

(<https://www.youtube.com/watch?v=3YqbO2AlepM>)

Dustom Object Detection Tensorflow Lite Raspberry Pi Bookworm

\$ git clone <https://github.com/freedomwebtech/tflite-custom-object-bookworm>

```
pi@raspberrypi:~ $ git clone https://github.com/freedomwebtech/tflite-custom-object-bookworm
'tflite-custom-object-bookworm'에 복제합니다...
remote: Enumerating objects: 23, done.
remote: Counting objects: 100% (23/23), done.
remote: Compressing objects: 100% (22/22), done.
remote: Total 23 (delta 5), reused 0 (delta 0), pack-reused 0
오브젝트를 받는 중: 100% (23/23), 3.22 MiB | 5.02 MiB/s, 완료.
델타를 알아내는 중: 100% (5/5), 완료.
pi@raspberrypi:~ $
```

```
$ sudo rm /usr/lib/python3.11/EXTERNALLY-MANAGED
```

```
파일(F) 편집(E) 탭(T) 도움말(H)
GNU nano 7.2 rp14.txt
sudo rm /usr/lib/python3.11/EXTERNALLY-MANAGED
```

```
$ sudo pip3 install opencv-python
```

```
pi@raspberrypi:~$ sudo pip3 install opencv-python
Looking in indexes: https://pypi.org/simple, https://www.piwheels.org/simple
Collecting opencv-python
  Downloading opencv-python-4.9.0.80-cp37-abi3-manylinux_2_17_aarch64.manylinux2014_aarch64.whl (41.3 MB)
    41.3/41.3 MB 2.9 MB/s eta 0:00:00
Requirement already satisfied: numpy>=1.21.2 in /usr/lib/python3/dist-packages (from opencv-python) (1.24.2)
Installing collected packages: opencv-python
Successfully installed opencv-python-4.9.0.80
WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour with the system package manager. It is recommended to use a virtual environment instead: https://pip.pypa.io/warnings/venv
pi@raspberrypi:~$
```

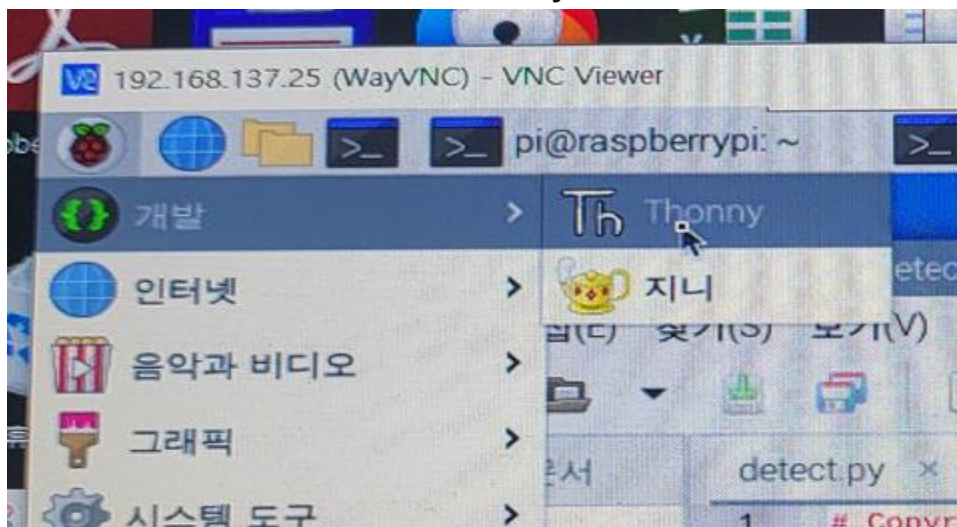
```
$ sudo pip3 install mediapipe
```

```
pi@raspberrypi:~$ sudo pip3 install mediapipe
Looking in indexes: https://pypi.org/simple, https://www.piwheels.org/simple
Collecting mediapipe
  Downloading mediapipe-0.10.13-cp311-cp311-manylinux_2_17_aarch64.manylinux2014_aarch64.whl (33.0 MB)
  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 33.0/33.0 MB 4.4 MB/s eta 0:00:00
Collecting absl-py
  Downloading https://www.piwheels.org/simple/absl-py/absl_py-2.1.0-py3-none-any.whl (133 kB)
  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 133.7/133.7 kB 110.3 kB/s eta 0:00:00
Collecting attrs>=19.1.0
  Downloading https://www.piwheels.org/simple/attrs/attrs-23.2.0-py3-none-any.whl (60 kB)
  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 60.8/60.8 kB 170.7 kB/s eta 0:00:00
Collecting flatbuffers>=2.0
  Downloading https://www.piwheels.org/simple/flatbuffers/flatbuffers-201810032
```

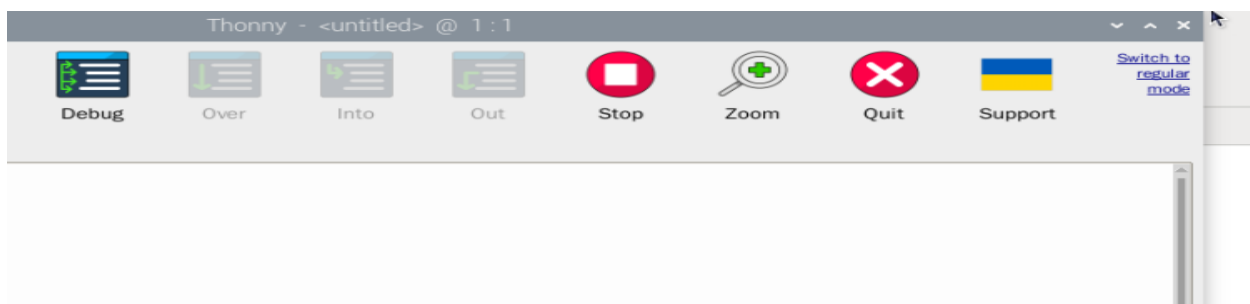
(중략)

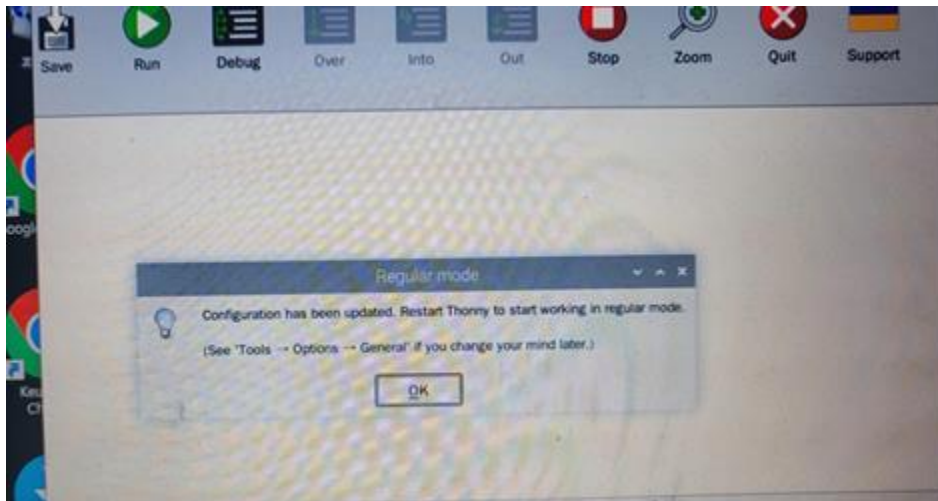
```
Downloading https://www.piwheels.org/simple/pycparser/pycparser-2.22-py3-none-any.whl (117 kB)
117.6/117.6 kB 3.7 MB/s eta 0:00:00
Requirement already satisfied: six>=1.5 in /usr/lib/python3/dist-packages (from python-dateutil>=2.7->matplotlib->mediapipe) (1.16.0)
Installing collected packages: flatbuffers, scipy, python-dateutil, pyparsing, pycparser, protobuf, packaging, opt-einsum, opencv-contrib-python, ml-dtypes, kiwisolver, fonttools, cycler, contourpy, attrs, absl-py, matplotlib, jaxlib, jax, CFFI, sounddevice, mediapipe
Successfully installed CFFI-1.16.0 absl-py-2.1.0 attrs-23.2.0 contourpy-1.2.1 cycler-0.12.1 flatbuffers-20181003210633 fonttools-4.51.0 jax-0.4.26 jaxlib-0.4.26 kiwisolver-1.4.5 matplotlib-3.8.4 mediapipe-0.10.13 ml-dtypes-0.4.0 opencv-contrib-python-4.9.0.80 opt-einsum-3.3.0 packaging-24.0 protobuf-4.25.3 pycparser-2.22 pyparsing-3.1.2 python-dateutil-2.9.0.post0 scipy-1.13.0 sounddevice-0.4.6
WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour with the system package manager. It is recommended to use a virtual environment instead: https://pip.pypa.io/warnings/venv
pi@raspberrypi:~$
```

. 라즈베리파이 버튼 중 ‘개발’에서 ‘Thonny’를 클릭

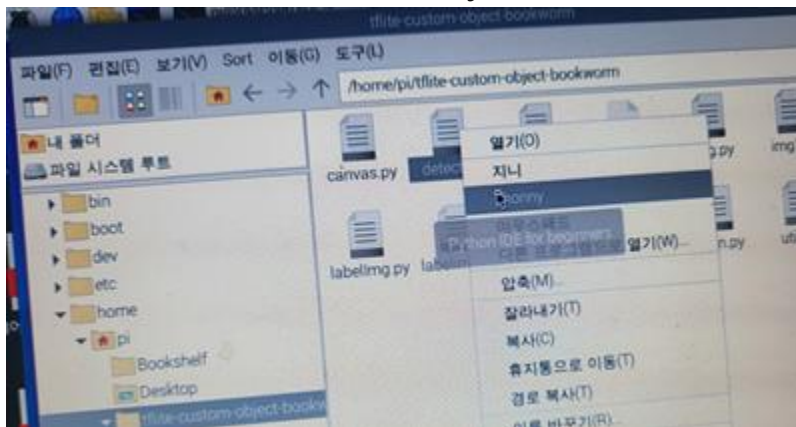


* 우측 상단에서 ‘Switch to regular mode’를 클릭하고, 뜨는 창에서 ‘ok’ 눌러 종료





* Thonny 창을 닫음. 파일메니저에서 'detect.py' (USB 카메라용. detect1.py 는 파일 카메라용)를 우측 버튼에서 'Thonny'를 오픈



. detect.py 에서 #47 의 'VideoCapture(0)'에서 '0'는 USB 카메라용

```

44
45
46     # Start capturing video input from the camera
47     cap = cv2.VideoCapture(0)
48     cap.set(cv2.CAP_PROP_FRAME_WIDTH, width)
49     cap.set(cv2.CAP_PROP_FRAME_HEIGHT, height)
50
51     # Visualization parameters

```

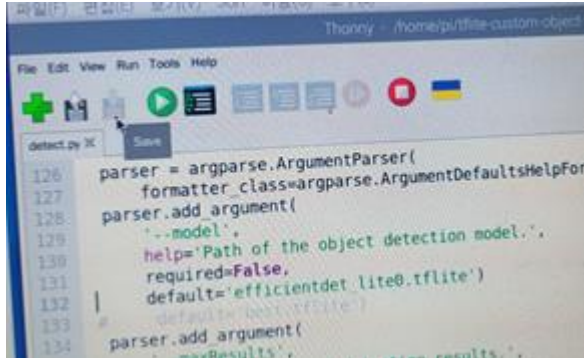
. # 133 를 comment 하고 (custom model 결과라서), #132 의 커멘트를 해제

```

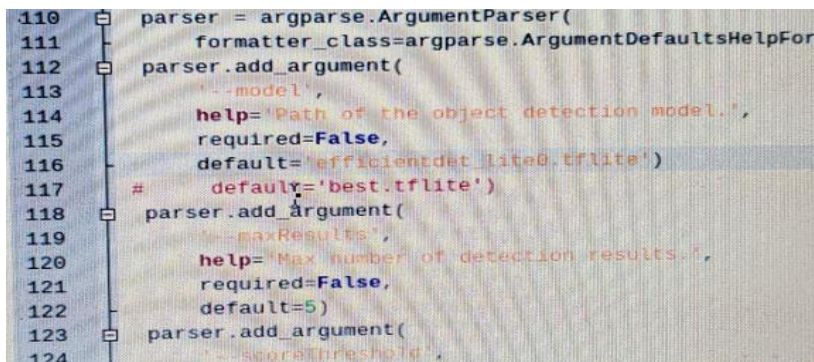
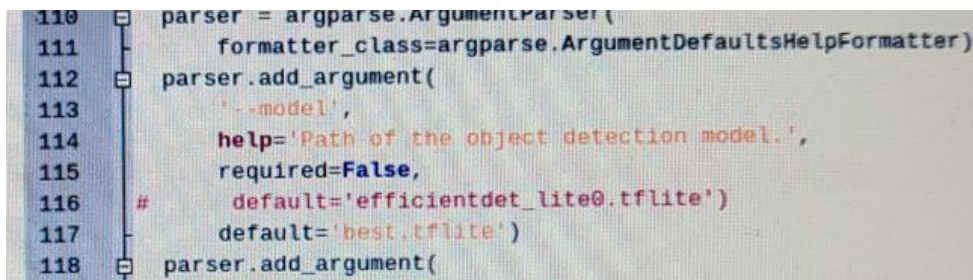
131         required=False,
132         |         default='efficientdet_lite0.tflite')
133         #         default='best.tflite')
134     parser.add_argument(
135         '--maxResults'

```

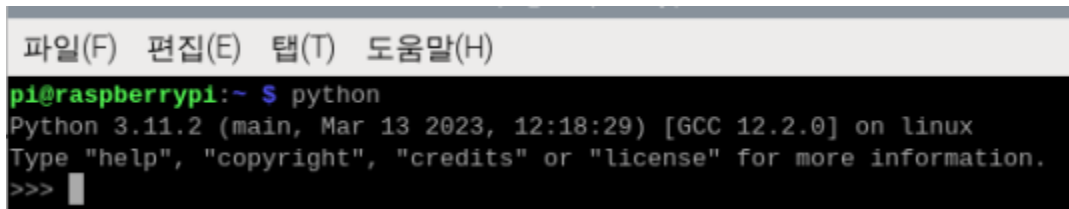
. 수정한 후, 상단의 저장 버튼을 클릭하여 저장



. picamera 경우는 'detect1.py'를 불러서 같은 방법으로 수정



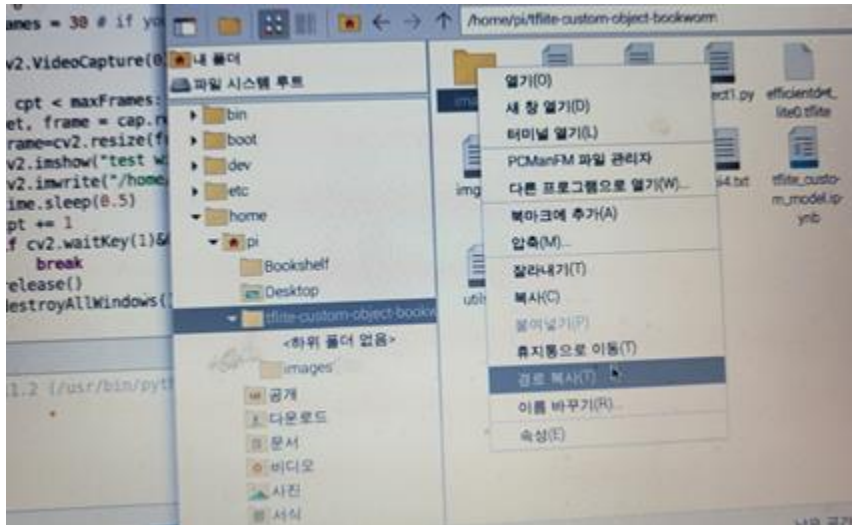
. 파이썬은 3.11 버전을 사용 중



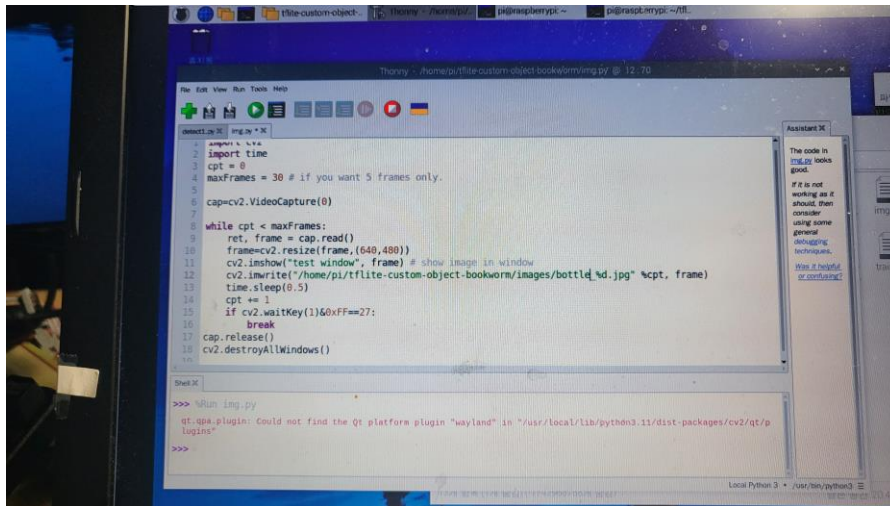
custom 이미지 만들기(img.py 이용)

\$ mkdir images

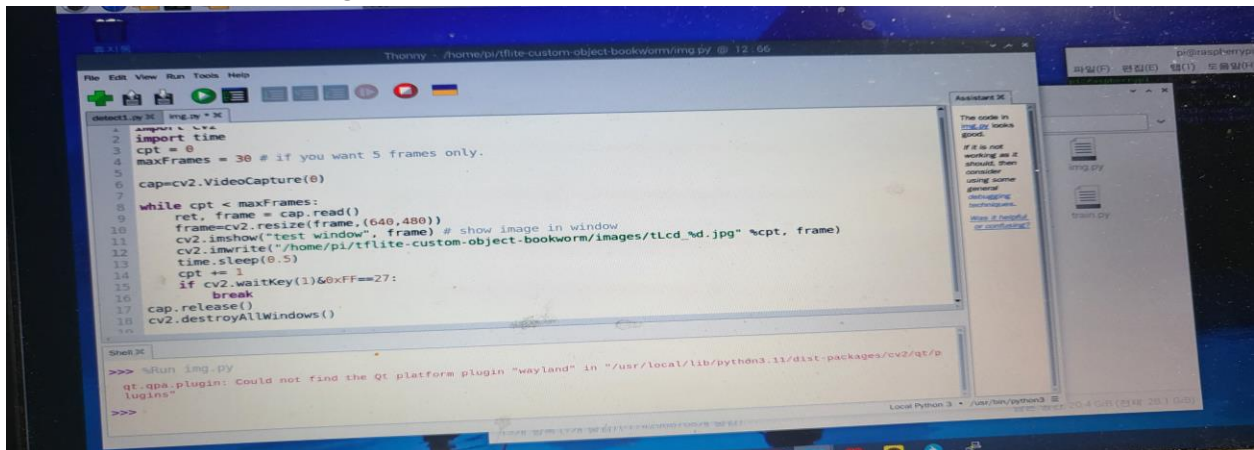
. images 폴더의 path 를 마우스 우측 버튼 이용 복사한 후 img.py 수정



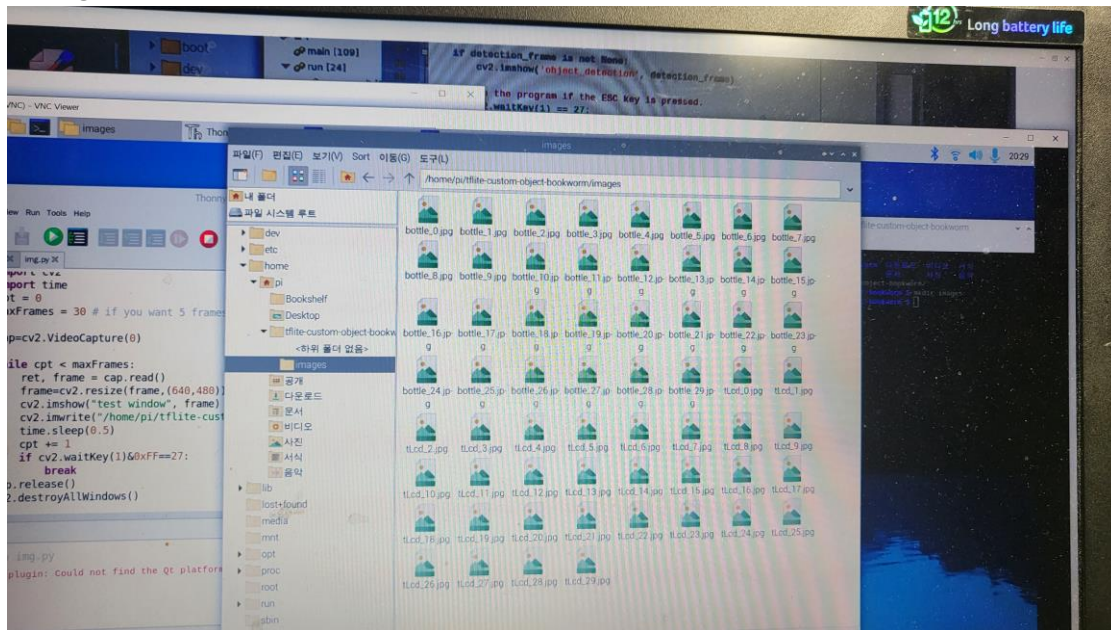
.img.py 에서 USB 카메라를 이용해서 '통'(bottle, 각자가 원하는 object)을 천천히 움직여서 30 장 사진 얻음



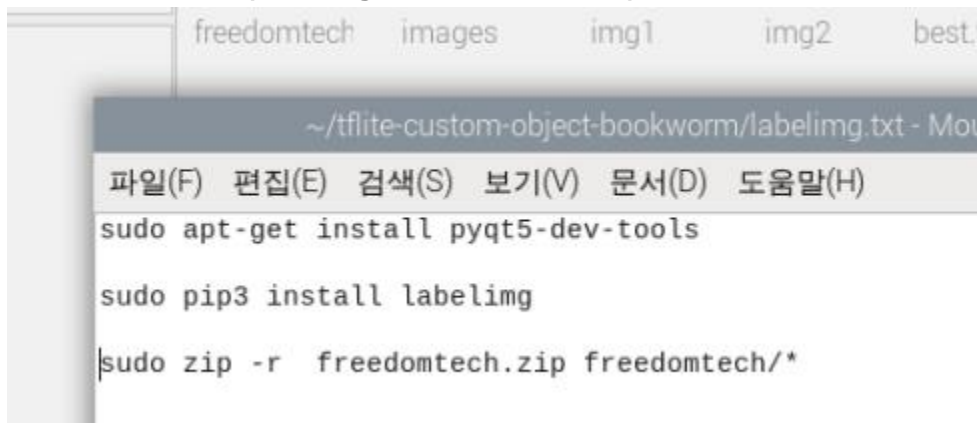
.img.py 에서 USB 카메라를 이용해서 'Text LCD'(각자가 원하는 object)를 천천히 움직여서 30 장 사진 얻음 (다른 img2 를 만들어서 별도로 하는 걸 추천. 삭제 때문에.)



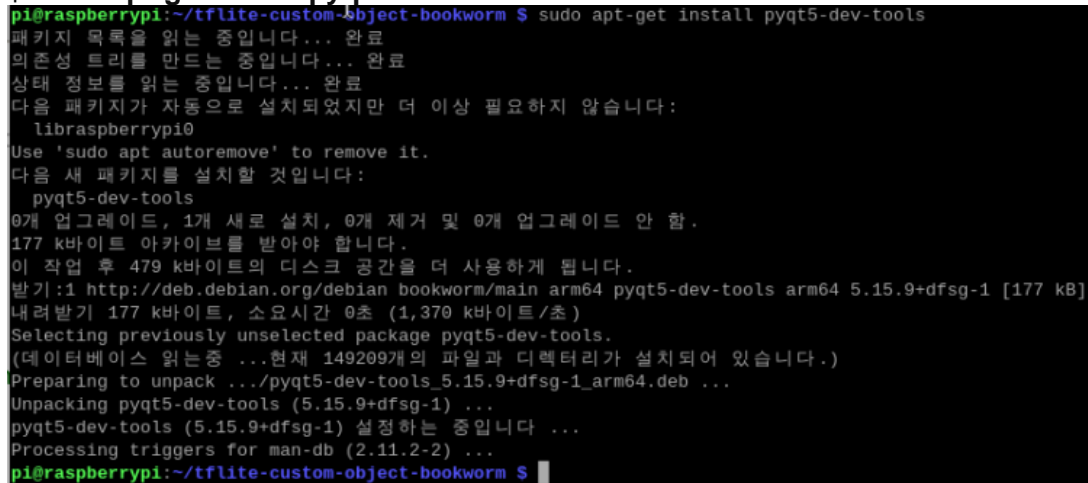
. images 폴더에는 총 60 장 사진이 저장됨



. 이미지 라벨 설정(labelimg.txt 에서 첫 줄 복사)



\$ sudo apt-get install pyqt5-dev-tools



. 두번째 줄 실행 (\$ sudo pip3 install labelimg)

```
pi@raspberrypi:~/tflite-custom-object-bookworm $ sudo pip3 install labelimg
Looking in indexes: https://pypi.org/simple, https://www.piwheels.org/simple
Collecting labelimg
  Downloading https://www.piwheels.org/simple/labelimg/labelimg-1.8.6-py2.py3-none-any.whl (265 kB)
    265.7/265.7 kB 282.8 kB/s eta 0:00:00
Requirement already satisfied: lxml in /usr/lib/python3/dist-packages (from labelimg) (4.9.2)
Requirement already satisfied: pyqt5 in /usr/lib/python3/dist-packages (from labelimg) (5.15.9)
Requirement already satisfied: PyQt5-sip<13,>=12.11 in /usr/lib/python3/dist-packages (from pyqt5->labelimg) (12.11.1)
Installing collected packages: labelimg
Successfully installed labelimg-1.8.6
WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour with the system package manager. It is recommended to use a virtual environment instead: https://pip.pypa.io/warnings/venv
pi@raspberrypi:~/tflite-custom-object-bookworm $
```

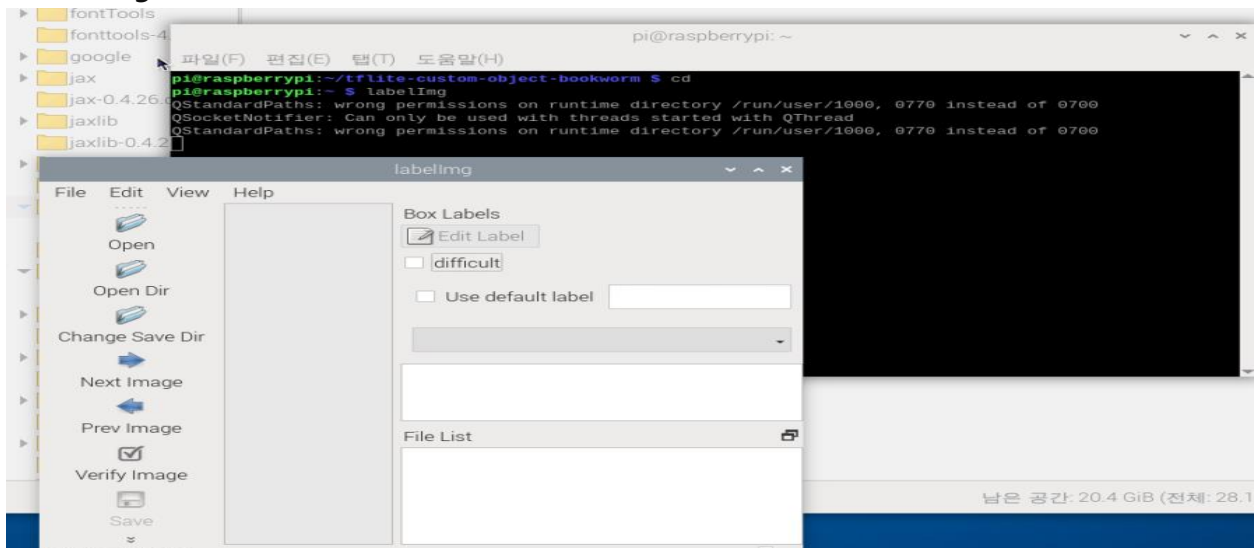
. canvas.py 삭제(\$ sudo rm -rf /usr/local/lib/python3.11/dist-packages/libs/canvas.py)하고 이곳에 새로운 canvas.py(repository에 있는)를 복사.

```
pi@raspberrypi:~ $ sudo rm -rf /usr/local/lib/python3.11/dist-packages/libs/canvas.py
pi@raspberrypi:~ $ cd tflite-custom-object-bookworm/
pi@raspberrypi:~/tflite-custom-object-bookworm $ sudo mv canvas.py /usr/local/lib/python3.11/dist-packages/libs
pi@raspberrypi:~/tflite-custom-object-bookworm $
```

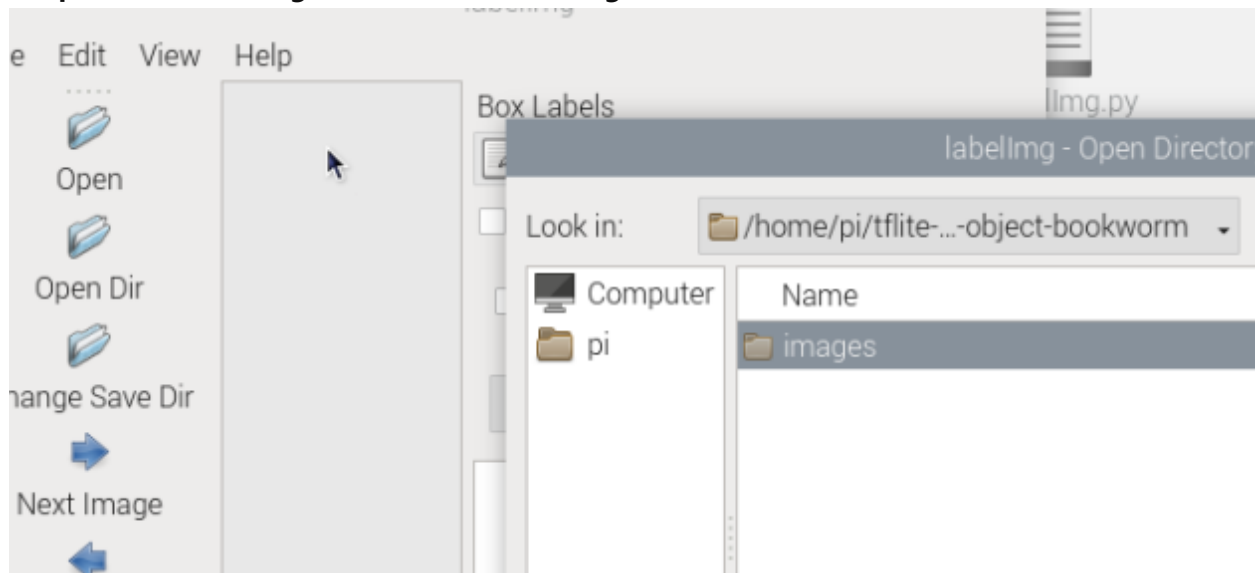
. labelimg.py (/usr/local/lib/python3.11/dist-packages/labelimg/labelimg.py)

```
pi@raspberrypi:~/tflite-custom-object-bookworm $ sudo rm -rf /usr/local/lib/python3.11/dist-packages/labelimg/labelimg.py
pi@raspberrypi:~/tflite-custom-object-bookworm $ sudo mv labelimg.py /usr/local/lib/python3.11/dist-packages/labelimg
pi@raspberrypi:~/tflite-custom-object-bookworm $
```

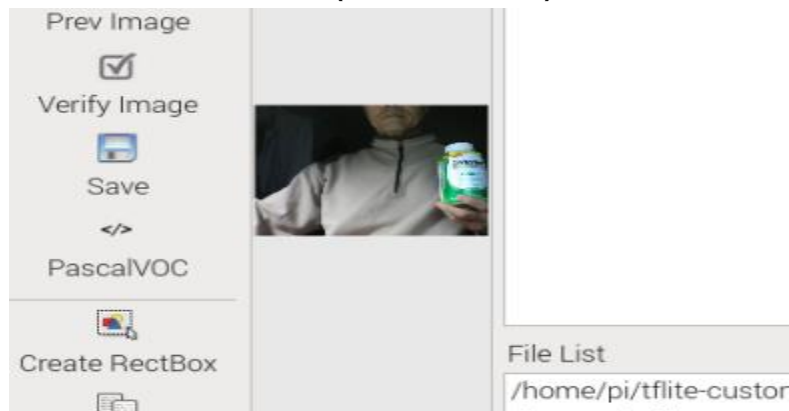
\$ labelimg



. 'Open Dir'과 'Change Save Dir'을 모두 img1 (또는 이미지가 있는 폴더)폴더로 지정

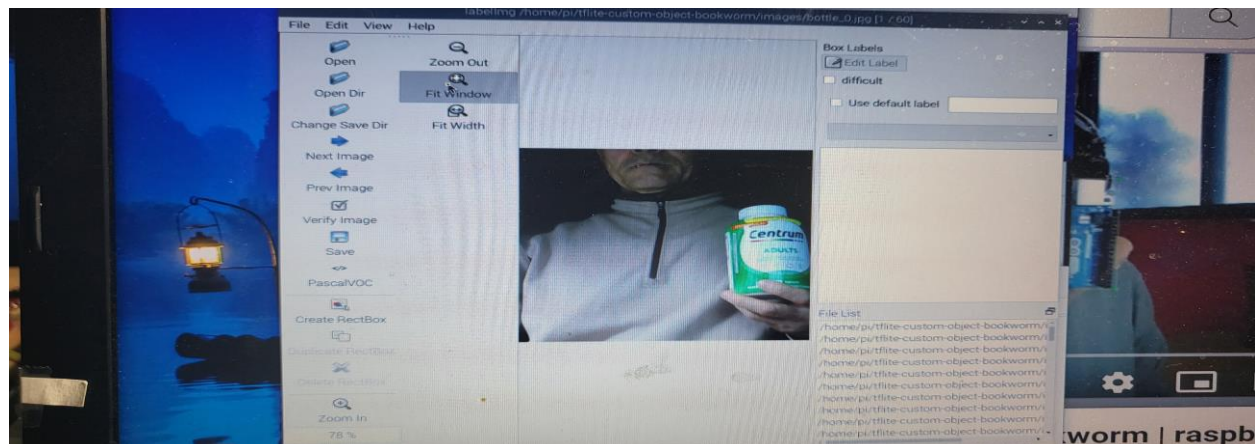


. format 은 'PascalVoc' (TensorFlow 용)선택

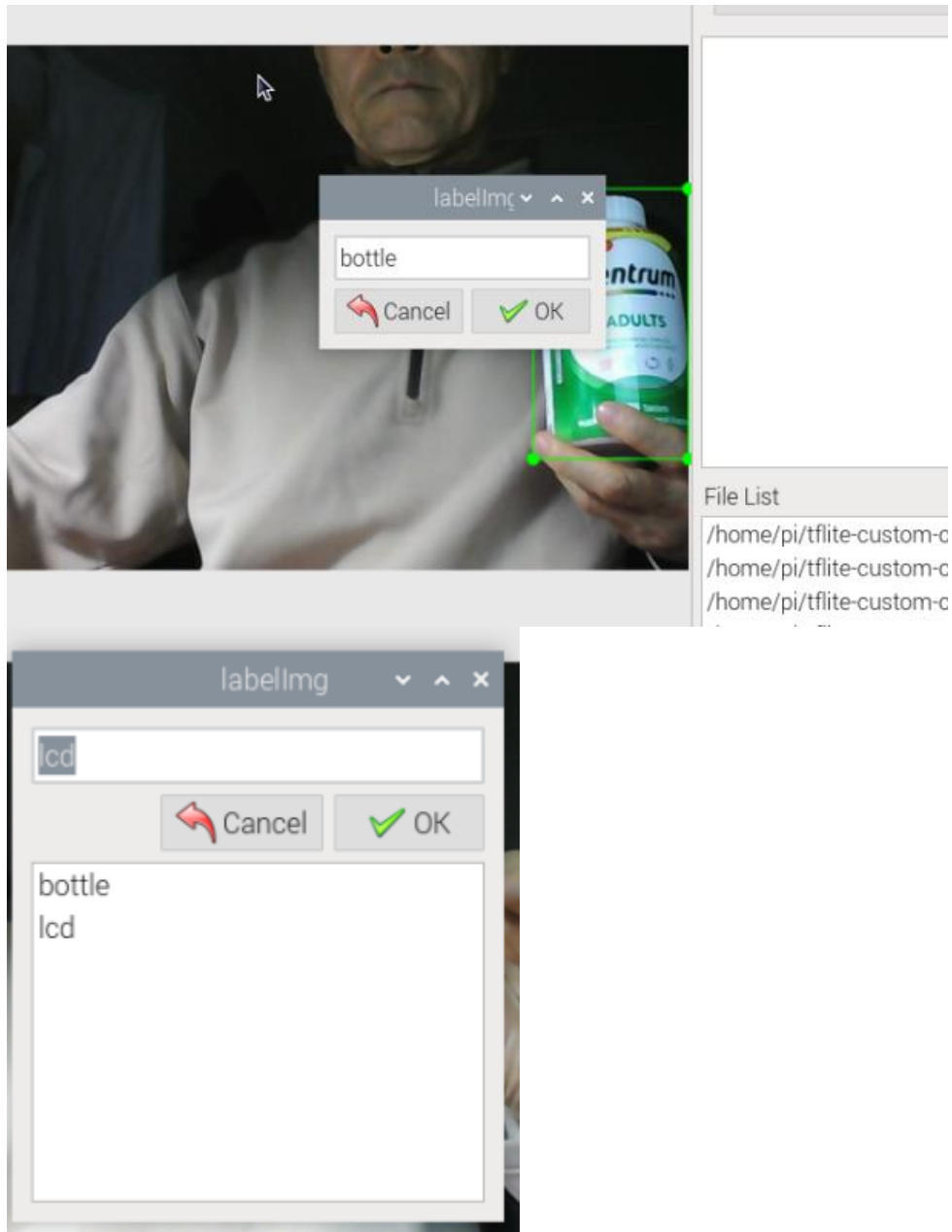


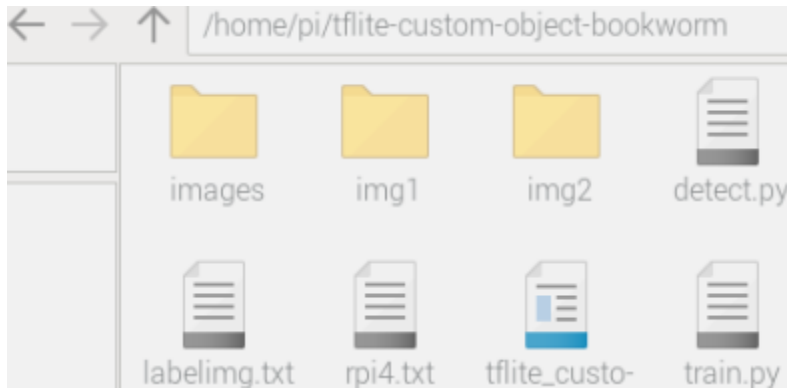
. 'Create RectBox'를 선택하고 라벨링 시작

. 그림 사이즈가 작으면 좌측 하단 메뉴 중에서 'Zoom In'을 선택하고 뜨는 창에서 'Fit Window'를 선택

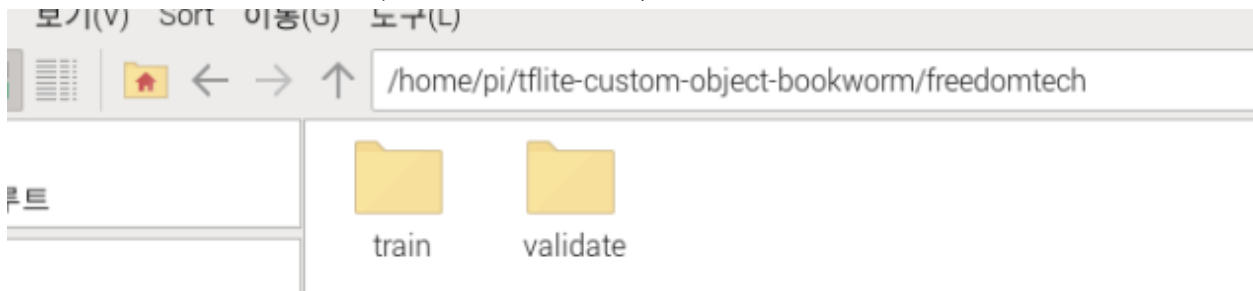


. 다시 'Create RectangleBox'를 누르고 직사각형으로 라벨링. 이름은 'bottle'로 (선택한 object 에 맞는 이름으로) 쓰고 'OK' 클릭. 좌측에서 'Save' 버튼을 누르고 'Next Image'를 클릭
. 2 번째는 폴더를 img2(본인이 정한 이미지 폴더)를 만들고 'lcd'(선택한 object 에 맞는 이름으로)이름으로 라벨링 (마음에 안 들 경우 폴더 삭제가 쉬움). 나중에 images 폴더를 만들어서 합칩.

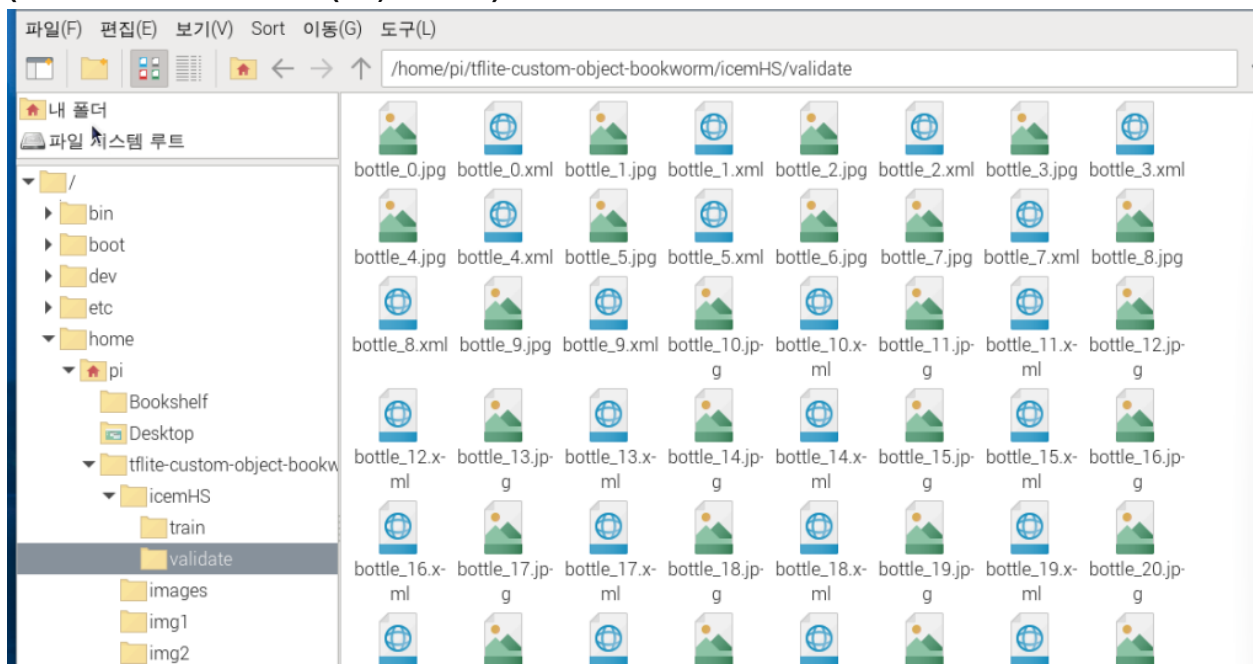




. freedomtech 폴더를 만들고, 하위 폴더로 'train', 'validate' 폴더를 만듦



. 폴더 'train', 'validate'에 images 폴더 모두를 복사해 넣음
(‘편집’에 있는 ‘모두 선택(^A)’을 이용)



.labelimg.txt 의 세번째 명령 실행 (\$ sudo zip -r freedomtech.zip freedomtech/*)

```

pi@raspberrypi:~/tflite-custom-object-bookworm $ sudo zip -r freedomtech.zip freedomtech/*
adding: freedomtech/train/ (stored 0%)
adding: freedomtech/train/bottle_9.xml (deflated 48%)
adding: freedomtech/train/bottle_8.xml (deflated 49%)
adding: freedomtech/train/bottle_5.xml (deflated 49%)
adding: freedomtech/train/tLcd_15.xml (deflated 48%)
adding: freedomtech/train/tLcd_14.xml (deflated 48%)
adding: freedomtech/train/bottle_17.xml (deflated 48%)
adding: freedomtech/train/bottle_4.jpg (deflated 0%)
adding: freedomtech/train/bottle_12.xml (deflated 48%)
adding: freedomtech/train/tLcd_12.xml (deflated 48%)
adding: freedomtech/train/tLcd_12.jpg (deflated 0%)

```

(중략)

```

adding: freedomtech/validate/bottle_27.jpg (deflated 0%)
adding: freedomtech/validate/tLcd_10.jpg (deflated 0%)
adding: freedomtech/validate/bottle_2.jpg (deflated 0%)
adding: freedomtech/validate/bottle_0.xml (deflated 49%)
adding: freedomtech/validate/tLcd_7.xml (deflated 48%)
adding: freedomtech/validate/tLcd_25.xml (deflated 47%)
adding: freedomtech/validate/tLcd_5.jpg (deflated 0%)
adding: freedomtech/validate/tLcd_8.jpg (deflated 0%)
adding: freedomtech/validate/tLcd_11.xml (deflated 48%)
adding: freedomtech/validate/tLcd_16.jpg (deflated 0%)
adding: freedomtech/validate/bottle_14.jpg (deflated 0%)
adding: freedomtech/validate/bottle_11.jpg (deflated 0%)
adding: freedomtech/validate/tLcd_13.xml (deflated 48%)
adding: freedomtech/validate/tLcd_19.xml (deflated 47%)
adding: freedomtech/validate/bottle_22.xml (deflated 48%)
pi@raspberrypi:~/tflite-custom-object-bookworm $

```

. 구글로그인.

인용 클라우드 스토리 x Google Drive: 로그인 x +

accounts.google.com/v3/signin/identifier?continue=http%3A%2F%2Fdrive.google.com%2F%3Futm_sour...

로그인

Google Drive로 이동

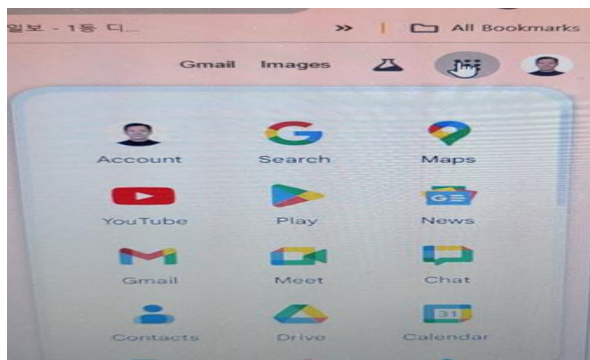
이메일 또는 휴대전화

이메일을 잊으셨나요?

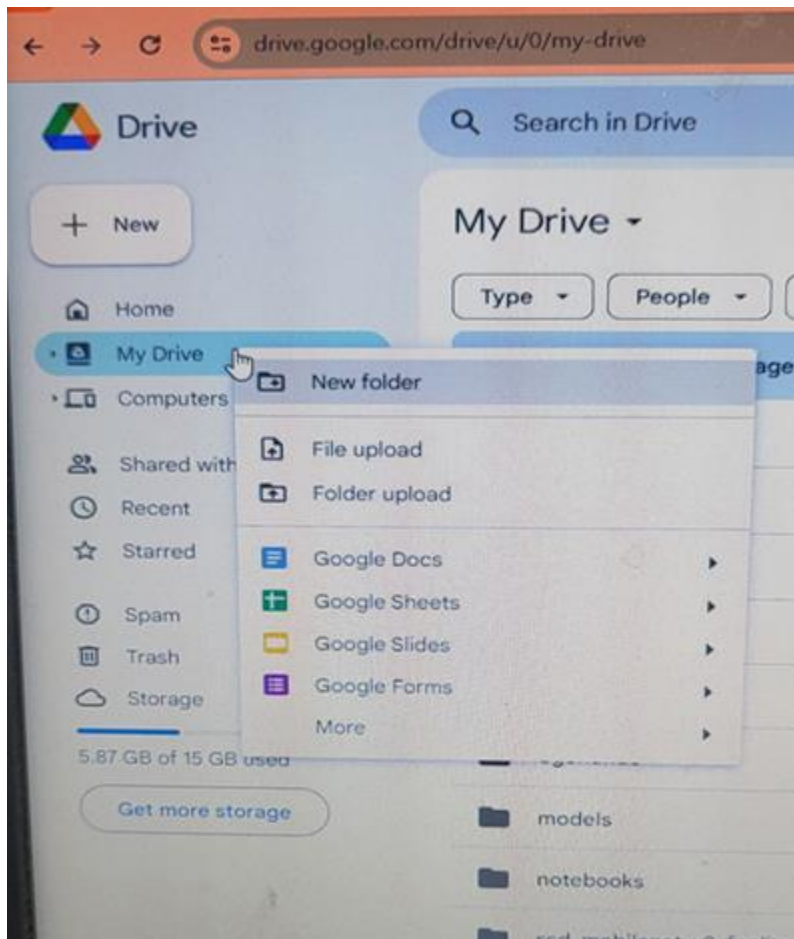
. 본인 인증절차를 거칩



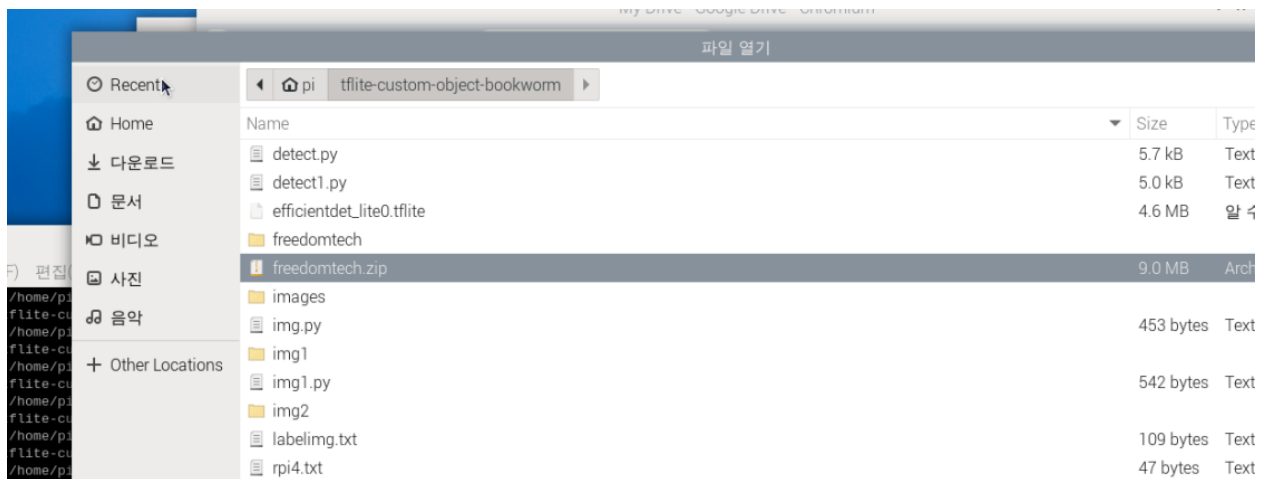
드라이버에 upload (구글 계정이 필요). 자기 이름의 좌측에 있는 점 9 개를 눌러서 뜨는 창에서 'Drive'를 클릭



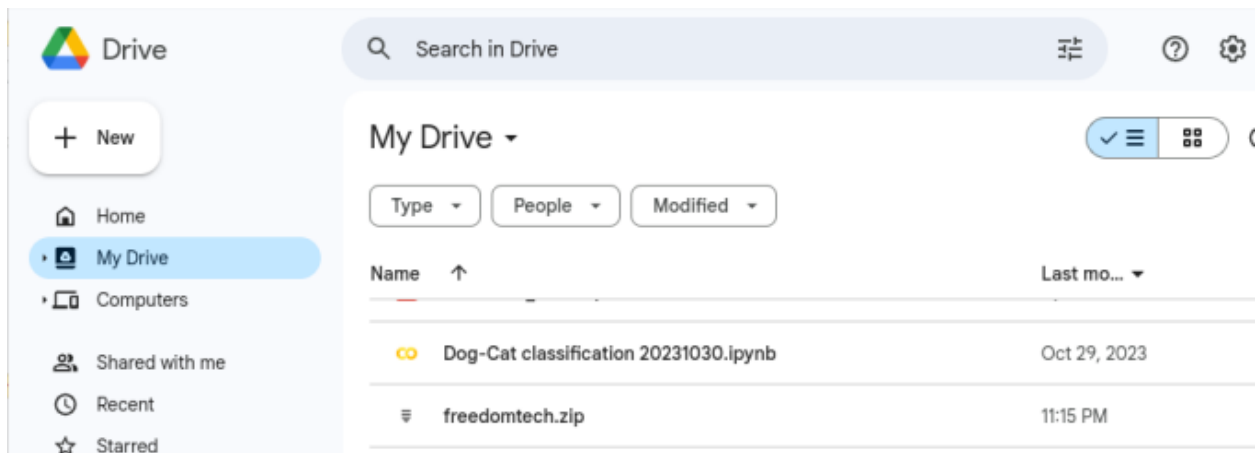
. 좌측 'My Drive'를 선택하고 뜨는 창에서 'File upload'를 클릭



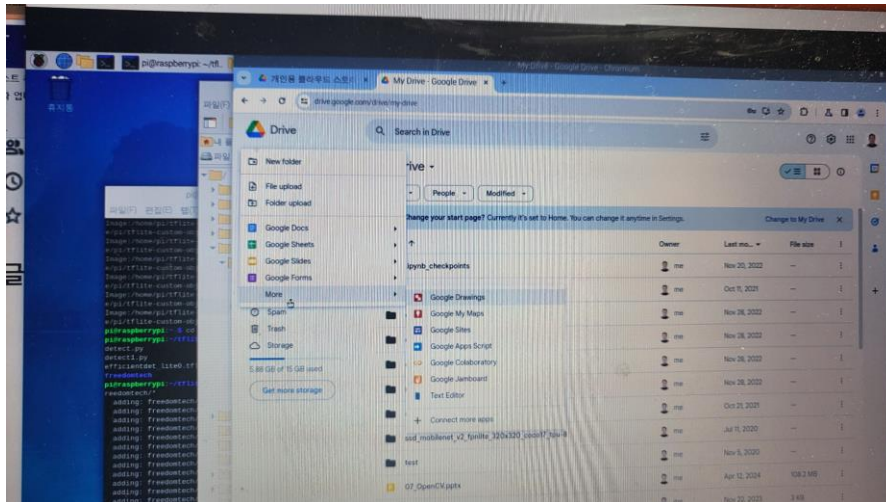
. 압축 파일 (freedomtech.zip)
을 선택하고 하단의 'open' 클릭



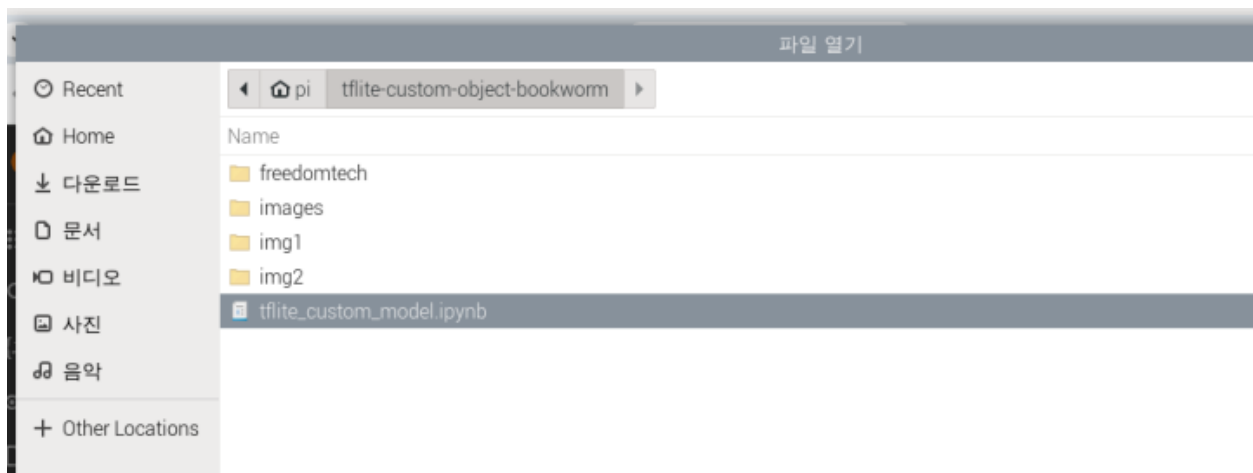
. 랩탑에서 구글 드라이버 염

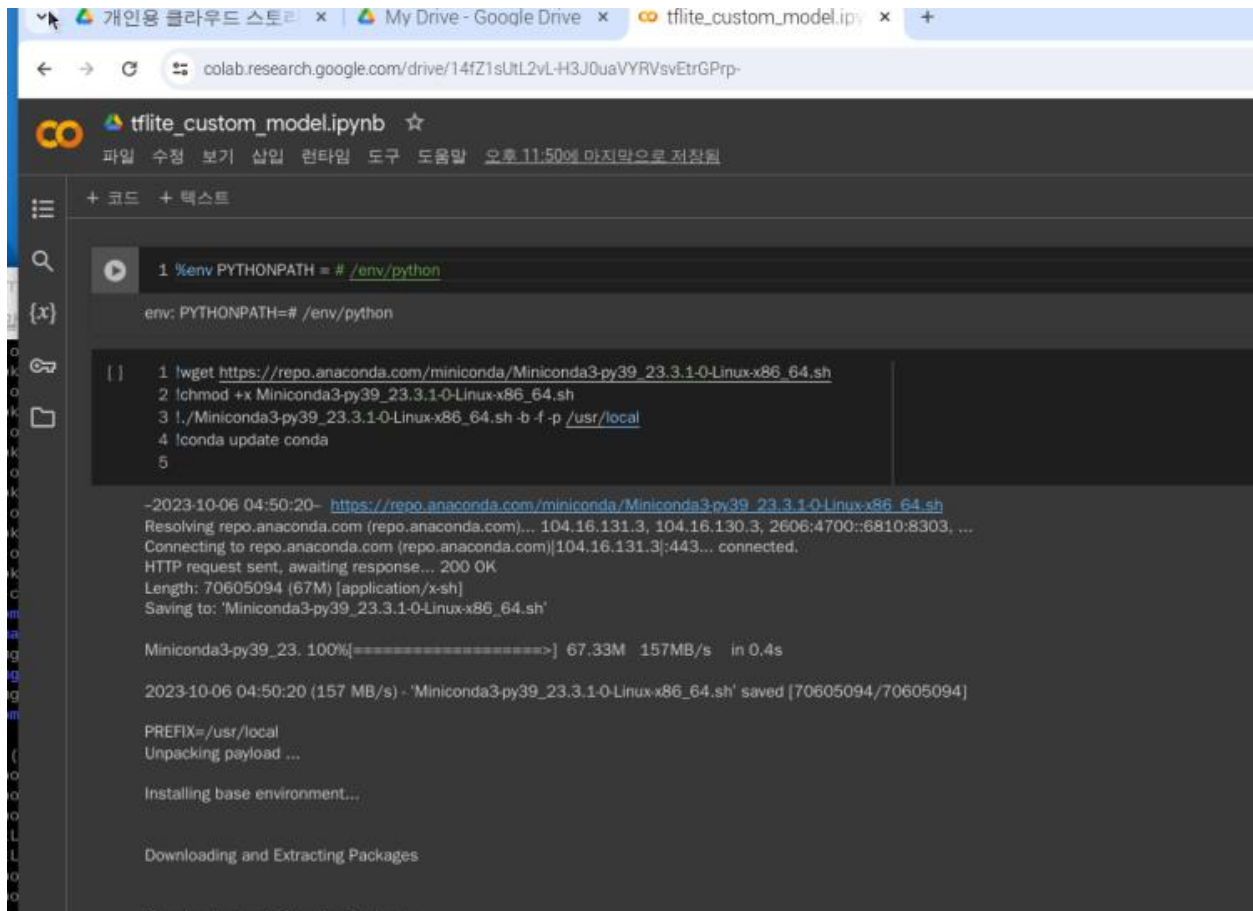


. 구글 Colab 오픈 (+New/ More / Google Colaboratory)

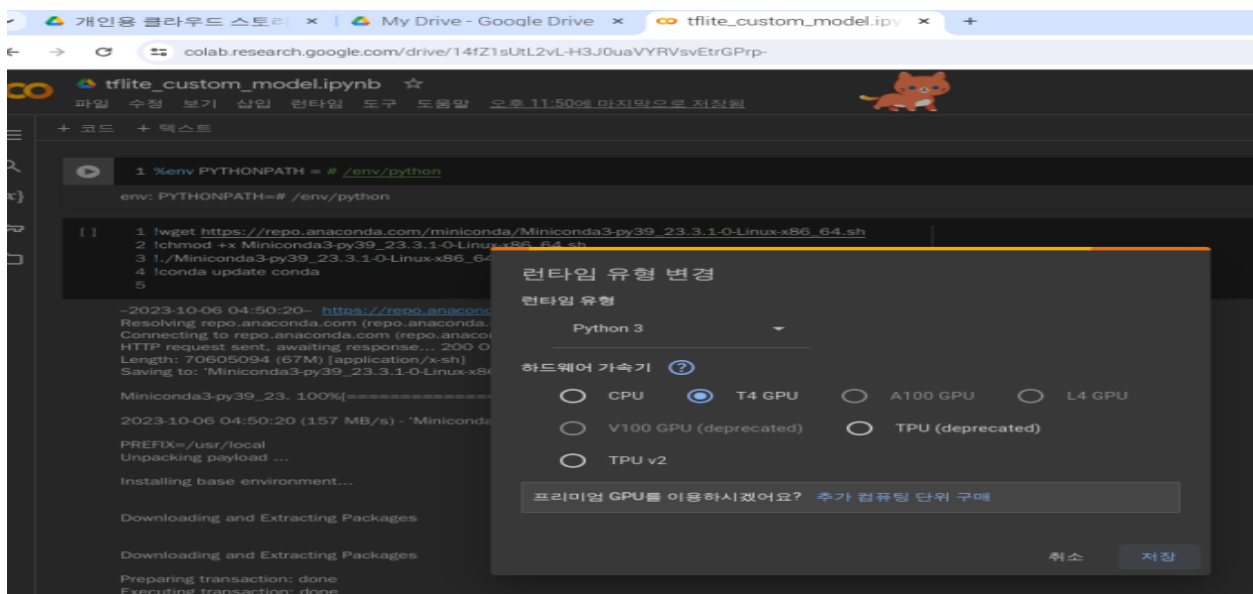


. Colab 에서 '노트열기'를 선택하고 '업로드'/'둘러보기'/'Home'에서노프북 파일을 열기





. Colab 상단 메뉴에서 '런타임'을 눌러서 '런타임 유형 변경'을 눌러 뜨는 창에서 'T4 GPU' 선택



(뜨는 창에서 'GPU 없이 연결' 선택)

. cell 별로 실행

%env PYTHONPATH = # /env/python

```
[1] 1 %env PYTHONPATH = # /env/python
env: PYTHONPATH=# /env/python
```

!wget https://repo.anaconda.com/miniconda/Miniconda3-py39_23.3.1-0-Linux-x86_64.sh

!chmod +x Miniconda3-py39_23.3.1-0-Linux-x86_64.sh

!./Miniconda3-py39_23.3.1-0-Linux-x86_64.sh -b -f -p /usr/local

!conda update conda

```
1 !wget https://repo.anaconda.com/miniconda/Miniconda3-py39_23.3.1-0-Linux-x86_64.sh
2 !chmod +x Miniconda3-py39_23.3.1-0-Linux-x86_64.sh
3 !./Miniconda3-py39_23.3.1-0-Linux-x86_64.sh -b -f -p /usr/local
4 !conda update conda
5

--2024-05-04 15:06:50-- https://repo.anaconda.com/miniconda/Miniconda3-py39_23.3.1-0-Linux-x86_64.sh
Resolving repo.anaconda.com (repo.anaconda.com)... 104.16.32.241, 104.16.191.158, 2606:4700::6810:20f1, ...
Connecting to repo.anaconda.com (repo.anaconda.com)|104.16.32.241|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 70605094 (67M) [application/x-sh]
Saving to: 'Miniconda3-py39_23.3.1-0-Linux-x86_64.sh'

Miniconda3-py39_23. 100%[=====] 67.33M 65.9MB/s in 1.0s

2024-05-04 15:06:52 (65.9 MB/s) - 'Miniconda3-py39_23.3.1-0-Linux-x86_64.sh' saved [70605094/70605094]

PREFIX=/usr/local
Unpacking payload ...

Installing base environment...

Downloading and Extracting Packages
```

(중략. 'y/n'를 물어 보면 'y')

```
sqlite 3.41.1-h5eee18b_0 -> 3.45.3-h5eee18b_0
tqdm 4.65.0-py39hb070fc8_0 -> 4.66.2-py39h2f386ee_0
tzdata 2023c-h04d1e81_0 -> 2024a-h04d1e81_0
urllib3 1.26.15-py39h06a4308_0 -> 2.1.0-py39h06a4308_1
xz 5.2.10-h5eee18b_1 -> 5.4.6-h5eee18b_1
zlib 1.2.13-h5eee18b_0 -> 1.2.13-h5eee18b_1
zstandard 0.19.0-py39h5eee18b_0 -> 0.22.0-py39h2c38b39_0

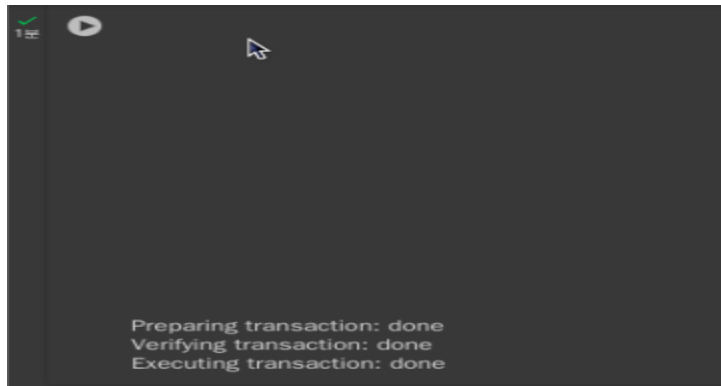
Proceed ([y]/n)? y

Proceed ([y]/n)? y

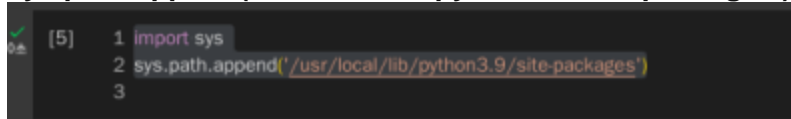
Downloading and Extracting Packages

Preparing transaction: done
Verifying transaction: done
Executing transaction: done
```

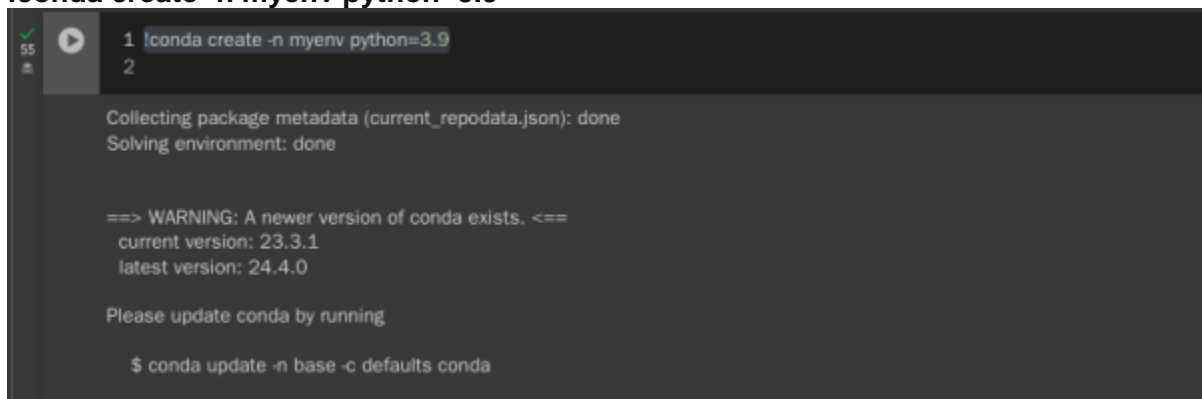
(중략)



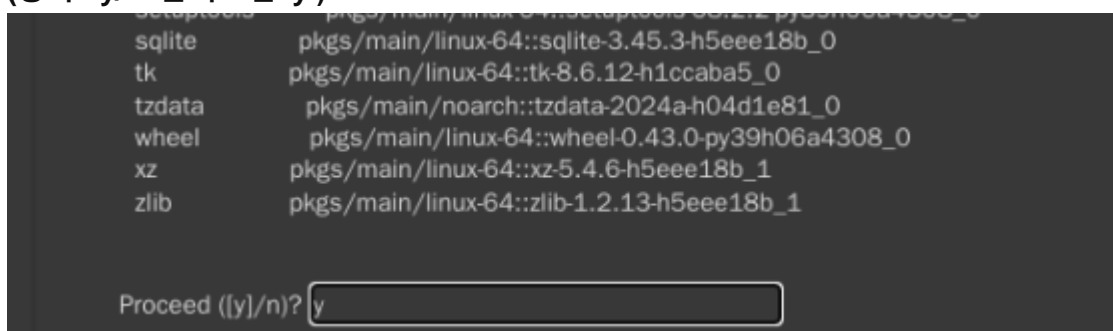
```
import sys
sys.path.append('/usr/local/lib/python3.9/site-packages')
```



!conda create -n myenv python=3.9



(중략. 'y/n' 물어보면 'y')



(중략)

```
pip-23.3.1 | 2.6 MB | : 100% 1.0/1 [00:00<00:00, 1.32it/s]

Preparing transaction: done
Verifying transaction: done
Executing transaction: done
#
# To activate this environment, use
#
# $ conda activate myenv
#
# To deactivate an active environment, use
#
# $ conda deactivate
```

```
%%shell
eval "$(conda shell.bash hook)"
conda activate myenv
pip install tf-lite-model-maker
```

```
1 %%shell
2 eval "$(conda shell.bash hook)"
3 conda activate myenv
4 pip install tf-lite-model-maker
5

Collecting tf-lite-model-maker
  Downloading tf_lite_model_maker-0.4.3-py3-none-any.whl.metadata (5.4 kB)
Collecting tf-models-official==2.3.0 (from tf-lite-model-maker)
  Downloading tf_models_official-2.3.0-py2.py3-none-any.whl.metadata (1.3 kB)
Collecting numpy<1.23.4,>=1.17.3 (from tf-lite-model-maker)
  Downloading numpy-1.23.3-cp39-cp39-manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (2.3 kB)
Collecting pillow>=7.0.0 (from tf-lite-model-maker)
  Downloading pillow-10.3.0-cp39-cp39-manylinux_2_28_x86_64.whl.metadata (9.2 kB)
Collecting sentencepiece>=0.1.91 (from tf-lite-model-maker)
  Downloading sentencepiece-0.2.0-cp39-cp39-manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (7.7 kB)
Collecting tensorflow-datasets>=2.1.0 (from tf-lite-model-maker)
  Downloading tensorflow_datasets-4.9.3-py3-none-any.whl.metadata (9.3 kB)
Collecting fire>=0.3.1 (from tf-lite-model-maker)
  Downloading fire-0.6.0.tar.gz (88 kB)

88.4/88.4 kB 5.3 MB/s eta 0:00:00

Preparing metadata (setup.py) ... done
```

(중략)

```
Building wheels for collected packages: fire, kaggle, promise
Building wheel for fire (setup.py) ... done
Created wheel for fire: filename=fire-0.6.0-py2.py3-none-any.whl size=117029 sha256=3371e5ea60826a2e390411e04f787710477e7cc0ca4ad3f1a65cd469a8c6949a
Stored in directory: /root/.cache/pip/wheels/ec/ce/ba/9d5764d2266c500c18776c7d8f1e3c023075994ccb6dea47db
Building wheel for kaggle (setup.py) ... done
Created wheel for kaggle: filename=kaggle-1.6.12-py3-none-any.whl size=102969 sha256=3a45ddfed93b2932b9d59c8baf5eb5d448815405cb938d8df685e93292038f75
Stored in directory: /root/.cache/pip/wheels/00/74/7d/52c235c074504cecd3dee430f10873c95d8a9e81263ece28e
Building wheel for promise (setup.py) ... done
Created wheel for promise: filename=promise-2.3-py3-none-any.whl size=21483 sha256=fd6a9f0686c725eed722a20cee8fc9b86baf9644876ca7ccde6508511b272b2d
Stored in directory: /root/.cache/pip/wheels/e1/e8/83/ddea66100678d139b14bc87692ece57c6a2a937956d2532608
Successfully built fire kaggle promise
Installing collected packages: webercodings, text-unidecode, tensorflow-estimator, tensorboard-plugin-wit, sentencepiece, pytz, py-cpuinfo, libclang, keras, gin-config, flatbuffers, dm-tree, dataclasses
Successfully installed CFFI-1.16.0 Cython-3.0.10 MarkupSafe-2.1.5 PyYAML-6.0.1 absl-py-1.4.0 array-record-0.5.1 astunparse-1.6.3 attrs-23.2.0 audioread-3.0.1 bleach-6.1.0 cachetools-5.3.3 cffi-1.16.0
WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour with the system package manager. It is recommended to use a virtual environment instead: https://pip.pypa.io/en/stable/user-guide/
```

```
%%shell
eval "$(conda shell.bash hook)"
conda activate myenv
pip install ipykernel
```

```
1 %%shell
2 eval "$(conda shell.bash hook)"
3 conda activate myenv
4 pip install ipykernel
5

Collecting pexpect>=4.3 (from ipython>=7.23.1->ipykernel)
  Downloading pexpect-4.9.0-py2.py3-none-any.whl.metadata (2.5 kB)
Requirement already satisfied: importlib-metadata>=4.8.3 in /usr/local/envs/myenv/lib/python3.9/site-packages (from jupyter-client>=6.1.12->ipykernel) (7.1.0)
Requirement already satisfied: python-dateutil>=2.8.2 in /usr/local/envs/myenv/lib/python3.9/site-packages (from jupyter-client>=6.1.12->ipykernel) (2.9.0.post0)
Requirement already satisfied: platformdirs>=2.5 in /usr/local/envs/myenv/lib/python3.9/site-packages (from jupyter-core!=5.0.*,>=4.1.2->ipykernel) (4.2.1)
Requirement already satisfied: pyparsing>=2.0.2 in /usr/local/envs/myenv/lib/python3.9/site-packages (from packaging>=20.0->ipykernel) (3.1.2)
Requirement already satisfied: zipp>=0.5 in /usr/local/envs/myenv/lib/python3.9/site-packages (from importlib-metadata>=4.8.3->jupyter-client>=6.1.12->ipykernel) (3.1.2)
Collecting parso<0.9.0,>=0.8.3 (from jedi>=0.16->ipython>=7.23.1->ipykernel)
  Downloading parso-0.8.4-py2.py3-none-any.whl.metadata (7.7 kB)
Collecting ptyprocess>=0.5 (from pexpect>4.3->ipython>=7.23.1->ipykernel)
  Downloading ptyprocess-0.7.0-py2.py3-none-any.whl.metadata (1.3 kB)
Collecting wcwidth (from prompt-toolkit<3.1.0,>=3.0.41->ipython>=7.23.1->ipykernel)
  Downloading wcwidth-0.2.13-py2.py3-none-any.whl.metadata (14 kB)
Requirement already satisfied: six>=1.5 in /usr/local/envs/myenv/lib/python3.9/site-packages (from python-dateutil>=2.8.2->jupyter-client>=6.1.12->ipykernel) (1.16.0)
Collecting executing>=1.2.0 (from stack-data->ipython>=7.23.1->ipykernel)
  Downloading executing-2.0.1-py2.py3-none-any.whl.metadata (9.0 kB)
Collecting asttokens>=2.1.0 (from stack-data->ipython>=7.23.1->ipykernel)
```

(중략)

```
Downloading stack_data-0.6.3-py3-none-any.whl (24 kB)
Downloading asttokens-2.4.1-py2.py3-none-any.whl (27 kB)
Downloading executing-2.0.1-py2.py3-none-any.whl (24 kB)
Downloading parso-0.8.4-py2.py3-none-any.whl (103 kB)
103.7/103.7 kB 10.7 MB/s eta 0:00:00

Downloading ptyprocess-0.7.0-py2.py3-none-any.whl (13 kB)
Downloading pure_eval-0.2.2-py3-none-any.whl (11 kB)
Downloading wcwidth-0.2.13-py2.py3-none-any.whl (34 kB)
Installing collected packages: wcwidth, pure-eval, ptyprocess, trailsets, tornado, pyzmq, pygments, prompt-toolkit, pexpect, parso, nest-asyncio, executing, exceptiongroup, debugpy, asttokens, stack-data
Successfully installed asttokens-2.4.1 comm-0.2.2 debugpy-1.8.1 exceptiongroup-1.2.1 executing-2.0.1 ipykernel-6.29.4 ipython-8.18.1 jedi-0.19.1 jupyter-client-8.6.1 jupyter-core-5.7.2 matplotlib-inline-0.1.6 nest-asyncio-1.5.8 parso-0.8.4 pexpect-4.9.0 prompt-toolkit-3.0.41 ptyprocess-0.7.0 pygments-2.16.1 pyzmq-25.1.2 trailsets-0.2.1 tornado-6.2.1 wcwidth-0.2.13
WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour with the system package manager. It is recommended to use a virtual environment instead: https://pip.pypa.io/encl...
```

```
%%shell
eval "$(conda shell.bash hook)"
conda activate myenv
pip install opencv-python
python --version
```

```
1 %%shell
2 eval "$(conda shell.bash hook)"
3 conda activate myenv
4 pip install opencv-python
5 python --version
6

Collecting opencv-python
  Downloading opencv_python-4.9.0.80-cp37-abi3-manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (20 kB)
Requirement already satisfied: numpy>=1.17.0 in /usr/local/envs/myenv/lib/python3.9/site-packages (from opencv-python) (1.23.4)
  Downloading opencv_python-4.9.0.80-cp37-abi3-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (62.2 MB)
62.2/62.2 MB 13.8 MB/s eta 0:00:00

Installing collected packages: opencv-python
Successfully installed opencv-python-4.9.0.80
WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour with the system package manager. It is recommended to use a virtual environment instead: https://pip.pypa.io/encl...
```

```
%%shell
eval "$(conda shell.bash hook)"
conda activate myenv
pip install numpy==1.23.4
```

```
1 %%shell
2 eval "$(conda shell.bash hook)"
3 conda activate myenv
4 pip install numpy==1.23.4

Collecting numpy==1.23.4
  Downloading numpy-1.23.4-cp39-cp39-manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (2.3 kB)
  Downloading numpy-1.23.4-cp39-cp39-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (17.1 MB)
  17.1/17.1 MB 67.6 MB/s eta 0:00:00

Installing collected packages: numpy
  Attempting uninstall: numpy
    Found existing installation: numpy 1.23.3
    Uninstalling numpy-1.23.3:
      Successfully uninstalled numpy-1.23.3
  ERROR: pip's dependency resolver does not currently take into account all the packages that are installed. This behaviour is the source of the following errors:
  tflite-model-maker 0.4.3 requires numpy<1.23.4, >=1.17.3, but you have numpy 1.23.4 which is incompatible.
  Successfully installed numpy-1.23.4
  WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour with the system package manager
```

(‘ERROR’는 무시)

```
%%shell
eval "$(conda shell.bash hook)"
conda activate myenv
pip install pycocotools
```

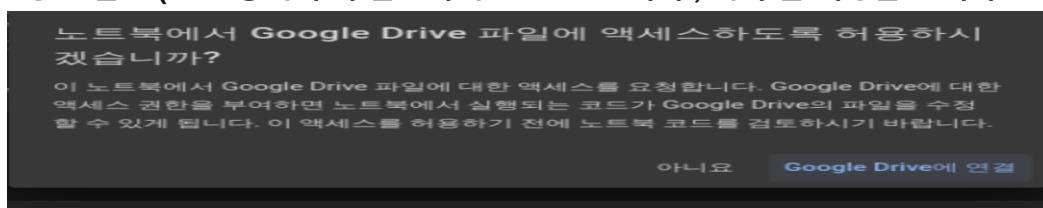
```
1 %%shell
2 eval "$(conda shell.bash hook)"
3 conda activate myenv
4 pip install pycocotools

Collecting pycocotools
  Downloading pycocotools-2.0.7-cp39-cp39-manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (1.1 kB)
  Requirement already satisfied: matplotlib>=2.1.0 in /usr/local/envs/myenv/lib/python3.9/site-packages (from pycocotools) (3.4.3)
  Requirement already satisfied: numpy in /usr/local/envs/myenv/lib/python3.9/site-packages (from pycocotools) (1.23.4)
  Requirement already satisfied: cycler>=0.10 in /usr/local/envs/myenv/lib/python3.9/site-packages (from matplotlib>=2.1.0->pycocotools) (0.12.1)
  Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/envs/myenv/lib/python3.9/site-packages (from matplotlib>=2.1.0->pycocotools) (1.4.5)
  Requirement already satisfied: pillow>=6.2.0 in /usr/local/envs/myenv/lib/python3.9/site-packages (from matplotlib>=2.1.0->pycocotools) (10.3.0)
  Requirement already satisfied: pyparsing>=2.2.1 in /usr/local/envs/myenv/lib/python3.9/site-packages (from matplotlib>=2.1.0->pycocotools) (3.1.2)
  Requirement already satisfied: python-dateutil>=2.7 in /usr/local/envs/myenv/lib/python3.9/site-packages (from matplotlib>=2.1.0->pycocotools) (2.9.0.post0)
  Requirement already satisfied: six>=1.5 in /usr/local/envs/myenv/lib/python3.9/site-packages (from python-dateutil>=2.7->matplotlib>=2.1.0->pycocotools) (1.16.0)
  Downloading pycocotools-2.0.7-cp39-cp39-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (435 kB)
  435.1/435.1 kB 8.9 MB/s eta 0:00:00

Installing collected packages: pycocotools
  Successfully installed pycocotools-2.0.7
  WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour with the system package manager. It is recommended to use a virtual environment to avoid affecting installed packages
```

```
from google.colab import drive
drive.mount('/content/gdrive')
!ln -s /content/gdrive/My\ Drive/ /mydrive
!ls /mydrive
```

. 승인 필요 (뜨는 창에서 '구글드라이브 연결' 선택 후, 내 구글 계정을 선택하고 계속 'continue')




```
1 from google.colab import drive
2 drive.mount('/content/gdrive')
3 !ln -s /content/gdrive/My Drive/ /mydrive
4 !ls /mydrive
5
```

Mounted at /content/gdrive

07_OpenCV.pptx	SafeDriving1213.zip
20231122_DogCat1.ipynb	SafeDriving3.ipynb
'Ch05 GUI_64bit2.docx'	Sample_Yolov5.ipynb
'Ch05 GUI_64bit2.pdf'	'SciTech2025 Fighter.pdf'
'Colab Notebooks'	ssd_mobilenet_v2_fpnlite_320x320_coco17_tpu-8
detect_hands	Student IoT.zip
detect_hands1	TensorFlowImgClass.ipynb
'Dog-Cat classification 20231030.ipynb'	test
egohands	test.record
freedomtech.zip	TF2_1130.ipynb
ICSEng_2023_Proceedings.pdf	TF2_custom_221213.ipynb
images.zip	TF2_safeDrive_221202.ipynb
'JGCD LSFMRIreviewers.txt'	TF2_TFRecord_20221203.ipynb
layoutwindow1.py	tflite_custom_model.ipynb
Lee1.ipynb	train.record
MNIST_TF.ipynb	Untitled0.ipynb
models	Untitled1.ipynb
notebooks	Untitled2.ipynb
SafeDrive211030.ipynb	Untitled3.ipynb
SafeDrive230114.v2i.yolov5pytorch.zip	Untitled4.ipynb
SafeDrive_class_1121.ipynb	Untitled5.ipynb
safeDrive_label_map.pbtxt	Yolov5_230131_SafeDrive.ipynb

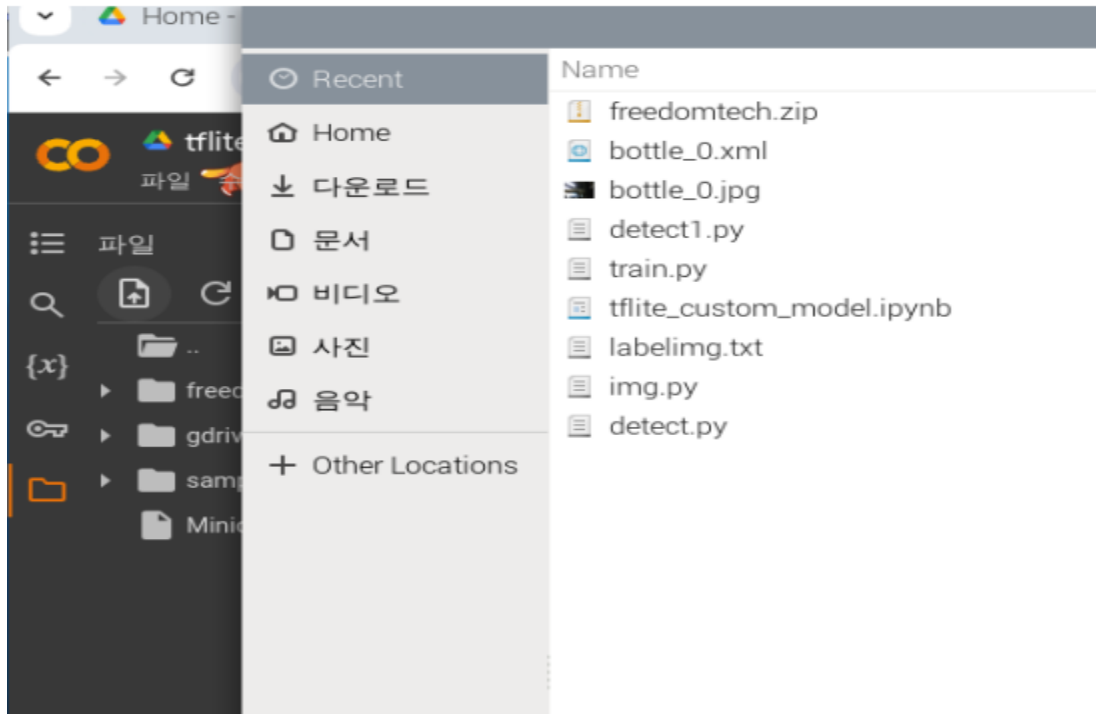
!unzip /mydrive/freedomtech.zip

```
1 !unzip /mydrive/freedomtech.zip
2
```

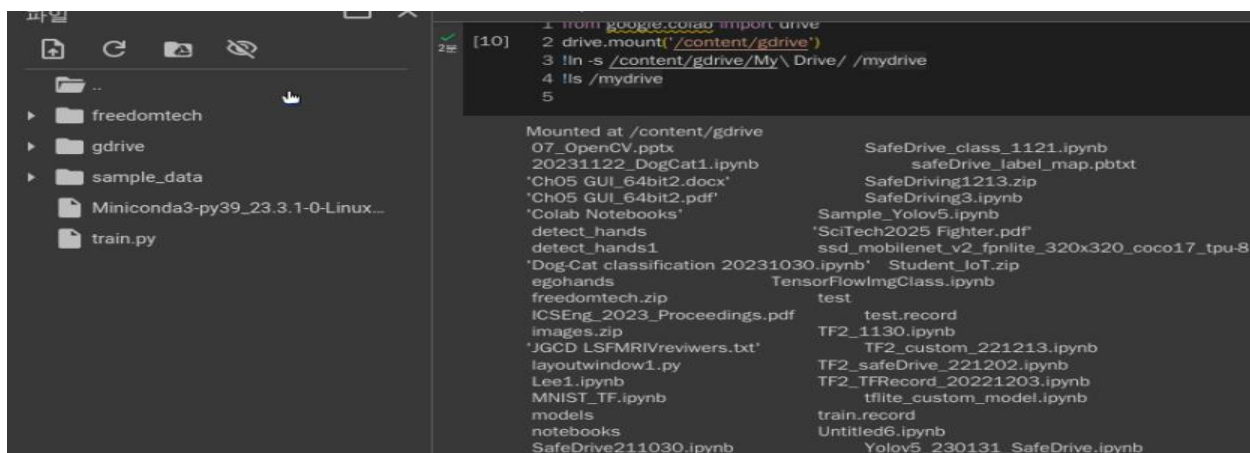
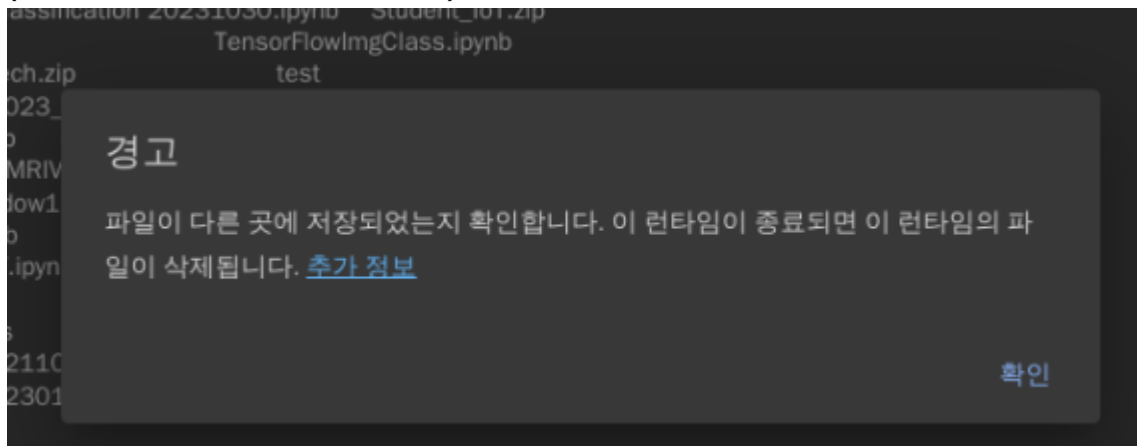
Archive: /mydrive/freedomtech.zip
creating: freedomtech/train/
inflating: freedomtech/train/bottle_9.xml
inflating: freedomtech/train/bottle_8.xml
inflating: freedomtech/train/bottle_5.xml
inflating: freedomtech/train/tLcd_15.xml
inflating: freedomtech/train/tLcd_14.xml
inflating: freedomtech/train/bottle_17.xml
inflating: freedomtech/train/bottle_4.jpg
inflating: freedomtech/train/bottle_12.xml
inflating: freedomtech/train/tLcd_12.xml
inflating: freedomtech/train/tLcd_13.jpg
inflating: freedomtech/train/bottle_13.jpg
inflating: freedomtech/train/bottle_6.jpg
inflating: freedomtech/train/tLcd_2.jpg
inflating: freedomtech/train/bottle_28.jpg
inflating: freedomtech/train/bottle_11.xml
inflating: freedomtech/train/bottle_7.xml
inflating: freedomtech/train/bottle_5.jpg

(중략. 좌측 폴더에 'freedomtech' 만들어짐)

. 좌측 노란 폴더를 클릭('/content'가 최상위 폴더임)하고 상단의 위쪽 화살표(파일열기)를 클릭하여 train.py 를 선택하고 하단의 'open'를 클릭하여 train.py 를 읽어 들임



(뜨는 경고창은 '확인' 누르고 무시)



. train.py 를 클릭해서 class 이름 변경 (train_data 및 val_data 에서
'bottle', 'lcd'로 변경)

```
train.py X
17
18
19 train_data = object_detector.DataLoader.from_pascal_voc(
20     'freedomtech/train',
21     'freedomtech/train',
22     ['bottle', 'lcd']
23 )
24
25 val_data = object_detector.DataLoader.from_pascal_voc(
26     'freedomtech/validate',
27     'freedomtech/validate',
28     ['bottle', 'lcd']
29 )
```

epochs=30 (개인적으로 실행 시 80 으로 변경. 현재는 30 을 유지. 100 으로 하면 90 에서 중단할 수 있음)으로 변경후 저장확인(파일이름 좌측 상단의 '*'기호가 사라지면(조금 기다리면) 저장된 것임) 후 'x'하여 닫음.

. 학습

```
%%shell
eval "$(conda shell.bash hook)"
conda activate myenv
python /content/train.py
```

```
1 %%shell
2 eval "$(conda shell.bash hook)"
3 conda activate myenv
4 python /content/train.py
```

2024-05-04 15:51:07.868386: W tensorflow/stream_executor/platform/default/dso_loader.cc:64] Could not load dynamic library 'libcudart.so.11.0'; dLError: libcudart.so.11.0: cannot open shared object file: No such file or directory

2024-05-04 15:51:07.868421: I tensorflow/stream_executor/cuda/cudart_stub.cc:29] Ignore above cudart dLError if you do not have a GPU set up on your machine.

/usr/local/envs/myenv/lib/python3.9/site-packages/tensorflow_addons/utils/tfa_eol_msg.py:23: UserWarning:

TensorFlow Addons (TFA) has ended development and introduction of new features.

TFA has entered a minimal maintenance and release mode until a planned end of life in May 2024.

Please modify downstream libraries to take dependencies from other repositories in our TensorFlow community (e.g. Keras, Keras-CV, and Keras-NLP).

For more information see: <https://github.com/tensorflow/addons/issues/2807>

warnings.warn(

/usr/local/envs/myenv/lib/python3.9/site-packages/tensorflow_addons/utils/ensure_tf_install.py:53: UserWarning: Tensorflow Addons supports using Python ops for all

The versions of TensorFlow you are currently using is 2.8.4 and is not supported.

Some things might work, some things might not.

If you were to encounter a bug, do not file an issue.

If you want to make sure you're using a tested and supported configuration, either change the TensorFlow version or the TensorFlow Addons's version.

You can find the compatibility matrix in TensorFlow Addon's readme:

<https://github.com/tensorflow/addons>

warnings.warn(

2024-05-04 15:51:13.646108: I tensorflow/stream_executor/cuda/cuda_gpu_executor.cc:936] successful NUMA node read from SysFS had negative value (-1), but there

2024-05-04 15:51:13.646589: W tensorflow/stream_executor/platform/default/dso_loader.cc:64] Could not load dynamic library 'libcudart.so.11.0'; dLError: libcudart.so.11.0: cannot open shared object file: No such file or directory

2024-05-04 15:51:13.646876: W tensorflow/stream_executor/platform/default/dso_loader.cc:64] Could not load dynamic library 'libcublas.so.11'; dLError: libcublas.so.11: cannot open shared object file: No such file or directory

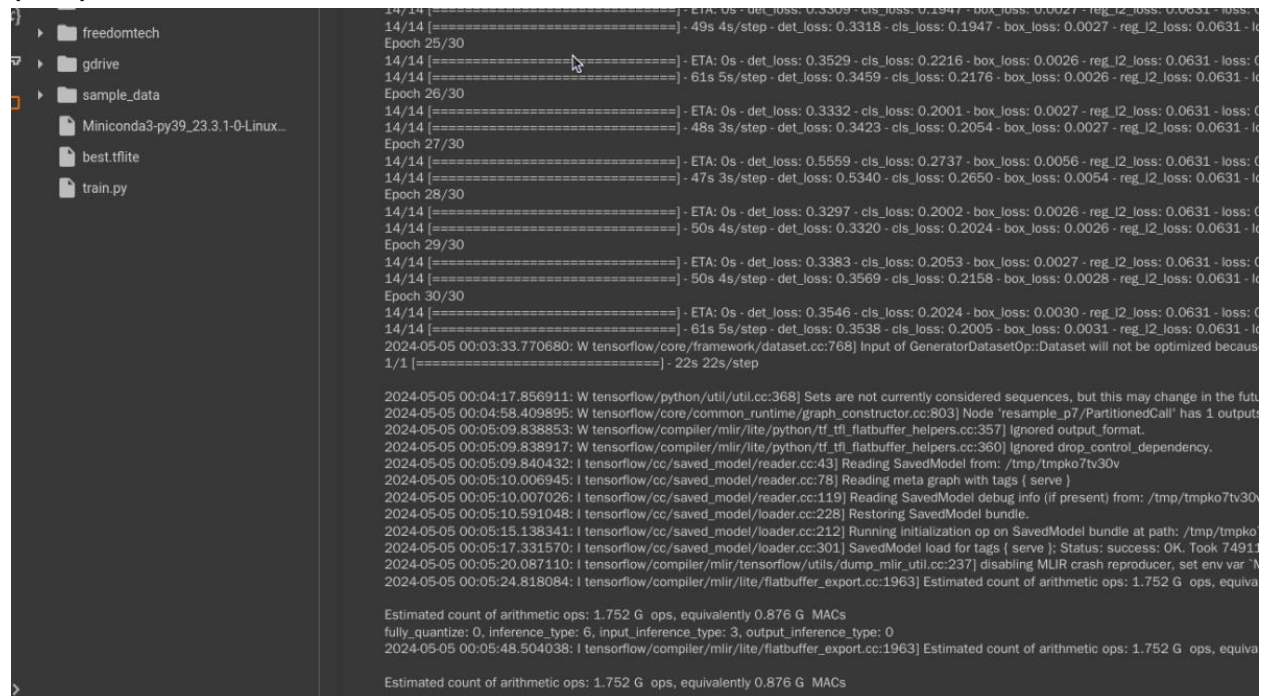
2024-05-04 15:51:13.647140: W tensorflow/stream_executor/platform/default/dso_loader.cc:64] Could not load dynamic library 'libcublasLt.so.11'; dLError: libcublasLt.so.11: cannot open shared object file: No such file or directory

2024-05-04 15:51:13.647340: W tensorflow/stream_executor/platform/default/dso_loader.cc:64] Could not load dynamic library 'libcufft.so.10'; dLError: libcufft.so.10: cannot open shared object file: No such file or directory

2024-05-04 15:51:14.198549: W tensorflow/stream_executor/platform/default/dso_loader.cc:64] Could not load dynamic library 'libcusparsesparse.so.11'; dLError: libcusparsesparse.so.11: cannot open shared object file: No such file or directory

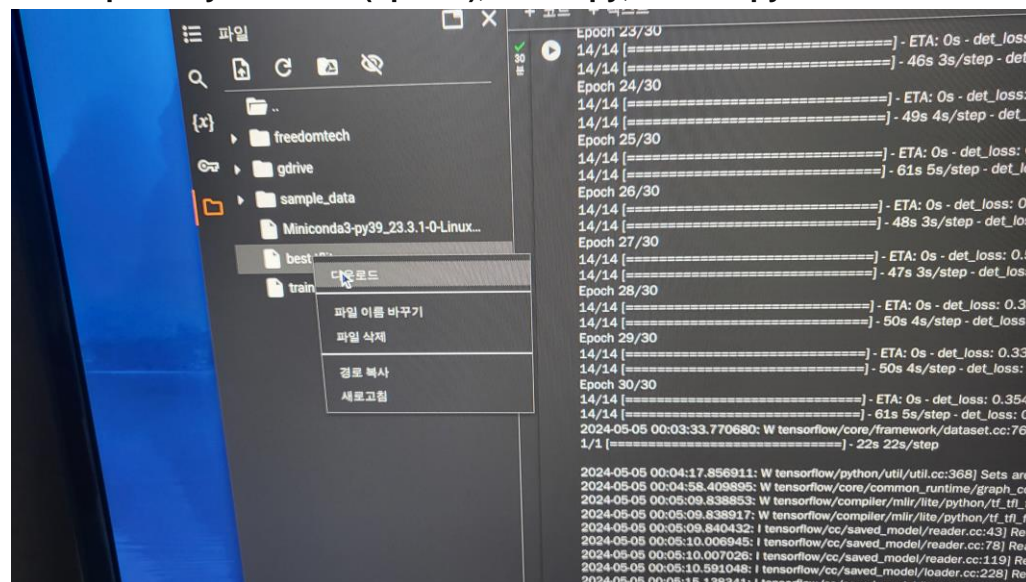
2024-05-04 15:51:14.202179: W tensorflow/core/common_runtime/gpu/gpu_device.cc:1850] Cannot dlopen some GPU libraries. Please make sure the missing libraries

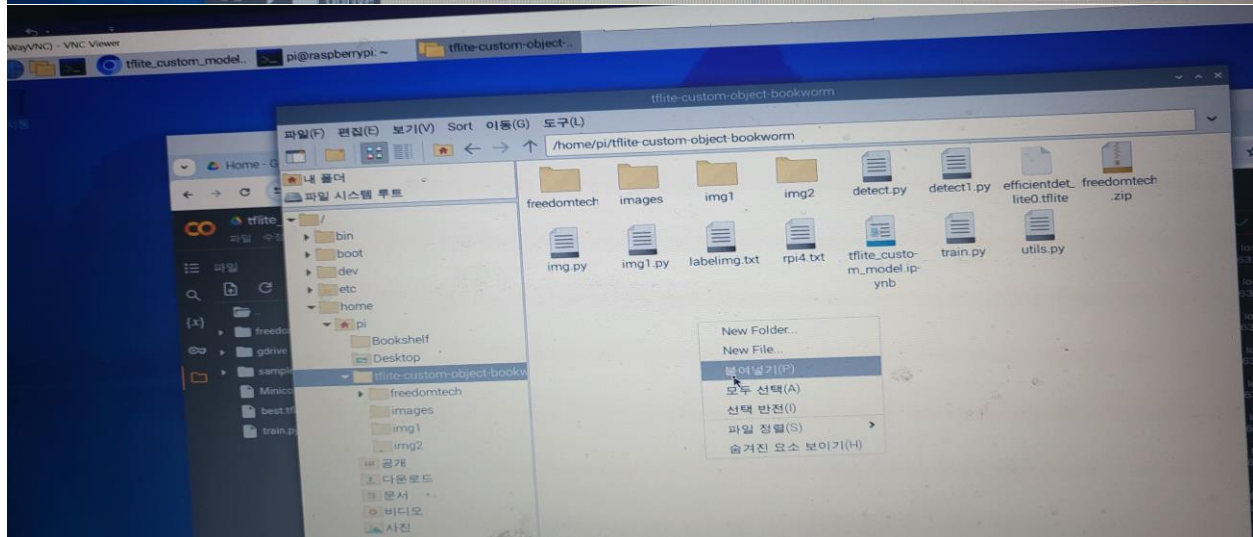
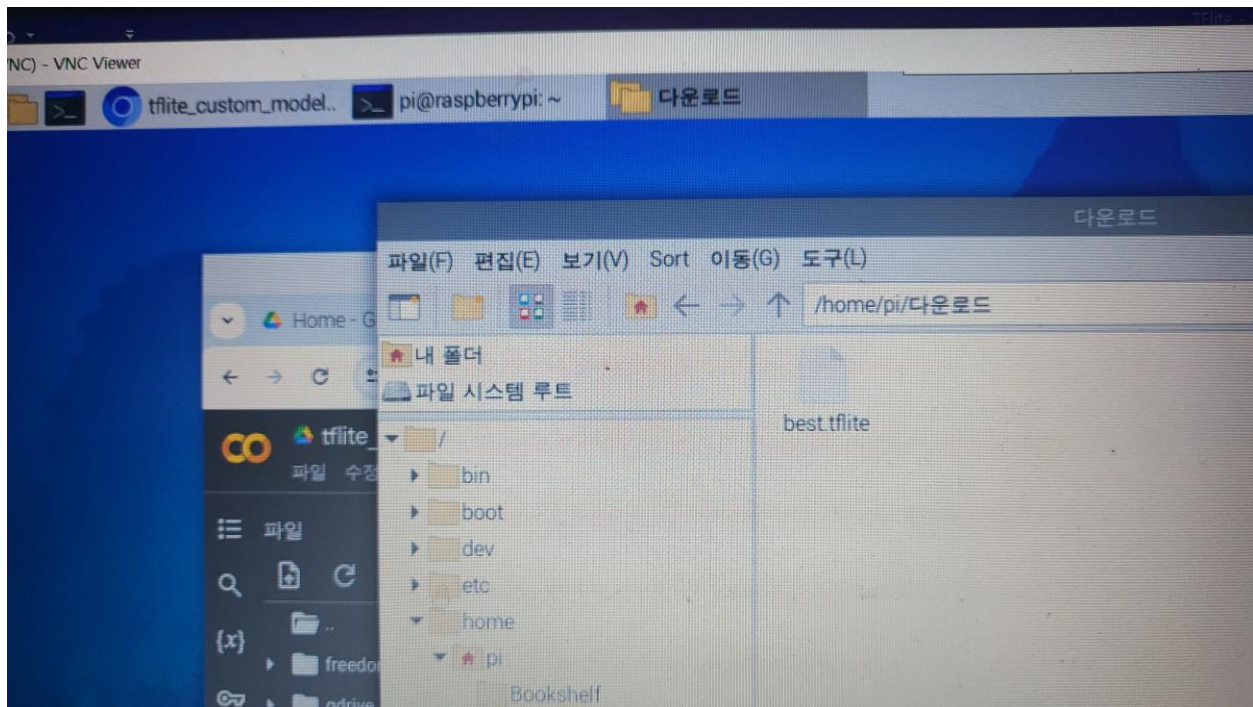
(중략)



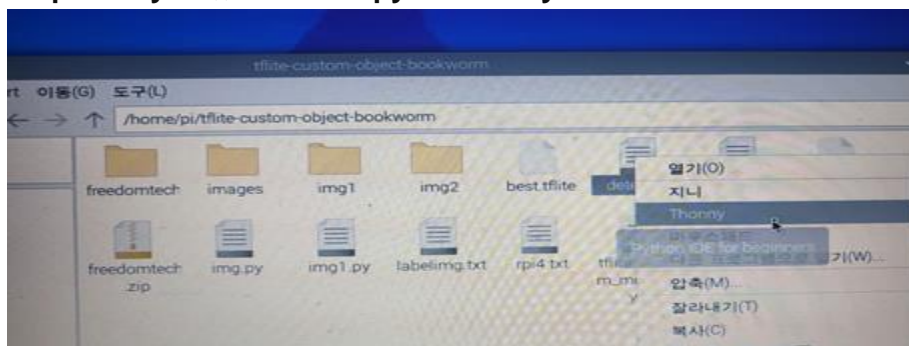
The image shows a terminal window with a file explorer on the left. The file explorer displays a directory structure with folders like 'freedomtech', 'gdrive', and 'sample_data', and files like 'Miniconda3-py39_23.3.1-0-Linux...', 'best.tflite', and 'train.py'. The terminal window shows the output of a training process, including progress bars for epochs 23/30, 24/30, 25/30, 26/30, 27/30, 28/30, 29/30, and 30/30. The progress bars show the current step, ETA, and various loss metrics (det_loss, cls_loss, box_loss, reg_l2_loss). The terminal also shows some error messages and warnings related to TensorFlow and MLIR.

. 좌측에 ‘best.tflite’ 가 만들어지면 우측 버튼 ‘다운로드’하여 home/downloads 로 옮긴 후에 다시 repository 로 옮기고 (update), detect.py, detect1.py 에서 이들로 수정한 후 detect 실행.





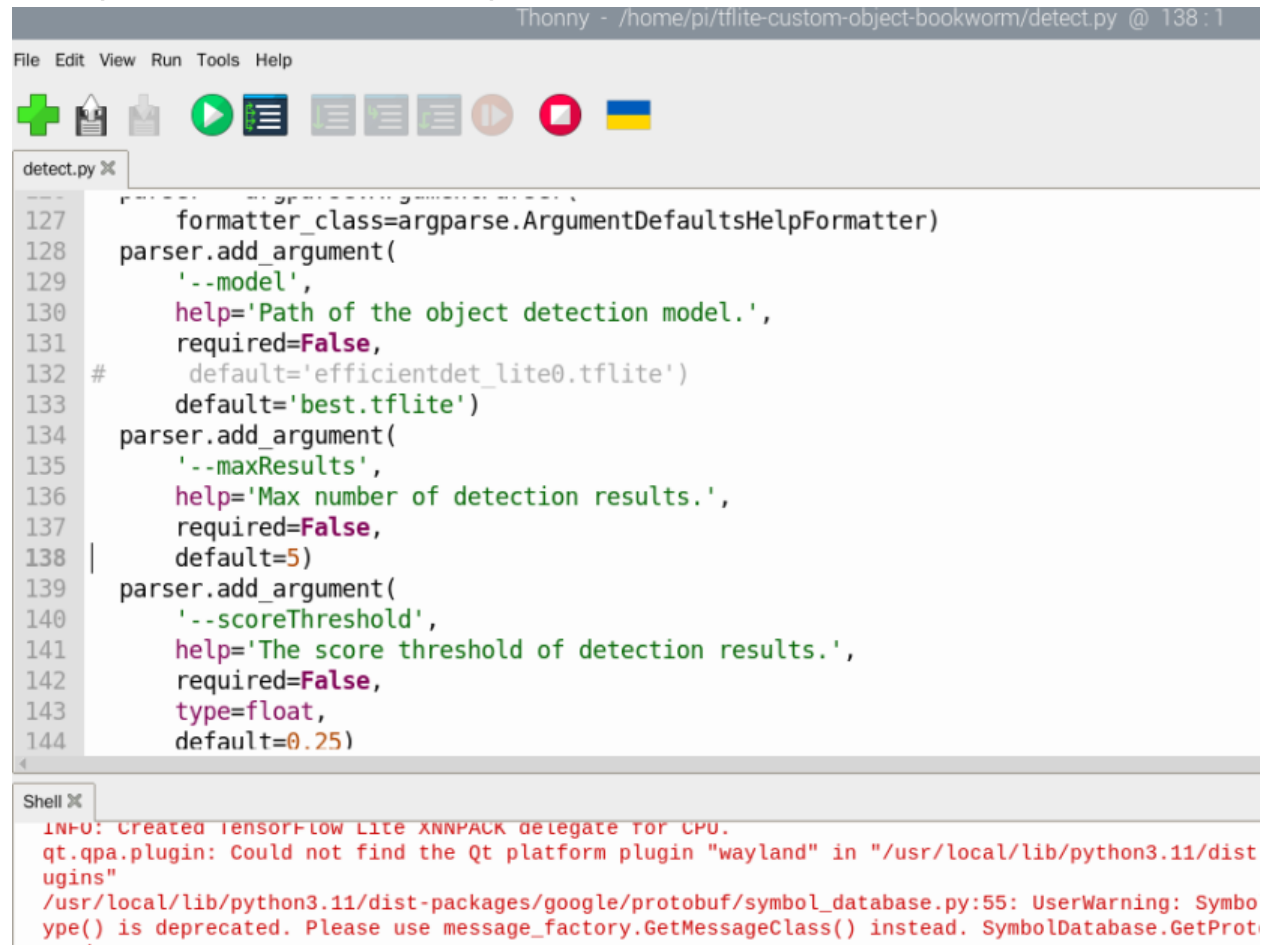
. repository 에 있는 detect.py 를 Thonny 로 열



. 파일 수정 (#132 는 comment, #133 은 uncomment)

```
129     '--model',
130     help='Path of the object detection model.',
131     required=False,
132     # default='efficientdet_lite0.tflite')
133     default='best.tflite')
134 parser.add_argument(
```

. 실행 (상단 녹색의 우측 화살표 클릭)



```
Thonny - /home/pi/tflite-custom-object-bookworm/detect.py @ 138:1
File Edit View Run Tools Help

detect.py
127     formatter_class=argparse.ArgumentDefaultsHelpFormatter)
128 parser.add_argument(
129     '--model',
130     help='Path of the object detection model.',
131     required=False,
132     # default='efficientdet_lite0.tflite')
133     default='best.tflite')
134 parser.add_argument(
135     '--maxResults',
136     help='Max number of detection results.',
137     required=False,
138     default=5)
139 parser.add_argument(
140     '--scoreThreshold',
141     help='The score threshold of detection results.',
142     required=False,
143     type=float,
144     default=0.25)

Shell
INFO: Created TensorFlow Lite XNNPACK delegate for CPU.
qt.qpa.plugin: Could not find the Qt platform plugin "wayland" in "/usr/local/lib/python3.11/dist
/usr/local/lib/python3.11/dist-packages/google/protobuf/symbol_database.py:55: UserWarning: Symbo
ype() is deprecated. Please use message_factory.GetMessageClass() instead. SymbolDatabase.GetProt
```

