

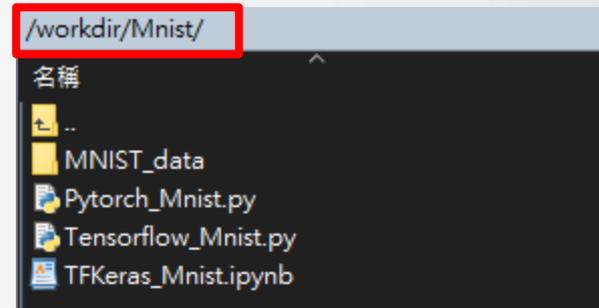
Exercise 1

Container Service

Video link : <https://youtu.be/yfTfEKJtxbA>

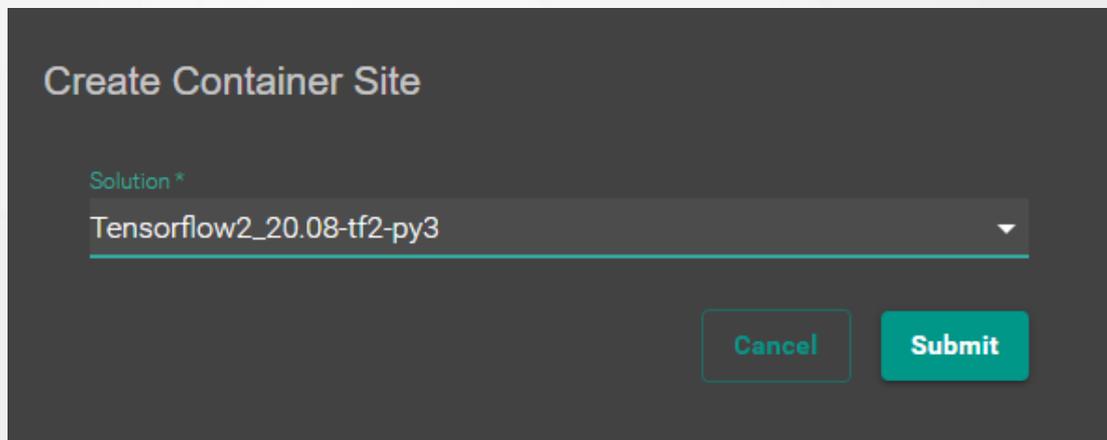
Container Service – uploading files and data

- Please download the zip file. Download link : <https://reurl.cc/V54QeA>
- Unzip the file and upload the folder to the server with FTP tool.
(Upload and put MNIST folder in /workdir directory.)
- The files in Mnist folder :
 - Pytorch_Mnist.py
 - Tensorflow_Mnist.py
 - TFKeras_Mnist.ipynb
 - MNIST_data (folder)



Exercise 1.1: The Implementation of MNIST Handwritten Digit Classification (Using Jupyter notebook)

1. Create Container Site and select Tensorflow2.0 image.



Create Container Site

Solution *

Tensorflow2_20.08-tf2-py3

Cancel Submit

Exercise 1.1: The Implementation of MNIST Handwritten Digit Classification (Using Jupyter notebook)

2. The setup of creating Container Site

(1) Please enter the information.

(2) Submit to complete the setup.

Description	e.g. Keras Mnist Training
Password	must contain at least one letter
Image	harbor.gemini.com:30003/tensorflow/tensorflow2:20.08-tf2-py3
Flavor	4CPU_30GRAM_1GPU (CPU: 4 Core, Memory: 30000 MB, GPU: 1 Core)

The screenshot shows a configuration page for a container. It is titled '3 Overview' and has a 'Basic Info' section. The 'Name' is 'duncanwang-1633311488986'. The 'Description' is 'default'. The 'password' field is 'password'. The 'Image' is 'harbor.gemini.com:30003/tensorflow/tensorflow2:20.08-tf2-py3'. The 'Flavor' is '4CPU_30GRAM_0GPU (CPU: 4 Core, Memory: 30000 MB, GPU: 0 Core)'. The interface is dark-themed with light-colored text.

Exercise 1.1: The Implementation of MNIST Handwritten Digit Classification (Using Jupyter notebook)

3. Switch to Service Info and click on the web link.

Service Info Site Parameter

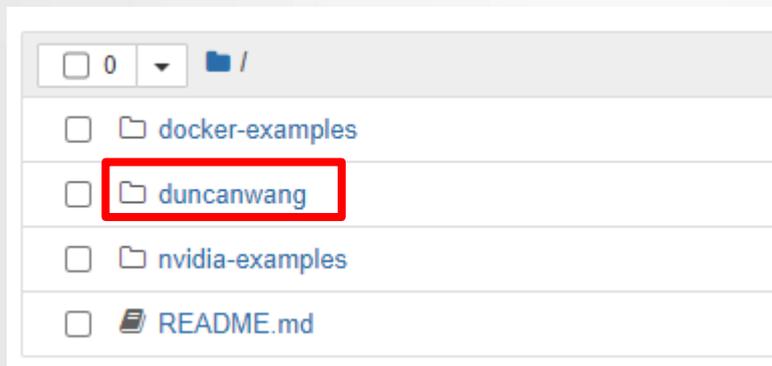
Public IP [140.138.175.9:31522 \(ssh\)](#), [140.138.175.9:32325 \(tensorboard\)](#), [140.138.175.9:31421 \(web\)](#)

User duncanwang

Created Time 2021-10-04 09:31:09

Exercise 1.1: The Implementation of MNIST Handwritten Digit Classification (Using Jupyter notebook)

4. Enter the password to access Jupyter Notebook.
5. Click on the “username” folder and then enter into /workdir directory.



Exercise 1.1: The Implementation of MNIST Handwritten Digit Classification (Using Jupyter notebook)

6. Click on “TFKeras_Mnist.ipynb” to open the file and then run the code.

```
In [1]: #import tensorflow
import tensorflow as tf

In [2]: mnist = tf.keras.datasets.mnist
(x_train, y_train), (x_test, y_test) = mnist.load_data()
x_train, x_test = x_train / 255.0, x_test / 255.0
print(len(x_train))
print(x_train[0].shape)

Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/mnist.npz
11493376/11490434 [=====] - 0s 0us/step
60000
(28, 28)

In [6]: model = tf.keras.models.Sequential([
    tf.keras.layers.Flatten(input_shape=(28, 28)),
    tf.keras.layers.Dense(128, activation='relu'),
    tf.keras.layers.Dropout(0.2),
    tf.keras.layers.Dense(10, activation='softmax')
])

# model 每寫完定義好後需要經過compile
model.compile(optimizer='adam',
              loss='sparse_categorical_crossentropy',
              metrics=['accuracy'])
model.summary()

Model: "sequential_2"
-----
```

Layer (type)	Output Shape	Param #
flatten_2 (Flatten)	(None, 784)	0
dense_4 (Dense)	(None, 128)	100480

Exercise 1.2: The Implementation of MNIST Handwritten Digit Classification (Run in Terminal)

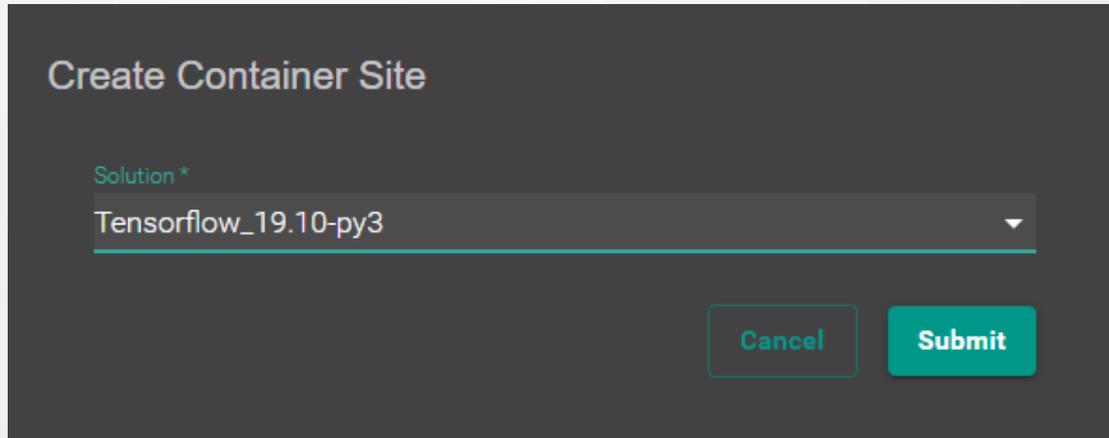
Two ways to run code in terminal (command line):

- Use SSH to connect to the container.
- Use terminal in Jupyter Notebook.

Exercise 1.2: The Implementation of MNIST Handwritten Digit Classification (Run in Terminal)

- Use SSH to connect to the container.

1. Create Container Site and select Tensorflow1.0 image.



Create Container Site

Solution *

Tensorflow_19.10-py3

Cancel Submit

Exercise 1.2: The Implementation of MNIST Handwritten Digit Classification (Run in Terminal)

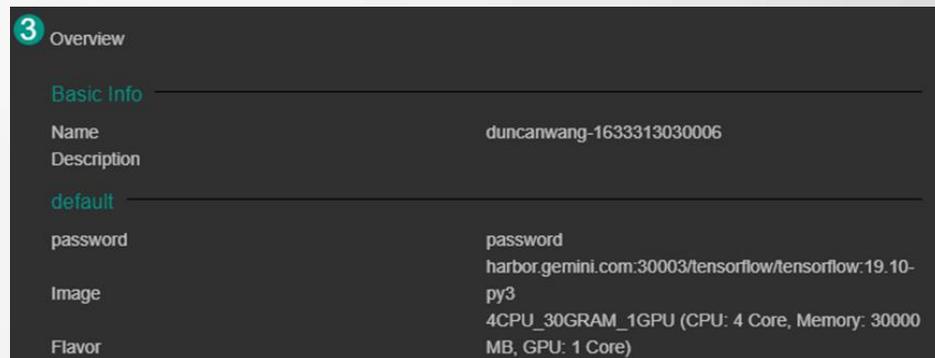
- Use SSH to connect to the container.

2. The setup of creating Container Site

(1) Please enter the information.

(2) Submit to complete the setup.

Description	e.g. Mnist Training
Password	must contain at least one letter
Image	harbor.gemini.com:30003/tensorflow/tensorflow:19.10-py3
Flavor	4CPU_30GRAM_1GPU (CPU: 4 Core, Memory: 30000 MB, GPU: 1 Core)



3 Overview	
Basic Info	
Name	duncanwang-1633313030006
Description	default
password	password
Image	harbor.gemini.com:30003/tensorflow/tensorflow:19.10-py3
Flavor	4CPU_30GRAM_1GPU (CPU: 4 Core, Memory: 30000 MB, GPU: 1 Core)

Exercise 1.2: The Implementation of MNIST Handwritten Digit Classification (Run in Terminal)

- Use SSH to connect to the container.

3. Switch to Service Info and the IP and port number for SSH connection can be seen.

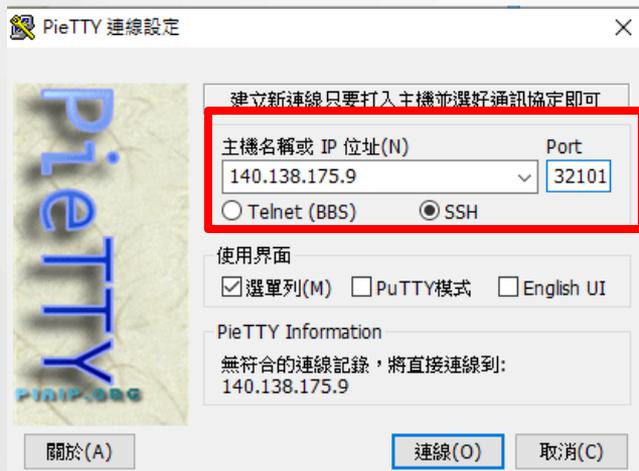
```
Service Info      Site Parameter
-----
Public IP 140.138.175.9:31336 (tensorboard), 140.138.175.9:32101 (ssh), 140.138.175.9:32601 (web)
User duncanwang
Created Time 2021-10-04 13:17:44
```

Exercise 1.2: The Implementation of MNIST Handwritten Digit Classification (Run in Terminal)

- Use SSH to connect to the container.

4. SSH tools - Enter IP and port number for connection.

(PieTTY)



(SSH Client command used on MacOS or Linux)

```
wanghsiaolun — root@lafdrtduncanwang-1633325250777-spdtl:~ ssh root@140.138.175.9 -p 32101
(base) wangxiaolundeMacBook-Air:~ wanghsiaolun
[root@140.138.175.9's password:
Welcome to Ubuntu 18.04.3 LTS (GNU/Linux 4.15.0-47-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage

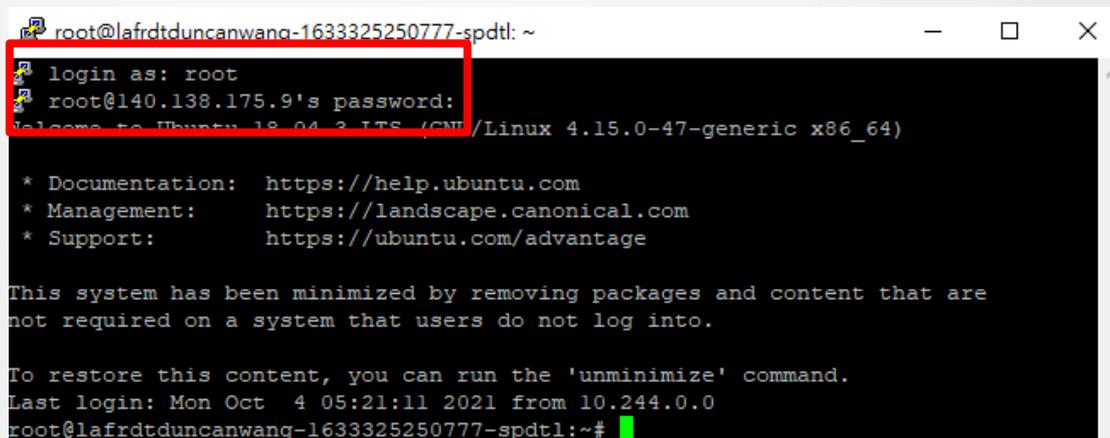
This system has been minimized by removing packages and content that are
not required on a system that users do not log into.

To restore this content, you can run the 'unminimize' command.
Last login: Mon Oct  4 07:59:24 2021 from 10.244.0.0
root@lafdrtduncanwang-1633325250777-spdtl:~#
```

Exercise 1.2: The Implementation of MNIST Handwritten Digit Classification (Run in Terminal)

- Use SSH to connect to the container.

5. Log in as root and enter the password.

A terminal window showing an SSH login process. The prompt is root@lafdrtduncanwang-1633325250777-spdtl: ~. The user enters 'login as: root' and the system prompts for the password. The password is entered and the system displays the Ubuntu logo and version information: 'Welcome to Ubuntu 18.04.3 LTS (GNU/Linux 4.15.0-47-generic x86_64)'. Below this, there are links for documentation, management, and support. A message states that the system has been minimized. The prompt returns to root@lafdrtduncanwang-1633325250777-spdtl:~#. A red box highlights the 'login as: root' and 'root@140.138.175.9's password:' lines.

```
root@lafdrtduncanwang-1633325250777-spdtl: ~
login as: root
root@140.138.175.9's password:
Welcome to Ubuntu 18.04.3 LTS (GNU/Linux 4.15.0-47-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage

This system has been minimized by removing packages and content that are
not required on a system that users do not log into.

To restore this content, you can run the 'unminimize' command.
Last login: Mon Oct  4 05:21:11 2021 from 10.244.0.0
root@lafdrtduncanwang-1633325250777-spdtl:~#
```

Exercise 1.2: The Implementation of MNIST Handwritten Digit Classification (Run in Terminal)

- Use SSH to connect to the container

6. After login successfully, enter into /workdir directory.

command : `cd /nfs_vol01/“username folder”/workdir`



```
root@lafrrtduncanwang-1633325250777-spdtl: /nfs_vol01/duncanwang/workdir
root@lafrrtduncanwang-1633325250777-spdtl:~# cd /nfs_vol01/duncanwang/workdir
root@lafrrtduncanwang-1633325250777-spdtl:/nfs_vol01/duncanwang/workdir# ls
Mnist
```

Exercise 1.2: The Implementation of MNIST Handwritten Digit Classification (Run in Terminal)

- Use SSH to connect to the container

7. Enter into Mnist folder and then execute the python code.

command : `python3 Tensorflow_Mnist.py`

```
root@lafirdtduncanwang-1633325250777-spdtl:/nfs_vol01/duncanwang/workdir/Mnist
root@lafirdtduncanwang-1633325250777-spdtl:/nfs_vol01/duncanwang/workdir# cd Mnist
root@lafirdtduncanwang-1633325250777-spdtl:/nfs_vol01/duncanwang/workdir/Mnist# ls
MNIST_data  Pytorch_Mnist.py  TFKeras_Mnist.ipynb  Tensorflow_Mnist.py
root@lafirdtduncanwang-1633325250777-spdtl:/nfs_vol01/duncanwang/workdir/Mnist# python3 Tensorflow_Mnist.py
```

Exercise 1.2: The Implementation of MNIST Handwritten Digit Classification (Run in Terminal)

- Use SSH to connect to the container.

8. The result of the execution shows the decline of loss and the improvement of accuracy after 100 epochs of training.

```
Train Epoch: 90 Loss= 1.6719 Accuracy= 0.97
Train Epoch: 91 Loss= 1.6358 Accuracy= 0.9698
Train Epoch: 92 Loss= 1.5792 Accuracy= 0.9696
Train Epoch: 93 Loss= 1.5632 Accuracy= 0.9698
Train Epoch: 94 Loss= 1.6421 Accuracy= 0.9702
Train Epoch: 95 Loss= 1.5896 Accuracy= 0.9688
Train Epoch: 96 Loss= 1.5296 Accuracy= 0.9702
Train Epoch: 97 Loss= 1.5179 Accuracy= 0.9728
Train Epoch: 98 Loss= 1.6063 Accuracy= 0.9704
Train Epoch: 99 Loss= 1.6737 Accuracy= 0.9694
Train Epoch: 100 Loss= 1.5871 Accuracy= 0.9718
Final Accuracy: 0.9699
root@lafirdtduncanwang-1633325250777-spdt1:/nfs_vol01/duncanwang/workdir/Mnist# █
```

Exercise 1.2: The Implementation of MNIST Handwritten Digit Classification (Run in Terminal)

- Use Terminal in Jupyter Notebook.

1. Switch to Service Info and click on the web link.

```
Service Info      Site Parameter
-----
Public IP 140.138.175.9:31336 (tensorboard), 140.138.175.9:32101 (ssh), 140.138.175.9:32601 (web)
User duncanwang
Created Time 2021-10-04 13:17:44
```

Exercise 1.2: The Implementation of MNIST Handwritten Digit Classification (Run in Terminal)

- Use Terminal in Jupyter Notebook.

2. Click on “New” button and select “Terminal”.



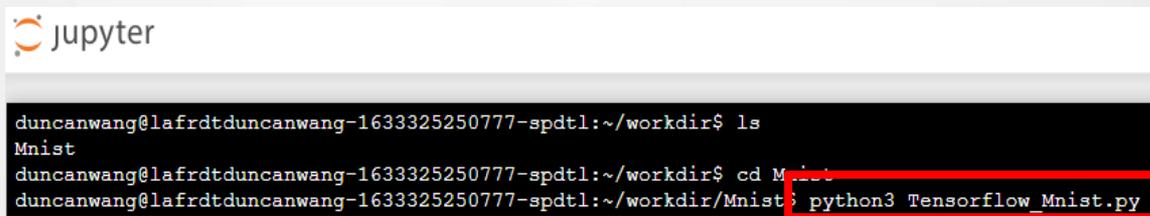
Exercise 1.2: The Implementation of MNIST Handwritten Digit Classification (Run in Terminal)

- Use Terminal in Jupyter Notebook.

3. Run “Tensorflow_Mnist.py” in /workdir directory.

command : cd /nfs_vol01/ “username folder”/workdir/

command : python3 Tensorflow_Mnist.py

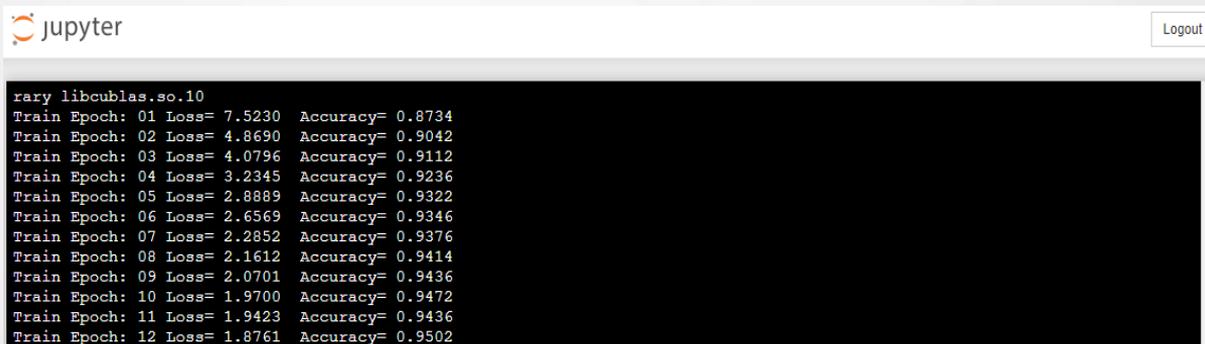


```
jupyter  
duncanwang@lafirdtduncanwang-1633325250777-spdtl:~/workdir$ ls  
Mnist  
duncanwang@lafirdtduncanwang-1633325250777-spdtl:~/workdir$ cd Mnist  
duncanwang@lafirdtduncanwang-1633325250777-spdtl:~/workdir/Mnist$ python3 Tensorflow_Mnist.py
```

Exercise 1.2: The Implementation of MNIST Handwritten Digit Classification (Run in Terminal)

- Use Terminal in Jupyter Notebook.

4. Same as using SSH connection, the result of execution can be seen in terminal.

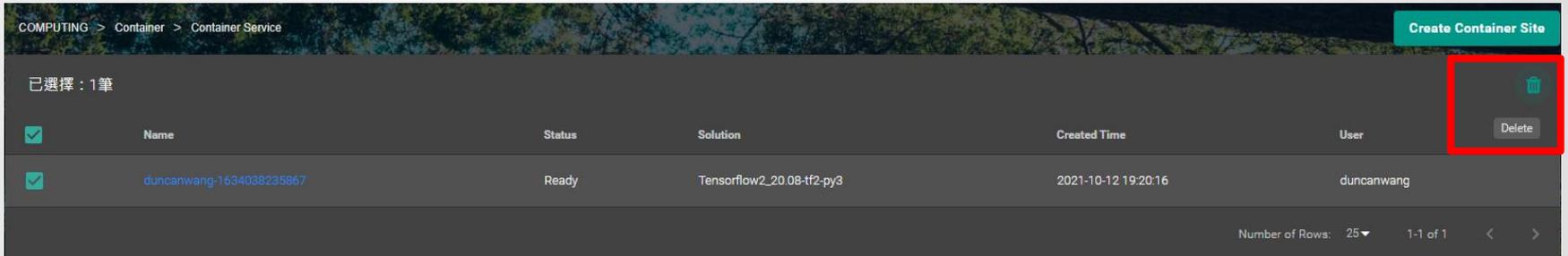


The screenshot shows a Jupyter Notebook terminal window with the following output:

```
rary libcublas.so.10
Train Epoch: 01 Loss= 7.5230 Accuracy= 0.8734
Train Epoch: 02 Loss= 4.8690 Accuracy= 0.9042
Train Epoch: 03 Loss= 4.0796 Accuracy= 0.9112
Train Epoch: 04 Loss= 3.2345 Accuracy= 0.9236
Train Epoch: 05 Loss= 2.8889 Accuracy= 0.9322
Train Epoch: 06 Loss= 2.6569 Accuracy= 0.9346
Train Epoch: 07 Loss= 2.2852 Accuracy= 0.9376
Train Epoch: 08 Loss= 2.1612 Accuracy= 0.9414
Train Epoch: 09 Loss= 2.0701 Accuracy= 0.9436
Train Epoch: 10 Loss= 1.9700 Accuracy= 0.9472
Train Epoch: 11 Loss= 1.9423 Accuracy= 0.9436
Train Epoch: 12 Loss= 1.8761 Accuracy= 0.9502
```

Container Service – deleting container site

- After finishing running the code, please delete the container site to release the resources(GPU).



COMPUTING > Container > Container Service Create Container Site

已選擇：1筆

<input checked="" type="checkbox"/>	Name	Status	Solution	Created Time	User	<input type="checkbox"/>
<input checked="" type="checkbox"/>	duncanwang-1634038235867	Ready	Tensorflow2_20.08-tf2-py3	2021-10-12 19:20:16	duncanwang	Delete

Number of Rows: 25 1-1 of 1