安裝說明 PyTorch /Cuda/ cuDnn install SOP

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深度學習準備前置作業
工具如下

- Pytorch 套件
- CUDA 是 Nvidia 專用於平行化運算的框架。
- cuDNN（CUDA Deep Neural Network Library）是CUDA 深度學習的函式庫。

小叮嚀:

- 30xx, 40xx 要安裝 CU11 以上的版本，否則無法執行
- 在一個獨立的python 環境中，能用 pip 安裝就用 pip，除非找不到適合的系統版本安裝包在使用 conda 指令安裝

CUDA 是否要安裝?

答:
如果電腦只有CPU，單純練習語法也是可以使用 pytorch，不一定要安裝 CUDA，
但是如果有部屬需求，例如導出TensorRT模型，則需要安裝CUDA

確認GPU驅動是否要更新

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法一: 指令確認

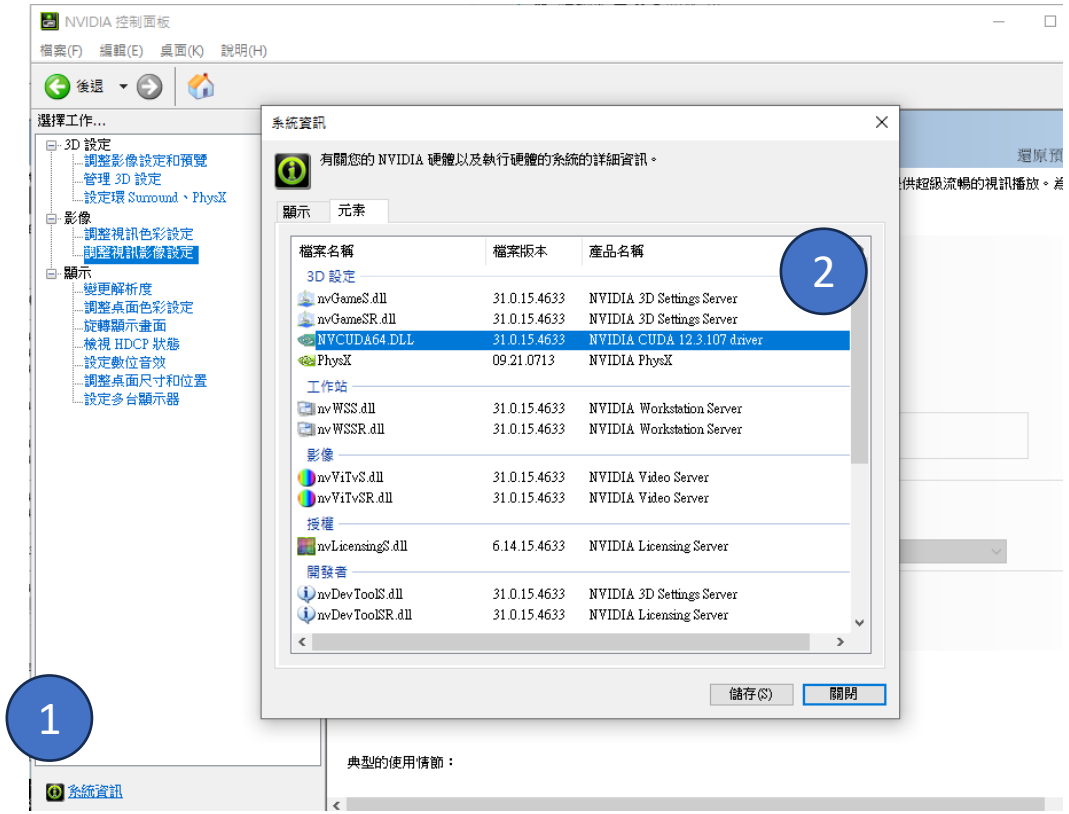
```
user@DESKTOP-QA3SSAC MINGW64 ~
$ nvidia-smi
Sun Jan 14 08:59:55 2024
+---------------------------------------------------------------------------------------+
| NVIDIA-SMI 546.33                 Driver Version: 546.33       CUDA Version: 12.3     |
|-----------------------------------------+----------------------+----------------------+
| GPU  Name                     TCC/WDDM  | Bus-Id        Disp.A | Volatile Uncorr. ECC |
| Fan  Temp   Perf          Pwr:Usage/Cap |         Memory-Usage | GPU-Util  Compute M. |
|                                         |                      |               MIG M. |
|=========================================+======================+======================|
|   0  NVIDIA GeForce RTX 3090      WDDM  | 00000000:01:00.0  On |                  N/A |
|  0%   33C    P8             28W / 390W |    624MiB / 24576MiB |      0%      Default |
|                                         |                      |                  N/A |
+-----------------------------------------+----------------------+----------------------+

+---------------------------------------------------------------------------------------+
| Processes:                                                                            |
|  GPU   GI   CI        PID   Type   Process name                            GPU Memory |
|        ID   ID                                                             Usage      |
|=======================================================================================|
|    0   N/A  N/A       984    C+G   ...n\120.0.2210.121\msedgewebview2.exe    N/A      |
|    0   N/A  N/A      2624    C+G   ...5n1h2txyewy\ShellExperienceHost.exe    N/A      |
|    0   N/A  N/A      3440    C+G   ....Search_cw5n1h2txyewy\SearchApp.exe    N/A      |
|    0   N/A  N/A      8708    C+G   ...yewy\Microsoft.AAD.BrokerPlugin.exe    N/A      |
|    0   N/A  N/A      9300    C+G   ...les\Microsoft OneDrive\OneDrive.exe    N/A      |
|    0   N/A  N/A     10352    C+G   ...GeForce Experience\NVIDIA Share.exe    N/A      |
|    0   N/A  N/A     10756    C+G   C:\Windows\explorer.exe                   N/A      |
|    0   N/A  N/A     10968    C+G   ...CBS_cw5n1h2txyewy\TextInputHost.exe    N/A      |
|    0   N/A  N/A     13336    C+G   ...oogle\Chrome\Application\chrome.exe    N/A      |
|    0   N/A  N/A     14876    C+G   ...2txyewy\StartMenuExperienceHost.exe    N/A      |
|    0   N/A  N/A     23632    C+G   ...4__8wekyb3d8bbwe\bin\PBIDesktop.exe    N/A      |
|    0   N/A  N/A     27104    C+G   ...siveControlPanel\SystemSettings.exe    N/A      |
|    0   N/A  N/A     30444    C+G   ...ience\NVIDIA GeForce Experience.exe    N/A      |
+---------------------------------------------------------------------------------------+

user@DESKTOP-QA3SSAC MINGW64 ~
$
```

Driver version: 546.33
CUDA version: 12.3 (最高支援)

法二: GUI 確認



1. 以 RTX 3090 為例
2. 打開CMD, 輸入 nvidia-smi 確認 GPU 驅動程式以及 CuDA 版本

在終端機輸入nvidia-smi指令，會跳出目前使用的顯示卡以及Cuda Driver API 的版本

更新GPU驅動

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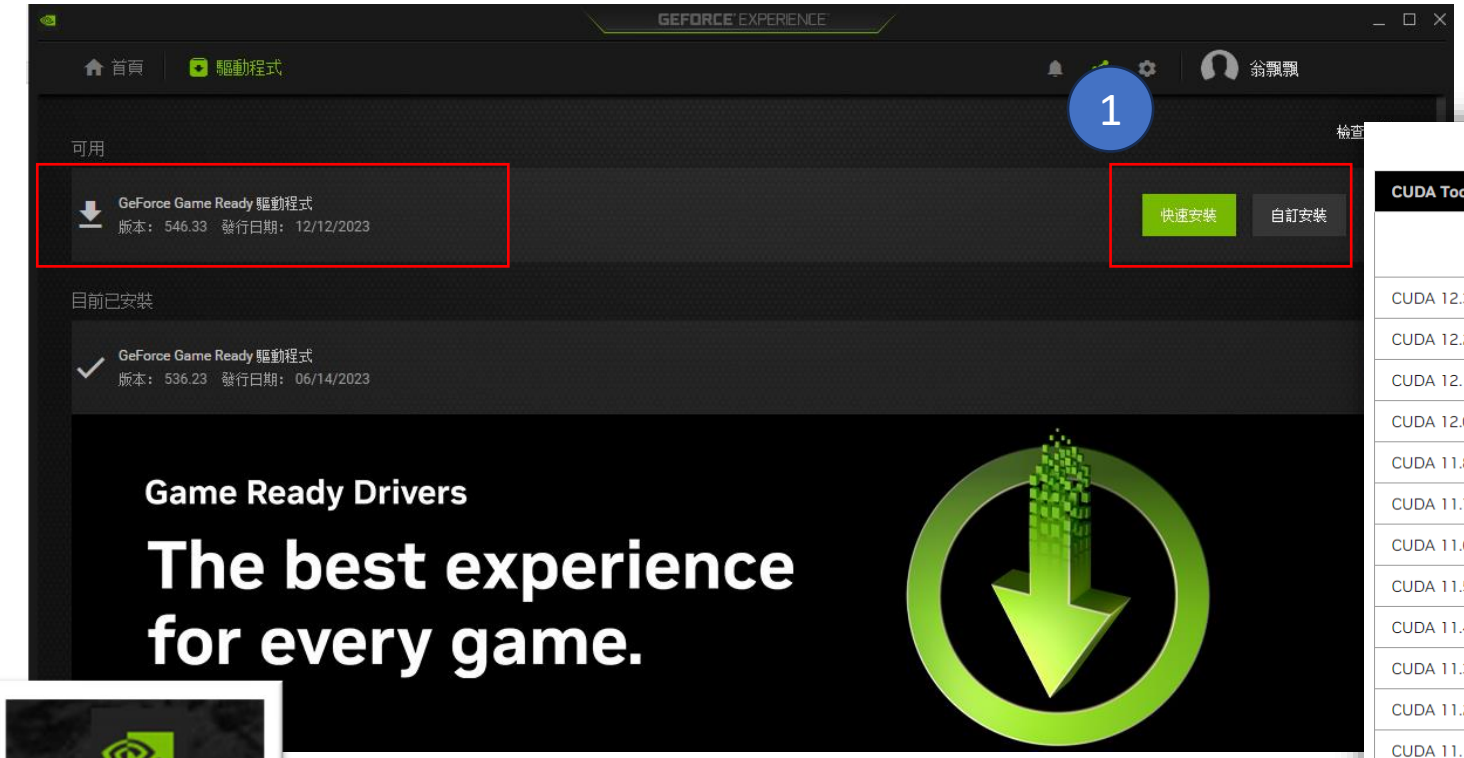

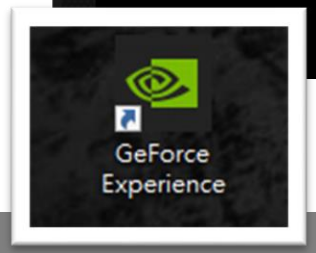

Table 2: CUDA Toolkit and Minimum Required Driver Version for CUDA Minor Version Compatibility

CUDA Toolkit	Minimum Required Driver Version for CUDA Minor Version Compatibility*	
	Linux x86_64 Driver Version	Windows x86_64 Driver Version
CUDA 12.3.x	>=525.60.13	>=527.41
CUDA 12.2.x	>=525.60.13	>=527.41
CUDA 12.1.x	>=525.60.13	>=527.41
CUDA 12.0.x	>=525.60.13	>=527.41
CUDA 11.8.x	>=450.80.02	>=452.39
CUDA 11.7.x	>=450.80.02	>=452.39
CUDA 11.6.x	>=450.80.02	>=452.39
CUDA 11.5.x	>=450.80.02	>=452.39
CUDA 11.4.x	>=450.80.02	>=452.39
CUDA 11.3.x	>=450.80.02	>=452.39
CUDA 11.2.x	>=450.80.02	>=452.39
CUDA 11.1 (11.1.0)	>=450.80.02	>=452.39
CUDA 11.0 (11.0.3)	>=450.36.06**	>=451.22**

1. NVIDIA CUDA Toolkit Release
2. 到 https://docs.nvidia.com/cuda/cuda-toolkit-release-notes/index.html 確認 GPU 驅動對應的 CUDA 版本
3. 以RTX 3090 為例，點選 nvidia Geforce experience 自動更新 (version: 536.23 -> 546.33)

確認 CUDA 版本相依性 -1

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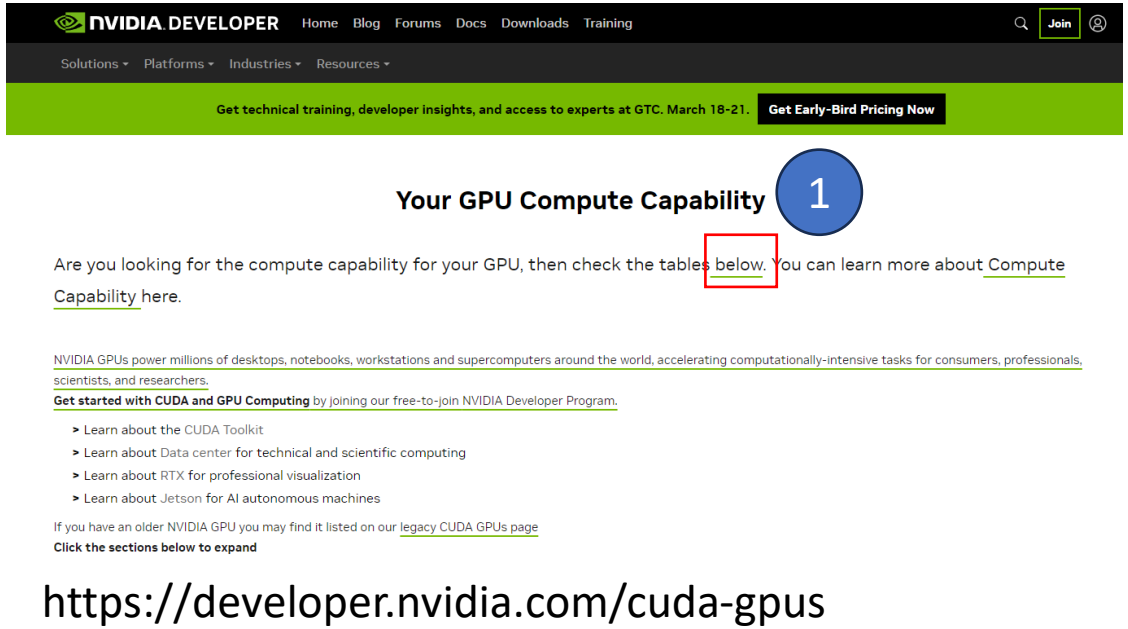

https://developer.nvidia.com/cuda-gpus

CUDA-Enabled GeForce and TITAN Products

GeForce and TITAN Products

GPU	Compute Capability
GeForce RTX 4090	8.9
GeForce RTX 4080	8.9
GeForce RTX 4070 Ti	8.9
GeForce RTX 3090 Ti	8.6
GeForce RTX 3090	8.6
GeForce RTX 3080 Ti	8.6
GeForce RTX 3080	8.6
GeForce RTX 3070 Ti	8.6
GeForce RTX 3070	8.6
Geforce RTX 3060 Ti	8.6
Geforce RTX 3060	8.6
GeForce GTX 1650 Ti	7.5
NVIDIA TITAN RTX	7.5
Geforce RTX 2080 Ti	7.5
Geforce RTX 2080	7.5
Geforce RTX 2070	7.5
Geforce RTX 2060	7.5
NVIDIA TITAN V	7.0
NVIDIA TITAN Xp	6.1

2

GeForce Notebook Products

GPU	Compute Capability
GeForce RTX 4090	8.9
GeForce RTX 4080	8.9
GeForce RTX 4070	8.9
GeForce RTX 4060	8.9
GeForce RTX 4050	8.9
GeForce RTX 3080 Ti	8.6
GeForce RTX 3080	8.6
GeForce RTX 3070 Ti	8.6
GeForce RTX 3070	8.6
GeForce RTX 3060 Ti	8.6
GeForce RTX 3060	8.6
GeForce RTX 3050 Ti	8.6
GeForce RTX 3050	8.6
Geforce RTX 2080	7.5
Geforce RTX 2070	7.5
Geforce RTX 2060	7.5
GeForce GTX 1080	6.1
GeForce GTX 1070	6.1
GeForce GTX 1060	6.1

1. 以 RTX 3090 為例
2. 到 NVIDIA DEVELOPER 網站，查看GPU型號的算力版本 (compute capability: 8.6)

確認 CUDA 版本相依性 -2

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Compute Capability (CUDA SDK support vs. Microarchitecture)

CUDA SDK version(s)	Tesla	Fermi	Kepler (early)	Kepler (late)	Maxwell	Pascal	Volta	Turing	Ampere	Ada Lovelace	Hopper
1.0[34]	1.0 – 1.1										
1.1	1.0 – 1.1+x										
2.0	1.0 – 1.1+x										
2.1 - 2.3.1[35][36][37][38]	1.0 – 1.3										
3.0 - 3.1[39][40]	1.0 –	2.0									
3.2[41]	1.0 –	2.1									
4.0 - 4.2	1.0 –	2.1+x									
5.0 - 5.5	1.0 –			3.5							
6.0	1.0 –			3.5							
6.5	1.1 –				5.x						
7.0 - 7.5		2.0 –			5.x						
8.0		2.0 –				6.x					
9.0 - 9.2			3.0 –				7.0				
10.0 - 10.2			3.0 –					7.5			
11.0[42]				3.5 –					8.0		
11.1 - 11.4[43]				3.5 –					8.6		
11.5 - 11.7.1[44]				3.5 –					8.7		
11.8[45]				3.5 –							9.0
12.0 - 12.2					5.0 –						9.0

GPU 硬體架構

1

因為 RTX 3090 的 Compute Capability = 8.6
所以CUDA 最低要求為 11.1 版

1. 以 RTX 3090 為例
2. 搭配 CUDA & CC 版本對照表確認版本號最低需求為 11.1 版
3. 以 CC = 8.6 的算力版本而言，CUDA 版本 11.1 – 12.2 都是可以的

安裝 PyTorch

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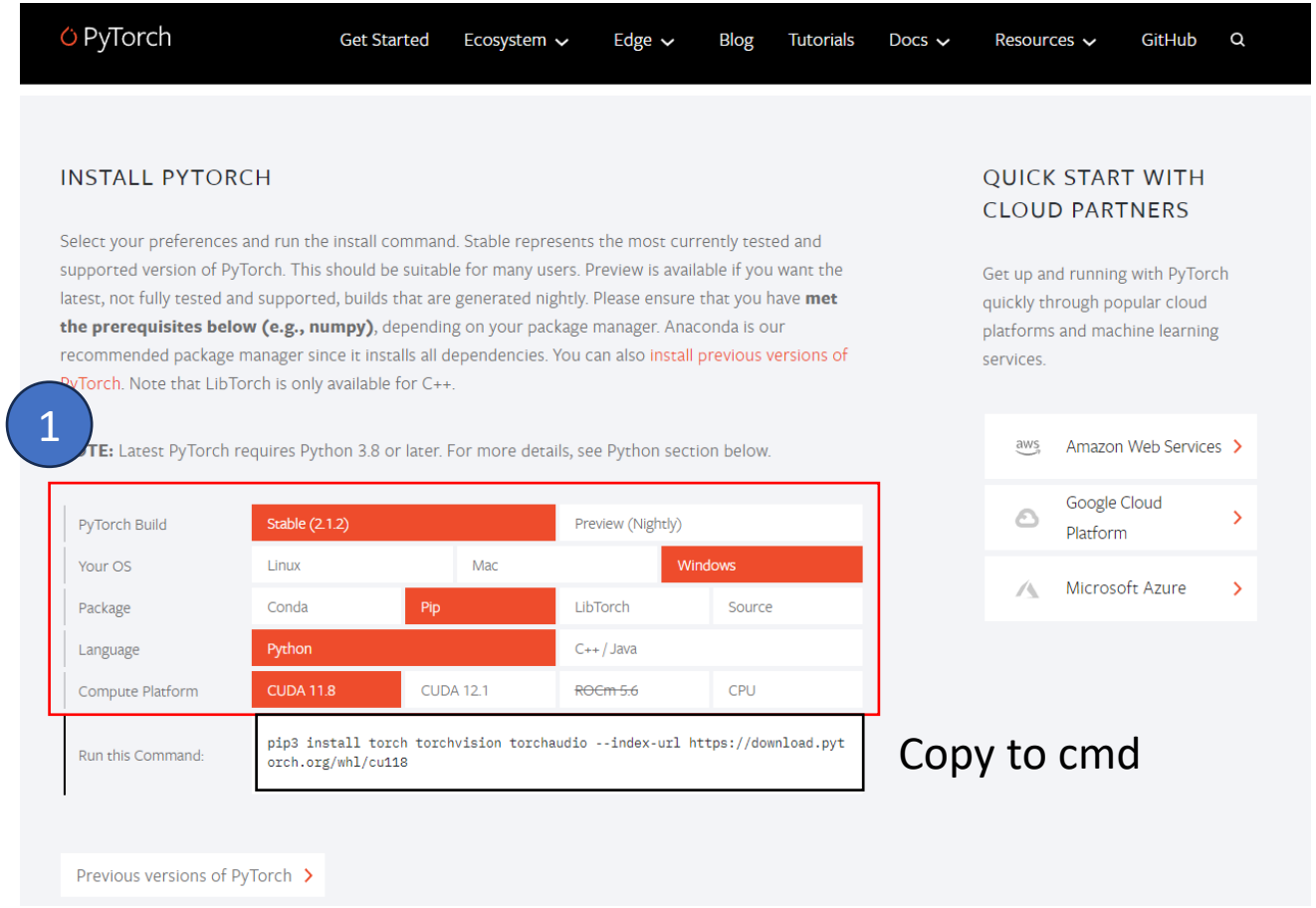

Copy to cmd

1. 以 RTX 3090 為例
2. 到 pytorch官網根據硬體型號選擇安裝指令(自動帶出)
3. 須注意最新版本的 python 可能還沒有 pytorch 支援，python 需要降版才可以安裝

安裝 CUDA

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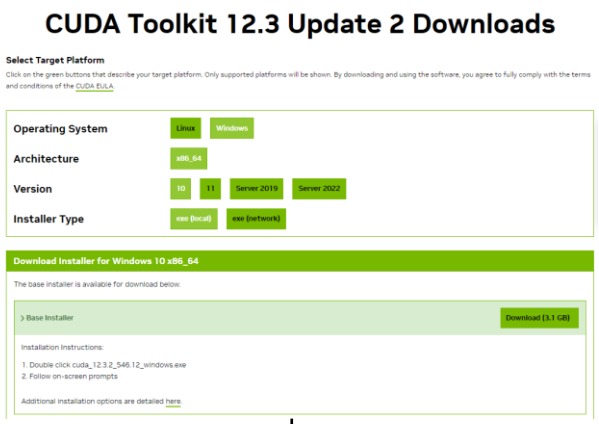
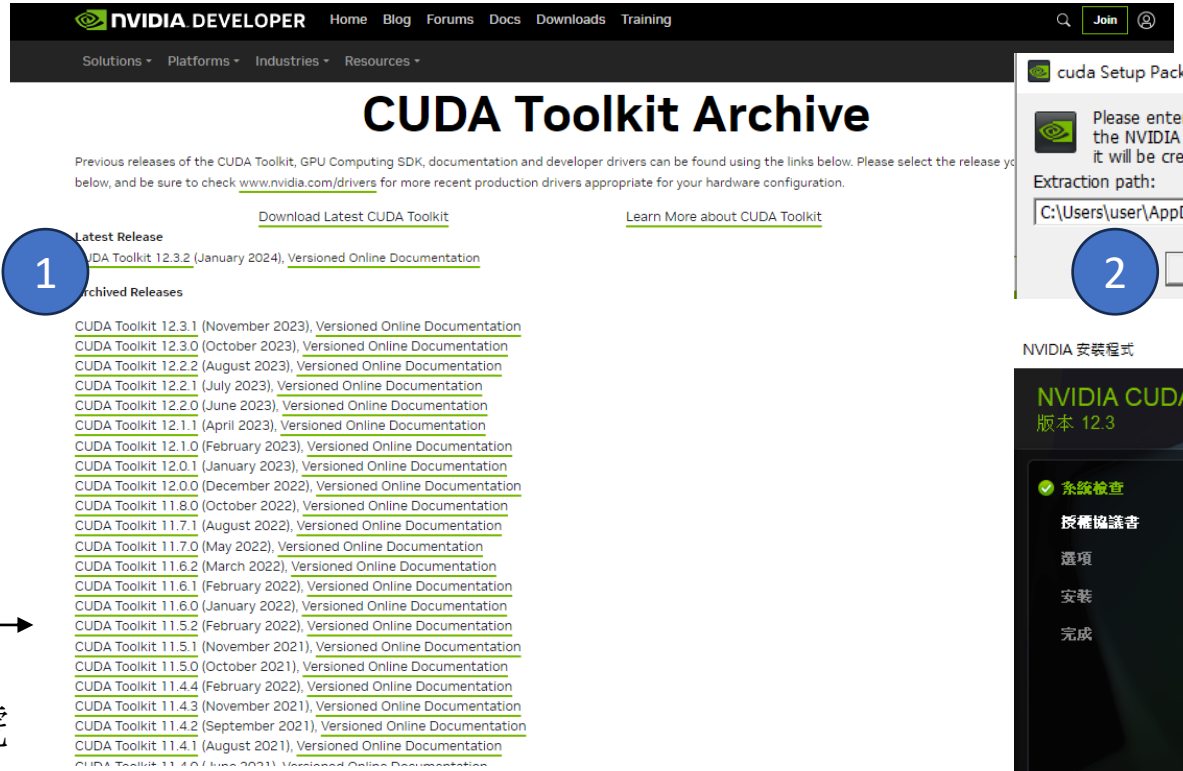
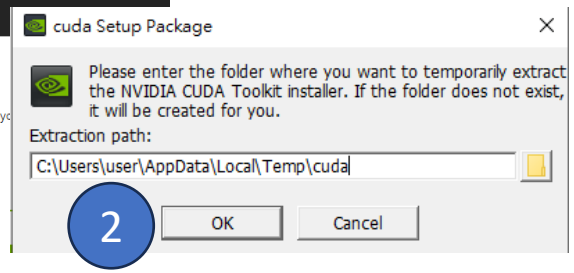
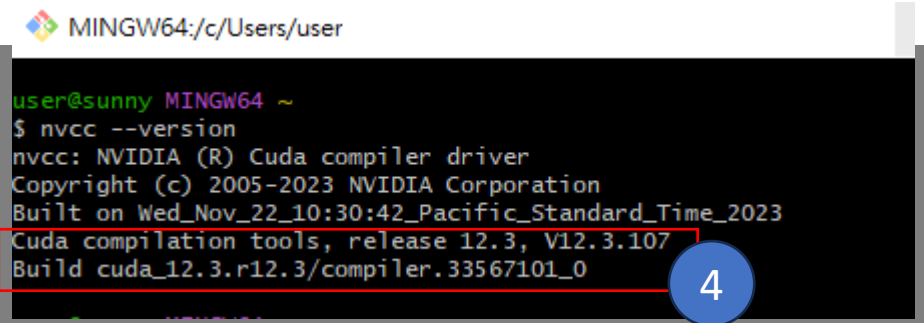






不想安裝最新版
可以到封存區找版本號

https://developer.nvidia.com/cuda-toolkit-archive



1. 以 RTX 3090 為例
2. 根據前面統計的版本區間，安裝對應的 CUDA (12.3)
3. 下載完點 OK
4. 用 nvcc --version 確認是否安裝成功 (linux 指令, cmd 不會吃)

安裝 cuDNN

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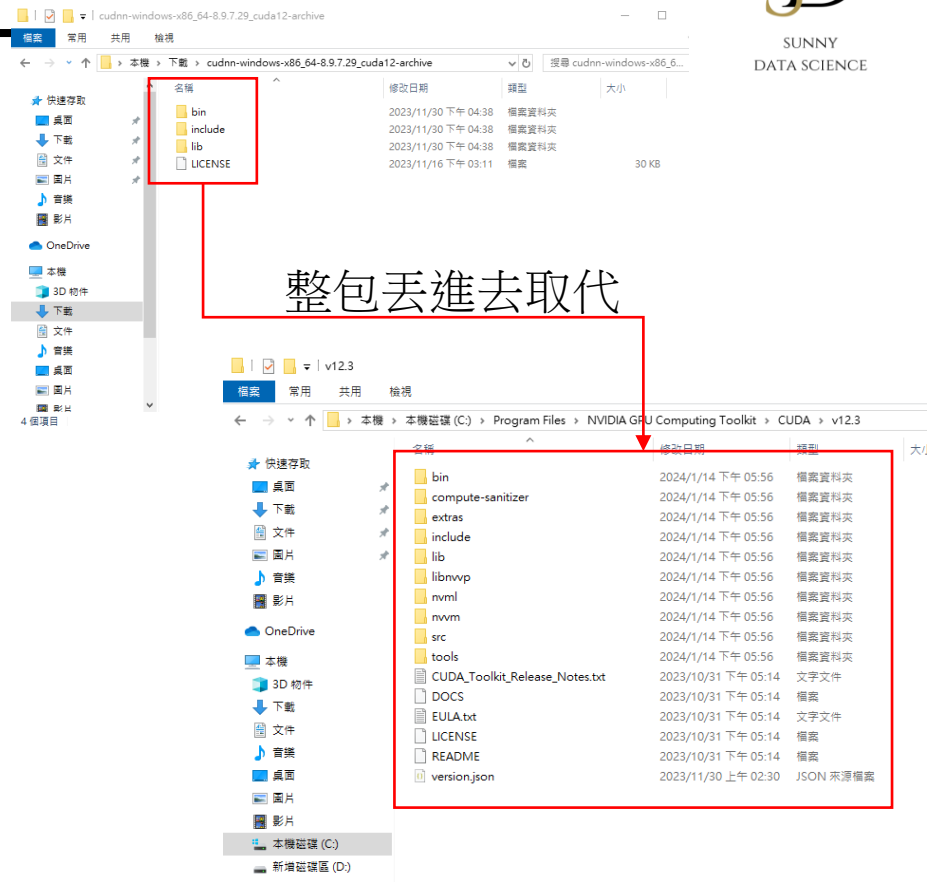
CUDA 版本要略大於 cuDNN (向下兼容)

舉例 CUDA == 12.1, cuDNN == 12.0



https://developer.nvidia.com/rdp/cudnn-download

1. 以 RTX 3090 為例
2. CuDnn 安裝 下載前要用 NVIDIA 帳號進行登入
3. GPU 加速套件
4. 安裝完解壓縮放入對應資料夾

- 將解壓縮後所有內容複製到CUDA安裝路徑
- *C:\Program Files\NVIDIA GPU Computing Toolkit\CUDA\v12.3*。(每個人位置可能不一樣)

Python torch 確認 GPU 是否可讀取成功

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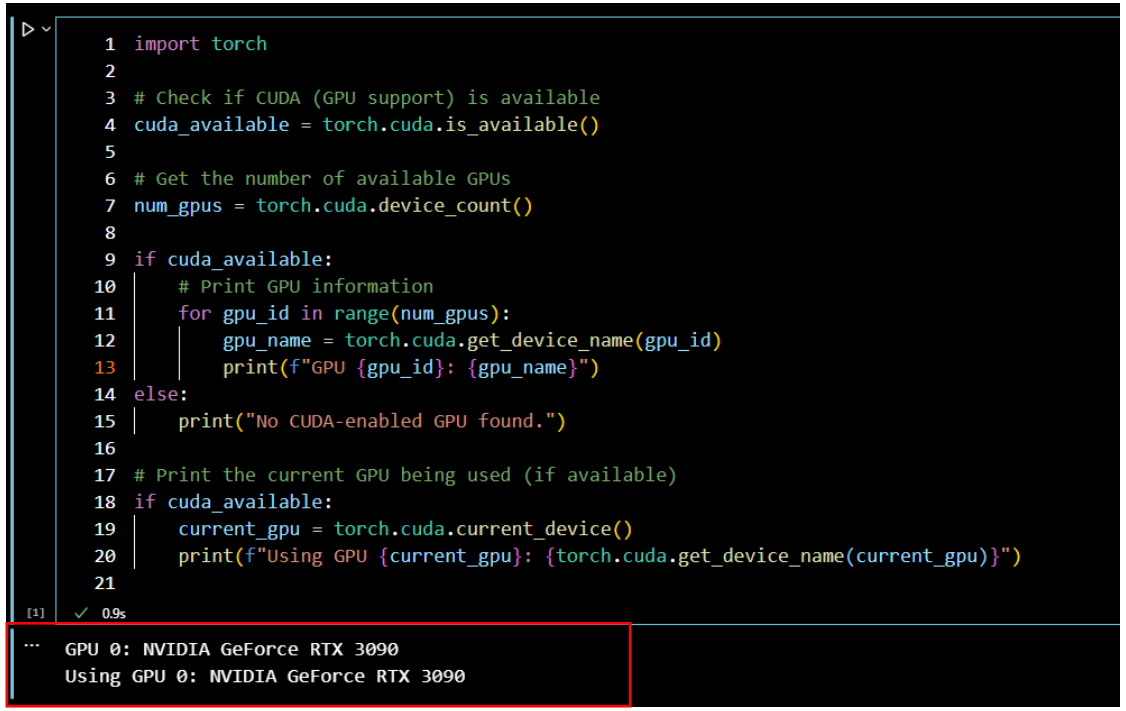
```
import torch

# Check if CUDA (GPU support) is available
cuda_available = torch.cuda.is_available()

# Get the number of available GPUs
num_gpus = torch.cuda.device_count()

if cuda_available:
    # Print GPU information
    for gpu_id in range(num_gpus):
        gpu_name = torch.cuda.get_device_name(gpu_id)
        print(f"GPU {gpu_id}: {gpu_name}")
else:
    print("No CUDA-enabled GPU found.")

# Print the current GPU being used (if available)
if cuda_available:
    current_gpu = torch.cuda.current_device()
    print(f"Using GPU {current_gpu}: {torch.cuda.get_device_name(current_gpu)}")
```



1. 程式碼貼到 jupyter notebook 確認結果