

Introduction to TensorFlow

Getting Started

郭耀仁

大綱

- 張量
- 運算
- TensorBoard
- 隨堂練習

張量 (tensor)

- n 維陣列 (array)
 - 純量 (scalar) : 零維張量
 - 向量 (vector) : 一維張量
 - 矩陣 (matrix) : 二維張量
 - 張量 (tensor) : n 維張量, $n \geq 3$

```
In [1]: import numpy as np
import tensorflow as tf

tf_scalar = tf.constant(87)
tf_vector = tf.constant([8, 7])
tf_matrix = tf.constant([
    [8, 7],
    [7, 8]
])
arr = np.arange(24).reshape(2, 3, 4)
tf_tensor = tf.constant(arr)

print(tf_scalar)
print(tf_vector)
print(tf_matrix)
print(tf_tensor)
```

```
Tensor("Const:0", shape=(), dtype=int32)
Tensor("Const_1:0", shape=(2,), dtype=int32)
Tensor("Const_2:0", shape=(2, 2), dtype=int32)
Tensor("Const_3:0", shape=(2, 3, 4), dtype=int64)
```

運算

加法

```
In [2]: x = tf.constant(8, name="x")
        y = tf.constant(7, name="y")
        print(x)
        print(y)
        tf_add = tf.add(x, y)
        print(tf_add)

Tensor("x:0", shape=(), dtype=int32)
Tensor("y:0", shape=(), dtype=int32)
Tensor("Add:0", shape=(), dtype=int32)
```

```
In [3]: # 建立一個 Session 獲得解答
sess = tf.Session()
ans = sess.run(tf_add)
print(ans)
sess.close()
```

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乘法


```
In [4]: # 用 with 建立 Session
tf_multiply = tf.multiply(x, y)
with tf.Session() as sess:
    ans = sess.run(tf_multiply)
    print(ans)
# sess.close() can be neglected if using with statement
```

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減法

```
In [5]: # 用 with 建立 Session
tf_subtract = tf.subtract(x, y)
with tf.Session() as sess:
    ans = sess.run(tf_subtract)
    print(ans)
```

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除法

In [6]:

```
# 注意 type 要為浮點數
x = tf.constant(8.0, name="x")
y = tf.constant(7.0, name="y")
print(x)
print(y)
```

```
Tensor("x_1:0", shape=(), dtype=float32)
Tensor("y_1:0", shape=(), dtype=float32)
```

```
In [7]: # 用 with 建立 Session
tf_div = tf.div(x, y)
with tf.Session() as sess:
    ans = sess.run(tf_div)
    print(ans)
```

1.1428572



```
In [8]: # 注意 type 為整數
x = tf.constant(8, name="x")
y = tf.constant(7, name="y")
print(x)
print(y)
tf_div = tf.truediv(x, y)
with tf.Session() as sess:
    ans = sess.run(tf_div)
    print(ans)
```

```
Tensor("x_2:0", shape=(), dtype=int32)
Tensor("y_2:0", shape=(), dtype=int32)
1.1428571428571428
```

TensorFlow 的運算方法不是唯一解，簡單點可以使用
Python 3 的運算符號

```
In [9]: x = tf.constant(11, name="x")
y = tf.constant(6, name="y")

tf_add = x + y
tf_multiply = x * y
tf_subtract = x - y
tf_div = x / y
tf_pow = x**2
tf_mod = x % y
tf_ans = x // y
tf_ops = [tf_add, tf_multiply, tf_subtract, tf_div, tf_pow, tf_mod, tf_ans]

with tf.Session() as sess:
    for tf_op in tf_ops:
        ans = sess.run(tf_op)
        print(ans)
```

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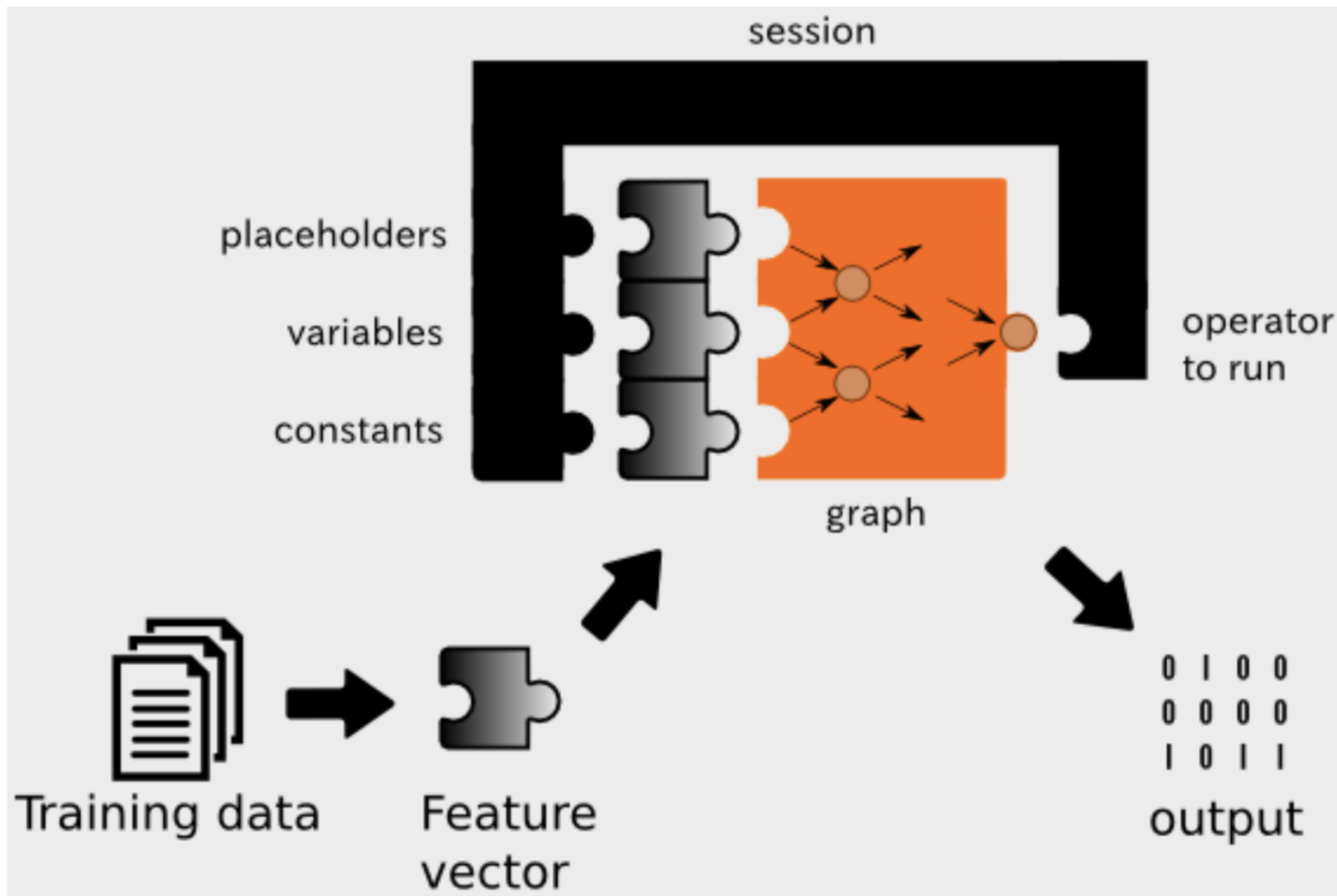
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Session 是 TensorFlow 的重要觀念

- 運算必須在 Session 中執行
- Session 接受三種類型：
 - Constant(We've used so far)
 - Placeholder(TBD)
 - Variable(TBD)

更具象化的 Session



TensorBoard

如何將 Graph 視覺化

建立一個叫做 `graphs` 的資料夾

```
mkdir graphs
```

撰寫一個相加的運算

```
In [10]: import tensorflow as tf

x = tf.constant(8, name="x")
y = tf.constant(7, name="y")
tf_add = tf.add(x, y)

with tf.Session() as sess:
    writer = tf.summary.FileWriter('./graphs/tf_add', sess.graph)
    print(sess.run(tf_add))
writer.close()
```

啟動 TensorBoard

```
tensorboard --logdir=./graphs/tf_add --host=127.0.0.1
```

```
## Starting TensorBoard b'41' on port 6006
```

```
## (You can navigate to http://127.0.0.1:6006)
```


打開 TensorBoard


- 打開瀏覽器前往 <http://127.0.0.1:6006>
(<http://127.0.0.1:6006>).
- 點選 GRAPHS 頁籤

We are all set!

TensorBoard

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 Fit to screen

 Download PNG

Run
(1)

Session
runs (0)


Upload

Trace inputs ☐

Color ☒ Structure
☐ Device

colors

Main GraphAuxiliary Nodes



隨堂練習

使用 TensorFlow 實作攝氏溫度轉換華氏溫度的計算

- 將現在台北市的攝氏溫度轉換為華氏溫度
- 啟動 TensorBoard 服務觀察這個運算，將日誌儲存至
`graphs/celcius_to_fahrenheit`

$$F = \frac{9}{5}C + 32$$

使用 TensorFlow 實作 BMI 的計算

- 計算 Shaquille O'Neal 巔峰時期（216 公分、147 公斤）的 BMI
- 啟動 TensorBoard 服務觀察這個運算，將日誌儲存至 `graphs/bmi`

$$BMI = \frac{weight_{kg}}{height_m^2}$$