

密级状态：绝密( ) 秘密( ) 内部( ) 公开(√)

## RKNN SDK 快速上手指南

(技术部，图形计算平台中心)

文件状态： [ ] 正在修改 [√] 正式发布	当前版本：	1.2.0
	作 者：	HPC
	完成日期：	2022-01-14
	审 核：	熊伟
	完成日期：	2022-01-14

瑞芯微电子股份有限公司

Rockchip Electronics Co., Ltd

(版本所有,翻版必究)

---

## 更新记录

版本	修改人	修改日期	修改说明	核定人
1.2.0	许东晨	2022-1-14	初始版本	卓鸿添

---

# 目 录

1	主要说明.....	4
2	准备工具.....	5
3	快速入门使用 RKNN-TOOLKIT2 和 RKNPU2.....	8
3.1	安装 RKNN-TOOLKIT2.....	8
3.1.1	通过 Docker 镜像安装并推理.....	8
3.1.2	通过 pip install 安装并推理.....	11
3.2	RKNN-TOOLKIT2 连板调试.....	14
3.2.1	连接板子至电脑.....	14
3.2.2	更新板子的 rknn_server 和 librknrt.so .....	15
3.2.3	连板调试.....	16
3.3	RKNPU2 的编译及使用方法 .....	18
3.3.1	下载编译所需工具.....	18
3.3.2	修改 examples/rknn_yolov5_demo/build-XXX.sh 的编译工具路径.....	19
3.3.3	更新 RKNN 模型.....	20
3.3.4	编译 rknn_yolov5_demo.....	20
3.3.5	在板端运行 rknn_yolov5_demo.....	21
4	参考文档.....	24
5	附录.....	25
5.1	查看和设置开发板的 CPU、DDR 和 NPU 频率 .....	25
5.1.1	CPU 定频命令 .....	25
5.1.2	DDR 定频命令 .....	25
5.1.3	NPU 定频命令 .....	26
5.2	命令 ADB DEVICES 查看不到设备 .....	27

---

## 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

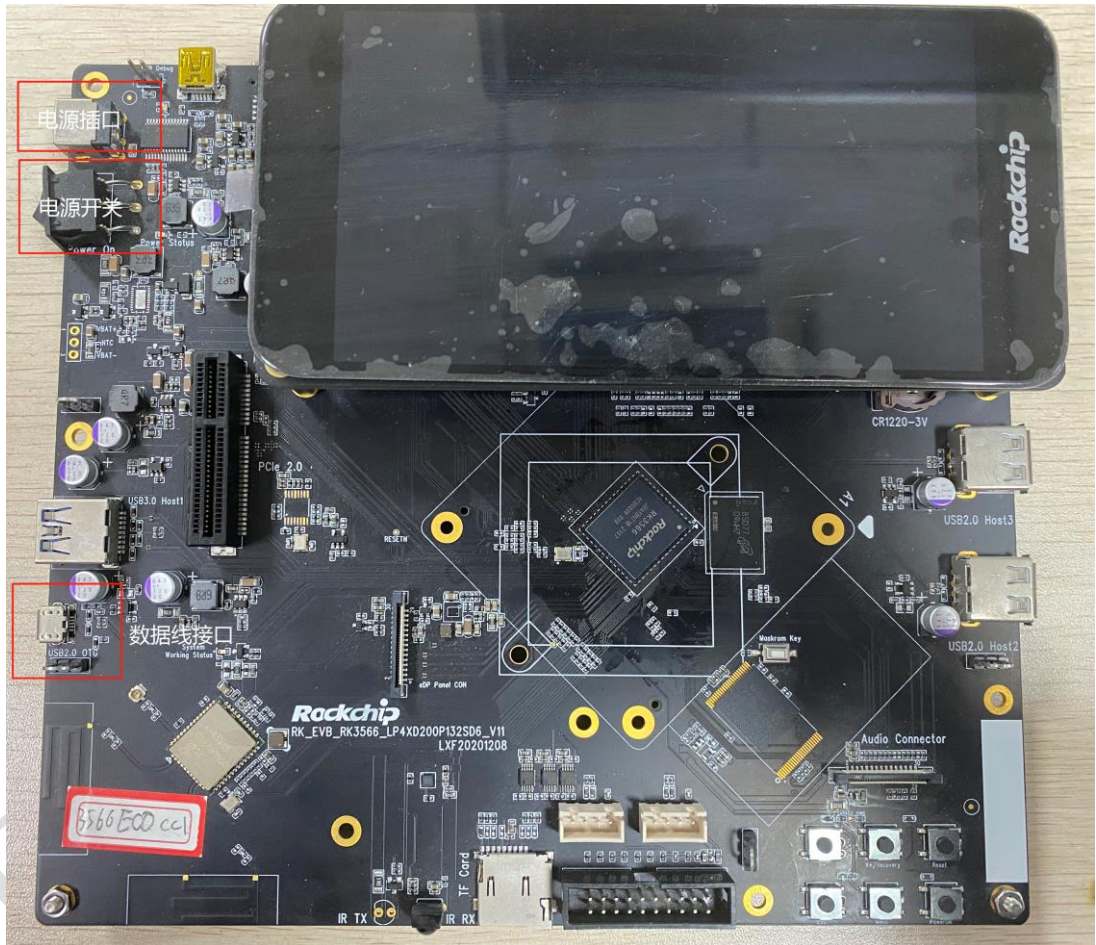
RKNPU2 工程下载地址：<https://github.com/rockchip-linux/rknpu2>

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

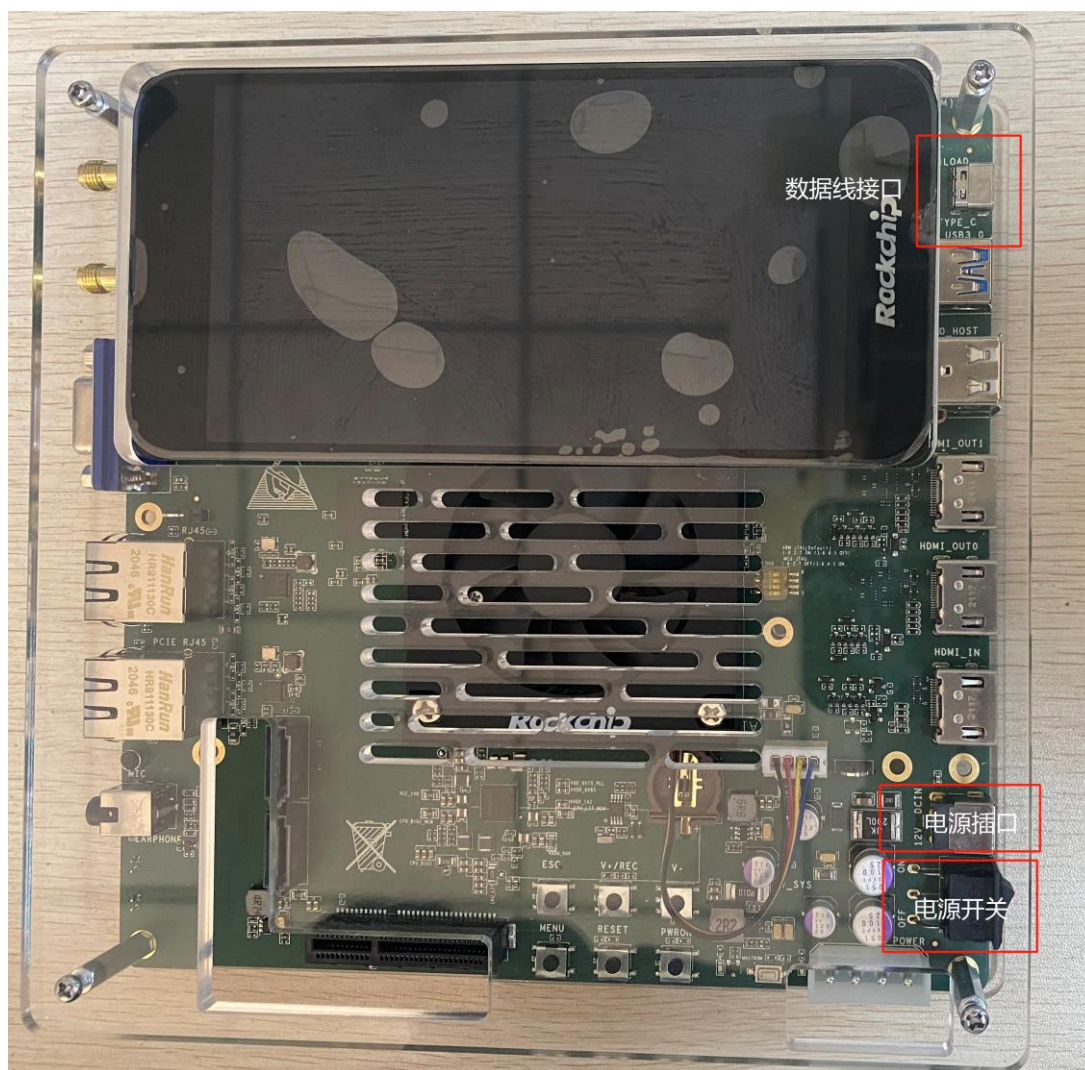
## 2 准备工具

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
4c068448808: 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

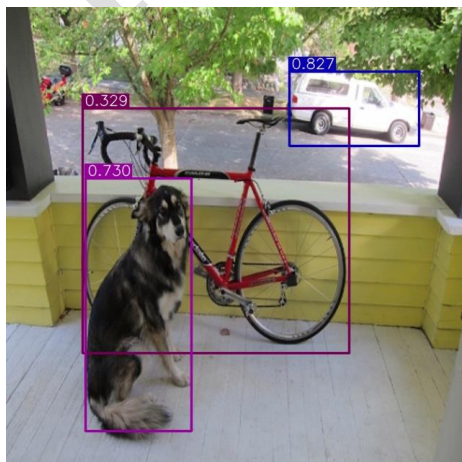
```
python3 ./test.py
```

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

I rknn 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`。



### 3.1.2 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
```

```
ubuntu1804@ubuntu1804:~$ cd ~/rknn-toolkit2-1.2.0/
ubuntu1804@ubuntu1804:~/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/6463d49a933f547439d
6b5b98b46af8742cc03ae83543e4d7688c2420f8b/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
```

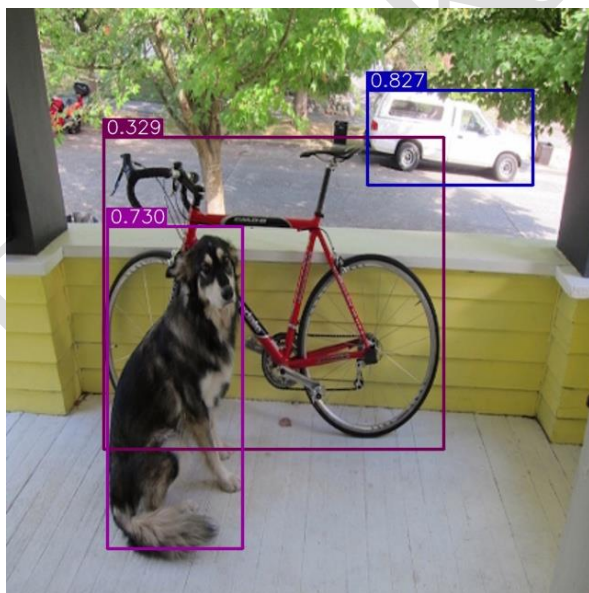
```

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`。



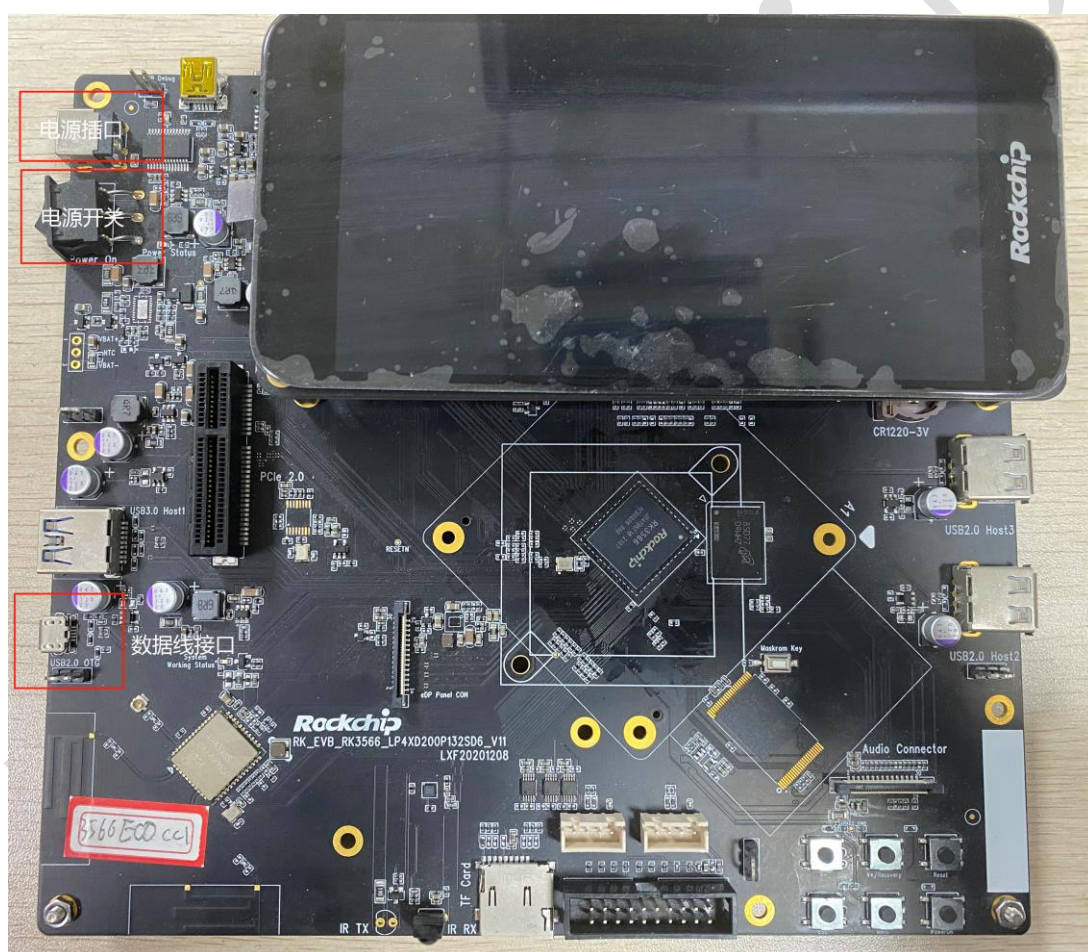


## 3.2 RKNN-Toolkit2 连板调试

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:~$ cd ~/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/librknn_api/arm64-v8a/librknnrt.so /vendor/lib64/

adb shell
chmod +x /vendor/bin/rknn_server
sync
reboot
```

```
xdc@xdc-HP-ProDesk-480-G7-PCI-Microtower-PC:~/Projects/rknpu2$ 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/rknpu2$ adb remount
remount succeeded
xdc@xdc-HP-ProDesk-480-G7-PCI-Microtower-PC:~/Projects/rknpu2$ adb push runtime/RK356X/Android/rknn_server/arm64-v8a/vendor/bin/rknn_server /vendor/lib64/
runtime/RK356X/Android/rknn_server/arm64-v8a/vendor/bin/rknn_server: file pushed. 26.8 MB/s (850160 bytes in 0.030s)
xdc@xdc-HP-ProDesk-480-G7-PCI-Microtower-PC:~/Projects/rknpu2$ adb push runtime/RK356X/Android/librknn_api/arm64-v8a/librknnrt.so /vendor/lib64/
runtime/RK356X/Android/librknn_api/arm64-v8a/librknnrt.so: file pushed. 27.1 MB/s (5039024 bytes in 0.177s)
xdc@xdc-HP-ProDesk-480-G7-PCI-Microtower-PC:~/Projects/rknpu2$
```

## 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 bulding 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 NPUTransfer: Starting NPU Transfer Client, Transfer version 2.1.0 (b5861e7@2020-11-23T11:50:36)
D NPUTransfer: Transfer spec = local:transfer_proxy
D NPUTransfer: Transfer interface successfully opened, fd = 3
D RKNNAPI: =====
D 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 NPUTransfer: 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。

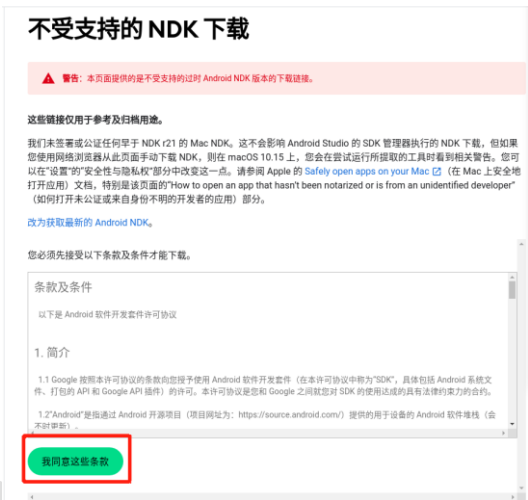
#### 3.3.1 下载编译所需工具

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](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)

```
android {
  ndkVersion "17.2.4988734"
}
```

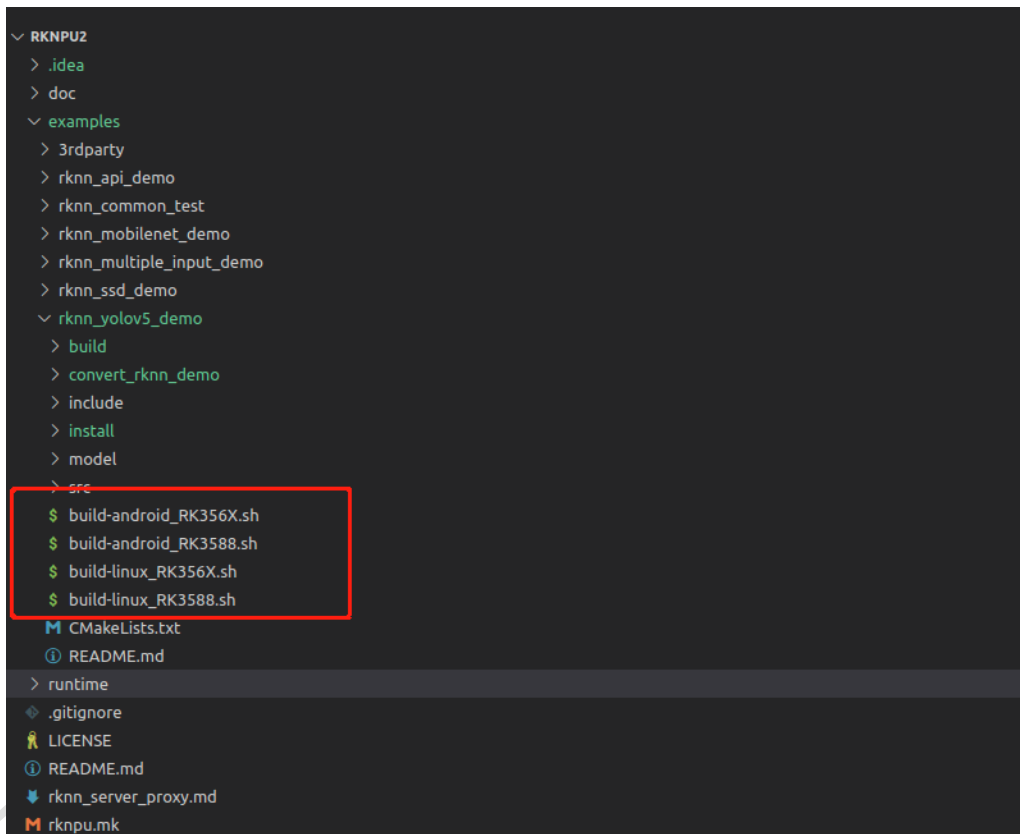
平台	软件包	大小 (字节)	SHA1 校验和
Windows 32 位	<a href="#">android-ndk-r17c-windows-x86.zip</a>	608358310	5bb25bf13fa494ee6c3433474c7aa90009f9f6a9
Windows 64 位	<a href="#">android-ndk-r17c-windows-x86_64.zip</a>	650626501	3e3b8d1650f9d297d130be2b342db956003f5992
Mac OS X	<a href="#">android-ndk-r17c-darwin-x86_64.zip</a>	675091485	f97e3d7711497e3b4faf9e7b3fa0f0da90bb649c
Linux 64 位 (x86)	<a href="#">android-ndk-r17c-linux-x86_64.zip</a>	709387703	12caacc70c3fd2f40574015631c00f41fb8a39048

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](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



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。



## 2) Linux 系统

修改 TOOL\_CHAIN 为本地电脑 gcc-9.3.0-x86\_64\_arch64-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=~/opts/gcc-buildroot-9.3.0-2020.03-x86_64_arch64-rockchip-linux-gnu
5
6  if [ x"${TOOL_CHAIN}" == x" " ]
7  then
8      echo "Please set TOOL_CHAIN!"
9      exit 1
10 fi
```

### 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/rknp2/examples/rknn_yolov5_demo$ ./build-android_RK356X.sh
-- Configuring done
-- Generating done
-- Build files have been written to: /home/xdc/Projects/rknp2/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/rknp2/examples/rknn_yolov5_demo/install/rknn_yolov5_demo_Android/./rknn_yolov5_demo
-- Up-to-date: /home/xdc/Projects/rknp2/examples/rknn_yolov5_demo/install/rknn_yolov5_demo_Android/lib/librknnrt.so
-- Up-to-date: /home/xdc/Projects/rknp2/examples/rknn_yolov5_demo/install/rknn_yolov5_demo_Android/./model
-- Up-to-date: /home/xdc/Projects/rknp2/examples/rknn_yolov5_demo/install/rknn_yolov5_demo_Android/./model/RK356X
-- Up-to-date: /home/xdc/Projects/rknp2/examples/rknn_yolov5_demo/install/rknn_yolov5_demo_Android/./model/RK356X/yolov5s-640-640.rknn
-- Up-to-date: /home/xdc/Projects/rknp2/examples/rknn_yolov5_demo/install/rknn_yolov5_demo_Android/./model/coco_80_labels_list.txt
-- Up-to-date: /home/xdc/Projects/rknp2/examples/rknn_yolov5_demo/install/rknn_yolov5_demo_Android/./model/bus.jpg
-- Up-to-date: /home/xdc/Projects/rknp2/examples/rknn_yolov5_demo/install/rknn_yolov5_demo_Android/./model/RK3588
-- Up-to-date: /home/xdc/Projects/rknp2/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/rknp2/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/rknp2/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
```

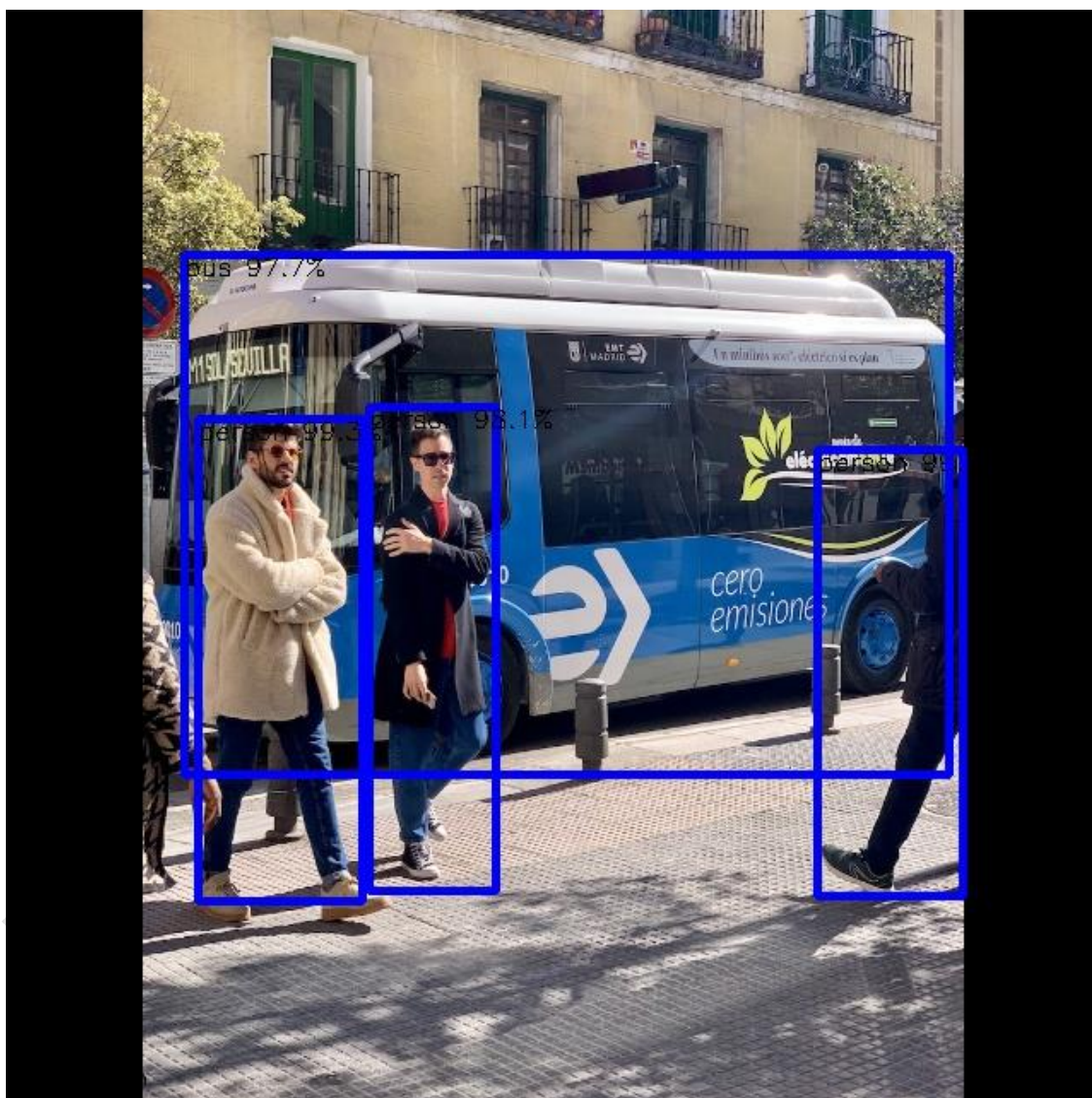
```
rk3566_r:/data/rknn_yolov5_demo_Linux # ./rknn_yolov5_demo ./rknn_yolov5_demo_Android/model/RK356X/yolov5s-640-640_rn_transpose.rknn ./model/bus.jpg
rk3566_r:/data/rknn_yolov5_demo_Linux # ls
lib  model  rknn_yolov5_demo
rk3566_r:/data/rknn_yolov5_demo_Linux # ./rknn_yolov5_demo
/system/bin/sh: ./rknn_yolov5_demo: No such file or directory
rk3566_r:/data/rknn_yolov5_demo_Linux # cd ../rk
rknn_yolov5_demo_Android/  rknn_yolov5_demo_Linux/
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/ RK3588/
rk3566_r:/data/rknn_yolov5_demo_Android # ./rknn_yolov5_demo ./model/RK356X/
yolov5s-640-640.rknn yolov5s-640-640_rn_transpose.rknn
rk3566_r:/data/rknn_yolov5_demo_Android # ./rknn_yolov5_demo ./model/RK356X/yolov5s-640-640
yolov5s-640-640.rknn yolov5s-640-640_rn_transpose.rknn
rk3566_r:/data/rknn_yolov5_demo_Android # ./rknn_yolov5_demo ./model/RK356X/yolov5s-640-640_rn_transpose.rknn ./model/bus.jpg
post process config: box_conf_threshold = 0.50, nms_threshold = 0.60
Read ./model/bus.jpg ...
img width = 640, img 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=NCHW, 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=NCHW, 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=NCHW, 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 @ (112 239 208 521) 0.993368
person @ (212 232 286 515) 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。

Rockchip

---

## 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
```