip
  Downloading https://files.pythonhosted.org/packages/a4/6d/6463d49a933f547439d6b5b98b46af8742cc03ae83543e4d7688c2420f8b/pip-21.3.1-py3-none-any.whl (1.7MB)
    100% |#####| 1.7MB 1.2MB/s
Installing collected packages: pip
Successfully installed pip-21.3.1
```

5. 安装 RKNN-Toolkit2 (Python3.6 for x86_64)

命令:

```
pip3 install \
package/rknn_toolkit2-1.2.0_f7bb160f-cp36-cp36m-linux_x86_64.whl
Installing collected packages: rknn-toolkit2
Successfully installed rknn-toolkit2-1.2.0-f7bb160f
```

6. 检查 RKNN-Toolkit2 是否安装成功

命令:

```
python3
from rknn.api import RKNN
ubuntu1804@ubuntu1804:~/rknn-toolkit2-1.2.0$ python3
Python 3.6.9 (default, Dec  8 2021, 21:08:43)
[GCC 8.4.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> from rknn.api import RKNN
>>>
```

若没有出现错误，说明安装成功。同时按住 Ctrl+D 退出 Python3。

7. cd 进入 rknn-toolkit2-1.2.0/examples/onnx/yolov5 目录

```
cd examples/onnx/yolov5
ubuntu1804@ubuntu1804:~/rknn-toolkit2-1.2.0$ cd examples/onnx/yolov5/
ubuntu1804@ubuntu1804:~/rknn-toolkit2-1.2.0/examples/onnx/yolov5$ ls
bus.jpg  dataset.txt  test.py  yolov5s.onnx
```

8. 转换 yolov5s.onnx 为 rknn 模型并运行模型推理图片

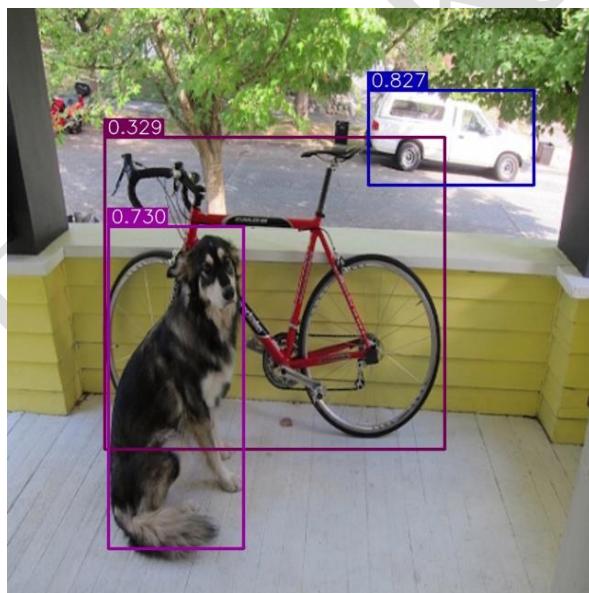
命令:

```
python3 test.py
ubuntu1804@ubuntu1804:~/rknn-toolkit2-1.2.0/examples/onnx/yolov5$ python3 test.py
```

```
I rknn building done
done
--> Export rknn model
done
--> Init runtime environment
Preparing :  0%|                                     | 0/163 [00:00<
Preparing :  6%|                                     | 9/163 [00:00<00:03, 4
Preparing : 60%|                                     | 98/163 [00:00<00:01, 5
Preparing : 100%|                                     | 163/163 [00:00<00:00, 44
0.32it/s]
W init_runtime: target is None, use simulator!
done
--> Running model
W inference: The dims of input(ndarray) shape (640, 640, 3) is wrong, expect dims is 4! Try
expand dims to (1, 640, 640, 3)!
done
class: person, score: 0.9983320832252502
box coordinate left,top,right,down: [474.55716973543167, 256.9547041654587, 561.31746405363
08, 516.4103471040726]
class: person, score: 0.9965435862541199
box coordinate left,top,right,down: [110.08729419112206, 230.1465458869934, 220.96309033036
232, 532.0092158317566]
class: person, score: 0.9758545756340027
box coordinate left,top,right,down: [210.40820306539536, 245.37266218662262, 288.3529663681
984, 507.16560685634613]
class: bus , score: 0.9926542043685913
box coordinate left,top,right,down: [73.90917986631393, 140.49429368972778, 567.08477765321
73, 442.35696363449097]
```

此脚本是在 PC 模拟器上运行，若需要连板调试请参考[章节 3.2](#)。

转换模型和推理脚本 test.py 运行成功，转换后的模型默认保存路径为 /rknn-toolkit2-1.2.0/examples/onnx/yolov5/yolov5s-640-640.rknn，推理的图片结果保存在 /rknn-toolkit2-1.2.0/examples/onnx/yolov5/result.jpg。

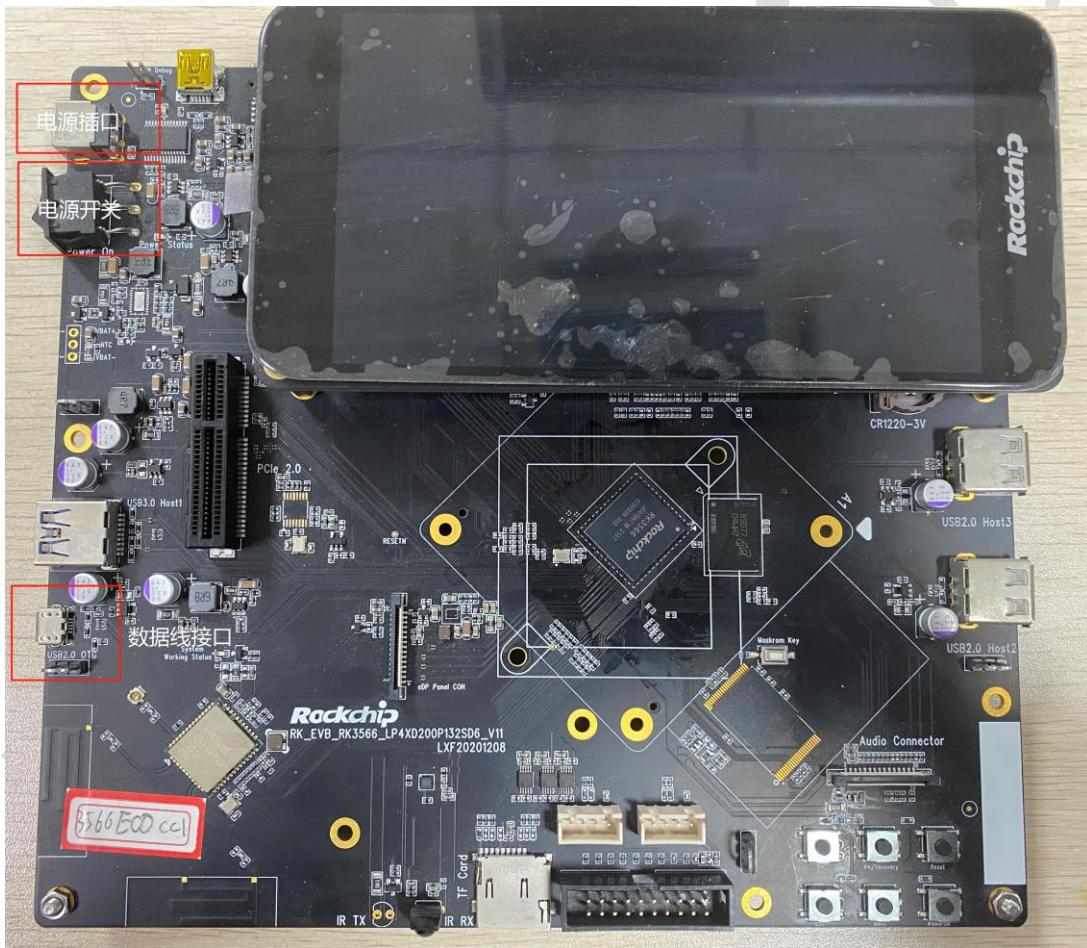


3.2 RKNN-Toolkit2 连板调试

通过 3.1.1 和 3.1.2 方式转换和推理模型均运行在 PC 端的模拟器环境中, 可设置脚本中的 target 和 device_id 进行连板调试。

3.2.1 连接板子至电脑

1. 按图中接口连接 RK3566 EVB 板子的电源、连接数据线至电脑，打开电源开关。



2. 查看板子设备

命令：

```
adb devices
```

```
root@9e5c8ee3530b:/# adb devices
List of devices attached
* daemon not running; starting now at tcp:5037
* daemon started successfully
DKUZ8B0PAB      device
```

查看 RK3566 设备的 ID 为 DKUZ8B0PAB，连接成功。若无设备显示可参考[附录 5.2](#)。

3.2.2 更新板子的 rknn_server 和 librknrt.so

librknrt.so: 是一个板端的 runtime 库。

rknn_server: 是一个运行在板子上的后台代理服务，用于接收 PC 通过 USB 传输过来的协议，然后执行板端 runtime 对应的接口，并返回结果给 PC。

详细可参考 rknpu2/rknn_server_proxy.md 的详细说明。

下面以 RK356X 安卓平台 64 位为例子介绍说明。

1) 打开一个终端命令窗口，进入 RKNPU2 工程目录

```
cd ~/Projects/rknpu2
```

```
xdc@xdc-HP-ProDesk-480-G7-PCI-Microtower-PC:~/Projects/rknpu2
xdc@xdc-HP-ProDesk-480-G7-PCI-Microtower-PC:~/Projects/rknpu2$ ls
doc examples LICENSE README.md rknn_server_proxy.md runtime
```

2) 更新板子的 rknn_server 和 librknrt.so

命令：

```
adb root  
adb remount  
  
adb push \  
runtime/RK356X/Android/rknn_server/arm64-v8a/vendor/bin/rknn_server \  
/vendor/bin/  
  
adb push \  
runtime/RK356X/Android/librknrt_api/arm64-v8a/librknrt.so /vendor/lib64/  
  
adb shell  
chmod +x /vendor/bin/rknn_server  
sync  
reboot
```

```
xdc@xdc-HP-ProDesk-480-G7-PCI-Microtower-PC:~/Projects/rknpus$ adb root  
* daemon not running; starting now at tcp:5037  
* daemon started successfully  
adb is already running as root  
xdc@xdc-HP-ProDesk-480-G7-PCI-Microtower-PC:~/Projects/rknpus$ adb remount  
remount succeeded  
xdc@xdc-HP-ProDesk-480-G7-PCI-Microtower-PC:~/Projects/rknpus$ adb push runtime/RK356X/Android/rknn_sever/arm64-v8a/vendor/bin/rknn_server /vendor/lib/  
runtime/RK356X/Android/rknn_server/arm64-v8a/ve...file pushed. 26.8 MB/s (850160 bytes in 0.030s)  
xdc@xdc-HP-ProDesk-480-G7-PCI-Microtower-PC:~/Projects/rknpus$ adb push runtime/RK356X/Android/librknrt_ap/i/arm64-v8a/librknrt.so /vendor/lib/  
runtime/RK356X/Android/librknrt_api/arm64-v8a/librkn... 1 file pushed. 27.1 MB/s (5039024 bytes in 0.177s)  
xdc@xdc-HP-ProDesk-480-G7-PCI-Microtower-PC:~/Projects/rknpus$
```

3) 查看更新是否成功

命令：

```
adb shell  
su  
setenforce 0  
pgrep rknn_server
```

```
les/onnx/yolov5$ adb shell  
rk3566_r:/ $ pgrep rknn_server  
155
```

查看到有 rknn_server 进程 id，更新成功。

3.2.3 连板调试

1) 查看设备 ID 命令 adb devices

```
root@4da66f8c2824:/rknn_yolov5_demo# adb devices
List of devices attached
* daemon not running; starting now at tcp:5037
* daemon started successfully
DKUZ8B0PAB      device
```

查看到此例子 RK3566 设备的 ID 为 DKUZ8B0PAB。若无设备显示可参考[附录 5.2](#)。

2) 修改脚本 target 和 device_id

修改对应平台类型值（rk3566、rk3568、rk3588）和设备 ID，保存后再执行脚本生成适用于板子的模型并进行推理图片，本例子中使用 rk3566 平台板子进行推理。

```
# Create RKNN object
rknn = RKNN(verbose=True)

rknn.config(mean_values=[[0, 0, 0]], std_values=[[255, 255, 255]], target_platform='rk3566')

# Load model
print('--> Loading model')
ret = rknn.load_onnx(MODEL_PATH)

# init runtime environment
print('--> Init runtime environment')
ret = rknn.init_runtime(target='rk3566', device_id='DKUZ8B0PAB')
if ret != 0:
    print('Init runtime environment failed')
    exit(ret)
print('done')
```

3) 执行转换和推理模型的 test.py 脚本：

```
python3 test.py
```

```
I rknn building done
done
--> Export rknn model
done
--> Init runtime environment
I target set by user is: rk3566
I Starting ntp or adb, target is RK3566
I Device [DKUZ8B0PAB] not found in ntb device list.
I Start adb...
I Connect to Device success!
I NPUTTransfer: Starting NPU Transfer Client, Transfer version 2.1.0 (b5861e7@2020-11-23T11:50:36)
D NPUTTransfer: Transfer spec = local:transfer_proxy
D NPUTTransfer: Transfer interface successfully opened, fd = 3
RKNNAPI: =====
RKNNAPI: RKNN VERSION:
D RKNNAPI: API: 1.2.0 (4c3573e build: 2022-01-13 20:03:13)
D RKNNAPI: DRV: rknn_server: 1.2.0 (4c3573e build: 2022-01-14 11:09:22)
D RKNNAPI: DRV: rknnrt: 1.2.0 (9db21b35d@2022-01-14T15:12:02)
D RKNNAPI: =====
done
--> Running model
done
class: person, score: 0.9981794357299805
box coordinate left,top,right,down: [474.55501848459244, 256.3733460903168, 561.3210801482201, 515.776983499527]
class: person, score: 0.9967917799949646
box coordinate left,top,right,down: [110.10428735613823, 229.3817499279976, 220.94869115948677, 531.2411748766899]
class: person, score: 0.9791850447654724
box coordinate left,top,right,down: [212.96840876340866, 245.36462771892548, 283.5629022717476, 507.1666833162308]
class: bus , score: 0.9926683902740479
box coordinate left,top,right,down: [74.84786373376846, 139.48901921510696, 568.0406250357628, 441.3484441637993]
D NPUTTransfer: Transfer client closed fd = 3
```

3.3 RKNPU2 的编译及使用方法

此章节以 rknn_yolov5_demo 在 RK3566 Android 64 位平台上运行为例，介绍如何使用 RKNPU2。

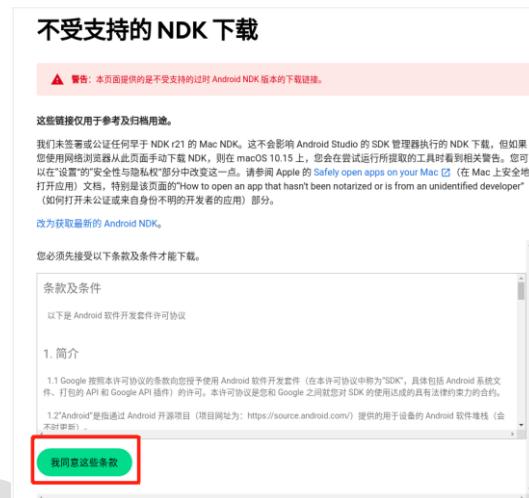
3.3.1 下载编译所需工具

下载完成后进行解压无需安装，记录文件夹的绝对路径。

1) 板子为 Android 系统则需 NDK，下载地址：

https://developer.android.google.cn/ndk/downloads/older_releases#ndk-17c-downloads

点击“我同意这些条款”。



往下找到 Android NDK r17c（建议的版本）选择 Linux 64 位（x86）的软件包。

Android NDK r17c (2018年6月)

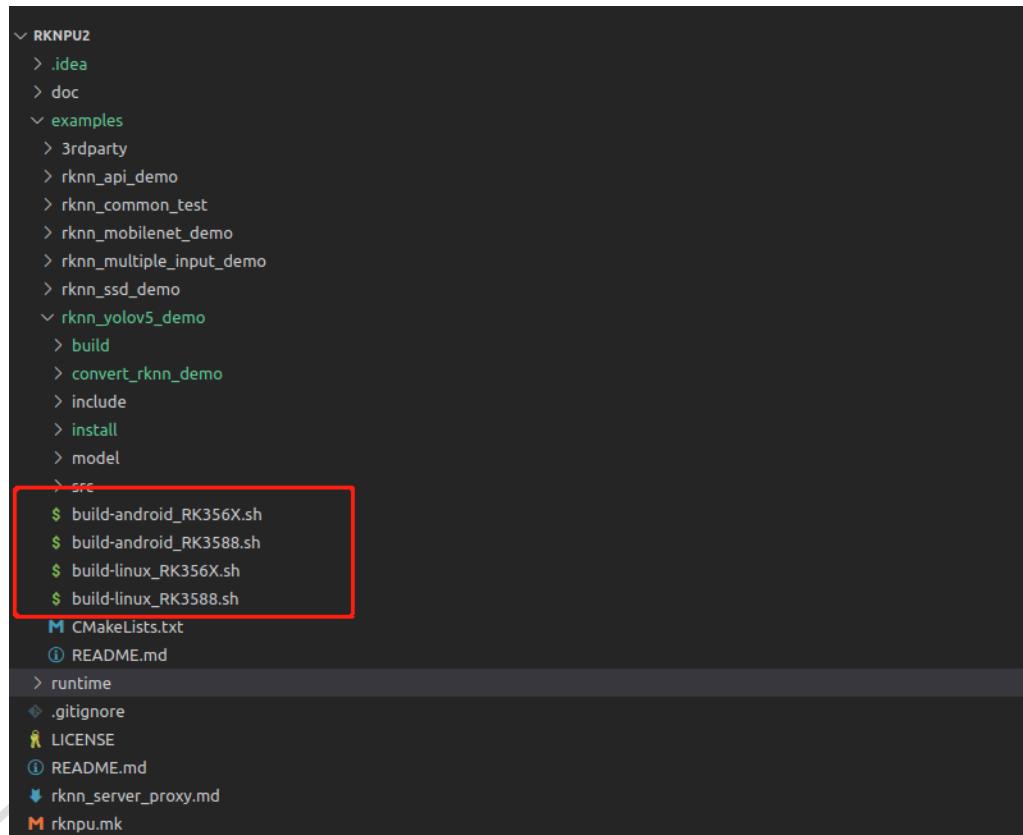
平台	软件包	大小 (字节)	SHA1 校验和
Windows 32 位	android-ndk-r17c-windows-x86.zip	608358310	5bb25bf13fa494ee6c3433474c7aa90009f9f6a9
Windows 64 位	android-ndk-r17c-windows-x86_64.zip	650626501	3e3b8d1650f9d297d130be2b342db956003f5992
Mac OS X	android-ndk-r17c-darwin-x86_64.zip	675091485	f97e3d7711497e3b4faf9e7b3fa0f0da90bb649c
Linux 64 位 (x86)	android-ndk-r17c-linux-x86_64.zip	709387703	12cac70c3fd2f40574015631c00f41fb8a39048

2) 板子为 linux 系统则需下载 gcc 交叉编译器

推荐版本 gcc-9.3.0-x86_64_aarch64-linux-gnu, 下载地址:

https://github.com/rockchip-linux/gcc-buildroot-9.3.0-2020.03-x86_64_aarch64-rockchip-linux-gnu

3.3.2 修改 examples/rknn_yolov5_demo/build-XXX.sh 的编译工具路径



```
└─ RKNPU2
    ├─ .idea
    ├─ doc
    └─ examples
        ├─ 3rdparty
        ├─ rknn_api_demo
        ├─ rknn_common_test
        ├─ rknn_mobilenet_demo
        ├─ rknn_multiple_input_demo
        ├─ rknn_ssd_demo
        └─ rknn_yolov5_demo
            ├─ build
            ├─ convert_rknn_demo
            ├─ include
            ├─ install
            ├─ model
            └─ src
                $ build-android_RK356X.sh
                $ build-android_RK3588.sh
                $ build-linux_RK356X.sh
                $ build-linux_RK3588.sh
            └─ CMakeLists.txt
            └─ README.md
        └─ runtime
    └─ .gitignore
    └─ LICENSE
    └─ README.md
    └─ rknn_server_proxy.md
    └─ rknpu.mk
```

1) Android 系统

修改 ANDROID_NDK_PATH 为本地电脑 android-ndk-r17c 的保存路径并保存。



```
$ build-android_RK356X.sh M X
examples > rknn_yolov5_demo > $ build-android_RK356X.sh
1  #!/bin/bash
2
3  set -e
4
5  ANDROID_NDK_PATH=~/opt/tool_chain/android-ndk-r17c
6
7  BUILD_TYPE=Release
8
9  TARGET_SOC="rk356x"
10
11 ROOT_PWD=$( cd "$( dirname $0 )" && cd -P "$( dirname "$SOURCE" )" && pwd )
12
```

2) Linux 系统

修改 TOOL_CHAIN 为本地电脑 gcc-9.3.0-x86_64_arcrh64-linux-gnu 的保存路径并保存。

```
$ build-linux_RK356X.sh M x
examples > rknn_yolov5_demo > $ build-linux_RK356X.sh
You, seconds ago | 2 authors (chifredhong and others)
1 set -e
2
3 TARGET_SOC="rk356x"
4 export TOOL_CHAIN=/opt/gcc-buildroot-9.3.0-2020.03-x86_64_aarch64-rockchip-linux-gnu
5
6 if [ "${TOOL_CHAIN}" == "" ]
7 then
8 echo "Please set TOOL_CHAIN!"
9 exit 1
10 fi
11
```

3.3.3 更新 RKNN 模型

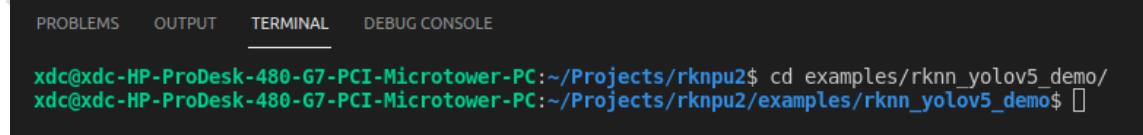
把章节 3.2 转换后的 RK3566 平台模型 yolov5s-640-640.rknn 复制到 rknpu2/examples/rknn_yolov5_demo/model/RK356X/ 目录下。

3.3.4 编译 rknn_yolov5_demo

- 1) 在终端命令窗口进入 rknn_yolov5_demo 文件夹

命令：

```
cd examples/rknn_yolov5_demo/
```



```
PROBLEMS OUTPUT TERMINAL DEBUG CONSOLE
xdc@xdc-HP-ProDesk-480-G7-PCI-Microtower-PC:~/Projects/rknpu2$ cd examples/rknn_yolov5_demo/
xdc@xdc-HP-ProDesk-480-G7-PCI-Microtower-PC:~/Projects/rknpu2/examples/rknn_yolov5_demo$
```

- 2) 运行 build-android_RK356X.sh 脚本编译程序

命令：

```
./build-android_RK356X.sh
```

```
PROBLEMS OUTPUT TERMINAL DEBUG CONSOLE

xdc@xdc-HP-ProDesk-480-G7-PCI-Microtower-PC:~/Projects/rknnpu2/examples/rknn_yolov5_demo$ ./build-android_RK356X.sh
-- Configuring done
-- Generating done
-- Build files have been written to: /home/xdc/Projects/rknnpu2/examples/rknn_yolov5_demo/build/build_android_v8a
[100%] Built target rknn_yolov5_demo
[100%] Built target rknn_yolov5_demo
Install the project...
-- Install configuration: "Release"
-- Up-to-date: /home/xdc/Projects/rknnpu2/examples/rknn_yolov5_demo/install/rknn_yolov5_demo_Android/.rknn_yolov5_demo
-- Up-to-date: /home/xdc/Projects/rknnpu2/examples/rknn_yolov5_demo/install/rknn_yolov5_demo_Android/lib/librknrt.so
-- Up-to-date: /home/xdc/Projects/rknnpu2/examples/rknn_yolov5_demo/install/rknn_yolov5_demo_Android/.model
-- Up-to-date: /home/xdc/Projects/rknnpu2/examples/rknn_yolov5_demo/install/rknn_yolov5_demo_Android/.model/RK356X
-- Up-to-date: /home/xdc/Projects/rknnpu2/examples/rknn_yolov5_demo/install/rknn_yolov5_demo_Android/.model/RK356X/yolov5s-640-640.rknn
-- Up-to-date: /home/xdc/Projects/rknnpu2/examples/rknn_yolov5_demo/install/rknn_yolov5_demo_Android/.model/coco_80_labels_list.txt
-- Up-to-date: /home/xdc/Projects/rknnpu2/examples/rknn_yolov5_demo/install/rknn_yolov5_demo_Android/.model/bus.jpg
-- Up-to-date: /home/xdc/Projects/rknnpu2/examples/rknn_yolov5_demo/install/rknn_yolov5_demo_Android/.model/RK3588
-- Up-to-date: /home/xdc/Projects/rknnpu2/examples/rknn_yolov5_demo/install/rknn_yolov5_demo_Android/.model/RK3588/yolov5s-640-640.rknn
```

备注：

- 1) 此例子为编译 RK356X 的安卓 64 位平台。若需要编译其他平台请选择相应的脚本。

详情可参考/rknnpu2/examples/rknn_yolov5_demo/README.md。

- 2) 若在编译时出现 cmake 错误，可执行以下命令安装 cmake 后再运行编译脚本。

```
sudo apt install cmake
```

3.3.5 在板端运行 rknn_yolov5_demo

- 1) 把编译好的程序和所需的文件 install/rknn_yolov5_demo_Android 文件夹上传到板子的 /data/ 文件夹下

命令：

```
adb root
adb push install/rknn_yolov5_demo_Android /data/
```

```
xdc@xdc-HP-ProDesk-480-G7-PCI-Microtower-PC:~/Projects/rknnpu2/examples/rknn_yolov5_demo$ adb push install/rknn_yolov5_demo_Android /data/
install/rknn_yolov5_demo_Android/: 6 files pushed. 32.5 MB/s (30752067 bytes in 0.902s)
```

- 2) 进入板子系统

命令：

```
adb shell
```

```
xdc@xdc-HP-ProDesk-480-G7-PCI-Microtower-PC:~$ adb shell
rk3566_r:/ #
```

- 3) cd 进入程序所在的目录

命令：

```
cd /data/rknn_yolov5_demo_Android/
```

```
rk3566_r:/ # cd /data/rknn_yolov5_demo_Android/  
rk3566_r:/data/rknn_yolov5_demo_Android # ls  
lib model rknn_yolov5_demo
```

4) 设置库文件路径

命令：

```
export LD_LIBRARY_PATH=./lib
```

5) 运行程序识别相应的图片中物体的类别

用法 Usage: ./rknn_yolov5_demo <rknn model> <jpg>

命令：

```
./rknn_yolov5_demo ./model/RK356X/yolov5s-640-640.rknn ./model/bus.jpg
```

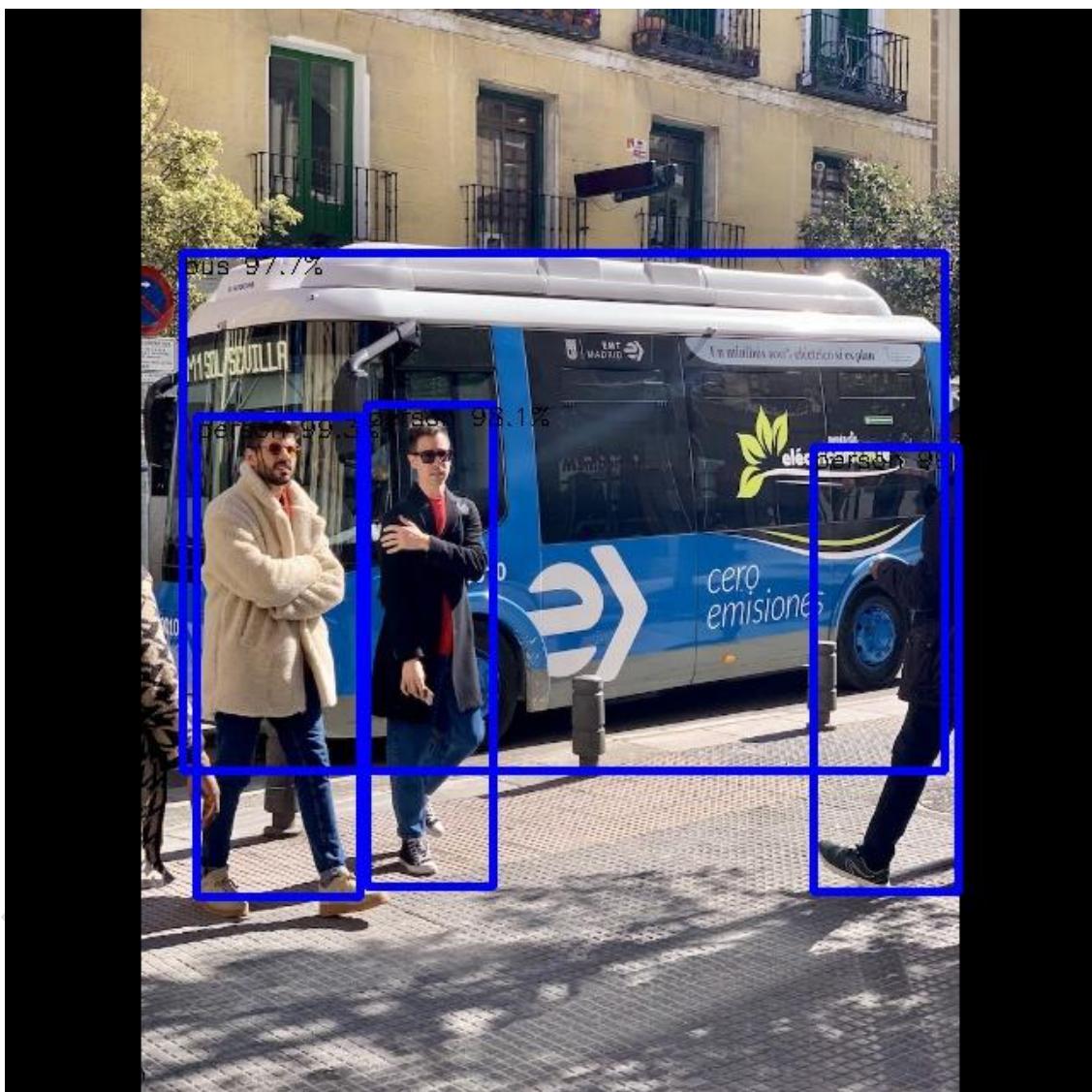
```
rk3566_r:/data/rknn_yolov5_demo_Linux # ./rknn_yolov5_demo ..../rknn_yolov5_demo_Android/model/RK356X/yolov5s-640-640_rm_transpose.rknn ./model/bus.jpg  
/system/bin/sh: ./rknn_yolov5_demo: No such file or directory  
1|rk3566_r:/data/rknn_yolov5_demo_Linux # ls  
lib model rknn_yolov5_demo  
rk3566_r:/data/rknn_yolov5_demo_Linux # ./rknn_yolov5_demo  
/system/bin/sh: ./rknn_yolov5_demo: No such file or directory  
1|rk3566_r:/data/rknn_yolov5_demo_Linux # cd ..../rk  
rknn_yolov5_demo_Android/    rknn_yolov5_demo_Linux/  
1|rk3566_r:/data/rknn_yolov5_demo_Linux # cd ..../rknn_yolov5_demo_Android/  
rk3566_r:/data/rknn_yolov5_demo_Android #  
rk3566_r:/data/rknn_yolov5_demo_Android #  
rk3566_r:/data/rknn_yolov5_demo_Android #  
rk3566_r:/data/rknn_yolov5_demo_Android #  
rk3566_r:/data/rknn_yolov5_demo_Android # ./rknn_yolov5_demo ./model/RK3  
RK356X/ RK358B/  
rk3566_r:/data/rknn_yolov5_demo_Android # ./rknn_yolov5_demo ./model/RK356X/  
yolov5s-640-640.rknn      yolov5s-640-640_rm_transpose.rknn  
rk3566_r:/data/rknn_yolov5_demo_Android # ./rknn_yolov5_demo ./model/RK356X/yolov5s-640-640  
yolov5s-640-640.rknn      yolov5s-640-640_rm_transpose.rknn  
rk3566_r:/data/rknn_yolov5_demo_Android # ./rknn_yolov5_demo ./model/RK356X/yolov5s-640-640_rm_transpose.rknn ./model/bus.jpg  
post process config: box_conf_threshold = 0.50, nms_threshold = 0.60  
Read ./model/bus.jpg ...  
ing width = 640, ing height = 640  
Loading mode...  
sdk version: 1.1.0 (8a9d6f66@2021-08-19T15:04:49) driver version: 0.4.2  
model input num: 1, output num: 3  
    index=0, name=images, n_dims=4, dims=[1, 640, 640, 3], n_elems=1228800, size=1228800, fmt=NHWC, type=UINT8, qnt_type=AFFINE, zp=-128, scale=0.003922  
    index=0, name=output, n_dims=5, dims=[1, 3, 85, 80], n_elems=1632000, size=1632000, fmt=NHCHW, type=INT8, qnt_type=AFFINE, zp=77, scale=0.080445  
    index=1, name=371, n_dims=5, dims=[1, 3, 85, 40], n_elems=408000, size=408000, fmt=NHCHW, type=INT8, qnt_type=AFFINE, zp=56, scale=0.080794  
    index=2, name=390, n_dims=5, dims=[1, 3, 85, 20], n_elems=102000, size=102000, fmt=NHCHW, type=INT8, qnt_type=AFFINE, zp=69, scale=0.081305  
model is NHWC input fmt  
model input height=640, width=640, channel=3  
once run use 71.763000 ms  
loadLabelName ./model/coco_80_labels_list.txt  
person @ (474 257 559 518) 0.996784  
person @ (112 239 260 521) 0.993368  
person @ (212 232 281 515) 0.981273  
bus @ (104 143 551 447) 0.976798  
loop count = 10 , average run 70.741500 ms
```

-
- 6) 打开一个新终端窗口并下载结果图片 out.jpg 至本地电脑中查看

命令：

```
adb pull /data/rknn_yolov5_demo_Android/out.jpg ./
```

```
xdc@xdc-HP-ProDesk-480-G7-PCI-Microtower-PC:~/Pictures$ adb pull /data/rknn_yolov5_demo_Android/out.jpg ./  
/data/rknn_yolov5_demo_Android/out.jpg: 1 file pulled. 25.2 MB/s (189698 bytes in 0.007s)
```



4 参考文档

有关 RKNN-Toolkit2 更详细的用法和接口说明，请参考《Rockchip_User_Guide_RKNN_Toolkit2_CN.pdf》手册。

有关 RKNPU API 更详细的用法和接口说明，请参考《Rockchip_RKNPU_User_Guide_RKNN_API_V1.2.0_CN.pdf》手册。

5 附录

5.1 查看和设置开发板的 CPU、DDR 和 NPU 频率

通常，板子上的各个单元的频率是动态调频，这种情况下测试出来的模型性能会有波动。为了防止性能测试结果不一致，在性能评估时，建议固定板子上的相关单元的频率再做测试。相关单元的频率查看和设置命令如下：

5.1.1 CPU 定频命令

1) 查看 CPU 频率

```
cat /sys/devices/system/cpu/cpu0/cpufreq/scaling_cur_freq  
或  
cat /sys/kernel/debug/clk/clk_summary | grep arm
```

2) 固定 CPU 频率

```
# 查看 CPU 可用频率  
cat /sys/devices/system/cpu/cpufreq/policy0/scaling_available_frequencies  
408000 600000 816000 1008000 1200000 1416000 1608000 1704000  
# 设置 CPU 频率，例如，设置 1.7GHz  
echo userspace > /sys/devices/system/cpu/cpufreq/policy0/scaling_governor  
echo 1704000 > /sys/devices/system/cpu/cpufreq/policy0/scaling_setspeed
```

5.1.2 DDR 定频命令

1) 查看 DDR 频率

```
cat /sys/class/devfreq/dmc/cur_freq  
或  
cat /sys/kernel/debug/clk/clk_summary | grep ddr
```

2) 固定 DDR 频率（需固件支持）

```
# 查看 DDR 可用频率  
cat /sys/class/devfreq/dmc/available_frequencies  
# 设置 DDR 频率，例如，设置 1560MHz  
echo userspace > /sys/class/devfreq/dmc/governor  
echo 1560000000 > /sys/class/devfreq/dmc/userspace/set_freq
```

5.1.3 NPU 定频命令

1) 查看 NPU 频率（需固件支持）

对于 RK356X:

```
cat /sys/kernel/debug/clk/clk_summary | grep npu  
或  
cat /sys/class/devfreq/fde40000.npu/cur_freq
```

对于 RK3588:

```
cat /sys/kernel/debug/clk/clk_summary | grep clk_npu_dsu0
```

2) 固定 NPU 频率（需固件支持）

对于 RK356X:

```
# 查看 NPU 可用频率  
cat /sys/class/devfreq/fde40000.npu/available_frequencies  
# 设置 NPU 频率，例如，设置 1 GHz  
echo userspace > /sys/class/devfreq/fde40000.npu/governor  
echo 1000000000 > /sys/kernel/debug/clk/clk_scmi_npu/clk_rate
```

对于 RK3588:

```
# 设置 NPU 频率，例如，设置 1GHz  
echo 1000000000 > /sys/kernel/debug/clk/clk_npu_dsu0/clk_rate
```

5.2 命令 adb devices 查看不到设备

1. 检查连线是否正确、重插拔或更换电脑 USB 插口
2. 在本地电脑和 docker 容器中使用 USB 连接的板子时，同一时间只能有一端使用 adb server。

故若在一端执行命令（adb devices）时查看不到设备，可在另一命令端执行命令

```
adb kill-server
```

终止外部 adb service，再返回原先命令终端窗口执行命令（adb devices）查看设备。

3. 出现以下错误时，是未安装 adb。需要执行安装命令安装 adb。

```
Command 'adb' not found, but can be installed with:  
sudo apt install adb
```

命令：

```
sudo apt install adb
```