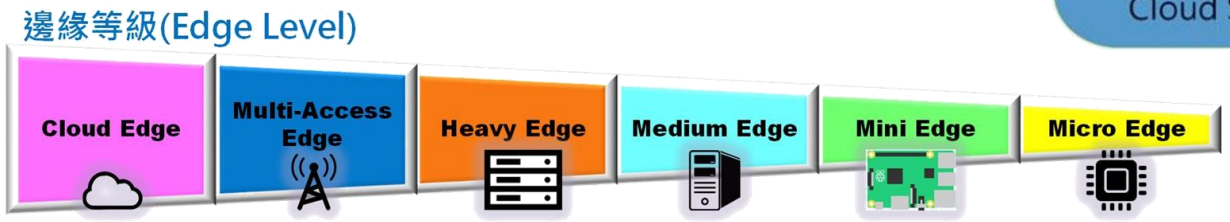
國立臺灣科技大學
NATIONAL TAIWAN UNIVERSITY OF SCIENCE AND TECHNOLOGY

Department of Computer Science & Information Engineering
資 訊 工 程 系

人工智慧與邊緣運算實務

Intel DevCloud
安裝與測試

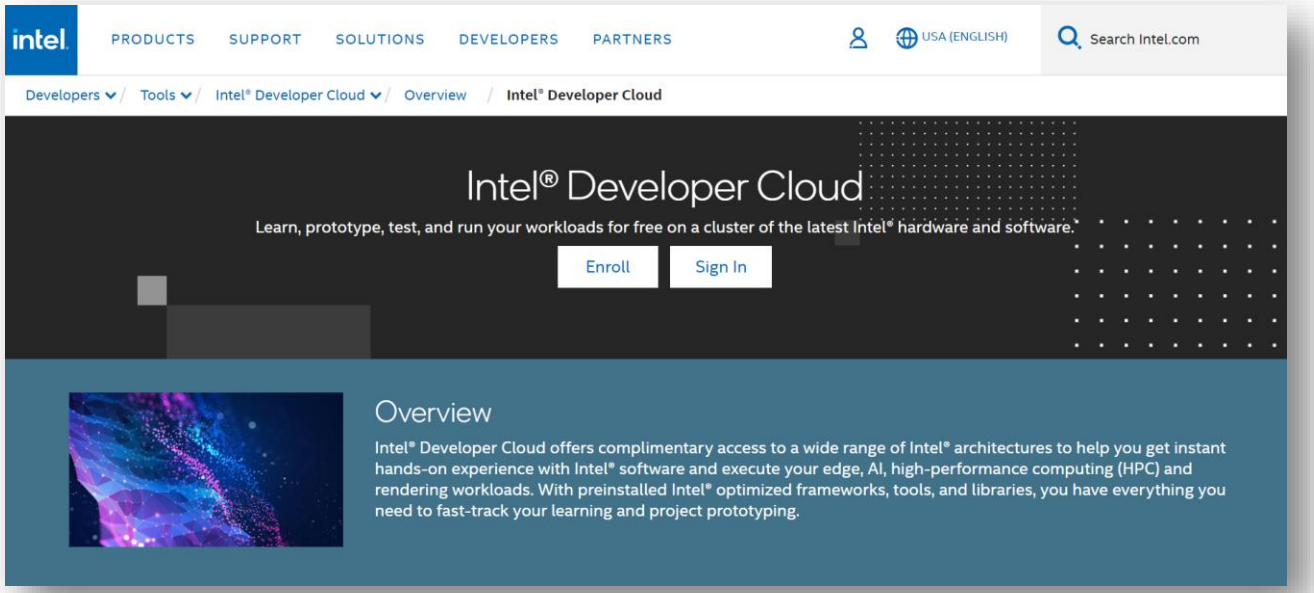


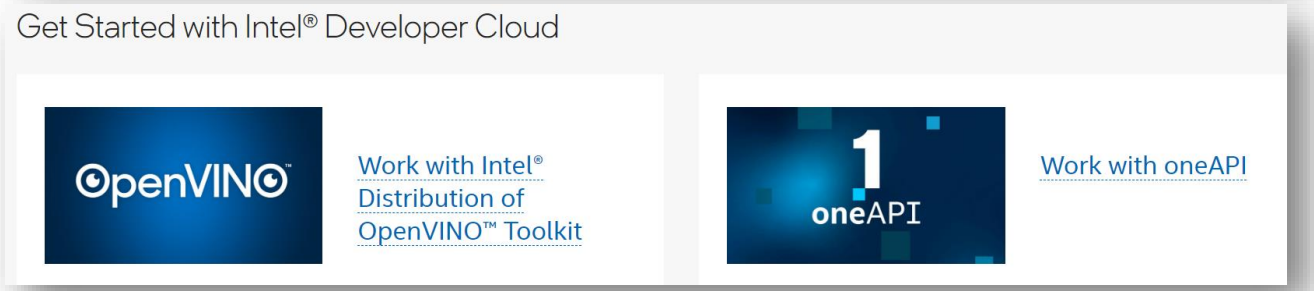
資訊工程系　許哲豪 助理教授

簡報大綱

- Intel DevCloud簡介
  - 帳號申請
  - 系統架構
  - 支援硬體
  - 工作環境
  - 預設環境
  - 應用範例
- 物件偵測範例
  - 工作排程指令
  - 分派及佇列
  - 輸出報表
    - 推論時間
    - 推論速度
    - 儀表板
- 運行Tutorials(Notebooks)

Intel DevCloud簡介

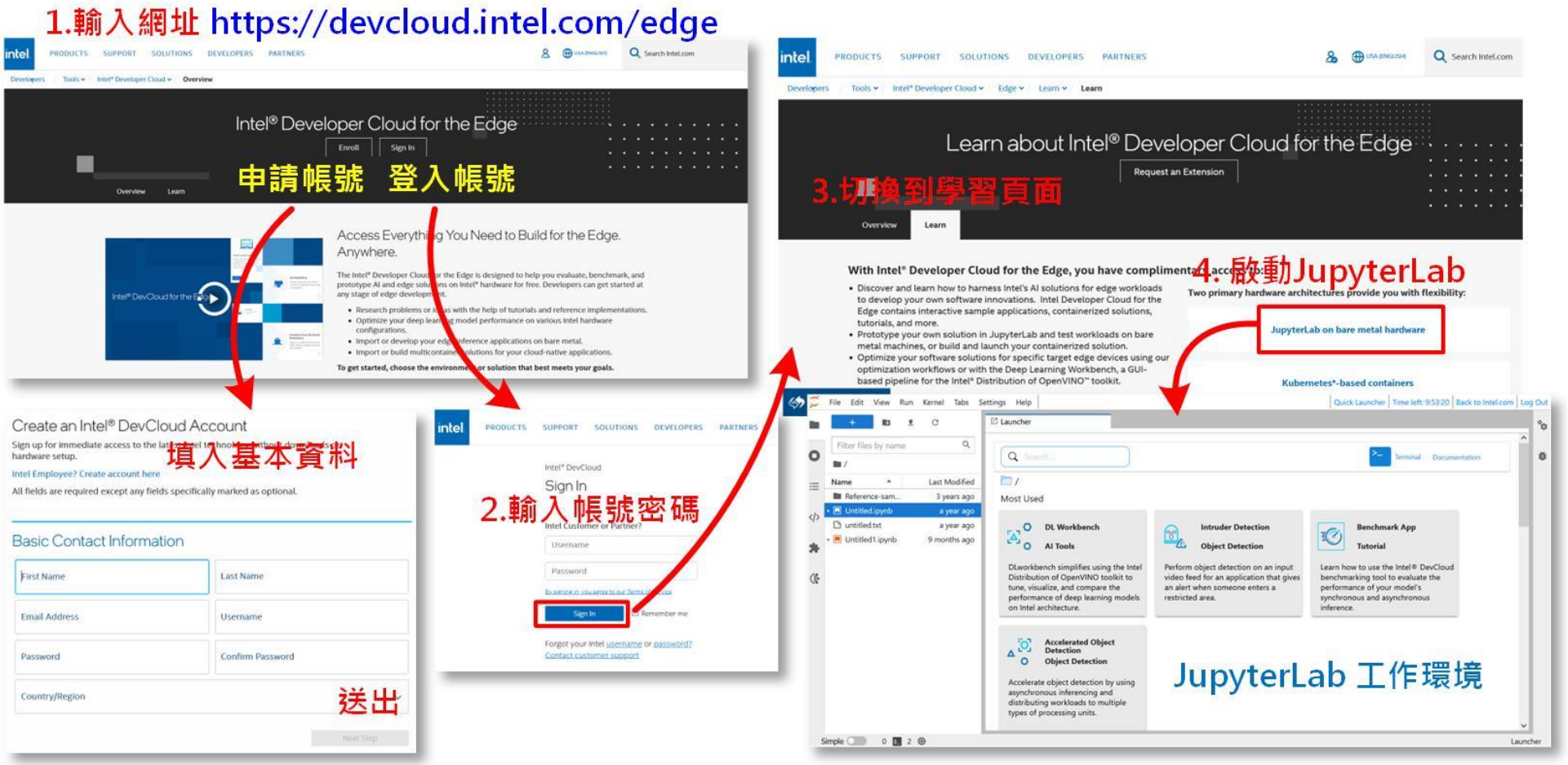




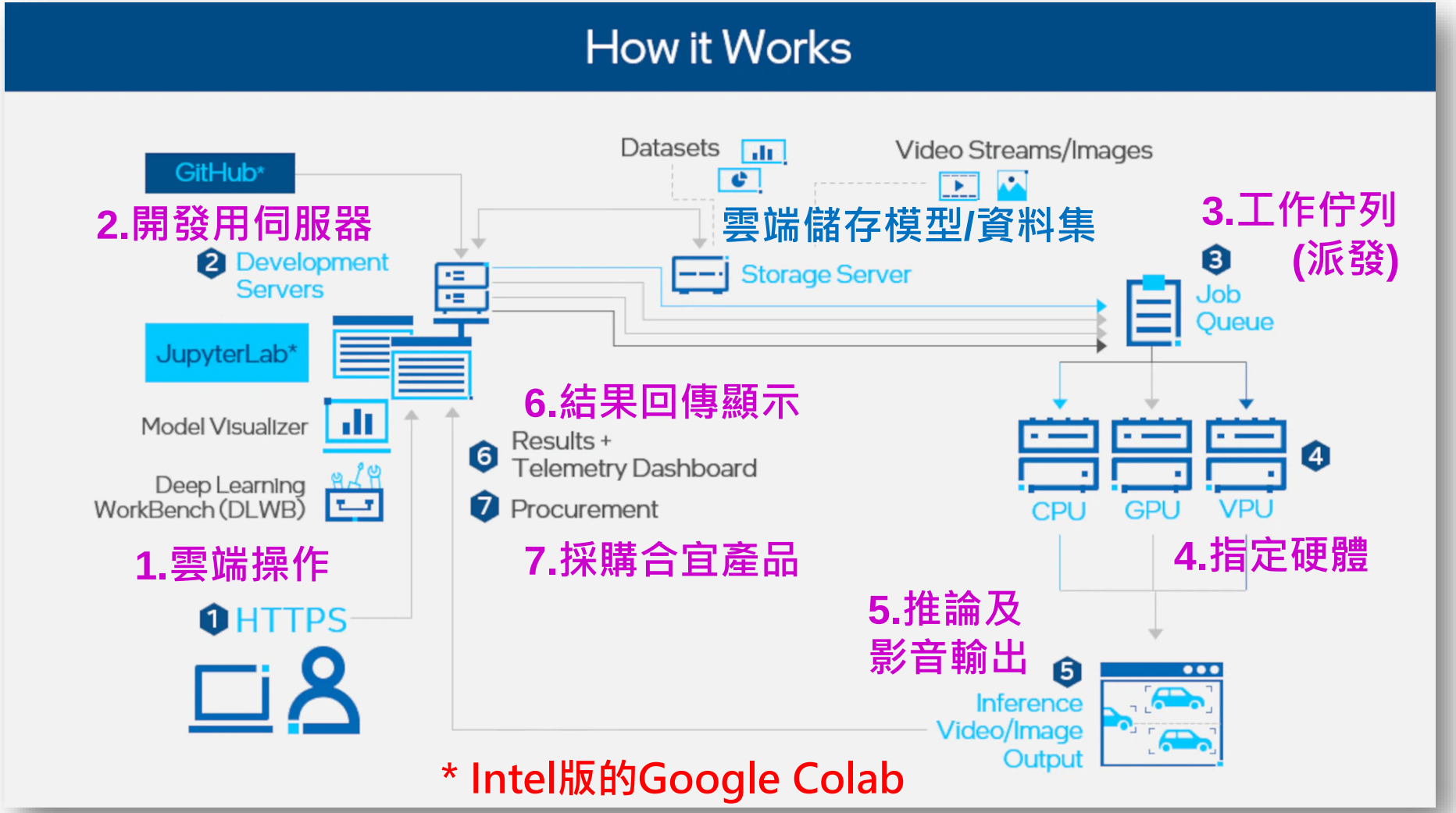
- 免費雲端開發環境 **類似Google Colab**
- 預建JupyterLab
- Python開發環境
- 預安裝OpenVINO
- 預安裝各種套件
- 少量免費空間
- 整合多種硬體可供同時測試效能
- 提供豐富可視化圖表方便分析問題

Intel OpenVINO雲端測試服務 https://devcloud.intel.com/edge/

DevCloud帳號申請與登入



DevCloud系統架構



DevCloud 可支援硬體

CPU　家族　記憶體　GPU　加速器　佇列標籤　節點(Group ID)

43種硬體排列組合

Processor	Processor Family	RAM	GPU	Inference Accelerator	Queue Labels	Node (Group ID)
Intel® Xeon® D Processor	Intel Core i7-12700TE Processor	12th generation Intel Core i7	16 GB	Intel® UHD Graphics 770 (Integrated)	None	CPU: i7-12700TE	idc072
Intel Xeon D Processor	Intel Core i5-12500TE Processor						
Intel Xeon D Processor	Intel® Core™ i5-6442EQ Processor						
Intel Xeon D Processor	Intel Core i5 6500TE Processor						
Intel® Core™ i7-11700b Processor							
Intel Core i9-11900kb Processor							
	Intel Core i5-7500 Processor						
	Intel Core i5-7500T Processor						
	Intel Core-i5 8365UE Processor						
	Intel Core i7-8665UE Processor						
			Intel Core i7-1065G7 Processor	10th generation Intel Core i7	16 GB	Intel® Iris® Plus Graphics G7 (Integrated)	None	CPU: i7-1065G7	idc030
			Intel Core i7-10700T Processor						
			Intel Core i7-10710U Processor						
			Intel Core i9 10900T Processor						
			Intel Atom® x5-E3940 Processor						
			Intel Atom® x7-E3950 Processor						
				Intel® Xeon® E-2286M Processor	Intel Xeon E processor (formerly code named Coffee Lake)	32 GB	Intel HD Graphics 630 (Integrated)	None	CPU: e-2286m	idc033
				Intel® Xeon® E3-1268L Processor v5						
				Intel® Xeon® Silver 4214R Processor						
				Intel® Xeon® Gold 5120 Processor						
				Intel Xeon Gold 5220R Processor						
				Intel Xeon Gold 6258R Processor						
				Intel® Xeon® W-1290TE Processor						
				Intel® Celeron® 4305UE Processor						
					Intel Xeon Gold 6314U Processor	3rd generation Intel Xeon Scalable processor (formerly code named Ice Lake)	128 GB	None	None	CPU: intel-xeon 6314u	idc051
					Intel Xeon Gold 6338N Processor	3rd generation Intel Xeon Scalable processor (formerly code named Ice Lake)	128 GB	None	None	CPU: intel-xeon 6338n	idc052
					Intel Core i7-1185G7E Processor	11th generation Intel Core i7 processor (formerly code named Tiger Lake)	16 GB	Intel® Iris® X° Graphics (Integrated)	None	CPU: intel-core i7-1185g7e GPU: iris xe graphics	idc045
					Intel Core i5-1145G7E Processor	11th generation Intel Core i5 processor (formerly code named Tiger Lake)	16 GB	Intel Iris X° Graphics (Integrated)	None	CPU: intel-core i5-1145g7e GPU: iris xe graphics	idc045
					Intel® Pentium® J6426 Processor	Intel Pentium processor (formerly code named Elkhart Lake)	4 GB	Intel HD Graphics 530 (Integrated)	None	CPU: j6426 GPU: intel-hd-530	idc070
					Intel Atom® x6425RE Processor	Intel Atom X processor family (formerly code named Elkhart Lake)	16 GB	Intel HD Graphics 530 (Integrated)	None	CPU: x6425re GPU: intel-hd-530	idc071
					Intel Core i9-11900kb Processor	11th generation Intel Core i9 processors (formerly code named Tiger Lake)	32 GB	Intel UHD Graphics for 11th Generation Intel® Processors (Integrated)	None	CPU: i9-11900kb GPU: intel-uhd-11th-gen idc074	idc074
					Intel Core i7-11700b Processor	11th generation Intel Core i7 processors (formerly code named Tiger Lake)	32 GB	Intel UHD Graphics for 11th Generation Intel Processors (Integrated)	None	CPU: i7-11700b GPU: intel-uhd-11th-gen idc075	idc075

Group ID

CPU, iGPU, GPU, VPU, FPGA

資料來源：https://www.intel.com/content/www/us/en/developer/tools/devcloud/edge/hardware-workloads.html

JupyterLab工作環境

檔案瀏覽器

運行狀態

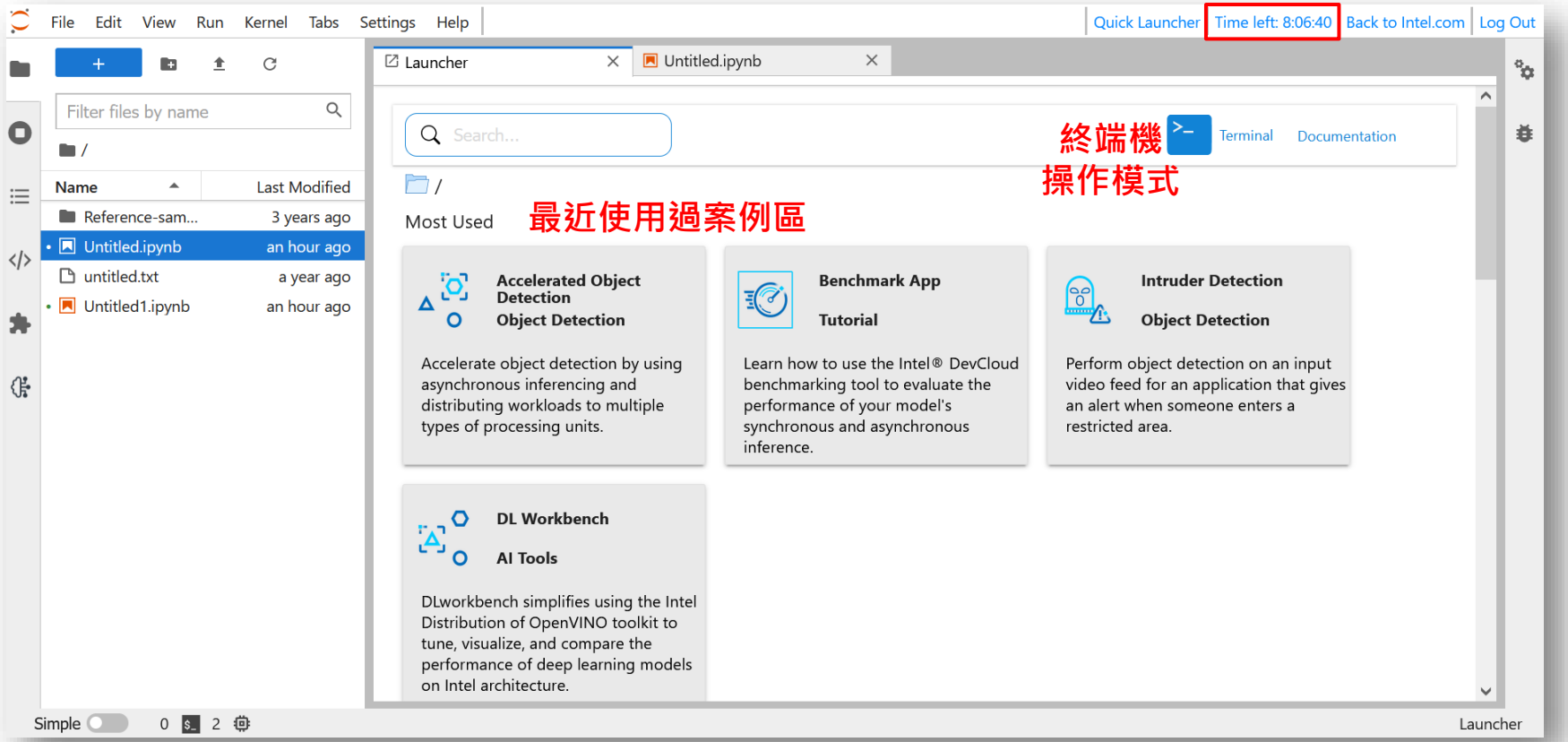
內容表

快速程式碼

插件管理

雲儲存連接器

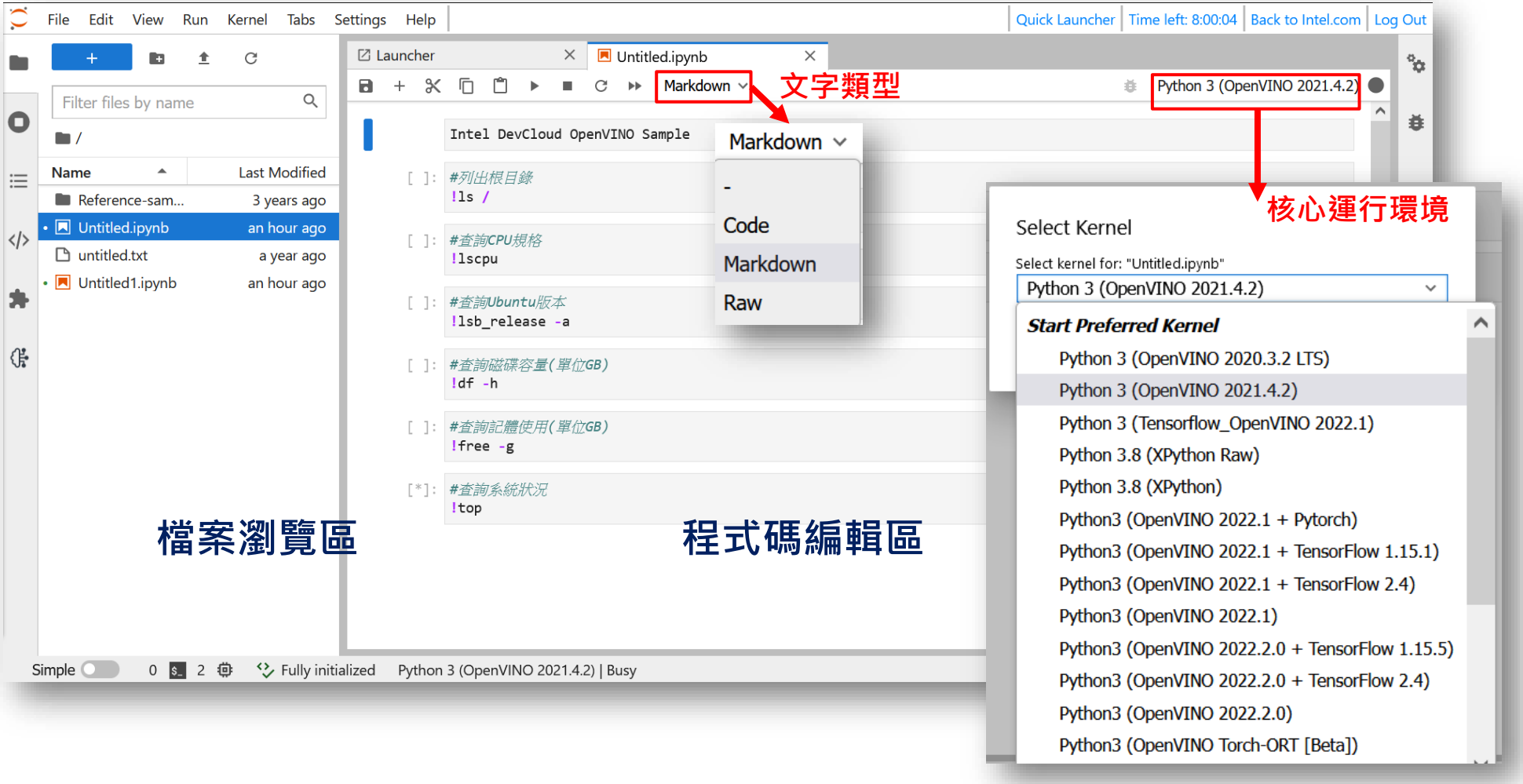
剩餘工作時間
(預設10小時)



終端機
操作模式

最近使用過案例區

程式碼編輯環境

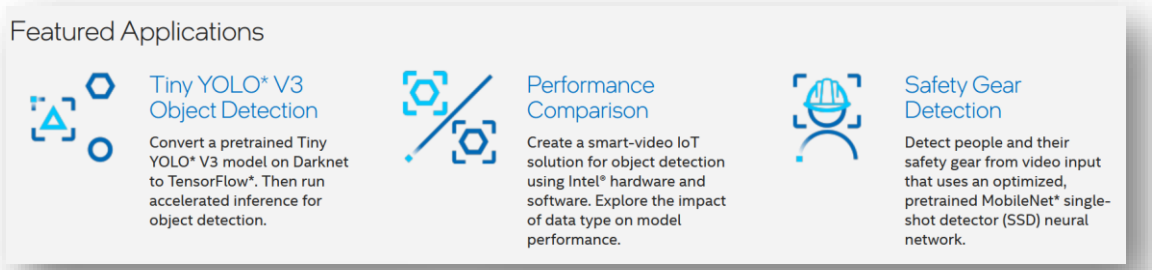

File Edit View Run Kernel Tabs Settings Help
Quick Launcher
Time left: 8:00:04
Back to Intel.com
Log Out
Launcher
Untitled.ipynb
Markdown
文字類型
Python 3 (OpenVINO 2021.4.2)
Filter files by name
Name
Last Modified
Reference-sam... 3 years ago
Untitled.ipynb an hour ago
untitled.txt a year ago
Untitled1.ipynb an hour ago
Intel DevCloud OpenVINO Sample
#列出根目錄
!ls /
#查詢CPU規格
!lscpu
#查詢Ubuntu版本
!lsb_release -a
#查詢磁碟容量(單位GB)
!df -h
#查詢記體使用(單位GB)
!free -g
#查詢系統狀況
!top
Markdown
-
Code
Markdown
Raw
核心運行環境
Select Kernel
Select kernel for: "Untitled.ipynb"
Python 3 (OpenVINO 2021.4.2)
Start Preferred Kernel
Python 3 (OpenVINO 2020.3.2 LTS)
Python 3 (OpenVINO 2021.4.2)
Python 3 (Tensorflow_OpenVINO 2022.1)
Python 3.8 (XPython Raw)
Python 3.8 (XPython)
Python3 (OpenVINO 2022.1 + Pytorch)
Python3 (OpenVINO 2022.1 + TensorFlow 1.15.1)
Python3 (OpenVINO 2022.1 + TensorFlow 2.4)
Python3 (OpenVINO 2022.1)
Python3 (OpenVINO 2022.2.0 + TensorFlow 1.15.5)
Python3 (OpenVINO 2022.2.0 + TensorFlow 2.4)
Python3 (OpenVINO 2022.2.0)
Python3 (OpenVINO Torch-ORT [Beta])
檔案瀏覽區
程式碼編輯區
Simple
Fully initialized
Python 3 (OpenVINO 2021.4.2) | Busy

DevCloud 執行環境及預安裝項目

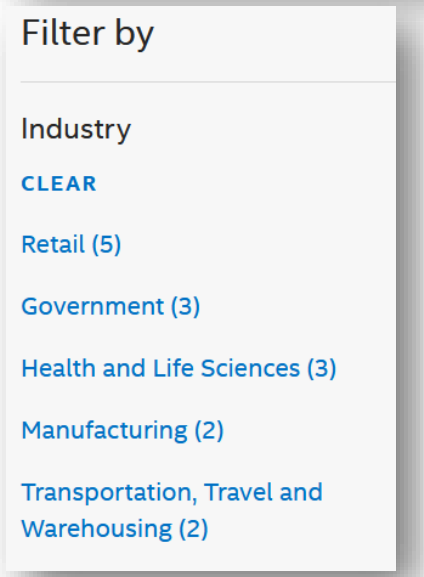
- CPU
  - Intel(R) Xeon(R) Gold 6138 CPU @ 2.00GHz
- OS
  - Ubuntu 18.04.6 LTS
- OpenVINO
  - 2022.1 (+ pytorch/TF1.5/TF2.4)
  - 2022.2 (TF1.5/TF2.4)
  - 2022.3
  - 2021.4.2
  - 2020.3.2 LTS
  - Xpython
- Python
  - 可用 print(sys.version)查詢版本
  - 可用 pip list查詢所有安裝套件
  - 這裡列出幾項常用
    - numpy
    - opencv-python
    - pip
    - scikit-learn
    - tensorflow
    - torch
    - torchvision

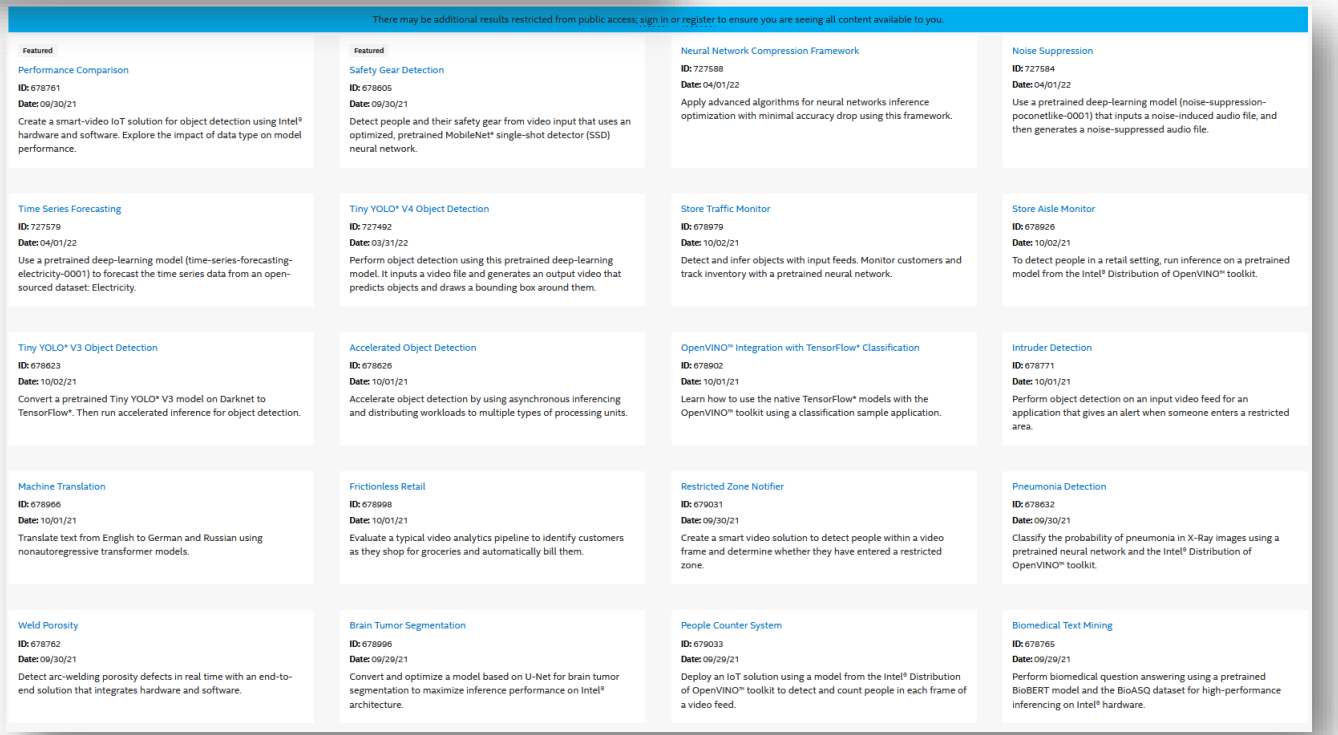
相關預安裝的套件數量、版本會隨選用Python + OpenVINO版本而有所不同。

DevCloud 應用範例



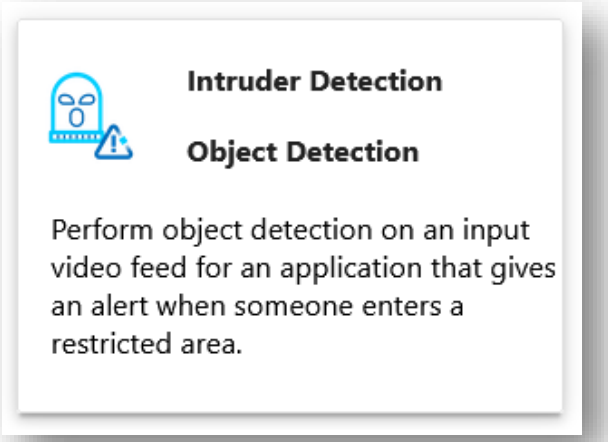
23個案例

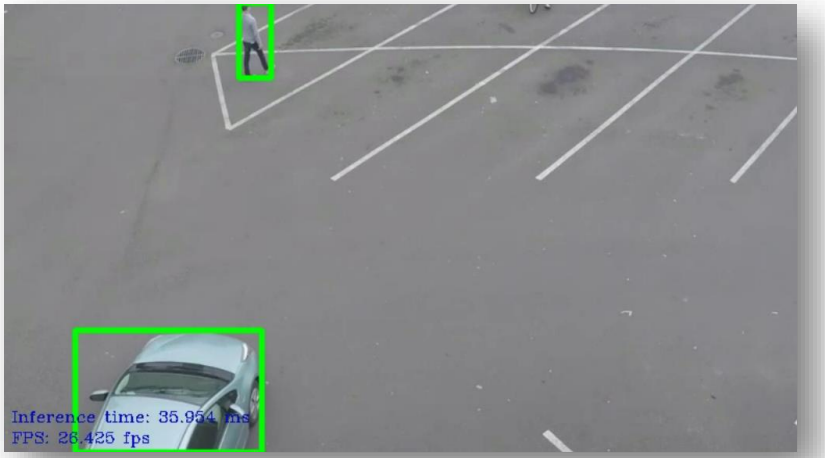




資料來源：https://www.intel.com/content/www/us/en/developer/tools/devcloud/edge/build/sample-apps.html

物件偵測範例





- **Intruder-detector-jupyter.ipynb**
- 闖入者偵測，主要包括人、車、腳踏車

- 主要依下列步驟執行

1. 使用Model Downloader下載模型
2. 建立多個工作並分派到指定硬體進行推論
3. 監看所有分派的工作直到全部完成
4. 檢視執行結果比較各硬體效能表現

工作排程指令

- 常用指令
- 多工批次
  - nodes=x:ppn=y (x, y為節點及節點運算單元數量)
- 工作派送
  - qsub
  - 成功回傳ID
- 查看狀態 / 取消作業
  - qstat / qdel
- 檢查所有支援硬體資訊及數量
  - !pbsnodes | grep compnode | awk '{print $3}' | sort | uniq -c

61種硬體排列組合

```
!pbsnodes | grep compnode | awk '{print $3}' | sort | uniq -c
      6 idc001skl,compnode,openvino-latest,intel-core,i5-6500te,intel-hd-530,ram8gb
      7 idc002mx8,compnode,openvino-latest,intel-core,i5-6500te,intel-hd-530,ram8gb,myriadx-8-vpu
      5 idc004nc2,compnode,openvino-latest,intel-core,i5-6500te,intel-hd-530,ram8gb,myriadx-1-vpu
      1 idc006kbl,compnode,openvino-latest,intel-core,i5-7500t,intel-hd-630,ram8gb
      2 idc007xv5,compnode,openvino-latest,intel-xeon,e3-1268l-v5,intel-hd-p530,ram32gb
      2 idc008u2g,compnode,openvino-latest,intel-atom,e3950,intel-hd-505,ram4gb,myriadx-1-vpu
      1 idc009jkl,compnode,openvino-latest,intel-core,i5-7500,intel-hd-630,ram8gb
      1 idc010jal,compnode,openvino-latest,intel-celeron,j3355,intel-hd-500,ram4gb
      1 idc011ark2250s,compnode,openvino-latest,intel-core,i5-6442eq,intel-hd-530,ram8gb,myriadx-3-vpu
      1 idc012ark1220l,compnode,openvino-latest,intel-atom,e3940,intel-hd-500,ram8gb,myriadx-2-vpu
```

工作分派及排程佇列

```
#Submit job to the queue
job_id_core = !qsub intruder_detector.sh -l nodes=1:idc001skl -F "results/core/ CPU FP32 " -N intrud_core -v VENV_PATH,OPENVINO_RUNTIME
print(job_id_core[0])
#Progress indicators
if job_id_core:
    progressIndicator('results/core', f'i_progress_{job_id_core[0]}.txt', "Inference", 0, 100)
```

```
707174.v-qsvr-1.devcloud-edge
```

Inference

Total Estimated: 46.0 seconds

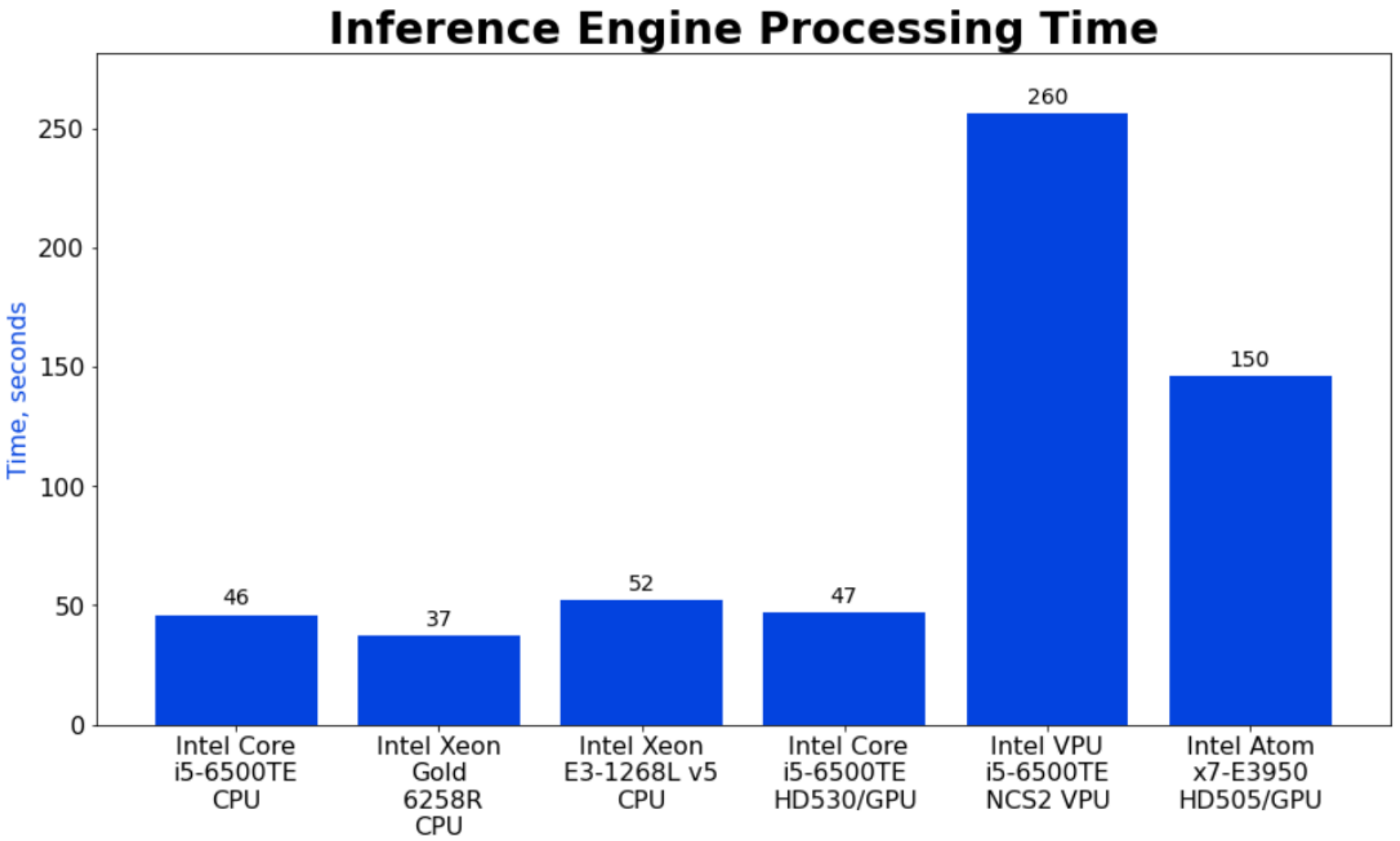
Remaining: 0 seconds

```
liveQstat()
```

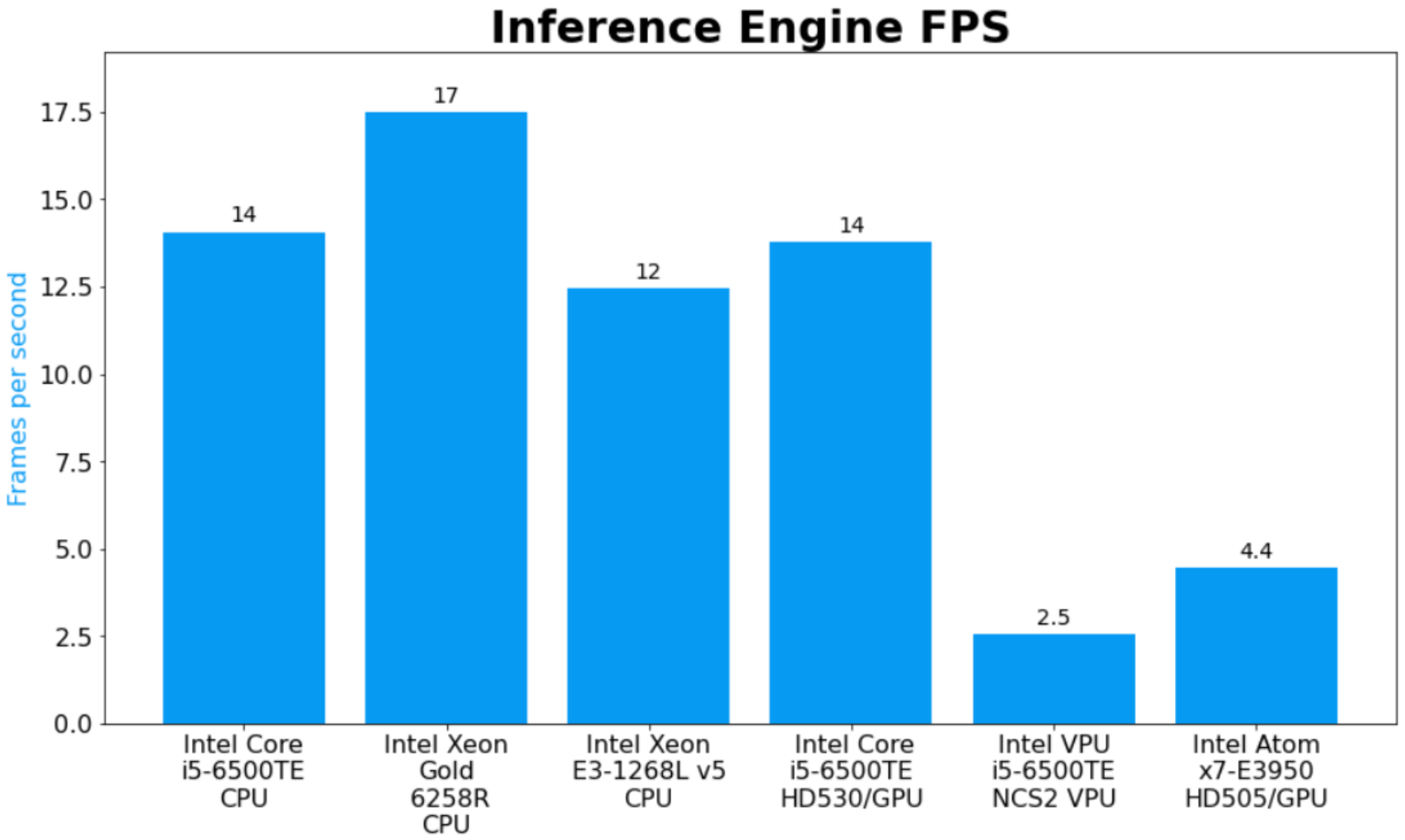
```
2022-12-14 15:07:55

Job ID                    Name             User            Time Use S Queue
------------------------- ---------------- --------------- -------- - -----
707194.v-qsvr-1            intrud_core      u79934                 0 R academia
707195.v-qsvr-1            ..._cascade_lake u79934          00:00:20 R academia
707196.v-qsvr-1            ..._xeon_skylake u79934                 0 R academia
707197.v-qsvr-1            intrud_gpu       u79934                 0 R academia
707198.v-qsvr-1            intrud_ncs2      u79934                 0 R academia
707199.v-qsvr-1            intrud_atom      u79934                 0 Q academia
```

Stop

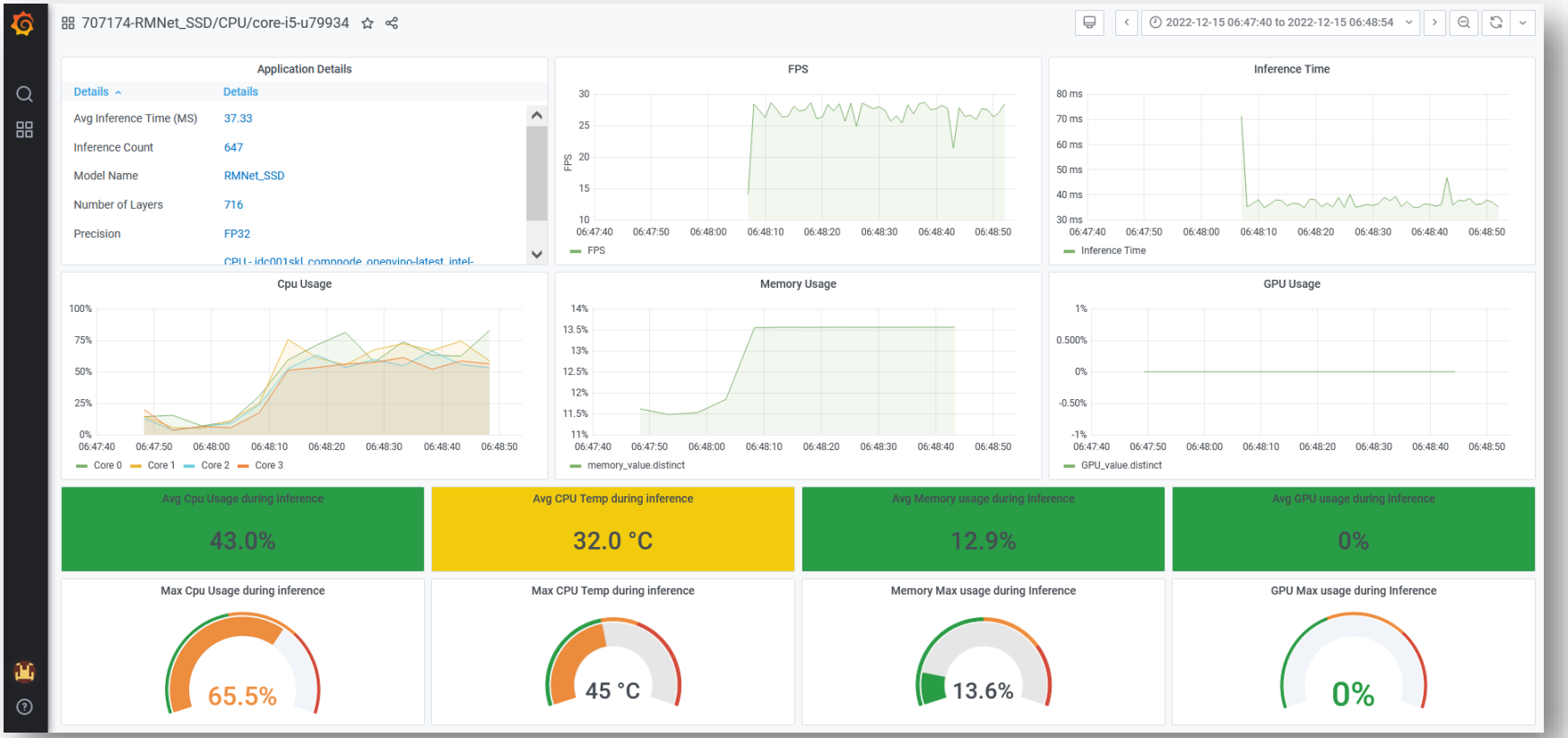
多硬體比較報表—推論時間(ms)



多硬體比較報表—推論速度(FPS)



儀表板展示


707174-RMNet_SSD/CPU/core-i5-u79934
2022-12-15 06:47:40 to 2022-12-15 06:48:54
Application Details
Details
Details
Avg Inference Time (MS) 37.33
Inference Count 647
Model Name RMNet_SSD
Number of Layers 716
Precision FP32
CPU - idc001skl_compnode_openvino-latest_intel-
FPS
FPS
Inference Time
Inference Time
Cpu Usage
Core 0 Core 1 Core 2 Core 3
Memory Usage
memory_value.distinct
GPU Usage
GPU_value.distinct
Avg Cpu Usage during inference
43.0%
Avg CPU Temp during inference
32.0 °C
Avg Memory usage during Inference
12.9%
Avg GPU usage during Inference
0%
Max Cpu Usage during inference
65.5%
Max CPU Temp during inference
45 °C
Memory Max usage during Inference
13.6%
GPU Max usage during Inference
0%

運行Tutorials (Notebooks)

參考資料：https://omnixri.blogspot.com/2023/03/intel-devcloudopenvino-notebooks.html

參考文獻

- Intel DevCloud

https://devcloud.intel.com/edge/

- Intel OpenVINO

https://docs.openvinotoolkit.org/latest/index.html

- Intel® DevCloud for Edge | OpenVINO™ toolkit | Ep. 58

https://youtu.be/OgNnBnzIsZs

- 許哲豪，如何在Intel DevCloud中執行OpenVINO Notebooks範例

https://omnixri.blogspot.com/2023/03/intel-devcloudopenvino-notebooks.html