

實驗25

A. 使用tensorflow計算函數

$z(x, y) = x^2 + \tanh(y^2)$ 的數值微分

B. 使用tensorflow計算函數 $y(x) = x^3$ 的一

階數值微分與二階數值微分

C. 使用tensorflow計算函數MLP的參數微分

實驗25-A

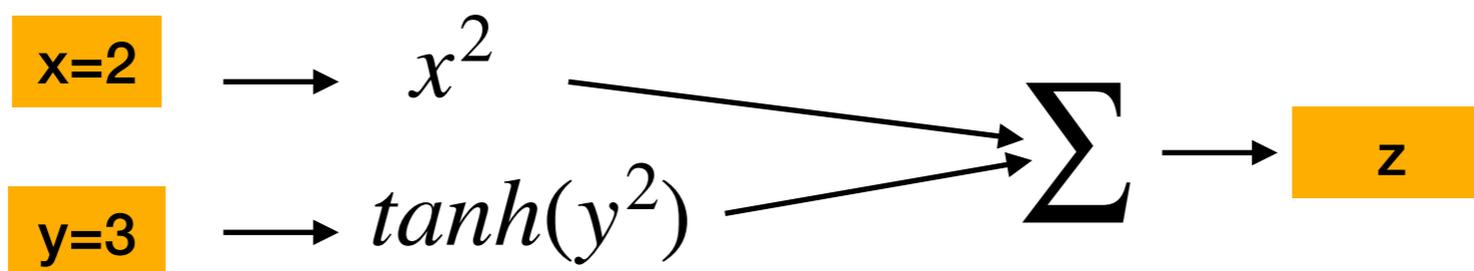
使用**tensorflow**計算函數

$$z(x, y) = x^2 + \tanh(y^2)$$

的數值微分

Lecture 19

函數計算流程



$$z = ?$$

步驟一、安裝後匯入 **tensorflow**

install
tensorflow

six	1.17.0	1.17.0
tensorboard	2.10.1	▲ 2.20.0
tensorboard-data-server	0.6.1	▲ 0.7.2
tensorboard-plugin-wit	1.8.1	1.8.1
tensorflow	2.10.0	▲ 2.20.0
tensorflow-estimator	2.10.0	▲ 2.15.0
tensorflow-io-gcs-filesystem	0.37.1	0.37.1
termcolor	3.1.0	▲ 3.2.0
typing-extensions	4.15.0	4.15.0

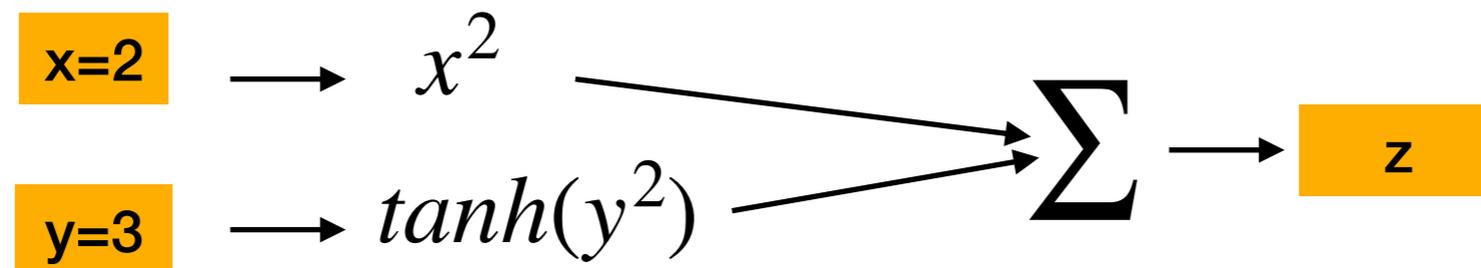
```
import tensorflow as tf
```

步驟二、順向計算

令 $x=2, y=2$

計算 $z = ?$

Forward computation



$z = ?$

```
x = tf.Variable(2.0)
y = tf.Variable(3.0)
y_sq = tf.math.tanh(y**2)
z = x**2 + y_sq
print(z.numpy())
```

步驟三、使用**tf.GradientTape()**錄製計算過程，求

$$\frac{dz}{dx} \Big|_{x=2,y=3}$$

$$\frac{dz}{dy} \Big|_{x=2,y=3}$$

實驗25-B

使用**tensorflow**計算函數

$$y(x) = x^3$$

的一階數值微分與二階數值微分

A yellow callout box with a pointed top, containing the text "Lecture 19".

Lecture 19

函數計算流程

$$\boxed{x=2} \longrightarrow x^3 \longrightarrow \boxed{y}$$

$$y = ?$$

步驟一、安裝後匯入 **tensorflow**

install
tensorflow

six	1.17.0	1.17.0
tensorboard	2.10.1	▲ 2.20.0
tensorboard-data-server	0.6.1	▲ 0.7.2
tensorboard-plugin-wit	1.8.1	1.8.1
tensorflow	2.10.0	▲ 2.20.0
tensorflow-estimator	2.10.0	▲ 2.15.0
tensorflow-io-gcs-filesystem	0.37.1	0.37.1
termcolor	3.1.0	▲ 3.2.0
typing-extensions	4.15.0	4.15.0

```
import tensorflow as tf
```

步驟二、順向計算

令 $x=2$

計算 $y=?$

Forward computation

$$\boxed{x=2} \longrightarrow x^3 \longrightarrow \boxed{y}$$

$$y = ?$$

```
x = tf.Variable(2.0)
y = x * x * x
print(y.numpy())
```

步驟三、使用**tf.GradientTape()**錄製計算過程，求

$$\frac{dy}{dx} \Big|_{x=2} = ?$$

$$\frac{d^2y}{dx^2} \Big|_{x=2} = ?$$

實驗25-C

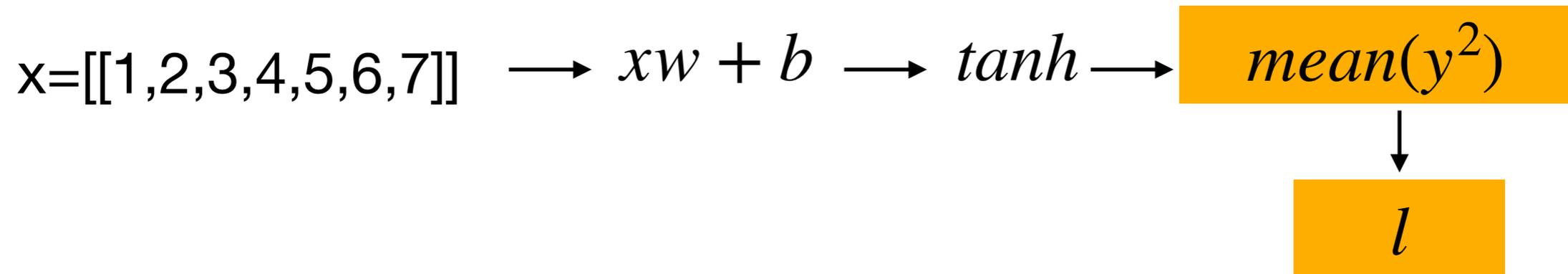
使用**tensorflow**計算函數

$$y = \tanh(xw + b), l = y^2$$

$\frac{dl}{dw}$ 與 $\frac{dl}{db}$ 的數值微分

Lecture 19

函數計算流程



For $w_{7 \times 2}$ and $b_{1 \times 2}$, $l = ?$

步驟一、安裝後匯入 **tensorflow**

install
tensorflow

six	1.17.0	1.17.0
tensorboard	2.10.1	▲ 2.20.0
tensorboard-data-server	0.6.1	▲ 0.7.2
tensorboard-plugin-wit	1.8.1	1.8.1
tensorflow	2.10.0	▲ 2.20.0
tensorflow-estimator	2.10.0	▲ 2.15.0
tensorflow-io-gcs-filesystem	0.37.1	0.37.1
termcolor	3.1.0	▲ 3.2.0
typing-extensions	4.15.0	4.15.0

```
import tensorflow as tf
```

步驟二、順向計算

令 $\mathbf{x} = [1, 2, 3, 4, 5, 6, 7]$

For random $w_{7 \times 2}$ and $b_{1 \times 2}$,
 $l = ?$

Forward computation

$x = [[1, 2, 3, 4, 5, 6, 7]] \rightarrow xw + b \rightarrow \tanh \rightarrow \text{mean}(y^2)$

For $w_{7 \times 2}$ and $b_{1 \times 2}$, $l = ?$

l

```
w = tf.Variable(tf.random.normal((7, 2)), name = 'w')
b = tf.Variable(tf.zeros(2, dtype = tf.float32), name = 'b')
x = [[1., 2., 3., 4., 5., 6., 7.]]
print(x[0:])
print('w', w.shape)
print('b', b.shape)
...
```

步驟三、使用tf.GradientTape()錄製計算過程，求

For $w_{7 \times 2}$ and $b_{1 \times 2}$, $\frac{dl}{db} = ?$

$$\frac{dl}{dw} = ?$$