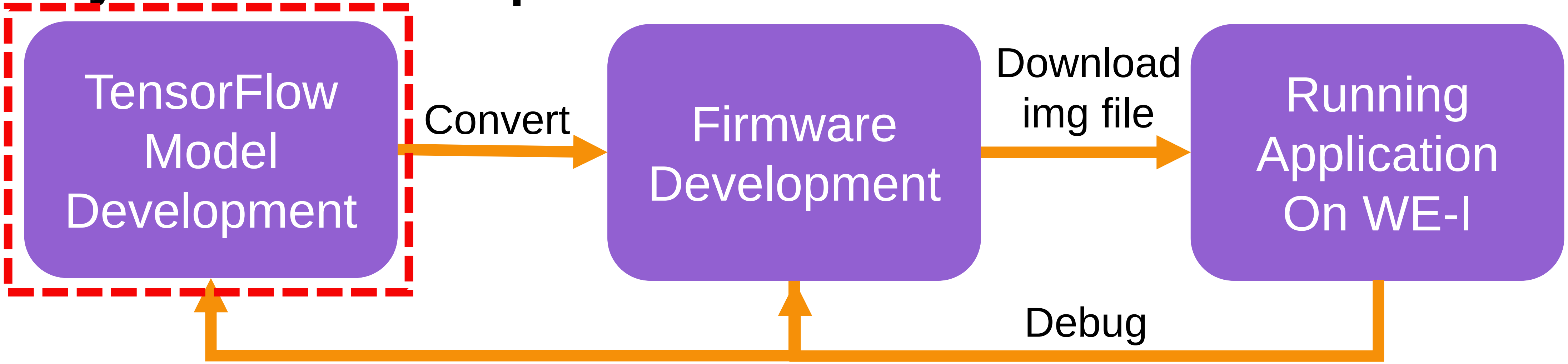
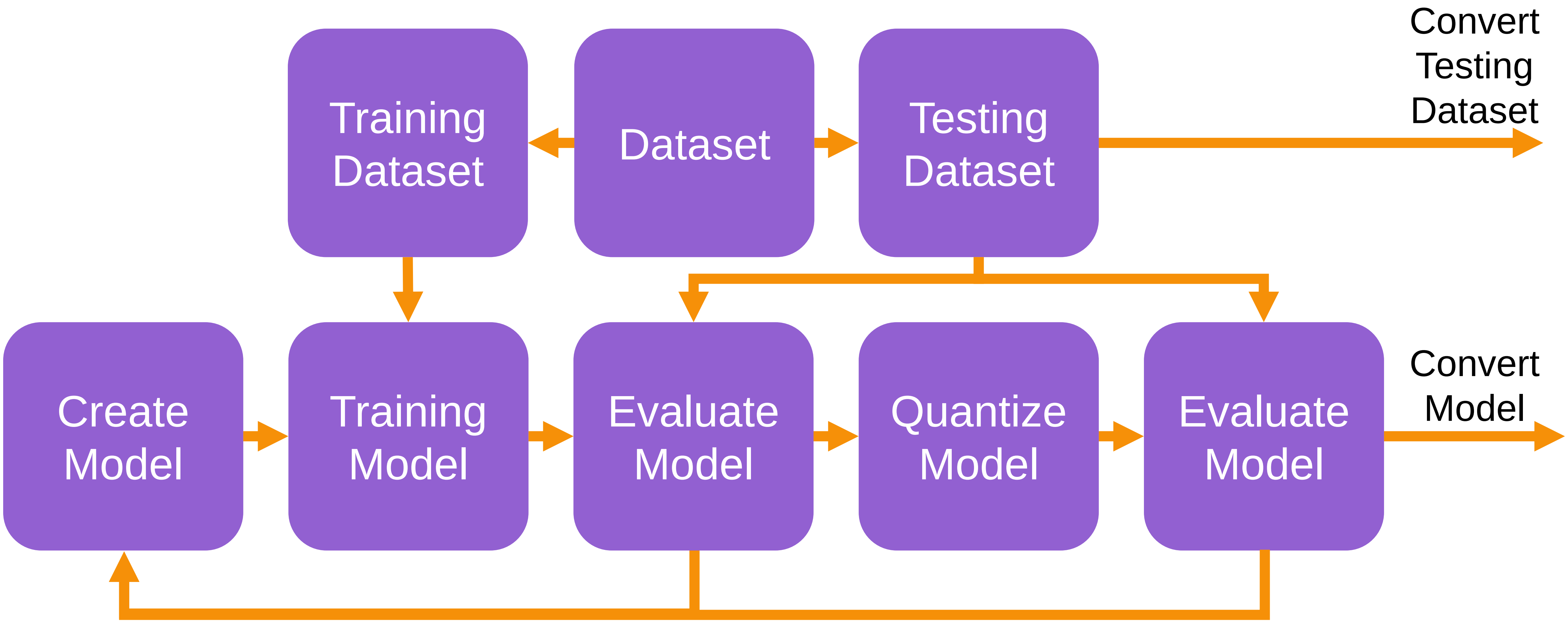
Tutorial 3 – TensorFlow Project Environment Setup & Development Flow

Project Development Flow



Stage	**TensorFlow Model Development**	**Firmware Development**	**Running Application On WE-I**
Tool	Anaconda Cygwin	Cygwin Metaware or ARC GNU VirtualBox (Ubuntu)	Tera Term USB Micro
Language	Python 3	C language C++ language	

TensorFlow Model Development



Training Dataset

Dataset

Testing Dataset

Convert Testing Dataset

Create Model

Training Model

Evaluate Model

Quantize Model

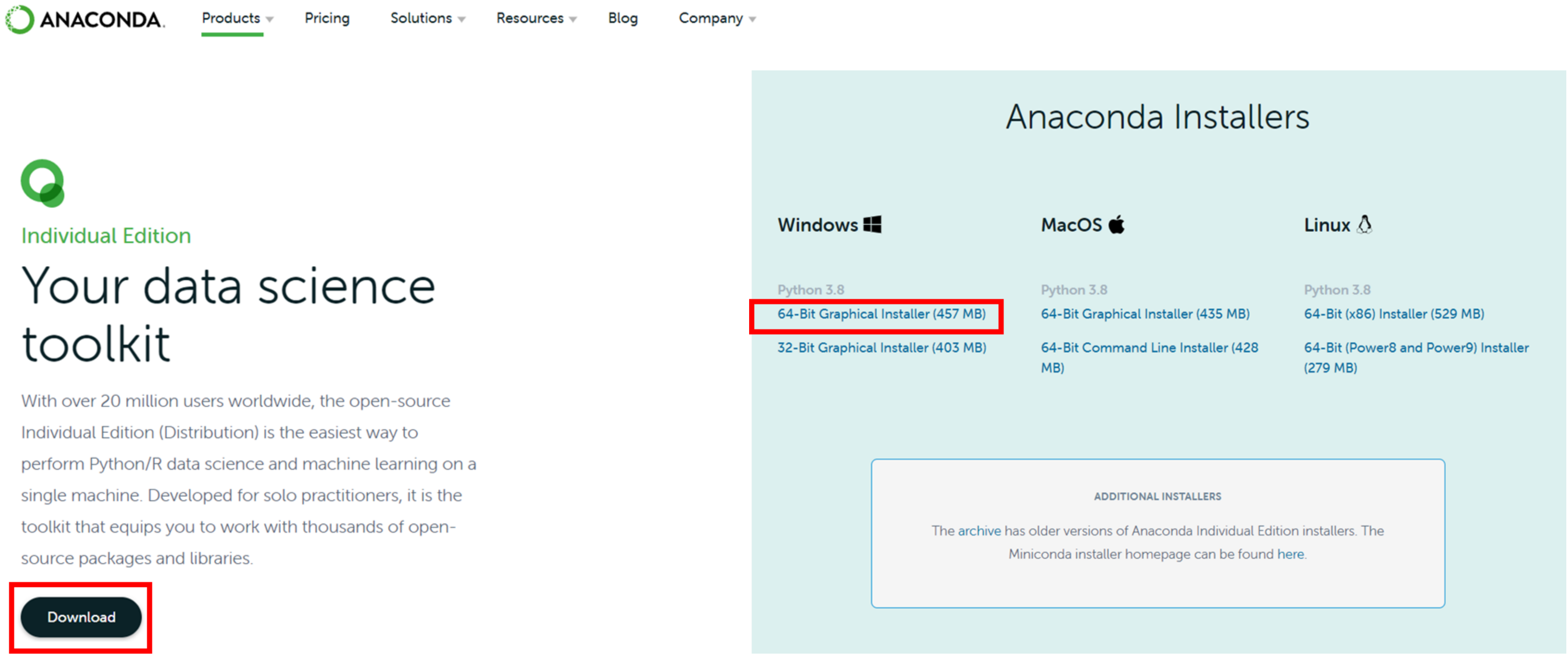
Evaluate Model

Convert Model

Anaconda3 Setup

Download

ANACONDA URL: 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.

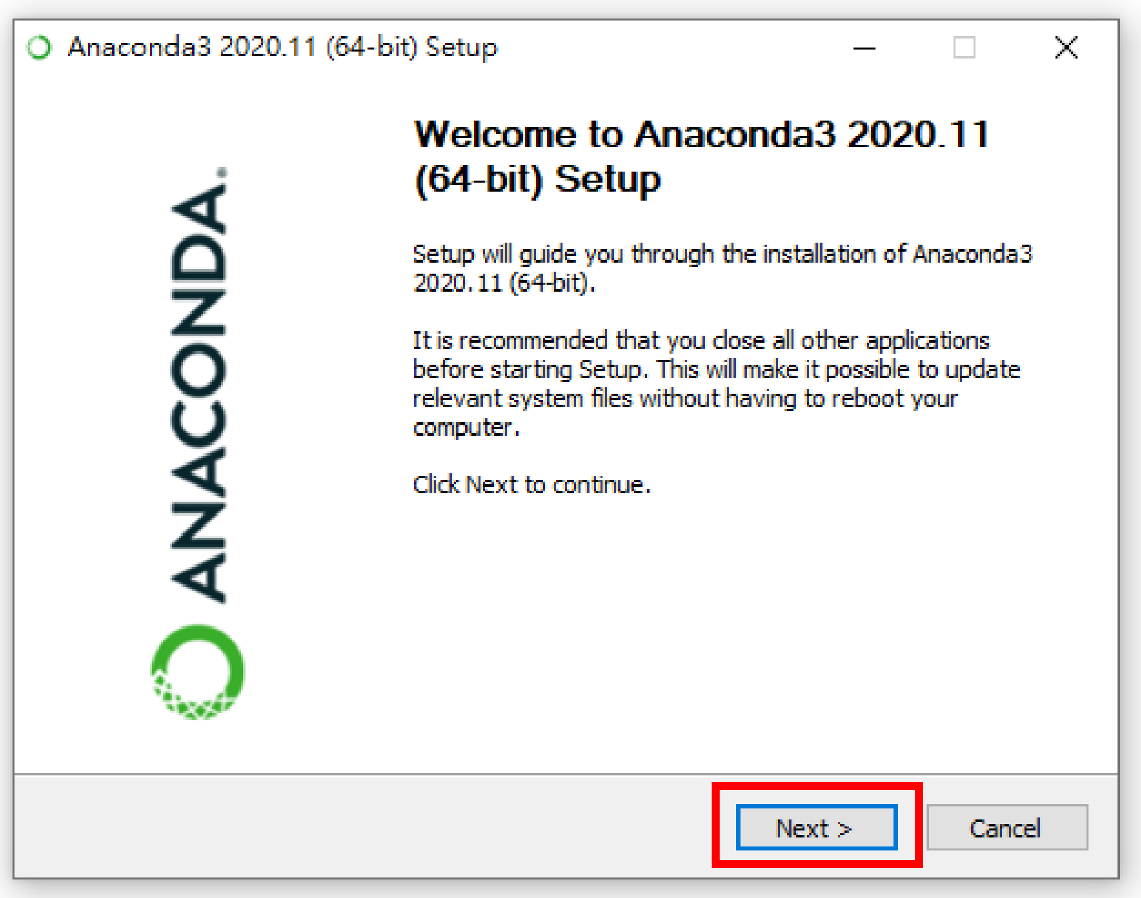
Anaconda Installers

Windows	MacOS	Linux
Python 3.8	Python 3.8	Python 3.8
64-Bit Graphical Installer (457 MB)	64-Bit Graphical Installer (435 MB)	64-Bit (x86) Installer (529 MB)
32-Bit Graphical Installer (403 MB)	64-Bit Command Line Installer (428 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



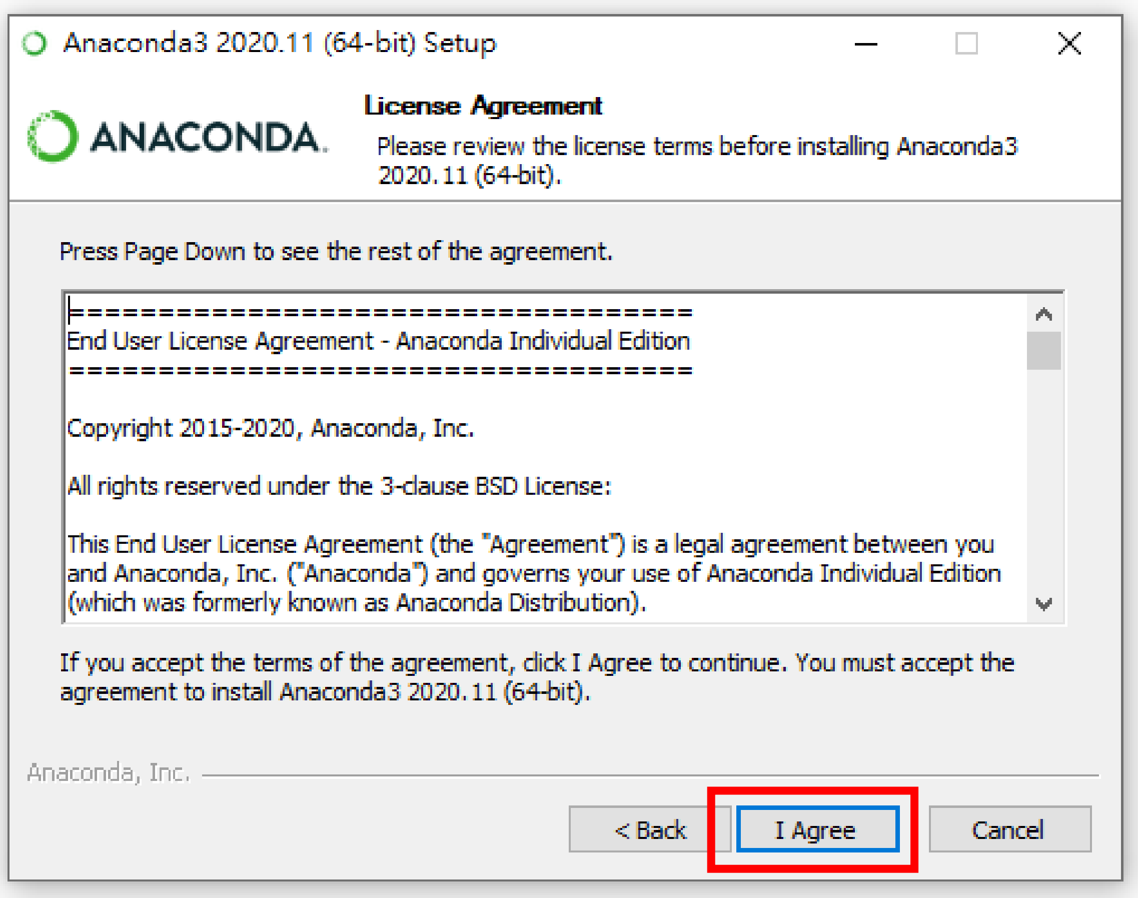
Anaconda3 2020.11 (64-bit) Setup

Welcome to Anaconda3 2020.11 (64-bit) Setup

Setup will guide you through the installation of Anaconda3 2020.11 (64-bit).

It is recommended that you close all other applications before starting Setup. This will make it possible to update relevant system files without having to reboot your computer.

Click Next to continue.



Anaconda3 2020.11 (64-bit) Setup

License Agreement

Please review the license terms before installing Anaconda3 2020.11 (64-bit).

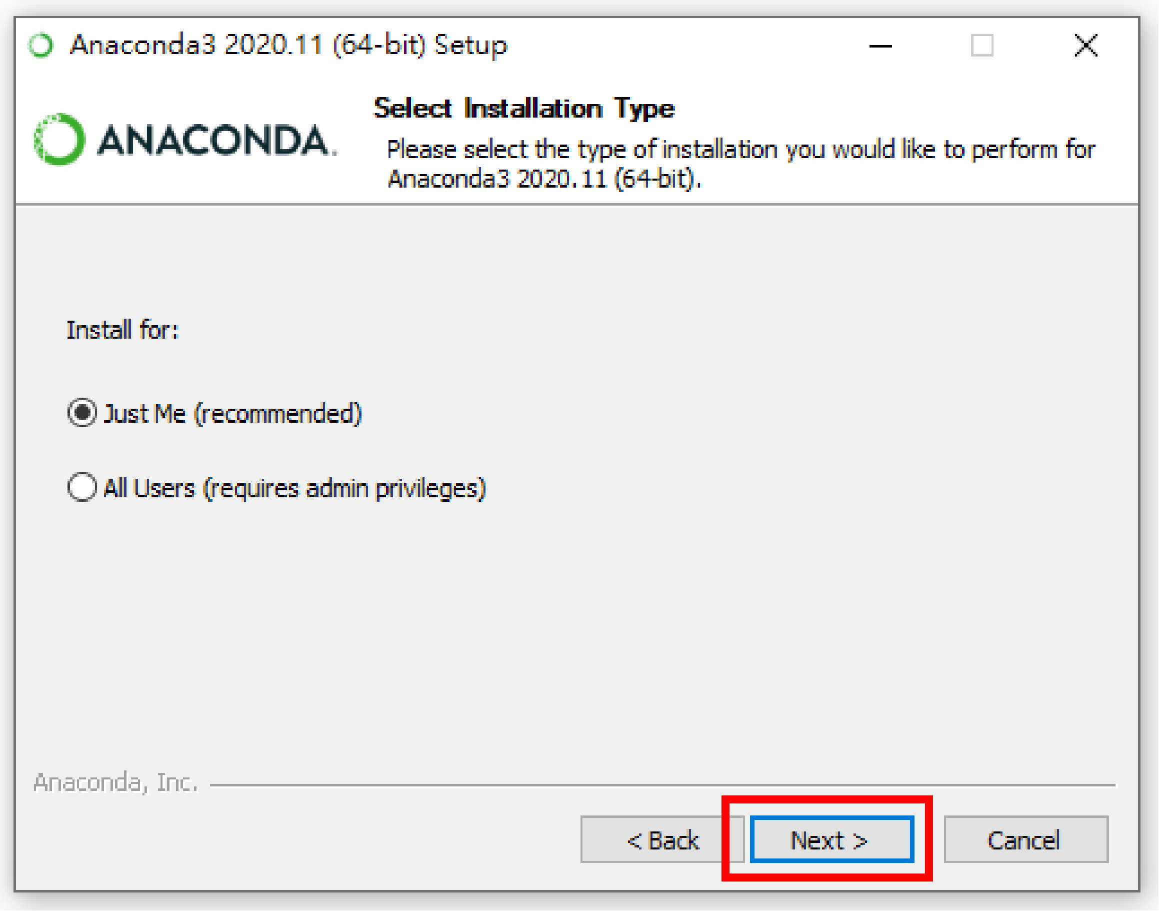
Press Page Down to see the rest of the agreement.

```
===================================
End User License Agreement - Anaconda Individual Edition
===================================

Copyright 2015-2020, Anaconda, Inc.

All rights reserved under the 3-clause BSD License:

This End User License Agreement (the "Agreement") is a legal agreement between you
and Anaconda, Inc. ("Anaconda") and governs your use of Anaconda Individual Edition
(which was formerly known as Anaconda Distribution).
```

If you accept the terms of the agreement, click I Agree to continue. You must accept the agreement to install Anaconda3 2020.11 (64-bit).

Anaconda, Inc.

Anaconda3 Setup



Anaconda3 2020.11 (64-bit) Setup

Select Installation Type

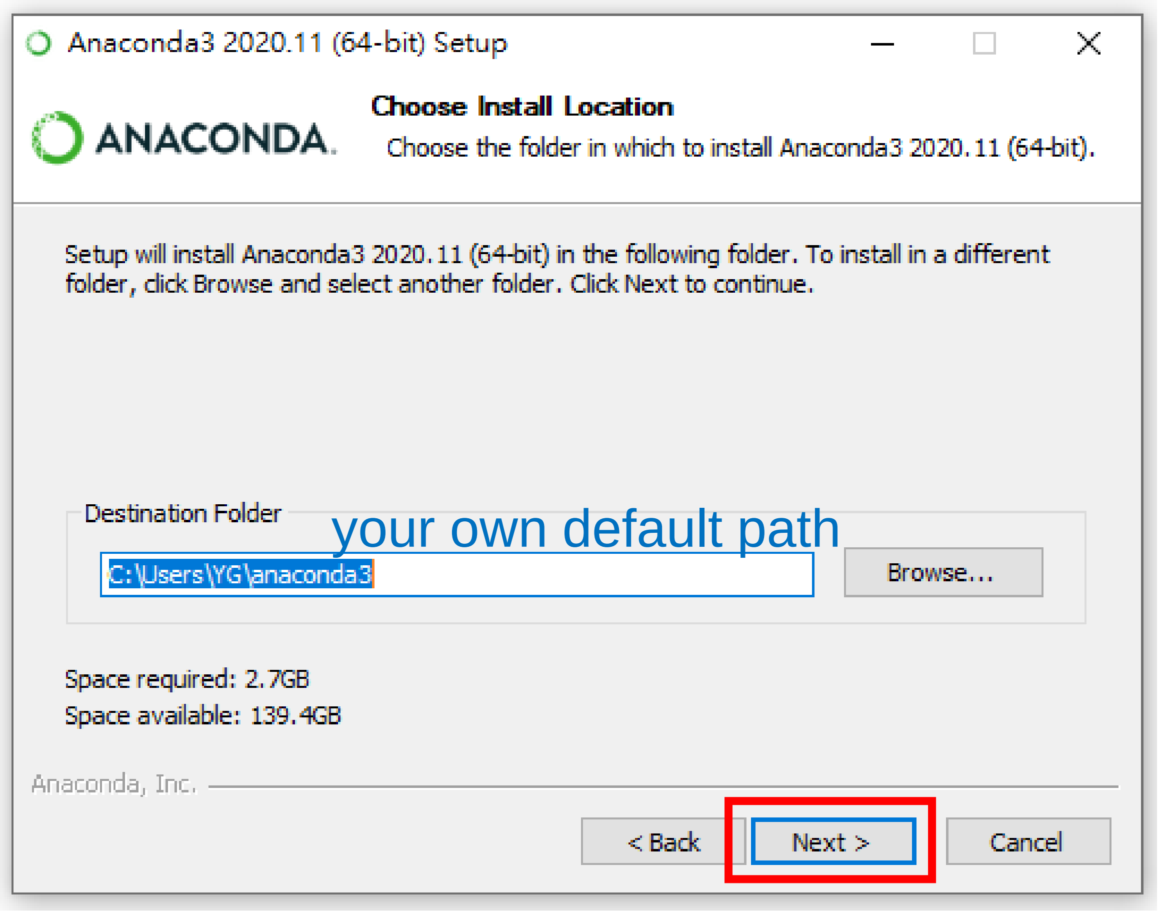
Please select the type of installation you would like to perform for Anaconda3 2020.11 (64-bit).

Install for:

● Just Me (recommended)

○ All Users (requires admin privileges)

Anaconda, Inc.



Anaconda3 2020.11 (64-bit) Setup

Choose Install Location

Choose the folder in which to install Anaconda3 2020.11 (64-bit).

Setup will install Anaconda3 2020.11 (64-bit) in the following folder. To install in a different folder, click Browse and select another folder. Click Next to continue.

Destination Folder: C:\Users\YG\anaconda3

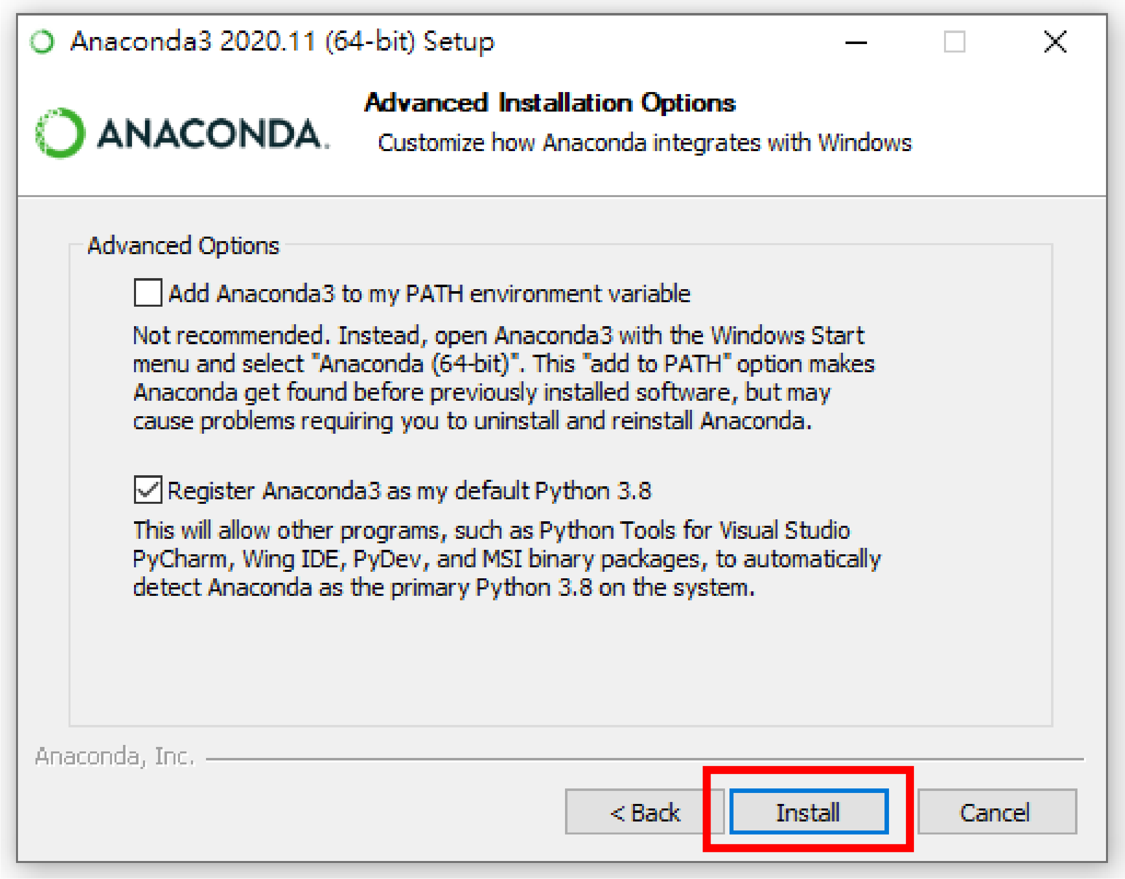
your own default path

Space required: 2.7GB

Space available: 139.4GB

Anaconda, Inc.

Anaconda3 Setup



Anaconda3 2020.11 (64-bit) Setup

Advanced Installation Options

Customize how Anaconda integrates with Windows

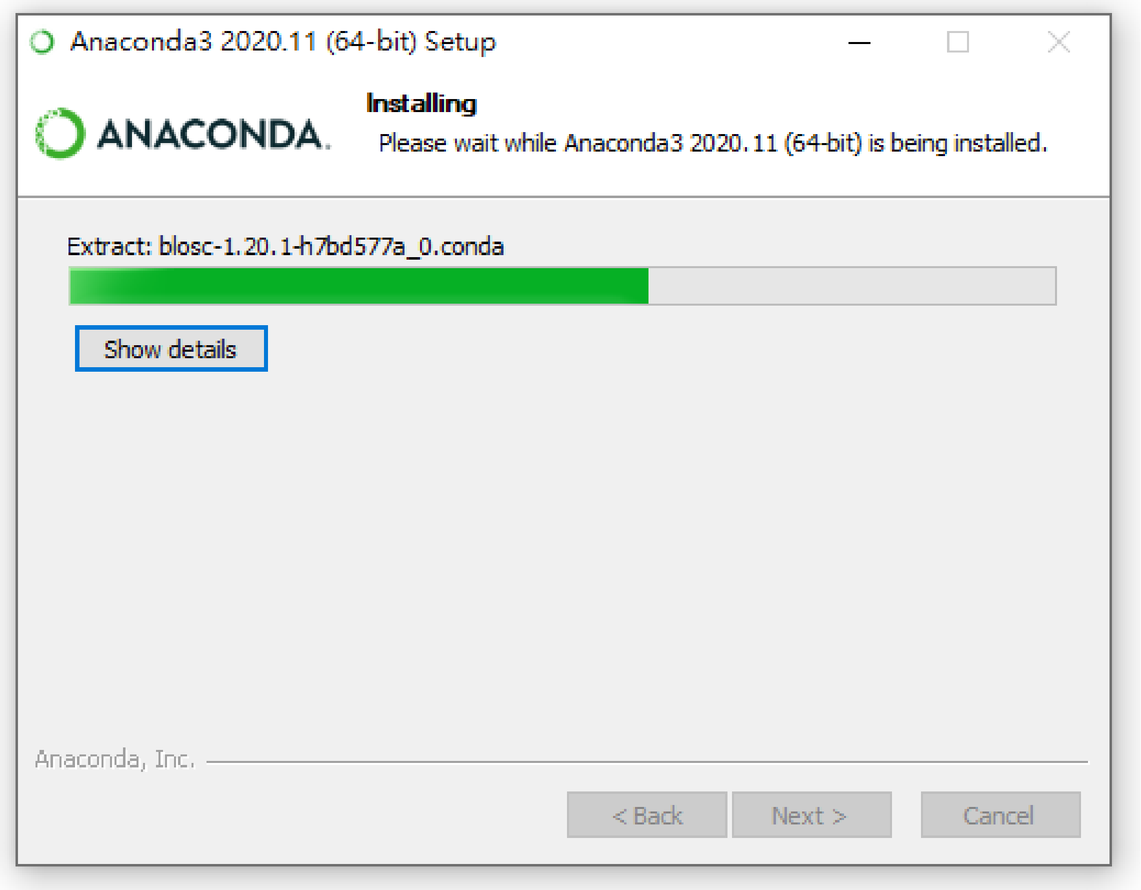
Advanced Options

□ Add Anaconda3 to my PATH environment variable

Not recommended. Instead, open Anaconda3 with the Windows Start menu and select "Anaconda (64-bit)". This "add to PATH" option makes Anaconda get found before previously installed software, but may cause problems requiring you to uninstall and reinstall Anaconda.

☑ Register Anaconda3 as my default Python 3.8

This will allow other programs, such as Python Tools for Visual Studio PyCharm, Wing IDE, PyDev, and MSI binary packages, to automatically detect Anaconda as the primary Python 3.8 on the system.



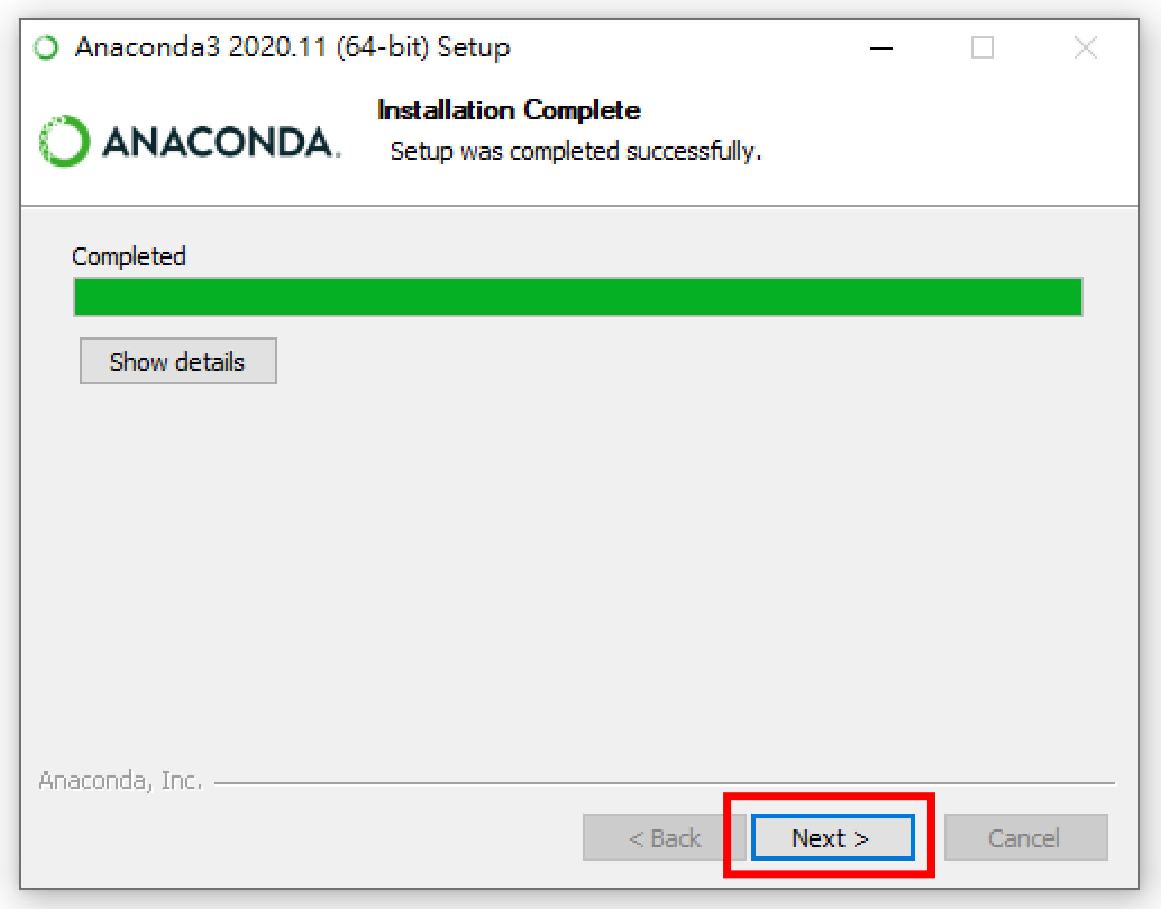
Anaconda3 2020.11 (64-bit) Setup

Installing

Please wait while Anaconda3 2020.11 (64-bit) is being installed.

Extract: blosc-1.20.1-h7bd577a_0.conda

Anaconda3 Setup

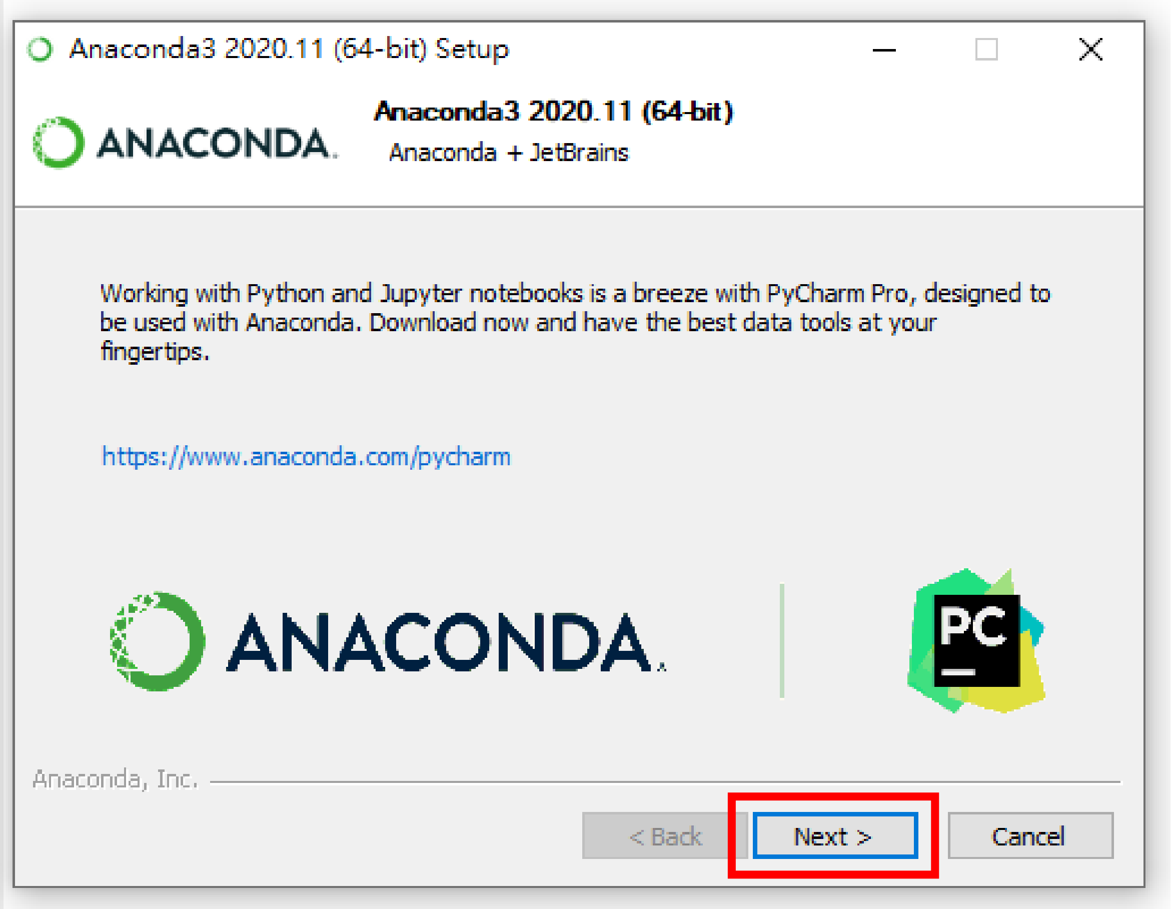


Anaconda3 2020.11 (64-bit) Setup

Installation Complete

Setup was completed successfully.

Completed



Anaconda3 2020.11 (64-bit) Setup

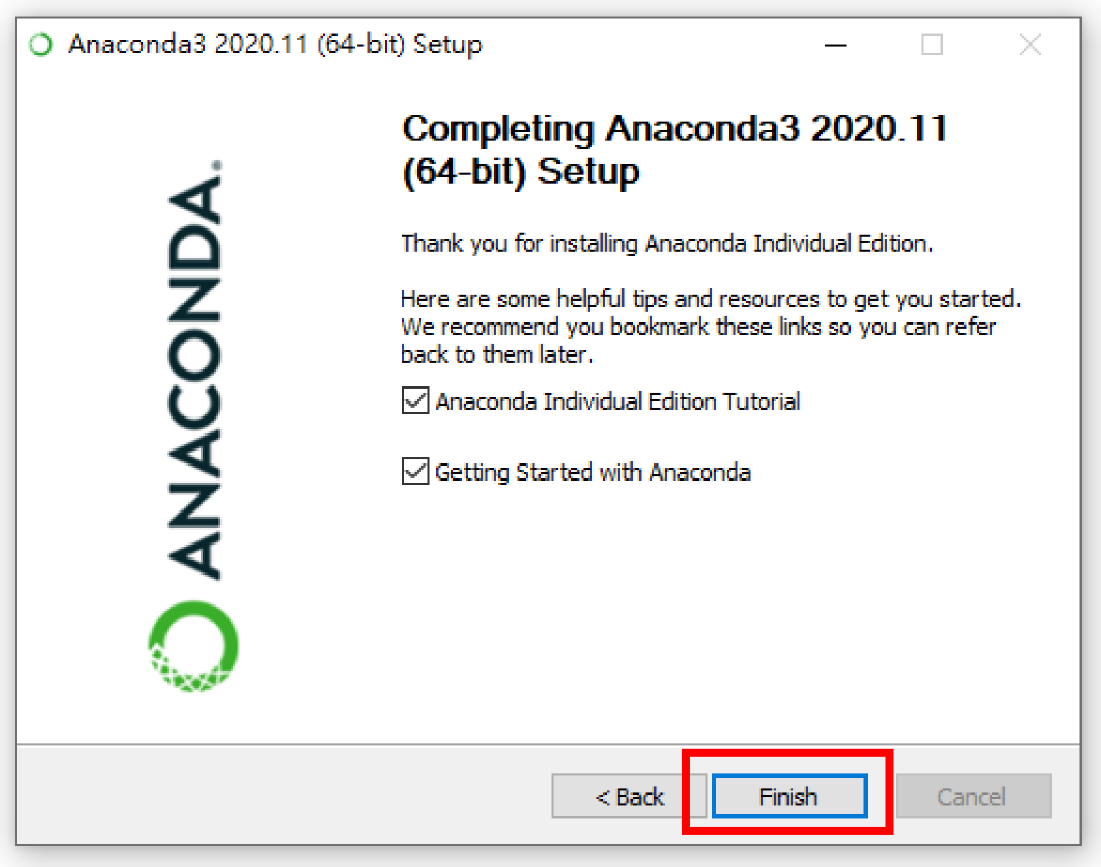
Anaconda3 2020.11 (64-bit)

Anaconda + JetBrains

Working with Python and Jupyter notebooks is a breeze with PyCharm Pro, designed to be used with Anaconda. Download now and have the best data tools at your fingertips.

https://www.anaconda.com/pycharm

Anaconda3 Setup



Anaconda3 2020.11 (64-bit) Setup

Completing Anaconda3 2020.11 (64-bit) Setup

Thank you for installing Anaconda Individual Edition.

Here are some helpful tips and resources to get you started. We recommend you bookmark these links so you can refer back to them later.

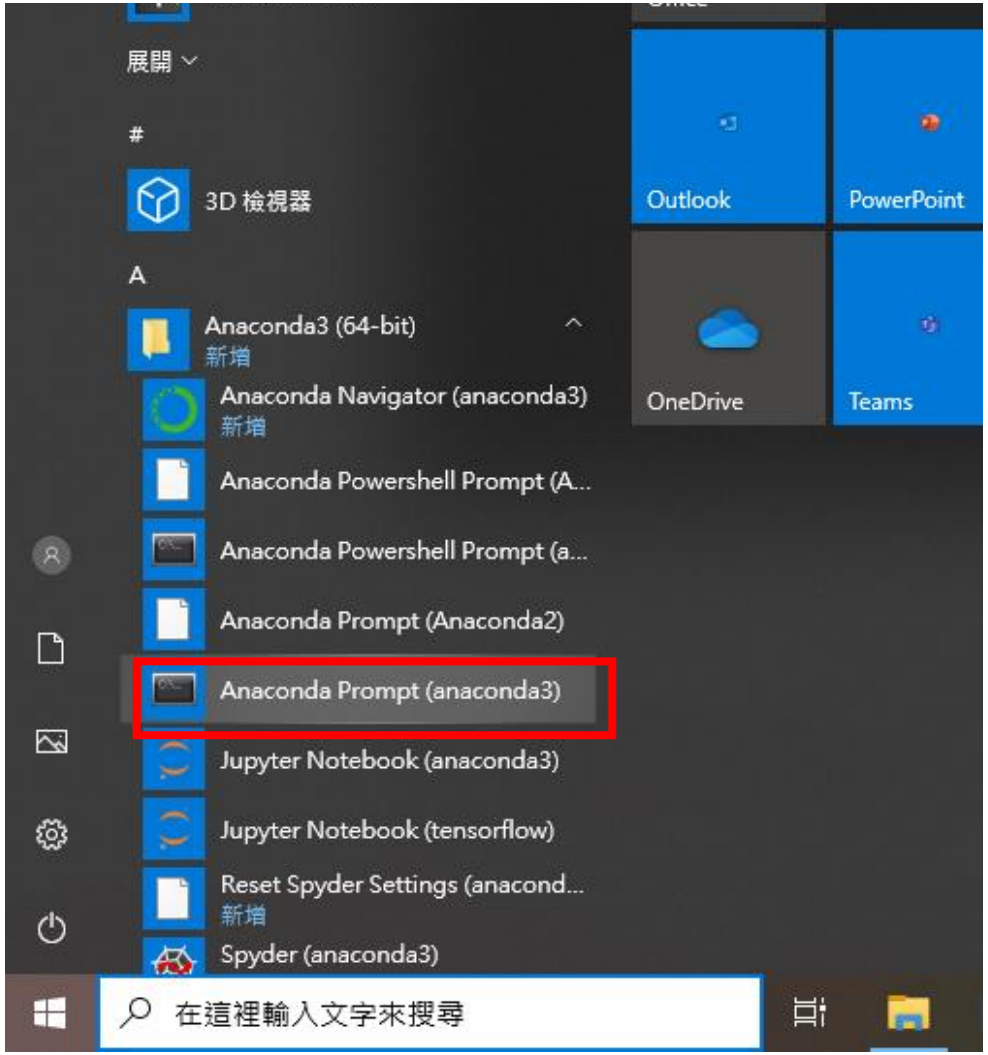
☑ Anaconda Individual Edition Tutorial

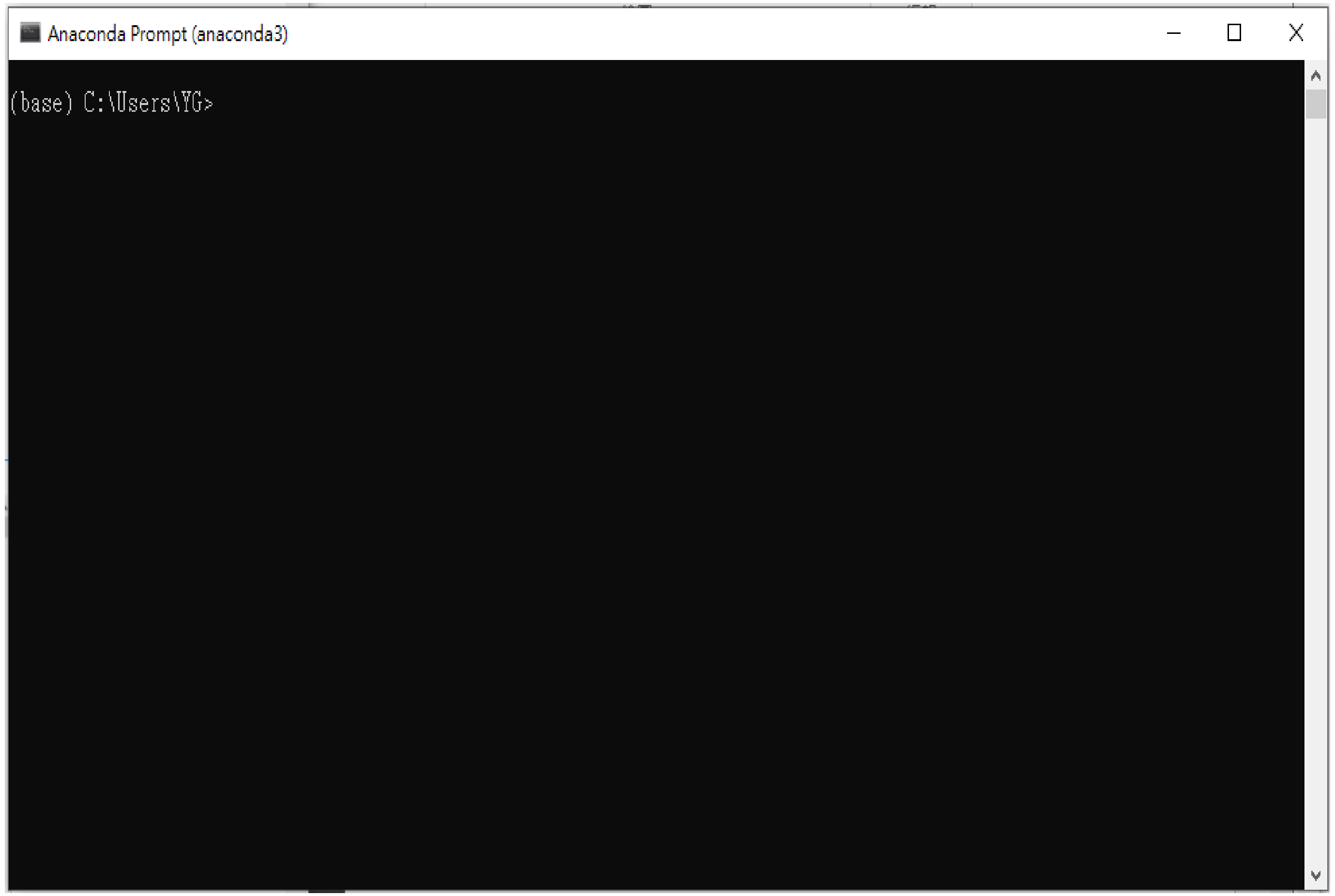
☑ Getting Started with Anaconda

Tensorflow Environment Setup

Tensorflow Environment Setup

開始 > Anaconda3 (64-bit) > Anaconda Prompt (anaconda3)


展開
#
3D 檢視器
A
Anaconda3 (64-bit)
新增
Anaconda Navigator (anaconda3)
新增
Anaconda Powershell Prompt (A...
Anaconda Powershell Prompt (a...
Anaconda Prompt (Anaconda2)
Anaconda Prompt (anaconda3)
Jupyter Notebook (anaconda3)
Jupyter Notebook (tensorflow)
Reset Spyder Settings (anacond...
新增
Spyder (anaconda3)
Outlook
PowerPoint
OneDrive
Teams
在這裡輸入文字來搜尋



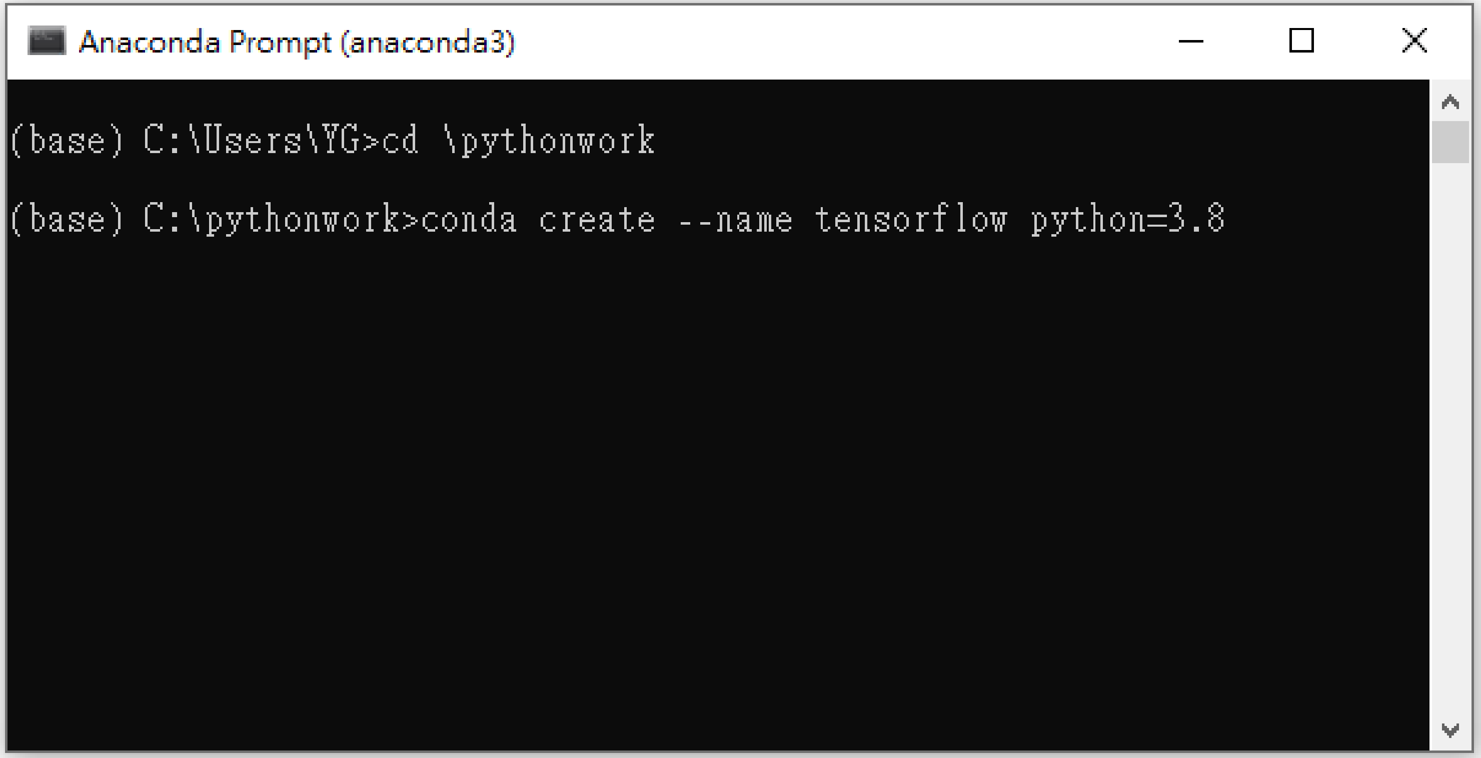
```
(base) C:\Users\YG>
```

Tensorflow Environment Setup

使用 conda 命令來建立一個命名為 tensorflow 的虛擬環境
並在裡面安裝 Python 3.8 版本

```
$ conda create --name tensorflow python=3.8
```

畫面出現“Proceed([y]/n)?”
請按 y 繼續



```
(base) C:\Users\YG>cd \pythonwork

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

TensorFlow Environment Setup

1. 啟動剛建立的anaconda虛擬環境

```
$ conda activate tensorflow
```

2. 安裝 Tensorflow

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

3. 安裝 Keras

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

4. 安裝 matplotlib

```
$ conda install matplotlib
```

5. 安裝 numpy

```
$ conda install numpy
```

6. 安裝 emnist

```
$ pip install emnist
```

7. 安裝 Jupyter notebook

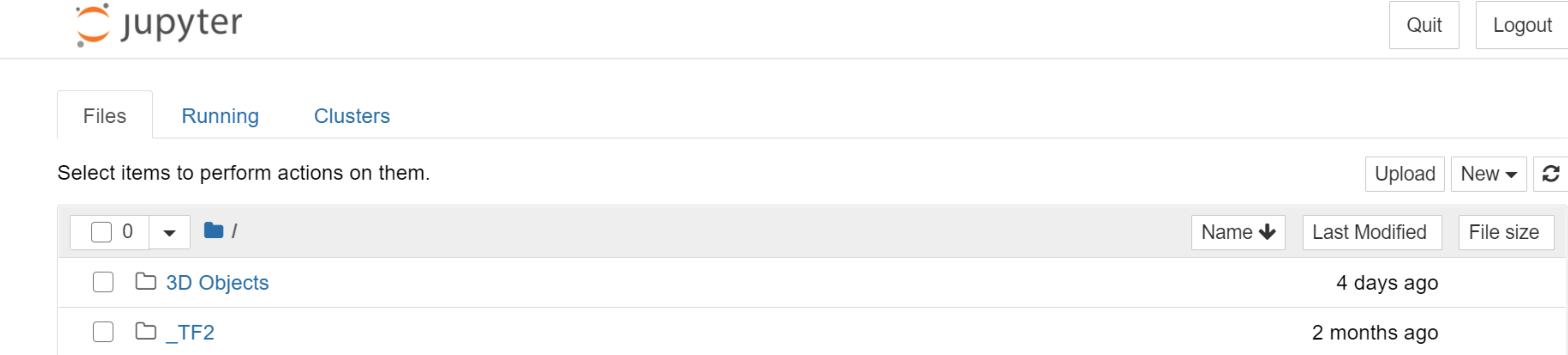
```
$ conda install jupyter notebook
```

- 如果安裝過程遇到問題，可以上網查詢相關強制安裝指令。

TensorFlow Environment Test

TensorFlow Environment Test

1. 複製資料夾 “......\arc_contest\Synopsys_SDK\Example_Project\Lab5_tflm_conversion_tutorial”
   到資料夾 “C:\Users\{username}\”
   (Jupyter Notebook預設路徑)
2. 開始 > Aanaconda3 (64-bit) > Jupyter Notebook (tensorflow)

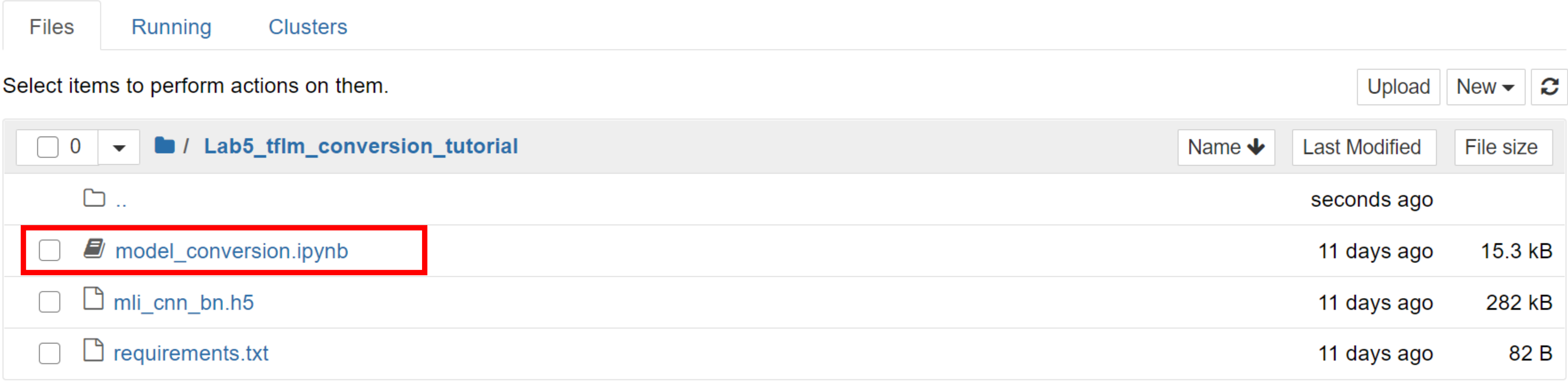


Select items to perform actions on them.

□ 3D Objects	4 days ago
□ _TF2	2 months ago

TensorFlow Environment Test

1. 回到 Jupyter Notebook
2. 點選資料夾 Lab5_tflm_conversion_tutorial
3. 開啟 model_conversion.ipynb



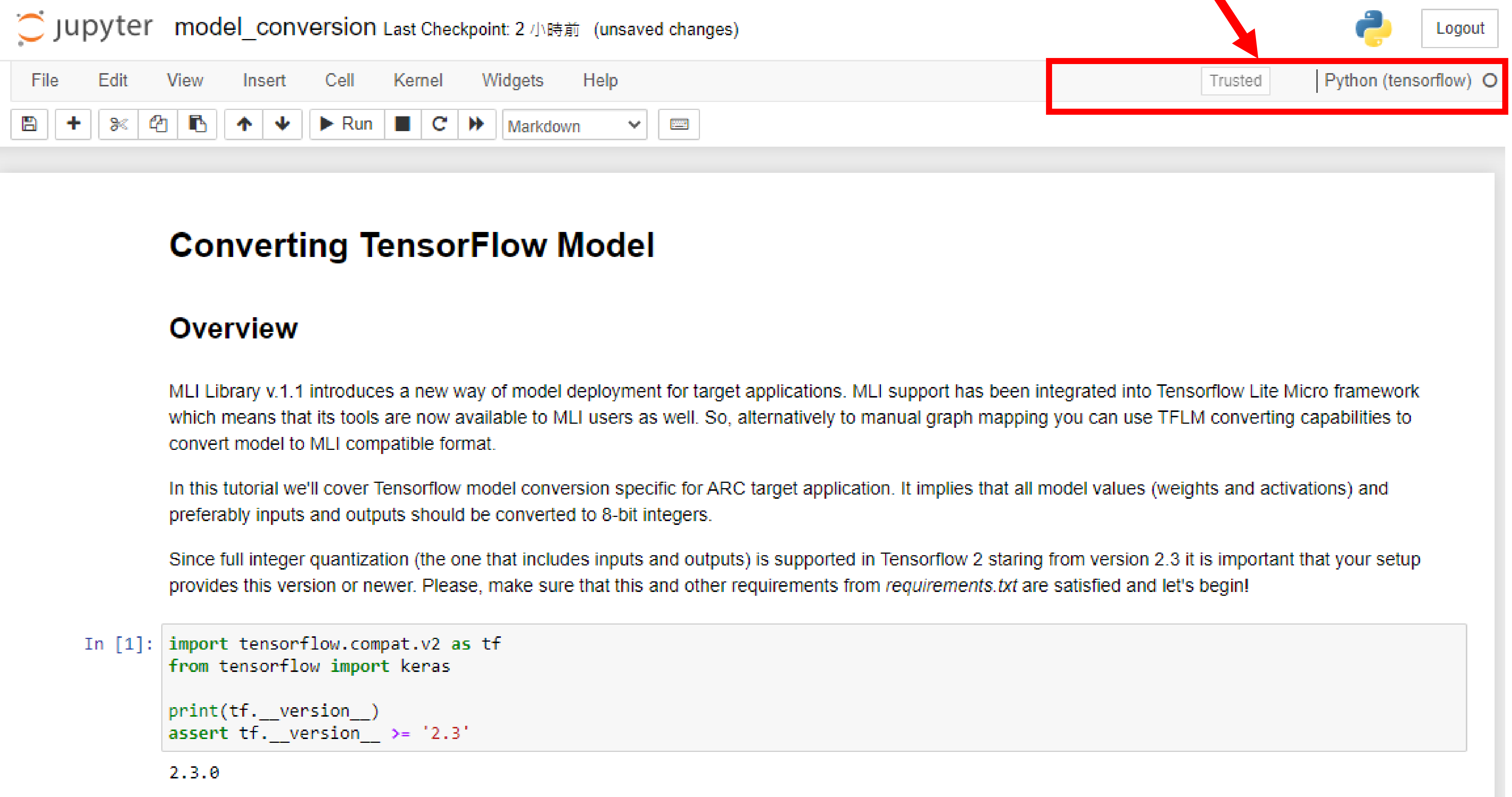
Select items to perform actions on them.

/ **Lab5_tflm_conversion_tutorial**

	Name	Last Modified	File size
	..	seconds ago	
□	model_conversion.ipynb	11 days ago	15.3 kB
□	mli_cnn_bn.h5	11 days ago	282 kB
□	requirements.txt	11 days ago	82 B

TensorFlow Environment Test

4. 請先確認紅框內是否顯示Python (tensorflow)，且()中的環境是否正確



Converting TensorFlow Model

Overview

MLI Library v.1.1 introduces a new way of model deployment for target applications. MLI support has been integrated into Tensorflow Lite Micro framework which means that its tools are now available to MLI users as well. So, alternatively to manual graph mapping you can use TFLM converting capabilities to convert model to MLI compatible format.

In this tutorial we'll cover Tensorflow model conversion specific for ARC target application. It implies that all model values (weights and activations) and preferably inputs and outputs should be converted to 8-bit integers.

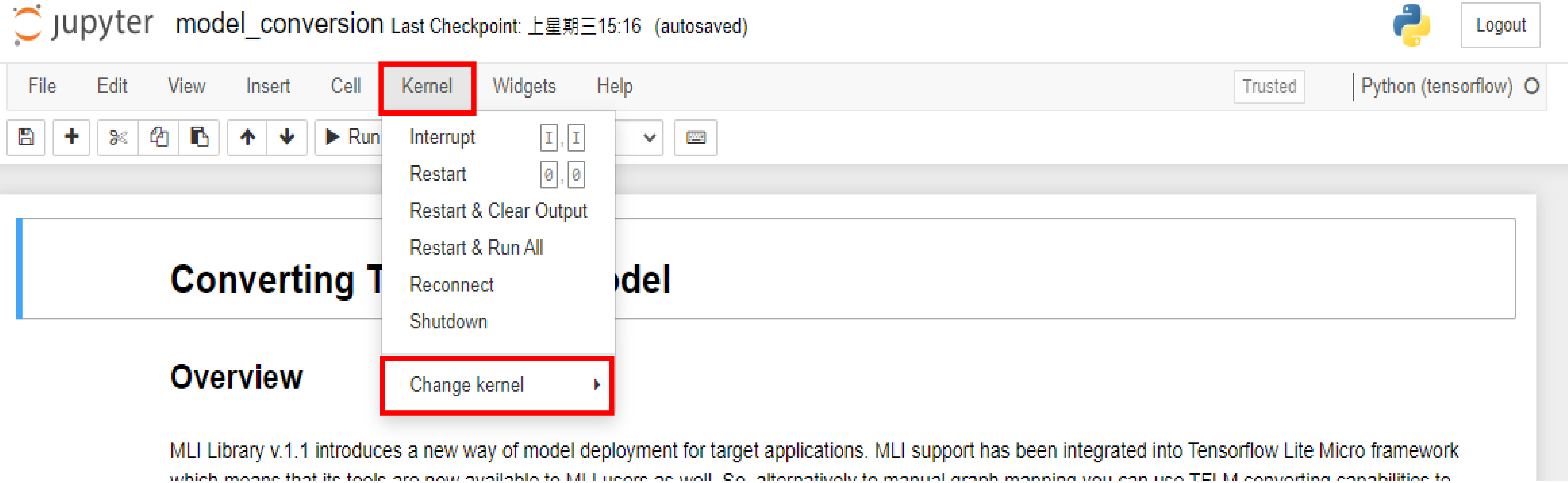
Since full integer quantization (the one that includes inputs and outputs) is supported in Tensorflow 2 staring from version 2.3 it is important that your setup provides this version or newer. Please, make sure that this and other requirements from *requirements.txt* are satisfied and let's begin!

In [1]:
```
import tensorflow.compat.v2 as tf
from tensorflow import keras

print(tf.__version__)
assert tf.__version__ >= '2.3'
```

```
2.3.0
```

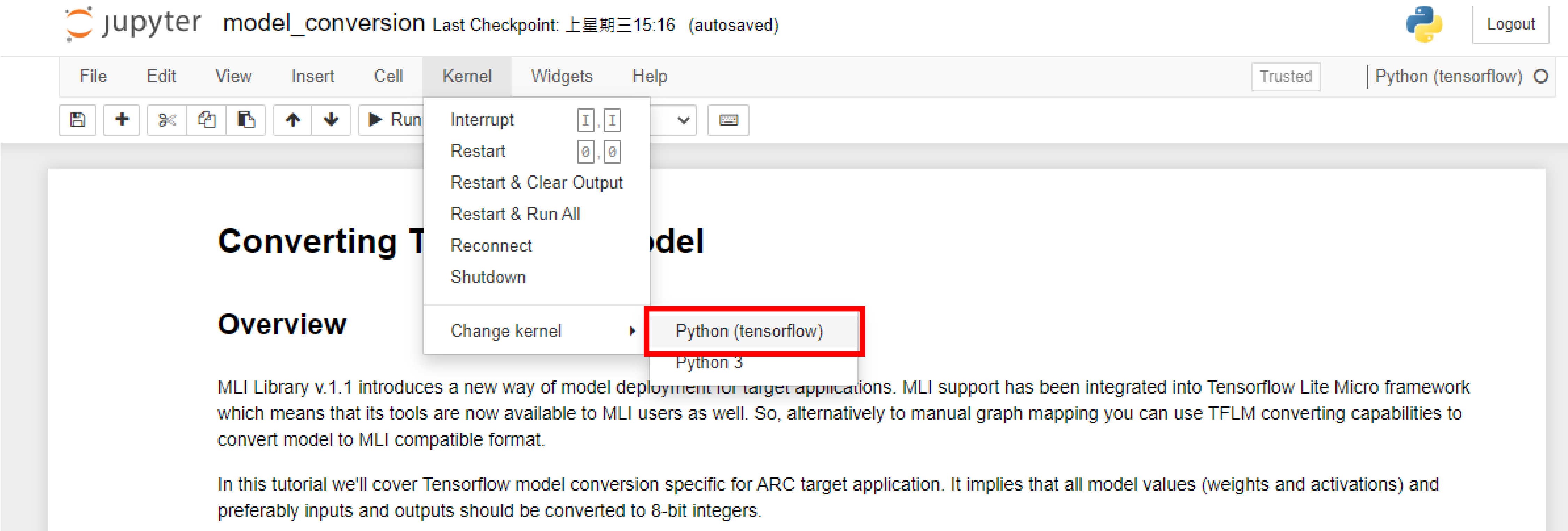
TensorFlow Environment Test

5. 若上頁有誤請試著做以下步驟修正:



MLI Library v.1.1 introduces a new way of model deployment for target applications. MLI support has been integrated into Tensorflow Lite Micro framework which means that its tools are now available to MLI users as well. So, alternatively to manual graph mapping you can use TFLM converting capabilities to

TensorFlow Environment Test



Converting T odel

Overview

MLI Library v.1.1 introduces a new way of model deployment for target applications. MLI support has been integrated into Tensorflow Lite Micro framework which means that its tools are now available to MLI users as well. So, alternatively to manual graph mapping you can use TFLM converting capabilities to convert model to MLI compatible format.

In this tutorial we'll cover Tensorflow model conversion specific for ARC target application. It implies that all model values (weights and activations) and preferably inputs and outputs should be converted to 8-bit integers.

TensorFlow Environment Test

6. 若Kernel沒有Python(tensorflow)的選項:
   安裝 ipykernel

   ```
   $  pip install ipykernel
   ```

   在(tensorflow)環境下輸入

   ```
   $  python -m ipykernel install --name tensorflow
   ```

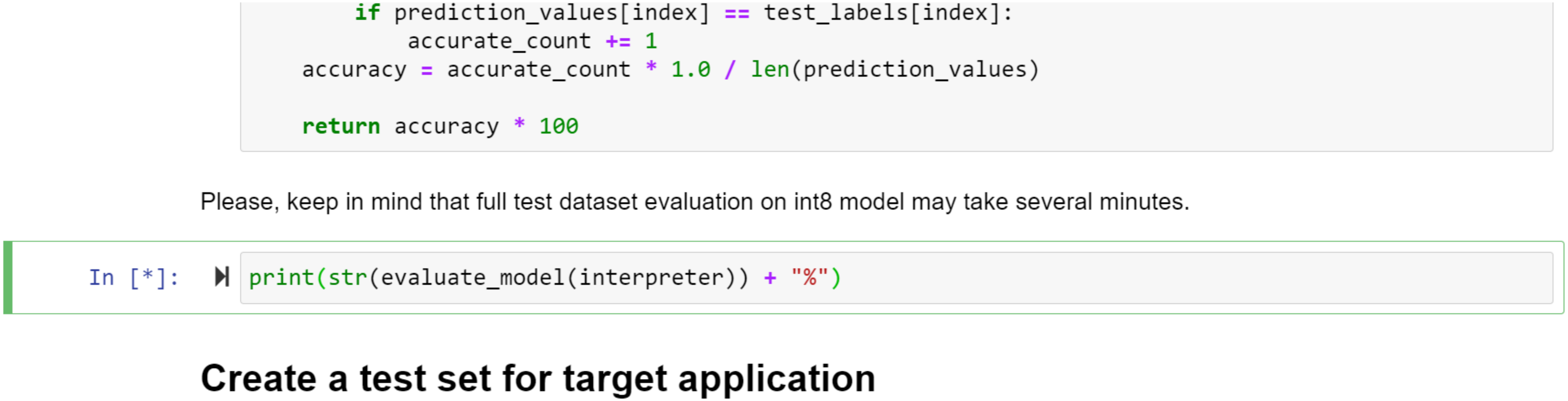
   然後啟動jupyter notebook，點選kernel會發現有tensorflow

TensorFlow Environment Test

7. 若執行過程有錯誤，請確認下列module是否有安裝，或版本正確。
   Numpy>=1.16.4
   matplotlibjupyterlab>=1.1.0
   tensorflow==2.3.0
   keras>=2.2.4
   emnist

TensorFlow Environment Test

8. evaluate_model會執行較久，請耐心等候



```
        if prediction_values[index] == test_labels[index]:
            accurate_count += 1
    accuracy = accurate_count * 1.0 / len(prediction_values)

    return accuracy * 100
```

Please, keep in mind that full test dataset evaluation on int8 model may take several minutes.

```
In [*]:  print(str(evaluate_model(interpreter)) + "%")
```

Create a test set for target application

TensorFlow Environment Test

9. 執行完成後，回到Lab5_tflm_conversion_tutorial資料夾會產生generated/emnist_model_int8.tflite與test_samples.cc代表TensorFlow開發環境已經安裝完成

```
Lab5_tflm_conversion_tutorial
|
----mli_cnn_bn.h5
----model_conversion.ipynb
----requirements.txt
---- test_samples.cc
----generated
    |
    ---- emnist_model_int8.tflite
```

TensorFlow Environment Test

10. 開啟Cygwin，並移動到Lab5_tflm_conversion_tutorial/generated

```
$ cd c:
$ cd Users/{username}/ (Jupyter Notebook Path)
$ cd Lab5_tflm_conversion_tutorial/generated/
```

11. Convert tflite to C model

```
$ cd Lab5_tflm_conversion_tutorial/generated/
$ xxd -i emnist_model_int8.tflite > model.h
```

12. You will see your TensorFlow model file model.h
13. Integrate model.h and test_samples.cc to your WE-I project (Later tutorial)