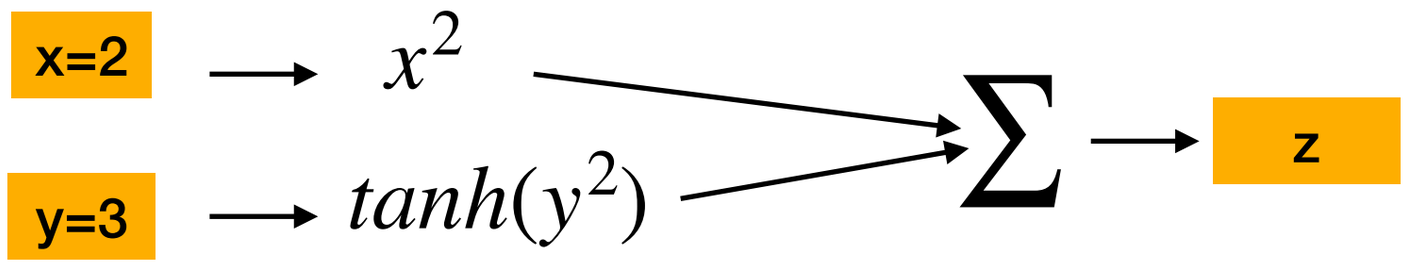
實驗25

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

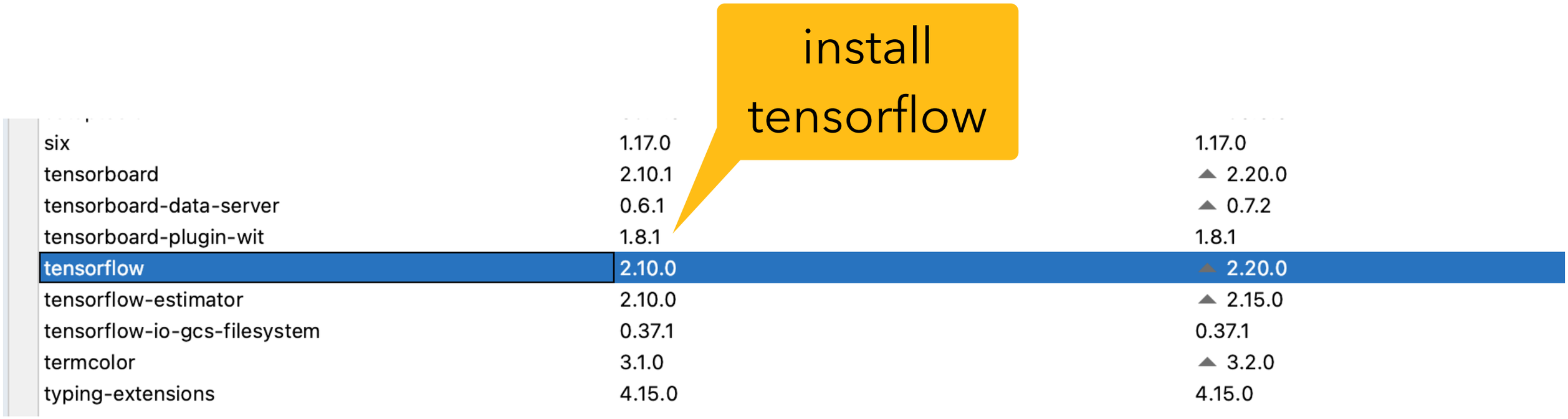
函數計算流程



$z = ?$

步驟一、安裝後匯入

tensorflow



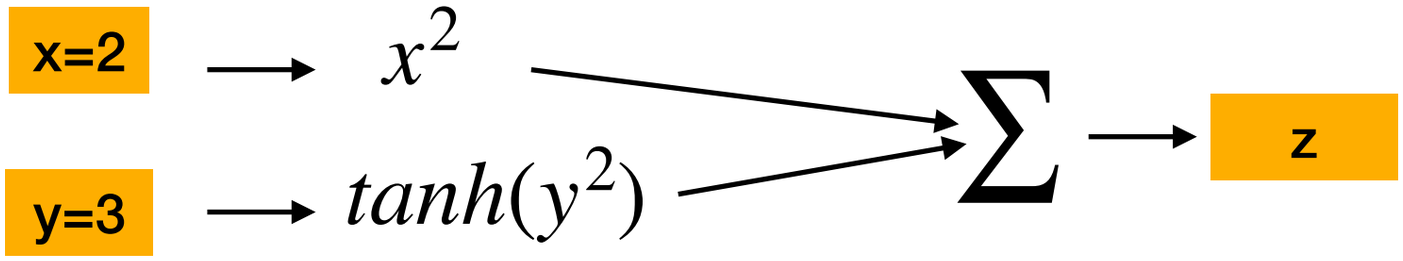

```
import tensorflow as tf
```

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

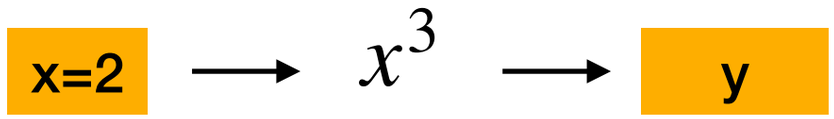
$$\frac{dz}{dx}\Big|_{x=2,y=3}$$

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

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

Lecture 19

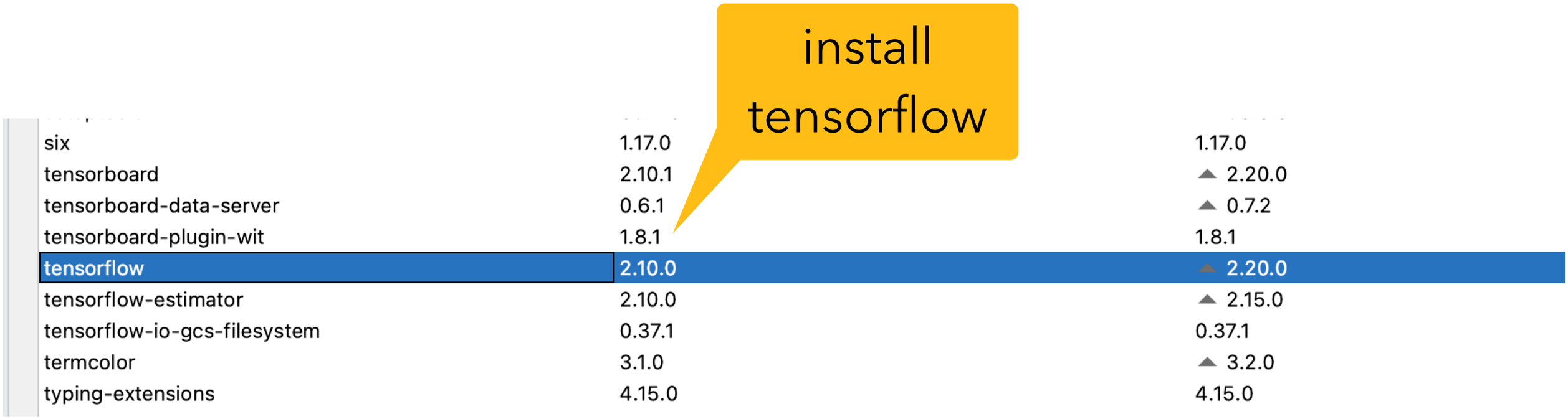
函數計算流程



$y = ?$

步驟一、安裝後匯入

tensorflow



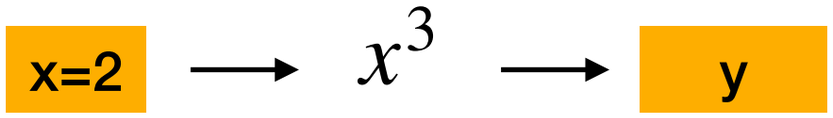

```
import tensorflow as tf
```

步驟二、順向計算

令$x=2$

計算$y=?$

Forward computation



$y = ?$

```
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

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

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

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

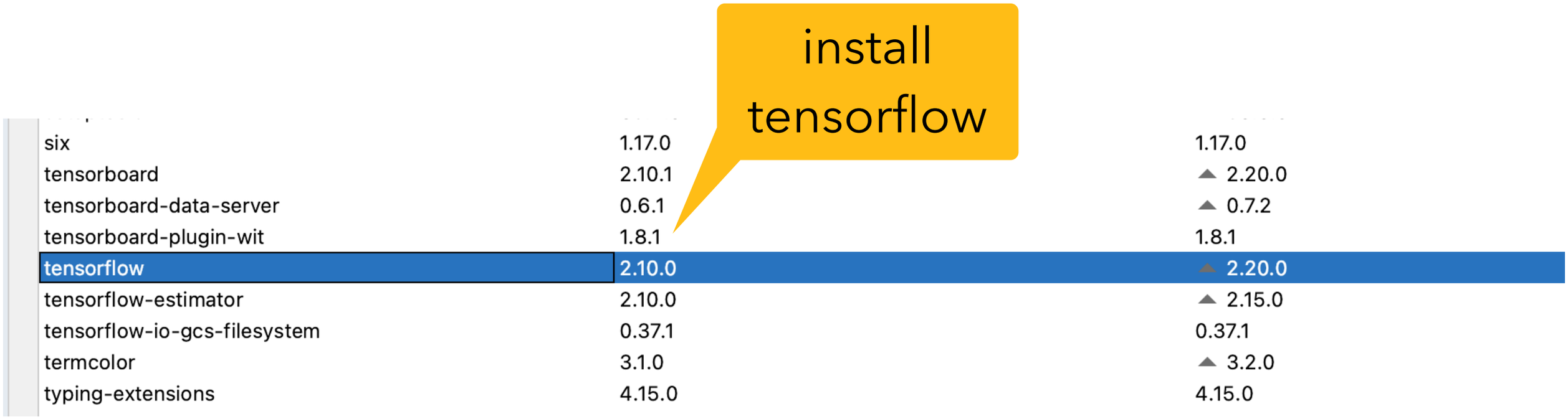
函數計算流程

x=[[1,2,3,4,5,6,7]] $\longrightarrow$ $xw+b$ $\longrightarrow$ $tanh$ $\longrightarrow$ $mean(y^2)$ $\downarrow$ l

For w_{7x2} and b_{1x2}, $l = ?$

步驟一、安裝後匯入

tensorflow




```
import tensorflow as tf
```

步驟二、順向計算

令x=[[1,2,3,4,5,6,7]]

For random w_{7x2} and b_{1x2},

$l = ?$

Forward computation

x=[[1,2,3,4,5,6,7]] $\longrightarrow$ $xw + b$ $\longrightarrow$ $tanh$ $\longrightarrow$ $mean(y^2)$ $\downarrow$ l

For w_{7x2} and b_{1x2}, $l = ?$

```
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_{7x2} and b_{1x2}, $\frac{dl}{db} = ?$

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