

# Tutorial 3 – TensorFlow Project Environment Setup & Development Flow

Willie Tsai  
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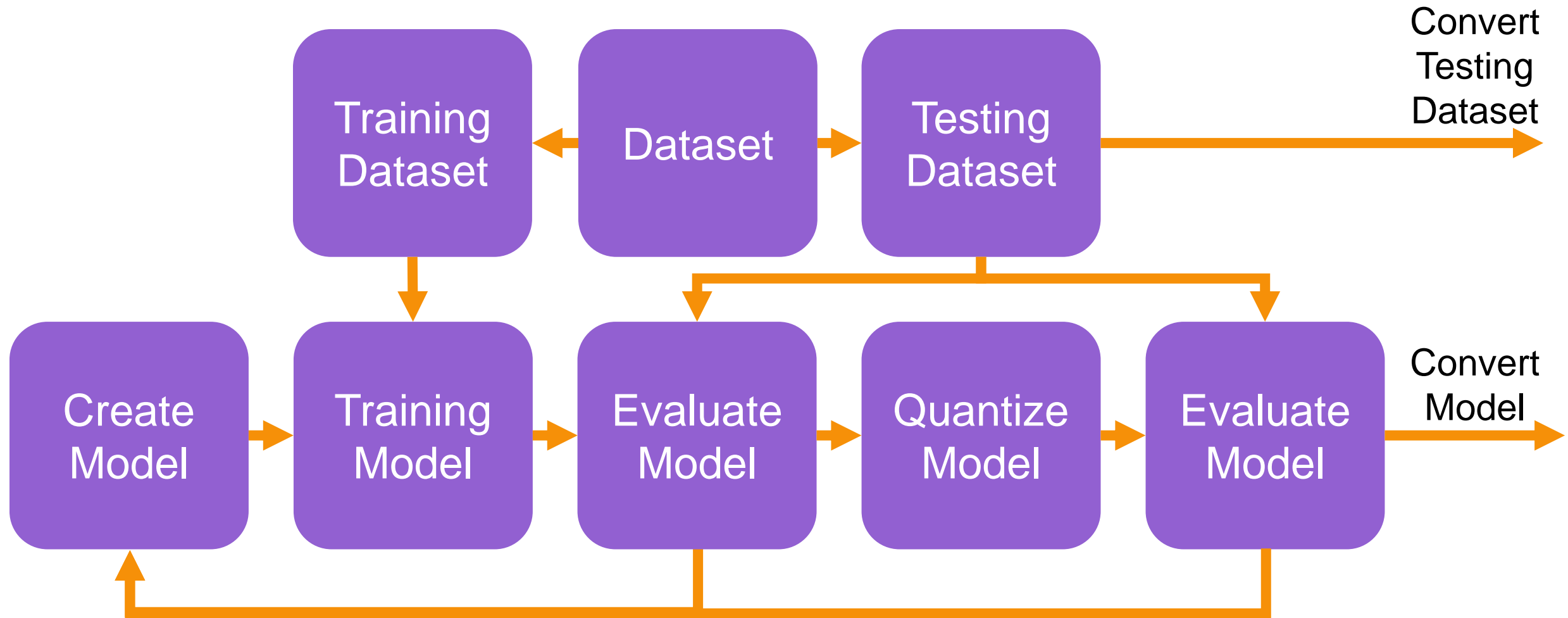


# ARC EM9D AIoT DK Project Development Flow



Stage	TensorFlow Model Development	Firmware Development	Run / Update Application On ARC EM9D AIoT DK
Tool	Anaconda Cygwin	Cygwin Metaware or ARC GNU VirtualBox (Ubuntu 20.04)	JTAG Himax-FT4222-GUI USB Cable
Language	Python 3	C language C++ language	

# TensorFlow Model Development



# Anaconda3 Setup



# Download

## 1. Download the installation file

<https://www.anaconda.com/products/individual>




Individual Edition

## Your data science toolkit

With over 20 million users worldwide, the open-source Individual Edition (Distribution) is the easiest way to perform Python/R data science and machine learning on a single machine. Developed for solo practitioners, it is the toolkit that equips you to work with thousands of open-source packages and libraries.

Download

## Anaconda Installers

Windows 

Python 3.8

64-Bit Graphical Installer (457 MB)


32-Bit Graphical Installer (403 MB)

MacOS 

Python 3.8

64-Bit Graphical Installer (435 MB)

64-Bit Command Line Installer (428 MB)

Linux 

Python 3.8

64-Bit (x86) Installer (529 MB)

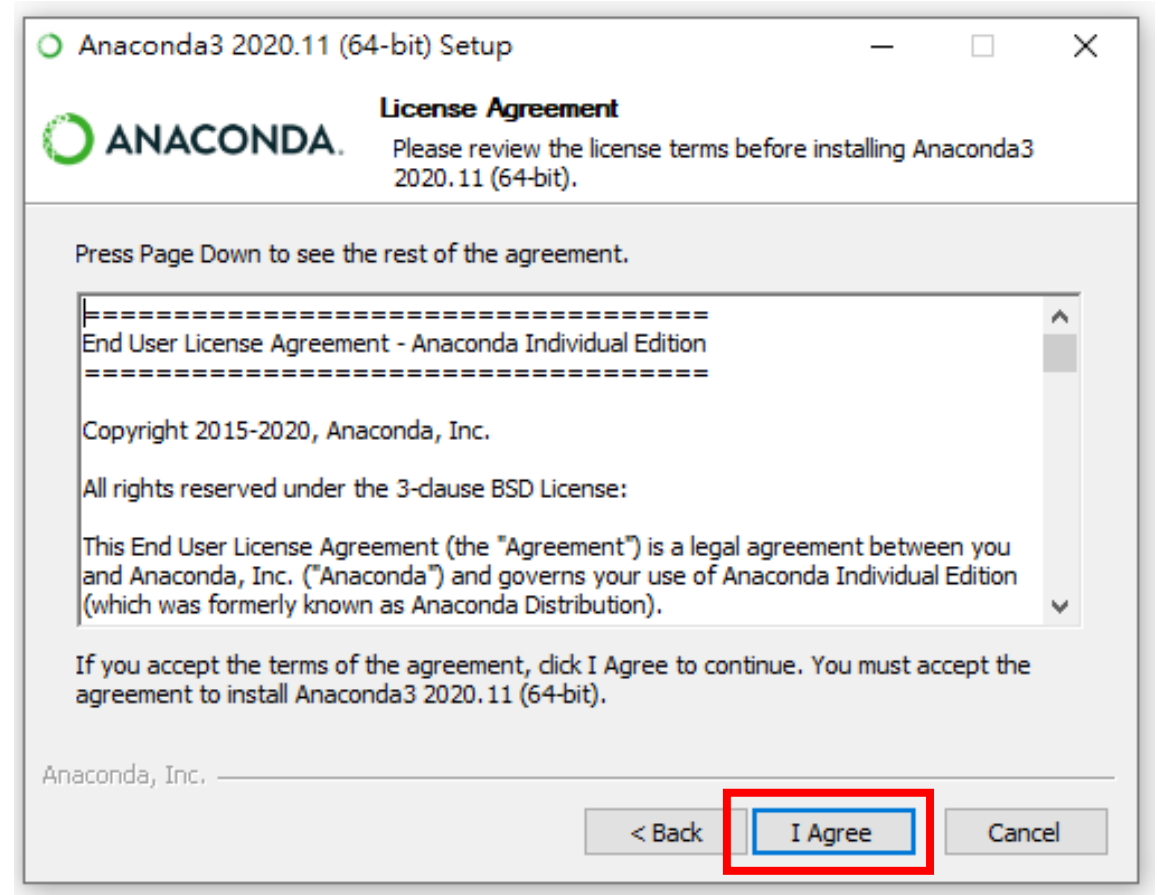
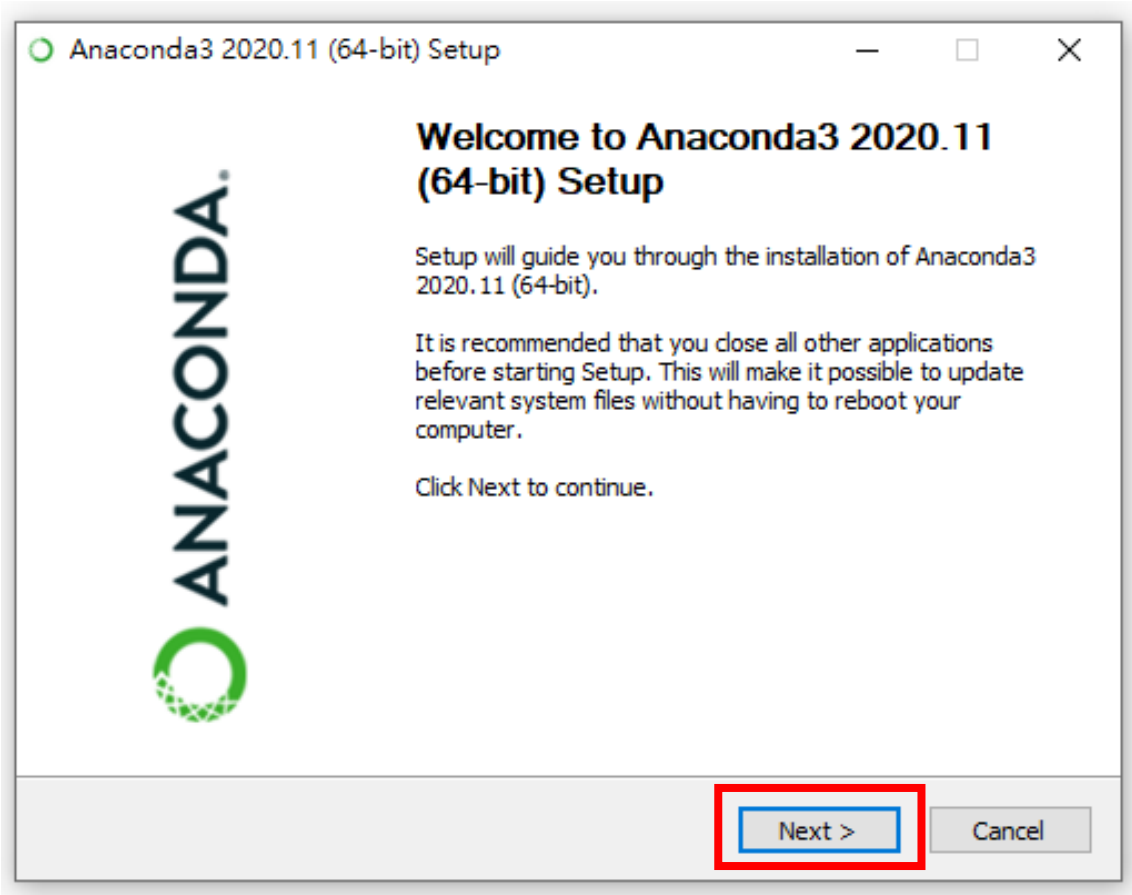
64-Bit (Power8 and Power9) Installer (279 MB)

### ADDITIONAL INSTALLERS

The [archive](#) has older versions of Anaconda Individual Edition installers. The Miniconda installer homepage can be found [here](#).

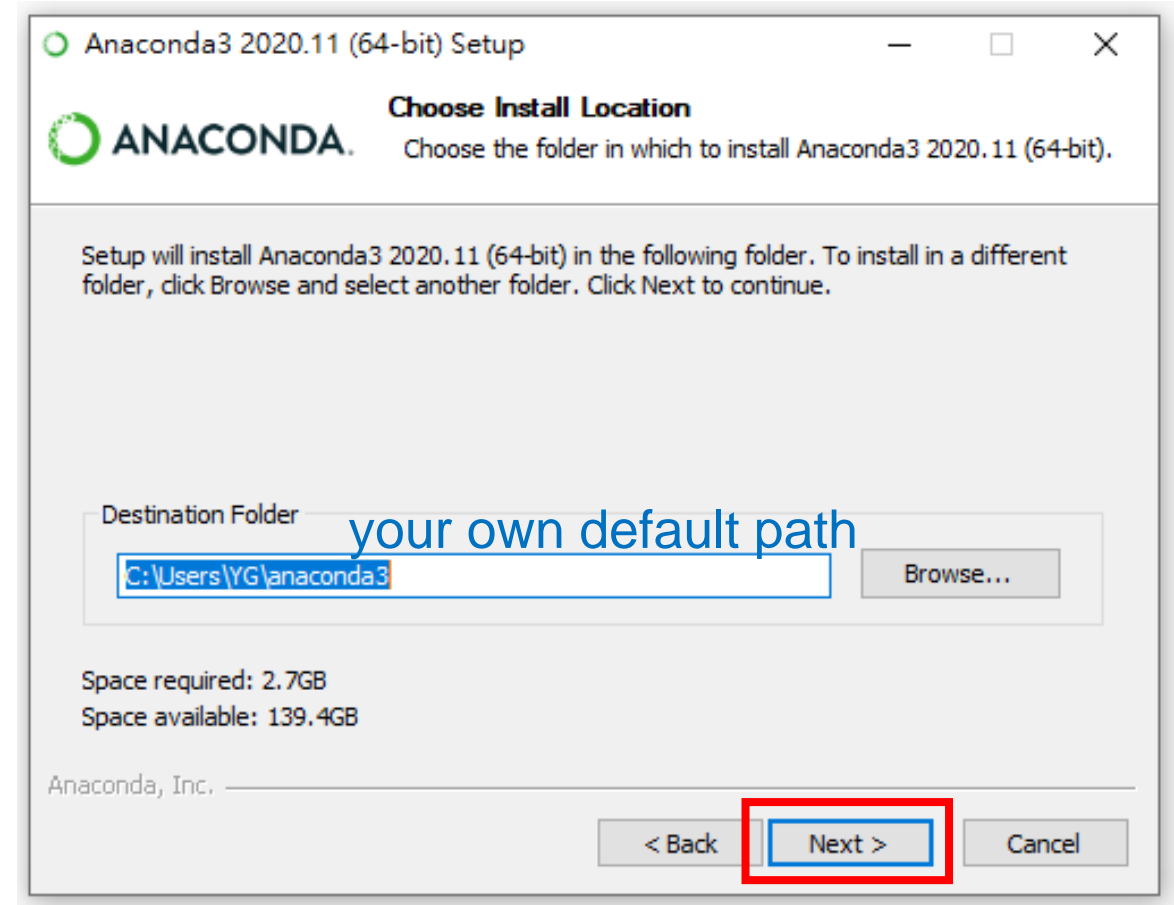
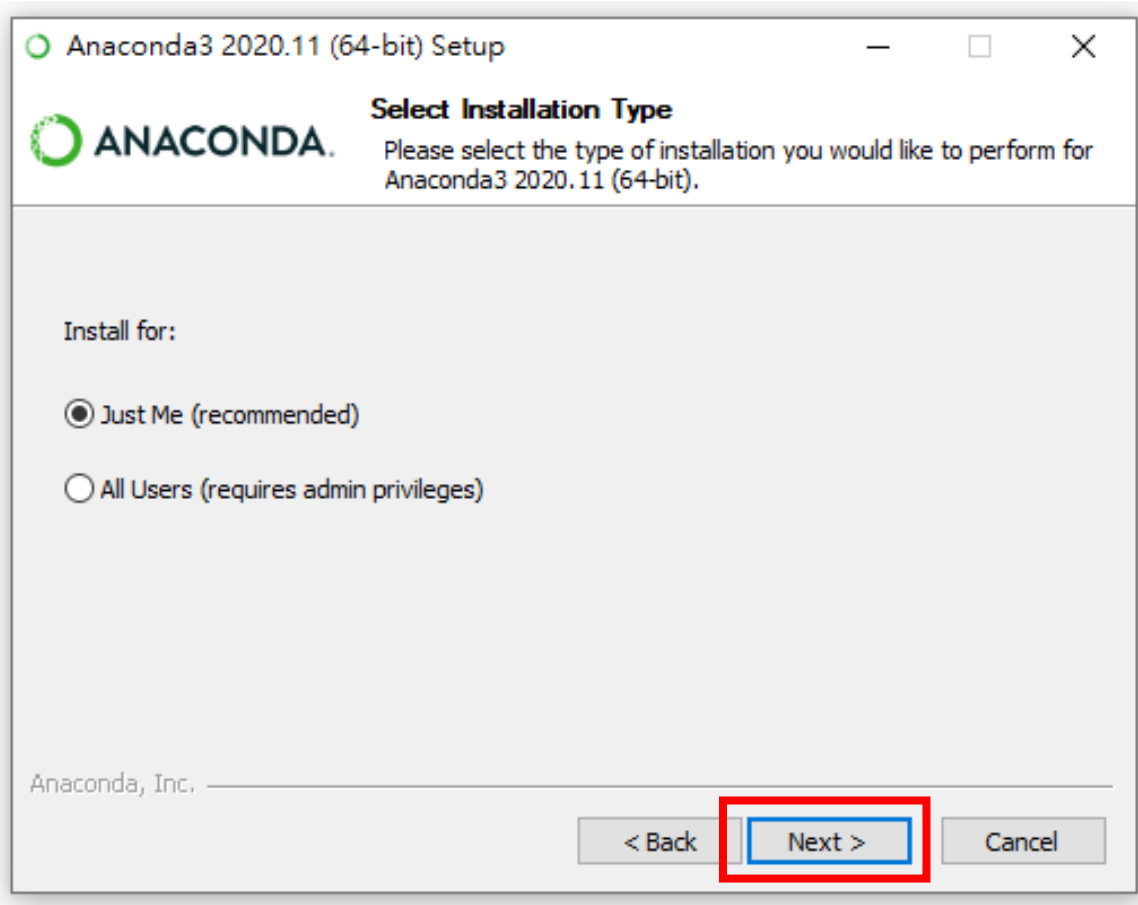
# Anaconda3 Setup

## 2. Click “Next” and “I Agree”



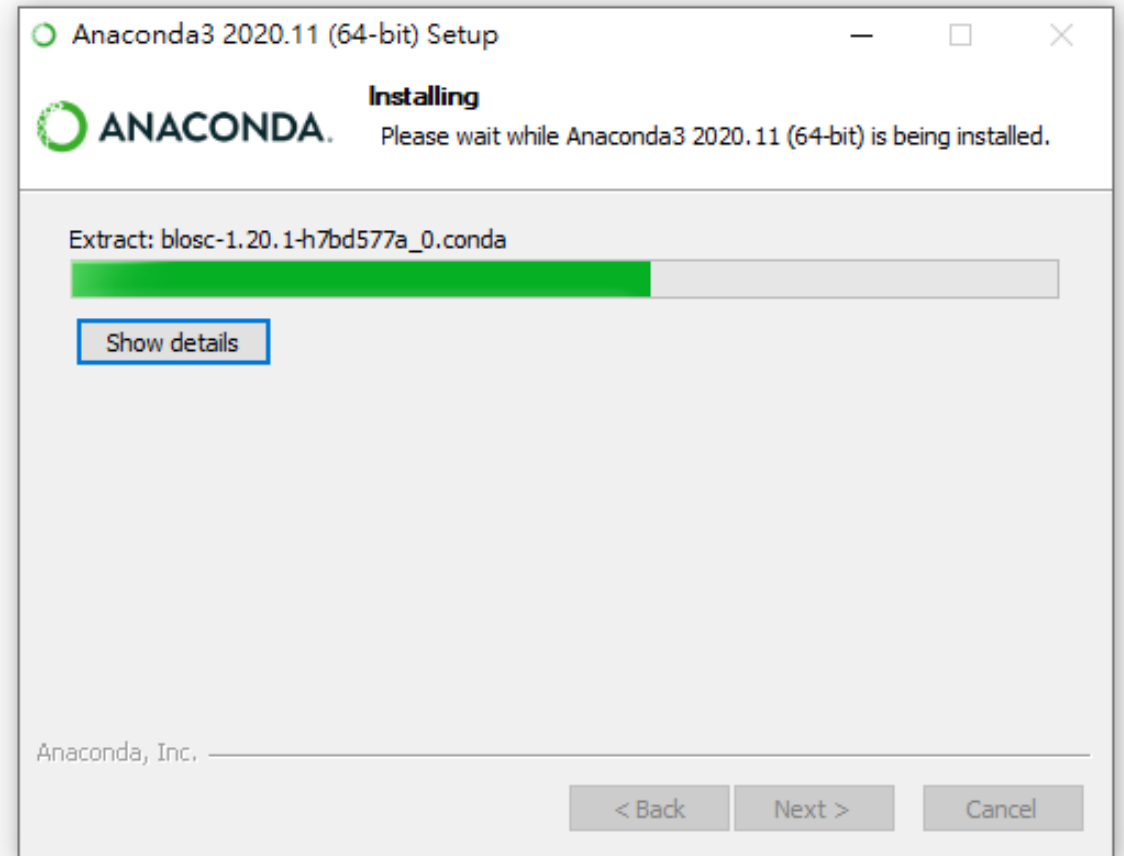
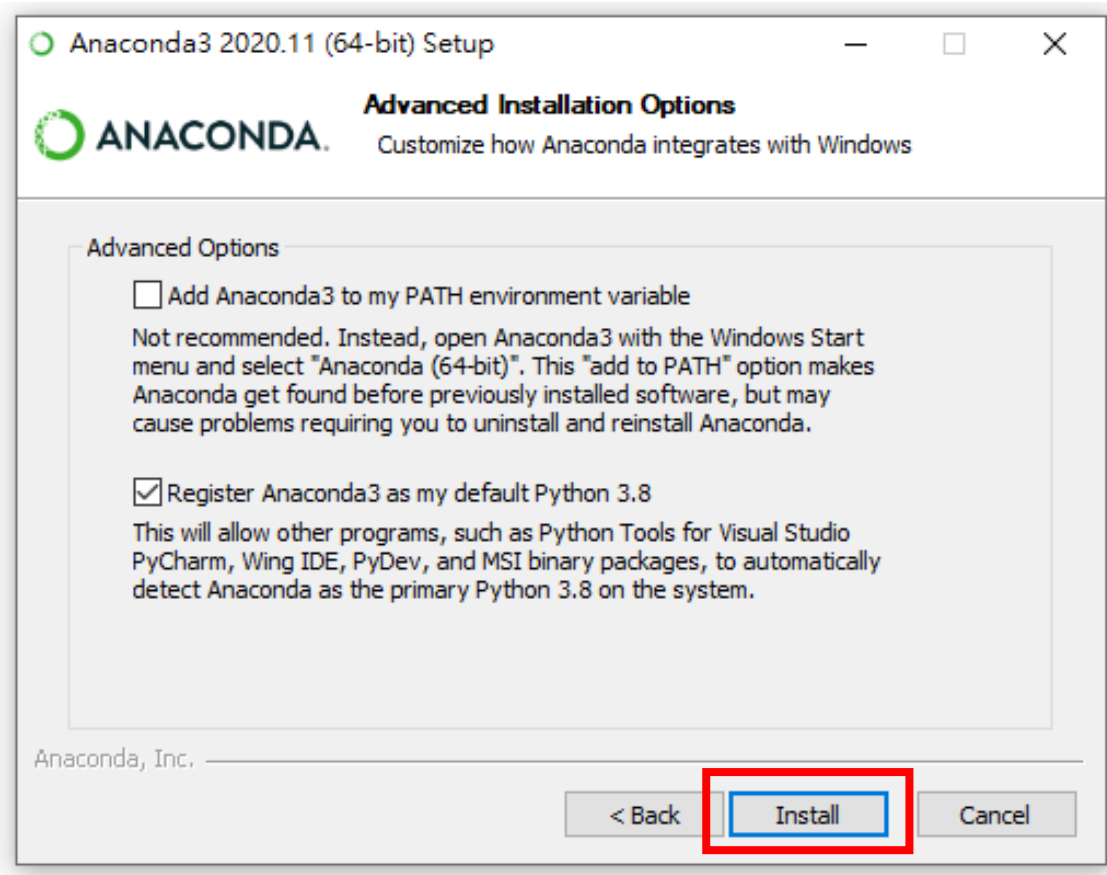
# Anaconda3 Setup

## 3. Click “Next”



# Anaconda3 Setup

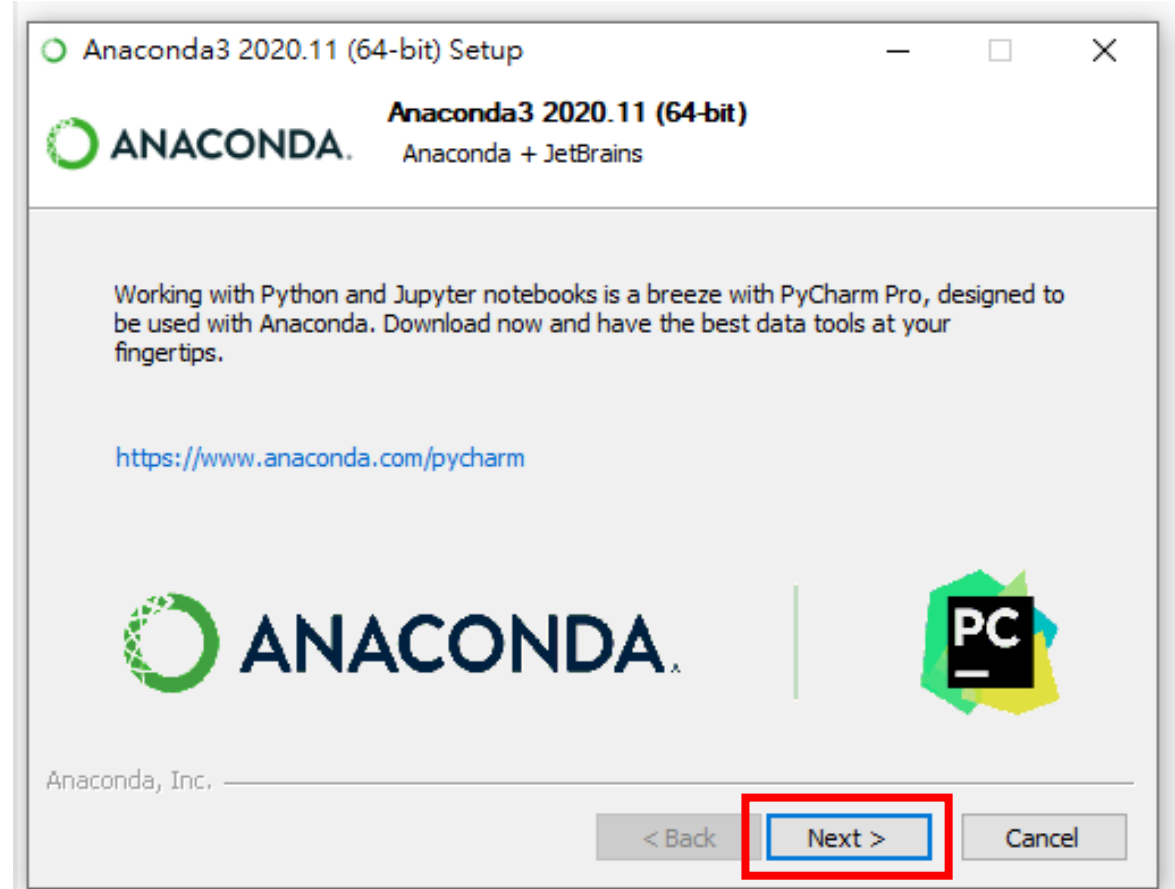
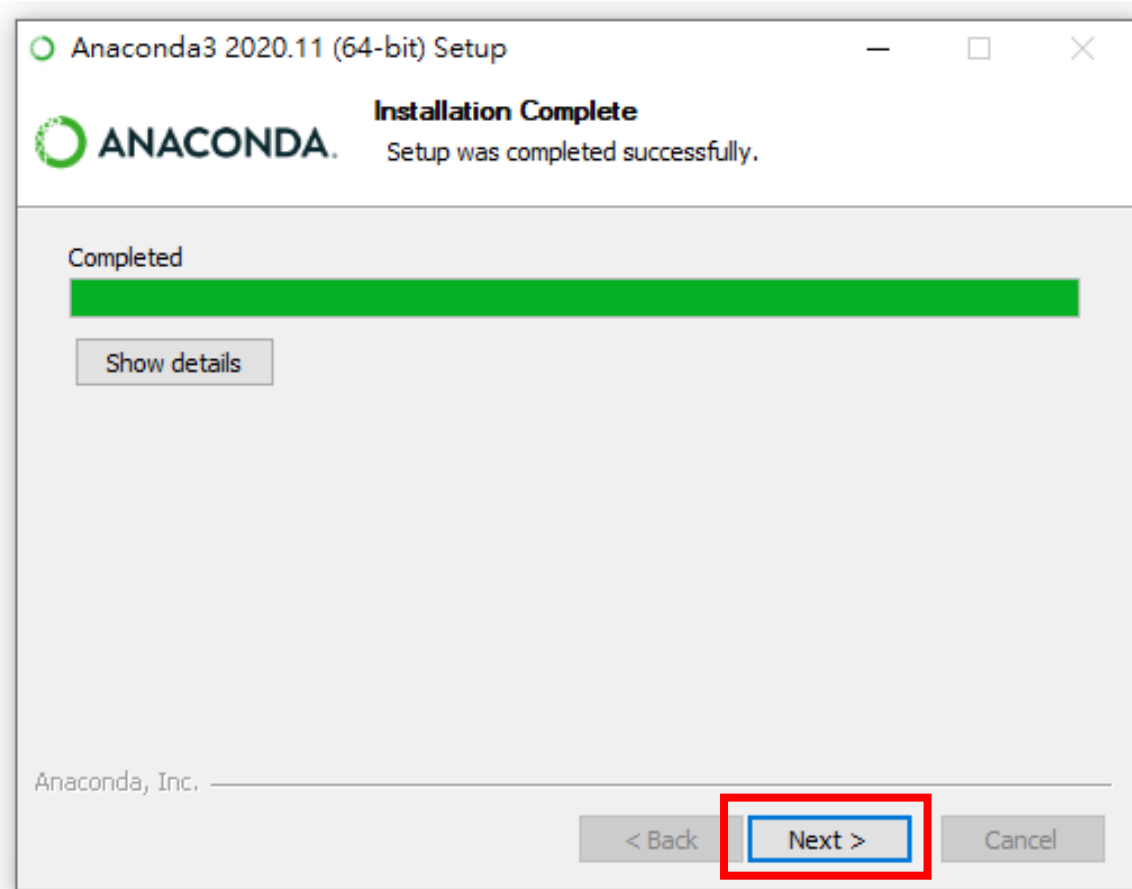
## 4. Click “Install”





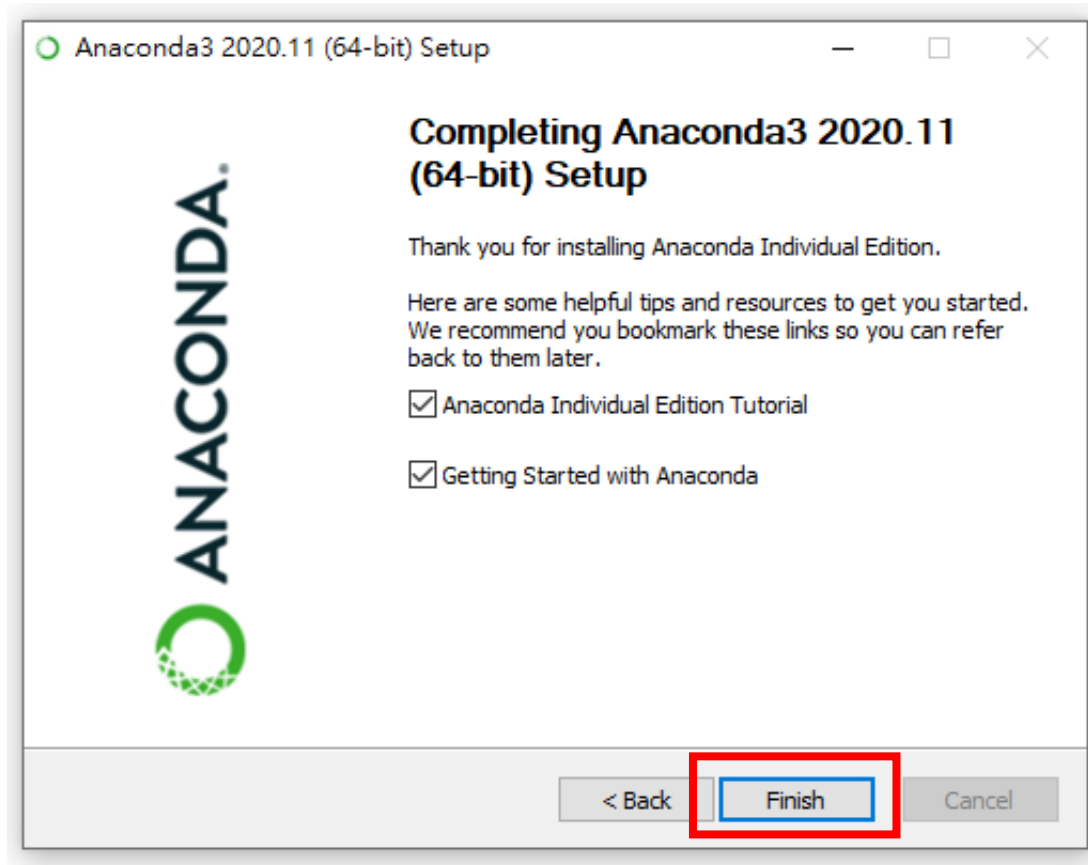
# Anaconda3 Setup

## 5. Click “Next”



# Anaconda3 Setup

## 6. Click “Finish”

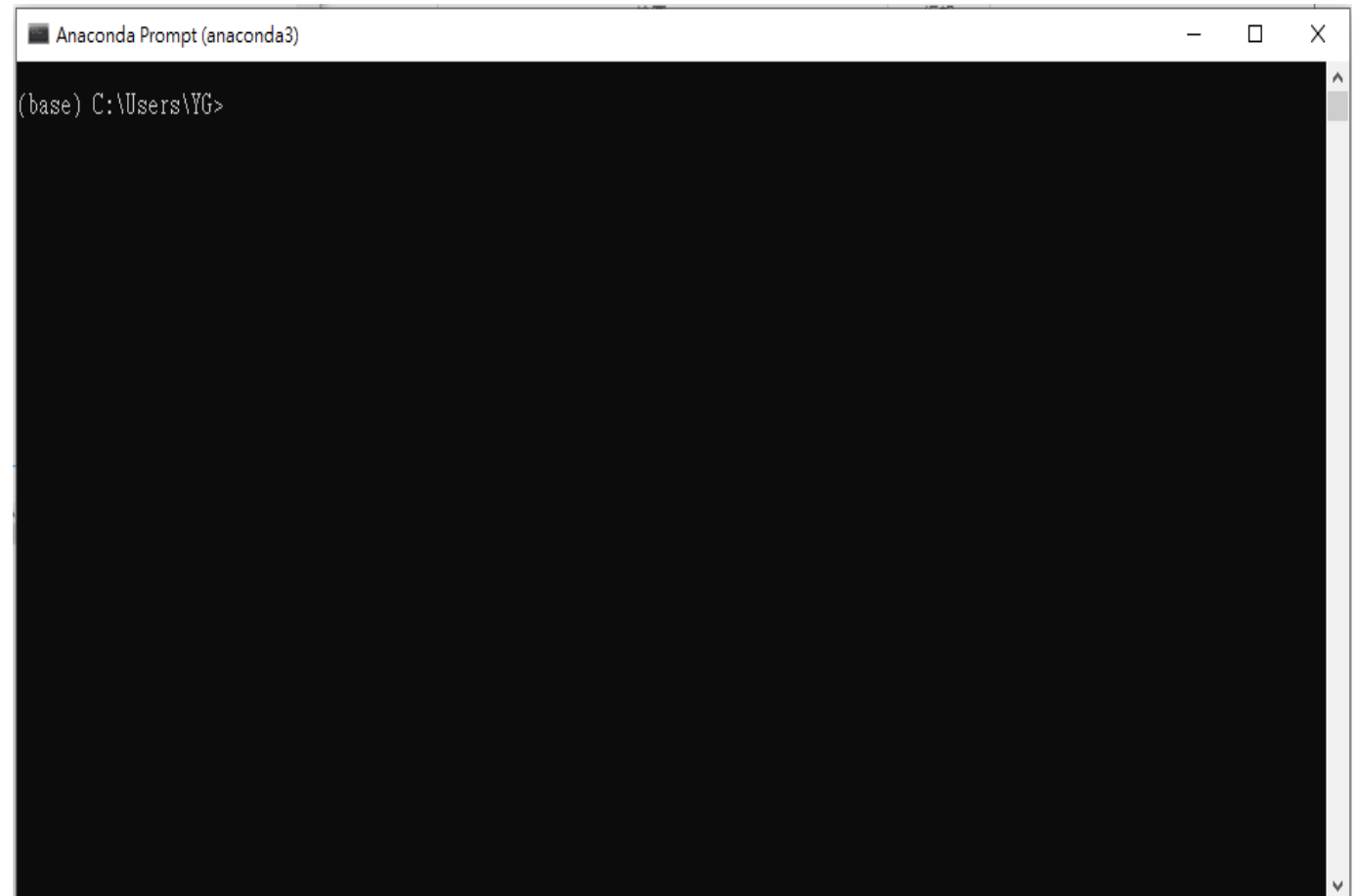
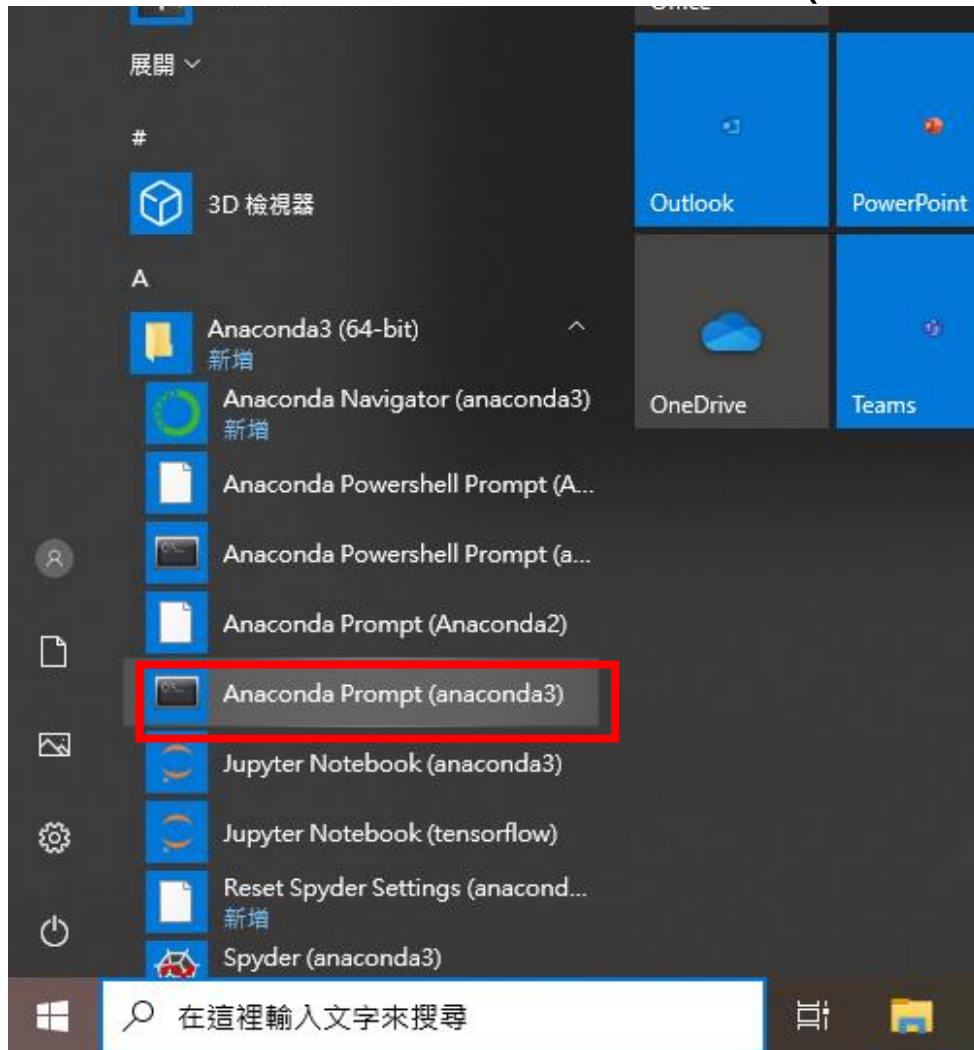


# Tensorflow Environment Setup



# Tensorflow Environment Setup

Windows > Anaconda3 (64-bit) > Anaconda Prompt (anaconda<sup>3</sup>)

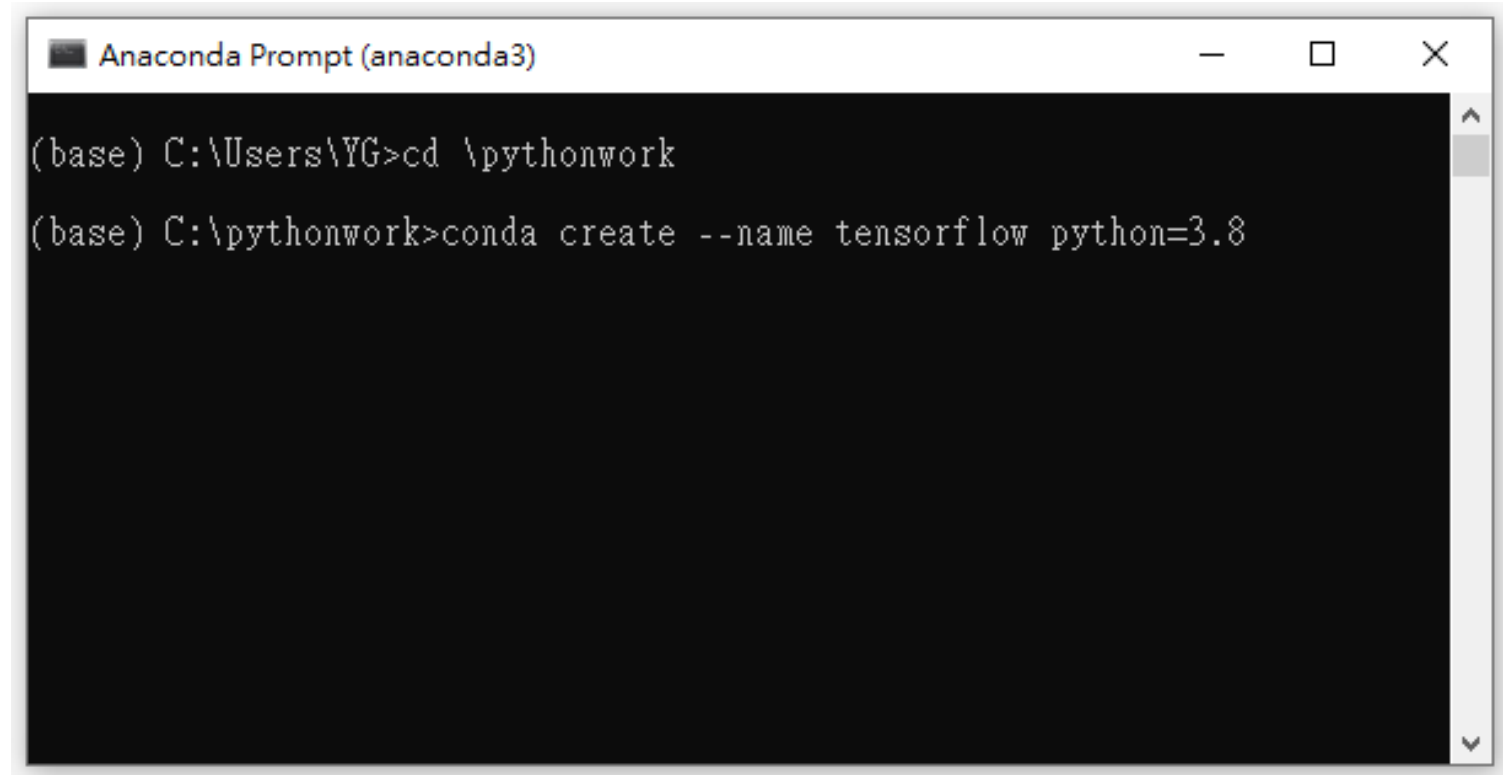


# Tensorflow Environment Setup

Use conda command to build a virtual environment which is named “tensorflow”, and install Python 3.8

**\$ conda create --name tensorflow python=3.8**

When it shows “Proceed([y]/n)?”  
Click **y** to continue

A screenshot of the Anaconda Prompt (anaconda3) window. The window title is "Anaconda Prompt (anaconda3)". The command prompt shows the user navigating to the \pythonwork directory and then running the command "conda create --name tensorflow python=3.8". The prompt is currently at the end of the command line, waiting for input.

```
Anaconda Prompt (anaconda3)

(base) C:\Users\YG>cd \pythonwork
(base) C:\pythonwork>conda create --name tensorflow python=3.8
```

# TensorFlow Environment Setup

1. Enable your anaconda virtual environment

```
$ conda activate tensorflow
```

2. Install Tensorflow

```
$ conda install tensorflow==2.3.0
```

3. Install Keras

```
$ conda install -c conda-forge keras
```

4. Install matplotlib

```
$ conda install matplotlib
```

5. Install numpy

```
$ conda install numpy
```

6. Install tensorflow\_datasets

```
$ pip install tensorflow_datasets==4.5.2
```

7. Install Jupyter notebook

```
$ conda install jupyter notebook
```

- When you have any problem during installation, please search the install command.

# TensorFlow Environment Test



# TensorFlow Environment Test

1. Windows > Anaconda3 (64-bit) > Jupyter Notebook ([tensorflow](#))
2. Your root path: “C:\Users\{[username](#)}\”  
(Jupyter Notebook default root path)
3. Select “VM/Synopsys\_SDK\_Vxx/Example\_Project/”



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Running

Clusters

Select items to perform actions on them.

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Name ▾

Last Modified

File size

☐ 📁 3D Objects

4 days ago

☐ 📁 \_TF2

2 months ago



# TensorFlow Environment Test

3. Open the folder “Lab5\_tflm\_emnist\_training\_letter”
4. Open “Lab5\_tflm\_emnist\_training.ipynb”

Files

Running

Clusters

Select items to perform actions on them.

☐ 0 ▾

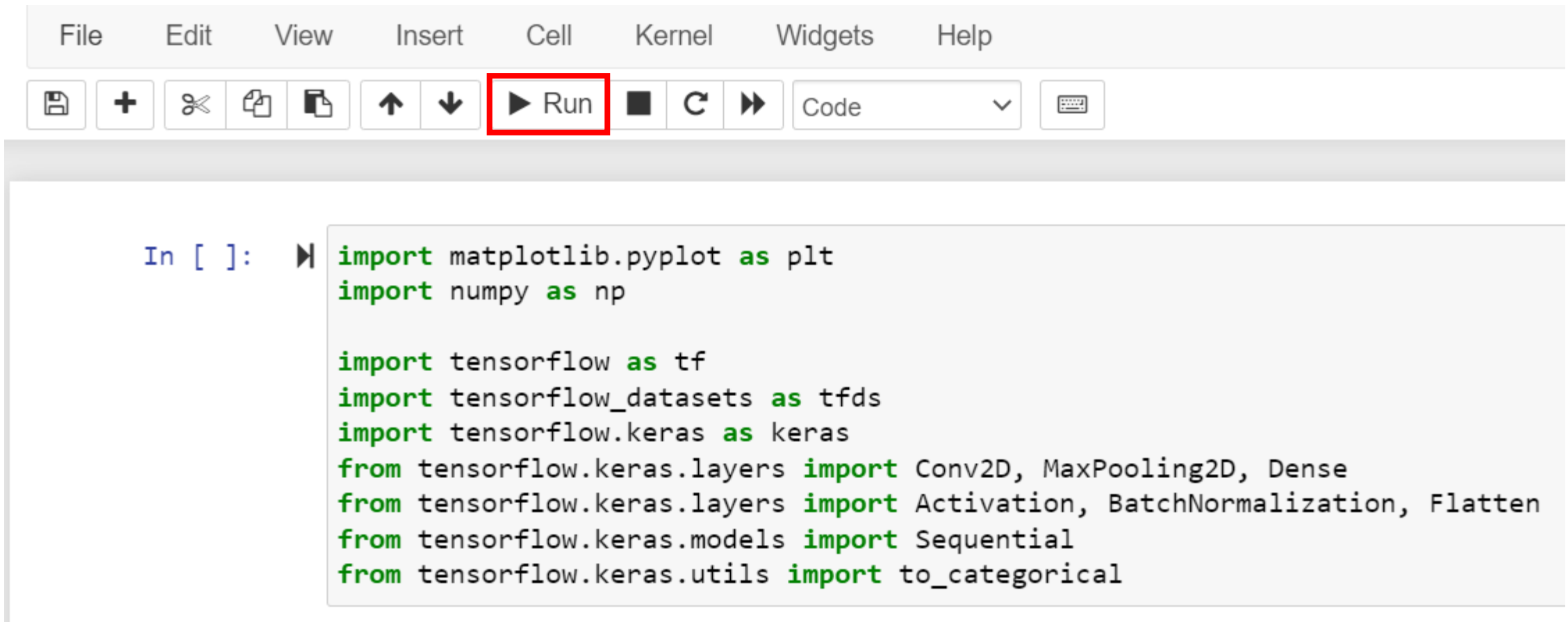
/ Documents / VM / Synopsys\_SDK\_V24\_Willie\_Used / Example\_Project / Lab5\_tflm\_emnist\_training\_letter

⏮ ..

☐  Lab5\_tflm\_emnist\_training.ipynb

# TensorFlow Environment Test

5. Press “Run” step by step, and make sure the current block is done without error messages.



The screenshot shows a Jupyter Notebook interface. The top toolbar contains menus: File, Edit, View, Insert, Cell, Kernel, Widgets, and Help. Below the menus is a row of icons: a save icon, a plus icon, a scissors icon, a copy icon, a paste icon, up and down arrows, a red-outlined 'Run' button (a play icon), a black square icon, a refresh icon, a next icon, a dropdown menu currently showing 'Code', and a keyboard icon. Below the toolbar is a code cell. The prompt 'In [ ]: ' is followed by a right-pointing arrow icon. The code inside the cell is as follows:

```
import matplotlib.pyplot as plt
import numpy as np

import tensorflow as tf
import tensorflow_datasets as tfds
import tensorflow.keras as keras
from tensorflow.keras.layers import Conv2D, MaxPooling2D, Dense
from tensorflow.keras.layers import Activation, BatchNormalization, Flatten
from tensorflow.keras.models import Sequential
from tensorflow.keras.utils import to_categorical
```

# TensorFlow Environment Test

6. When first time using dataset in your PC, the process will download automatically. Please make sure no error happens here.

Load and preprocess training and testing dataset

```
In [ ]: ▶ # Import training and testing dataset and save to the dataset_buffer

train_images_database, train_labels_database = tfds.as_numpy(tfds.load(
    'emnist/letters',
    split = 'train',
    shuffle_files = False,
    batch_size = -1,
    as_supervised = True,
```

Downloading and preparing dataset Unknown size (download: Unknown size, generated: Unknown size, total: Unknown size) to C:\Users\williet\tensorflow\_datasets\emnist\letters\3.0.0...

DI Completed...: 0% 0/1 [00:05<?, ? url/s]

DI Size...: 4% 23/535 [00:05<00:51, 10.02 MiB/s]

It will show the correct message.

Dataset emnist downloaded and prepared to C:\Users\williet\tensorflow\_datasets\emnist\letters\3.0.0. Subsequent calls will reuse this data.

# TensorFlow Environment Test

7. It needs some time to execute `evaluate_model`, please wait.  
Or you can reduce **1.00** → **0.01** to speed up the evaluation.

## Evaluate TensorFlow Lite INT-8 Model

Full test set contains 14800 samples. Evaluating int8 model on it might take more than 10 minutes. If you want to get estimation faster, please, limit number of samples to be evaluated by reducing **max\_samples** value

```
In [30]: ▶ max_samples = int(test_images_database.shape[0] * 0.20)
# max_samples = int(test_images_database.shape[0] * 1.00)

print(max_samples)

2960
```

# TensorFlow Environment Test

8. After running the python project, it will create "generated/emnist\_model\_int8.tflite" & "test\_samples.cpp" That means your TensorFlow environment is ready.

Lab5\_tflm\_conversion\_tutorial

|

---- model\_conversion.ipynb

---- generated

|

---- mnist\_model\_int8.tflite

---- test\_samples.cpp

---- model\_save (folder for model saving)

# TensorFlow Environment Test

9. Open Cygwin and goto Lab5\_tflm\_conversion\_tutorial/generated

```
$ cd c:
```

```
$ cd Users/{username}/
```

```
$ cd VM/Synopsys_SDK_Vxx/Example_Project/
```

```
$ cd Lab5_tflm_conversion_tutorial/generated/
```

10. Convert tflite to C model

```
$ cd Lab5_tflm_conversion_tutorial/generated/
```

```
$ xxd -i emnist_model_int8.tflite > model.h
```

11. You will see your TensorFlow model file model.h

12. Integrate model.h and test\_samples.cpp to your firmware project  
(Later tutorial)