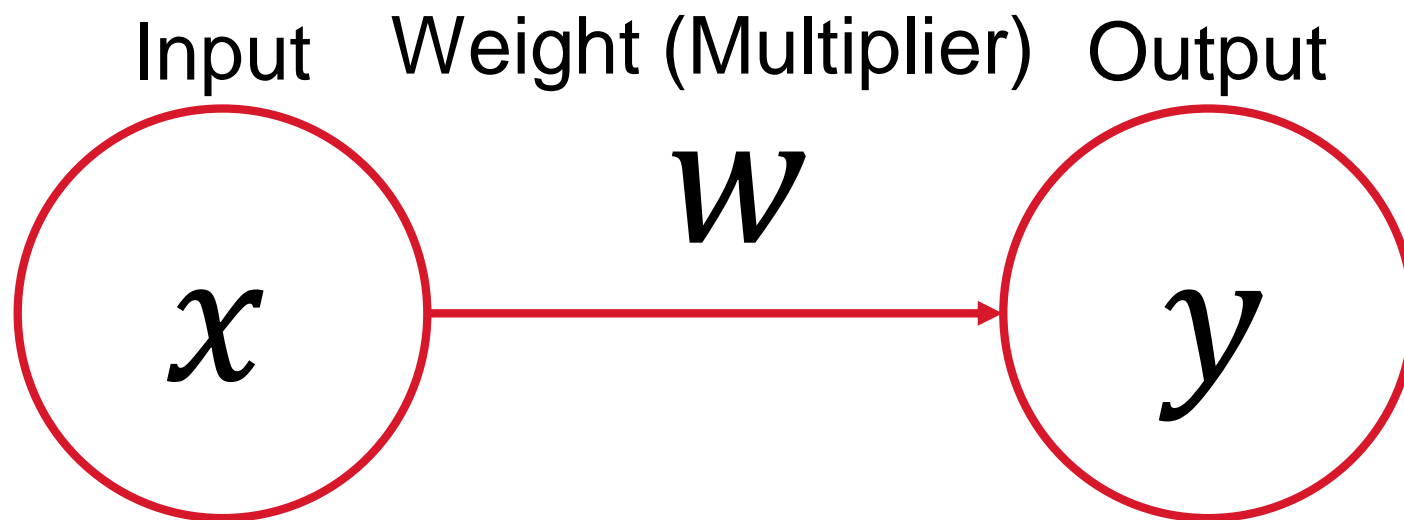
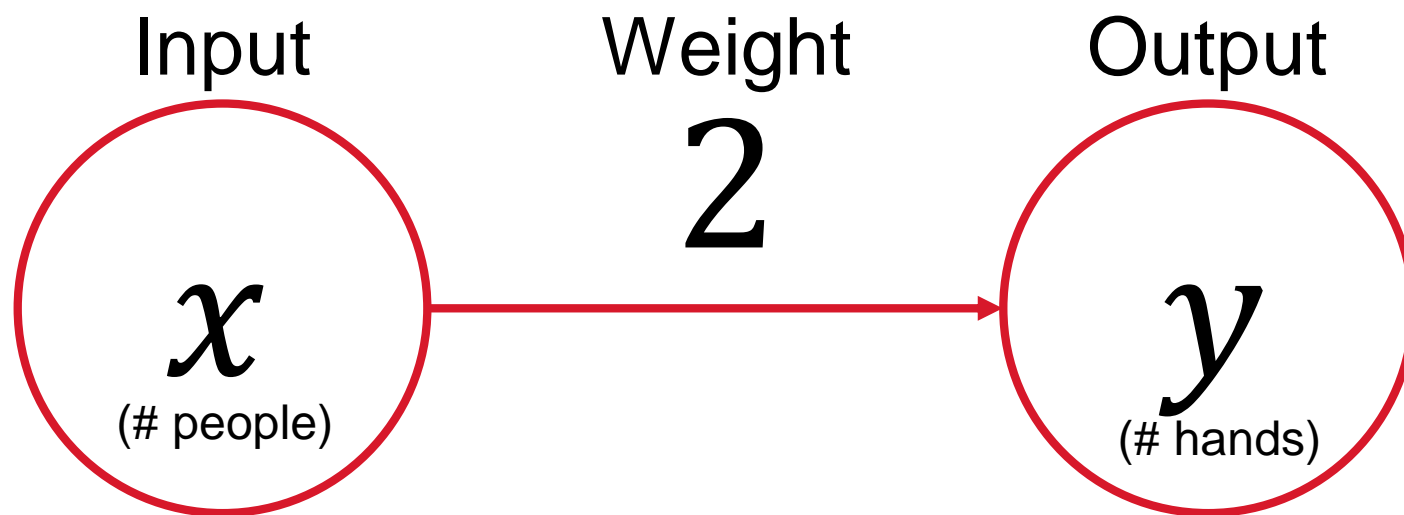


人工神經網路



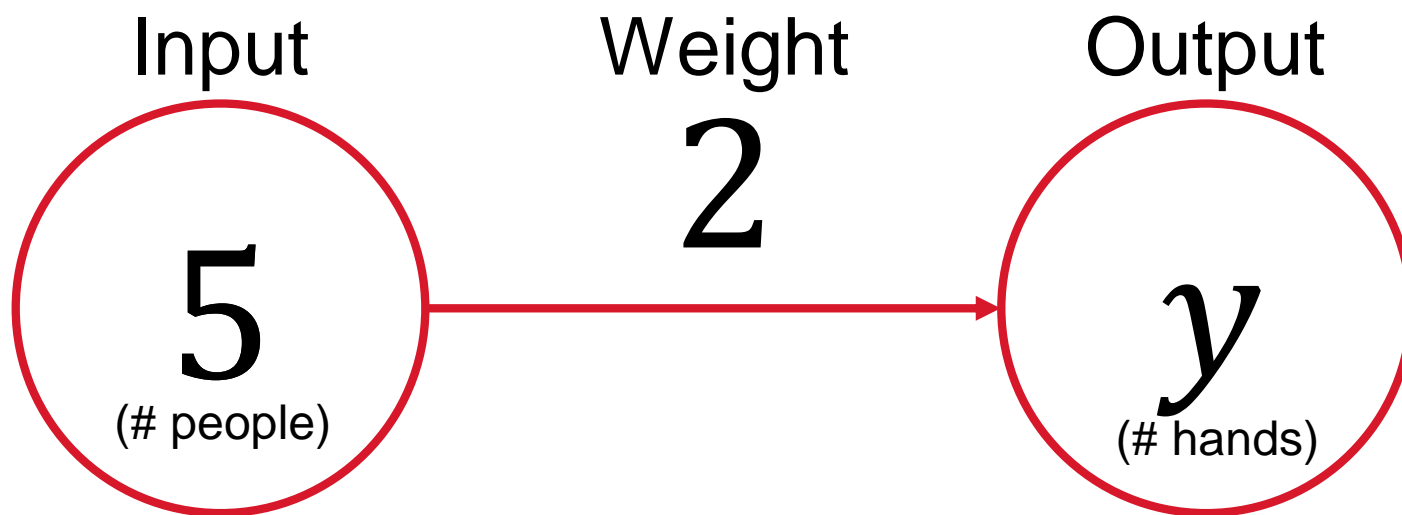
$$y = w \times x$$

Example: Predict the number of hands by the number of people



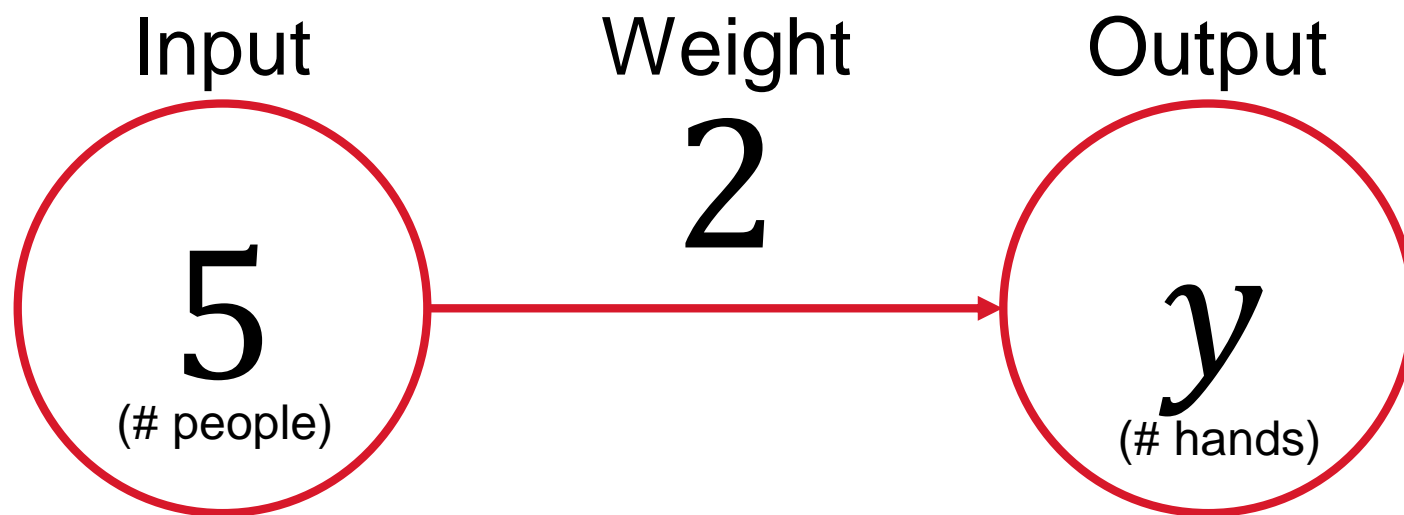
$$y = 2 \times x$$

Example: Predict the number of hands by the number of people



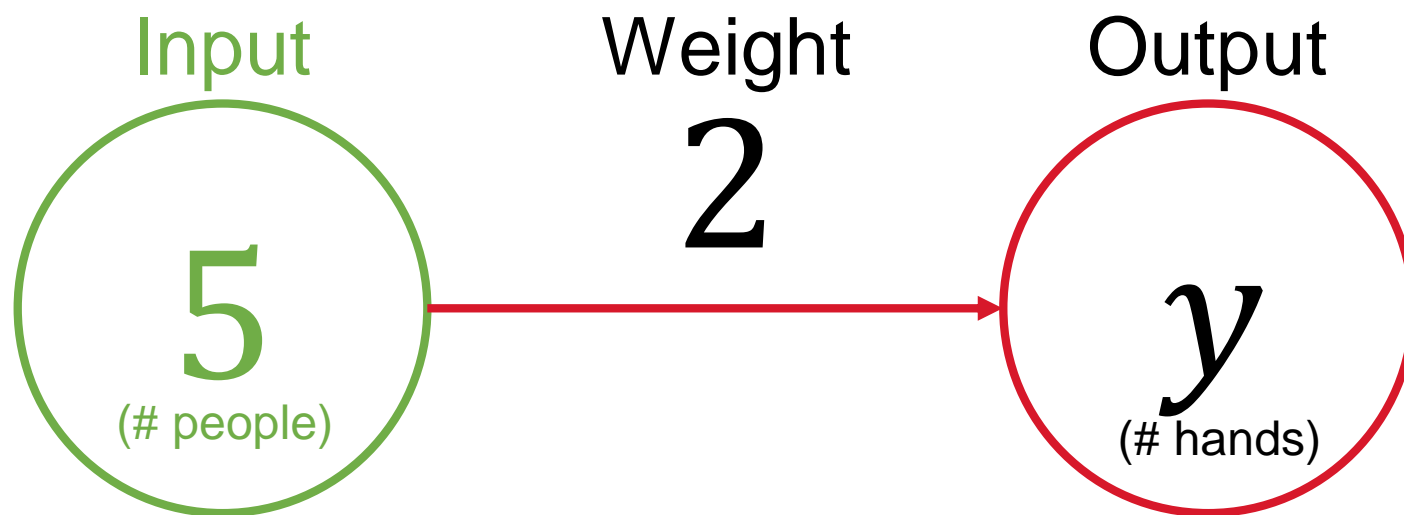
$$y = 2 \times x$$

Example: Predict the number of hands by the number of people



$$y = 2 \times 5$$

Example: Predict the number of hands by the number of people



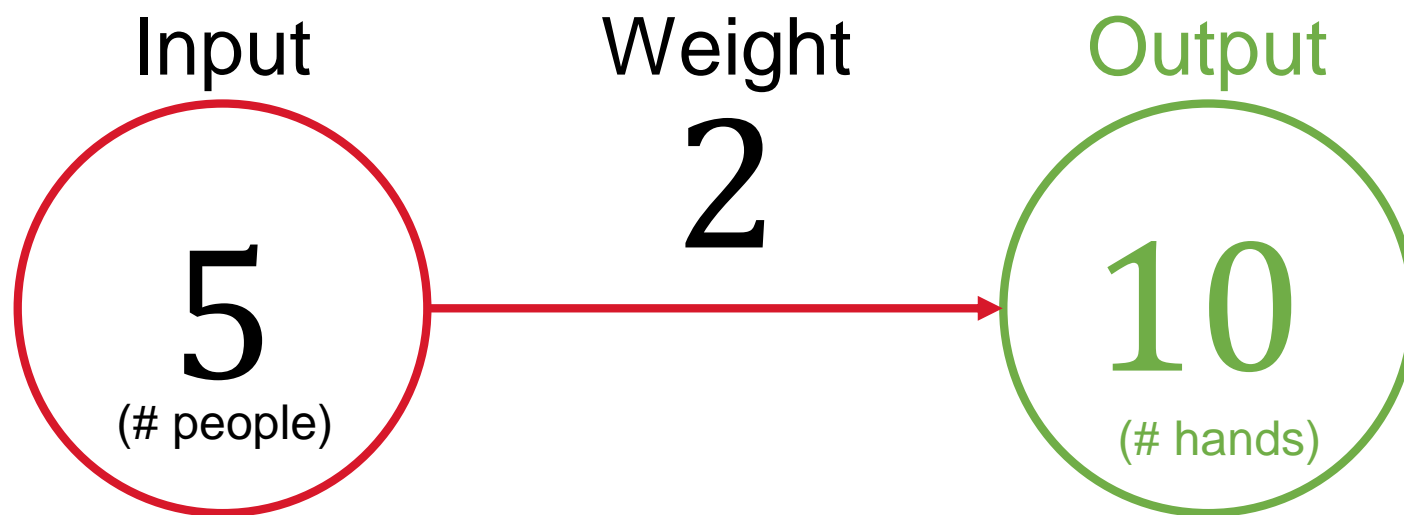
$$y = 2 \times 5$$

Example: Predict the number of hands by the number of people

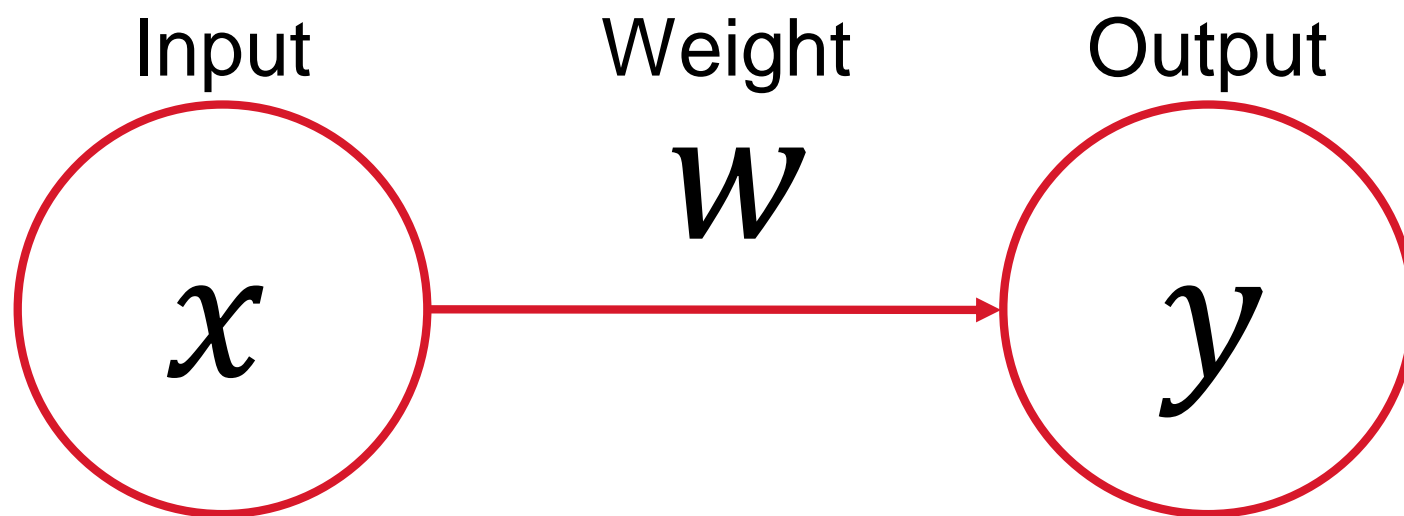


$$y = 2 \times 5$$

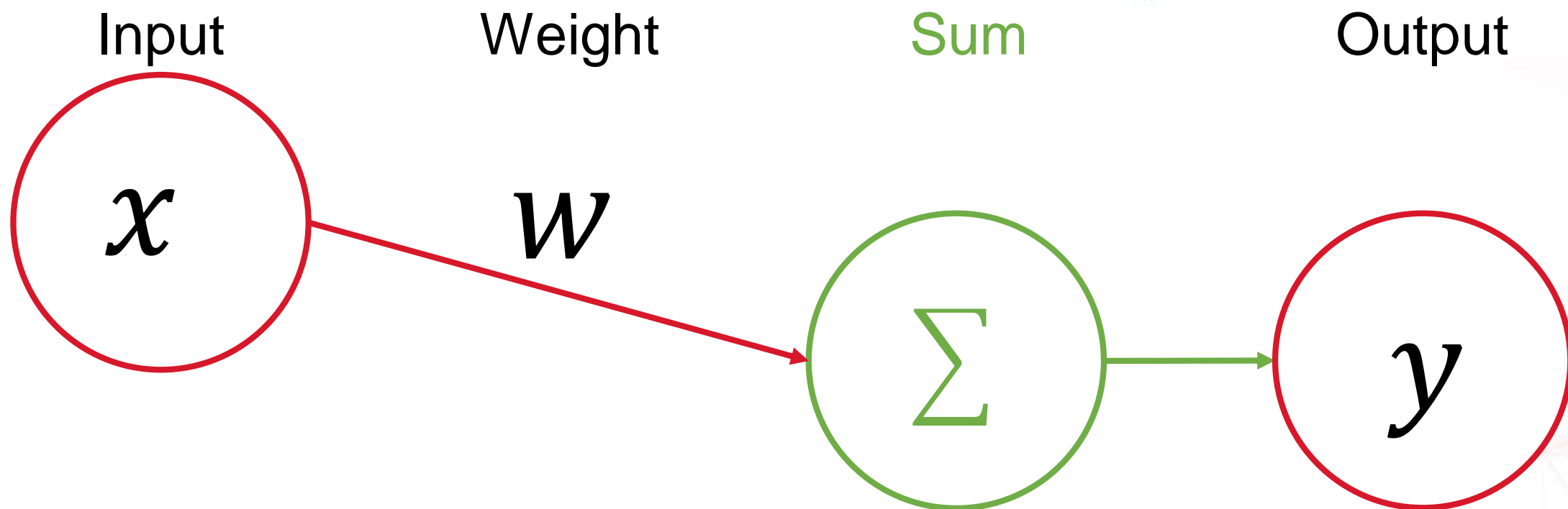
Example: Predict the number of hands by the number of people



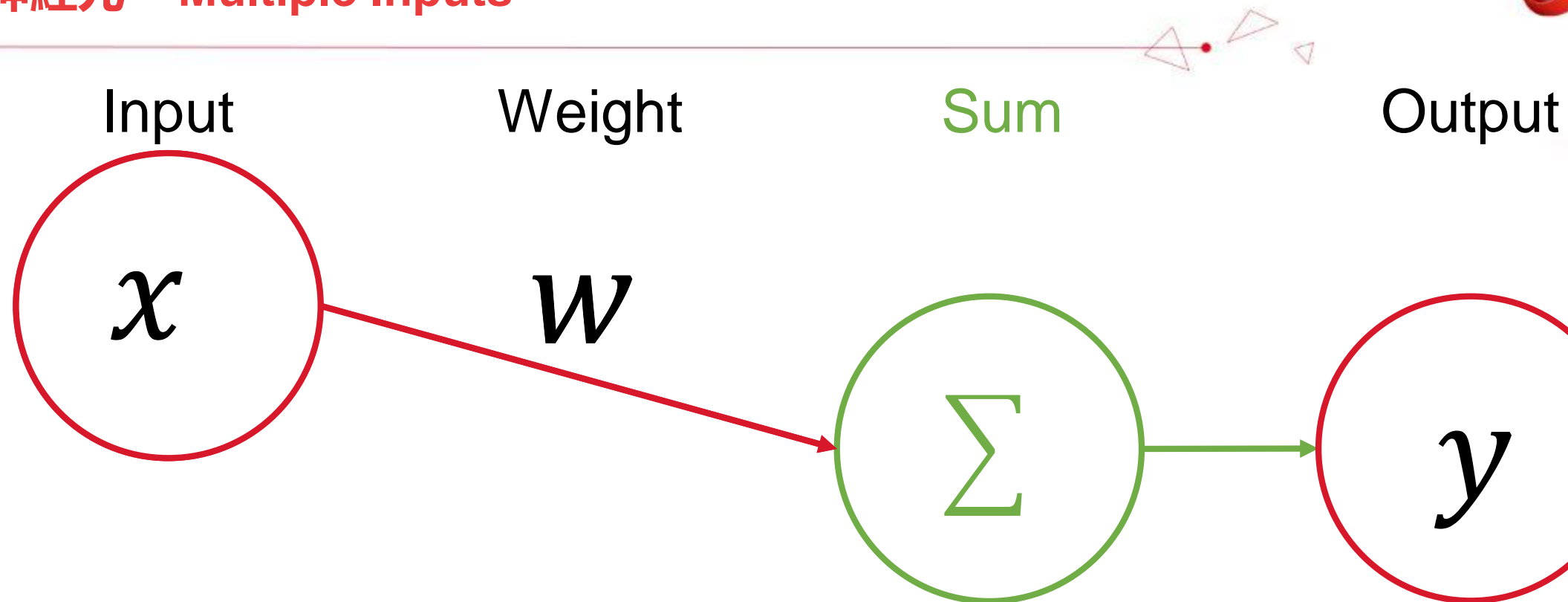
$$10 = 2 \times 5$$



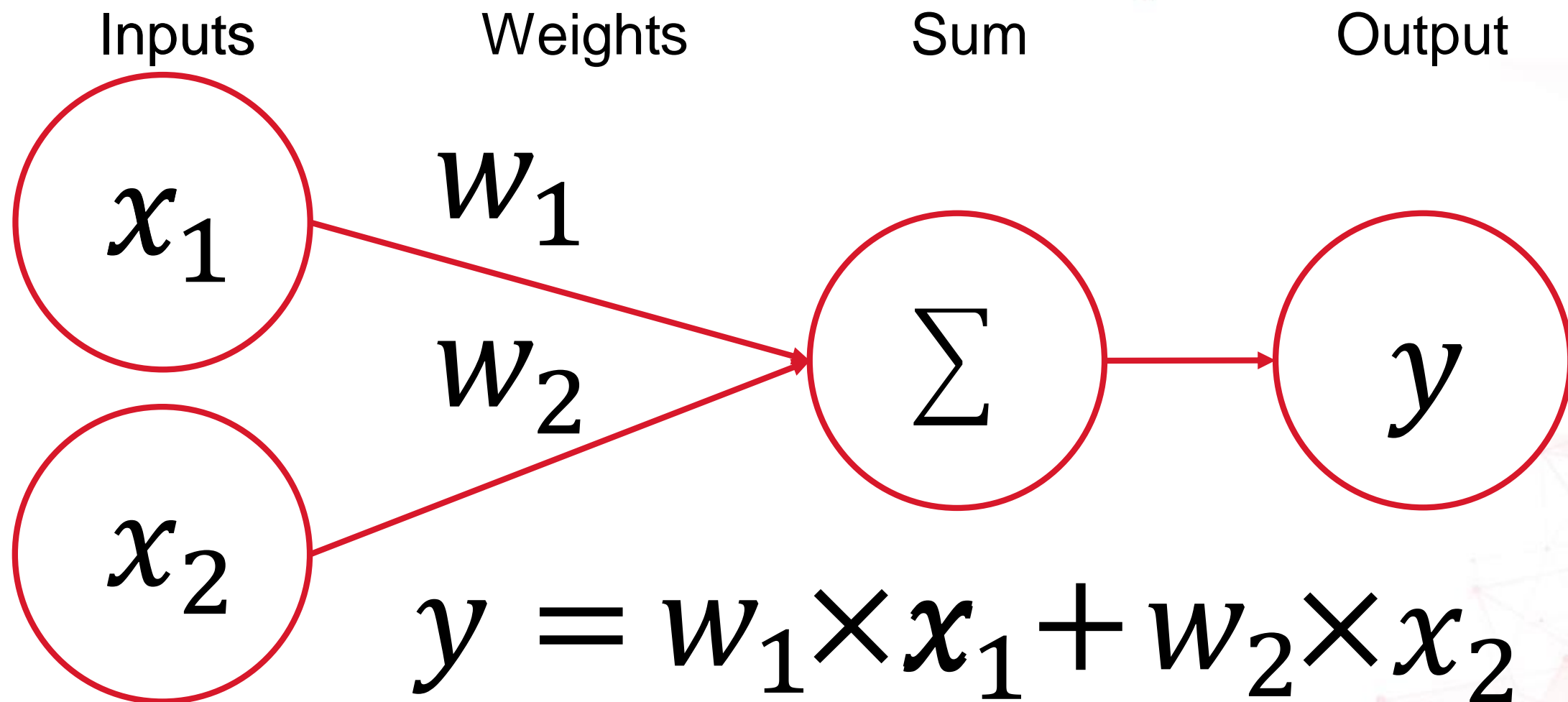
$$y = w \times x$$

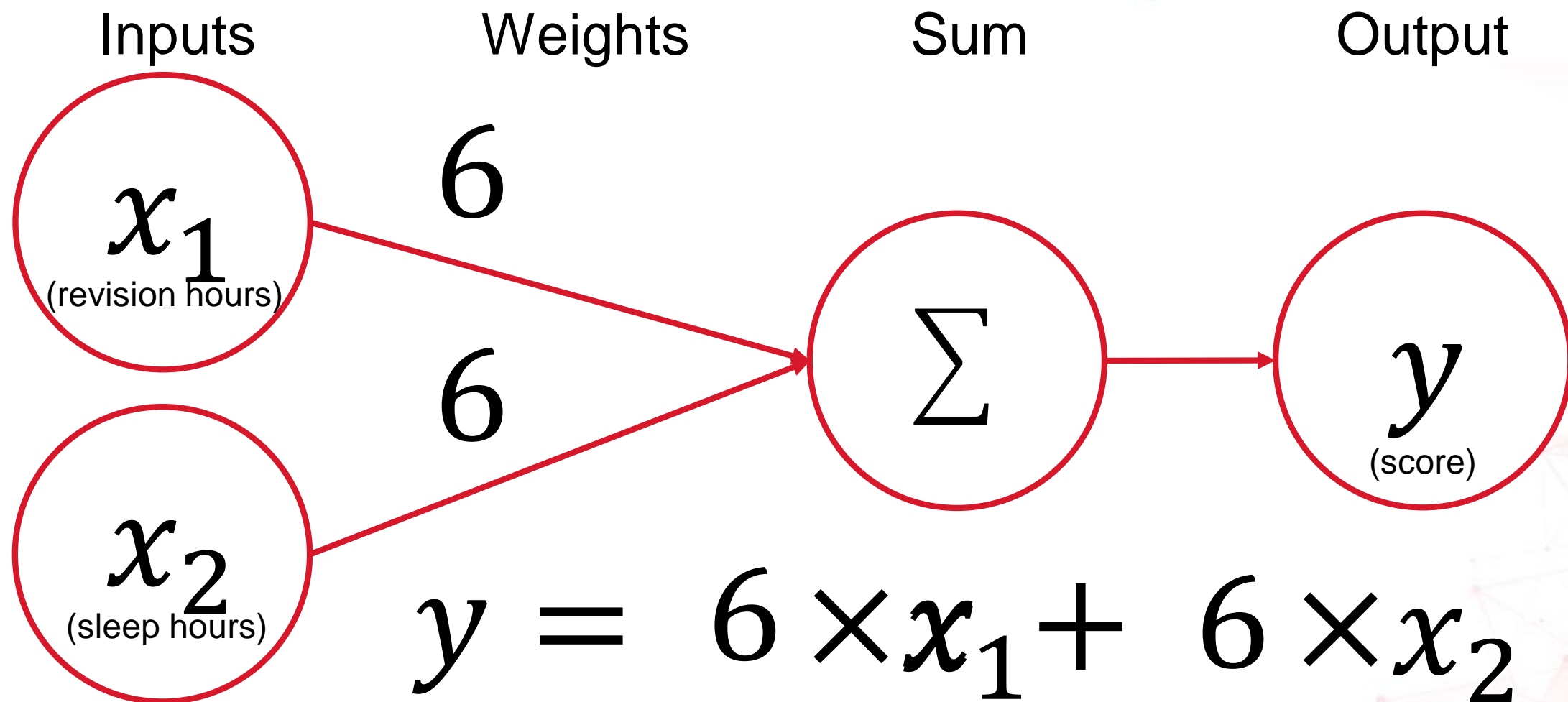


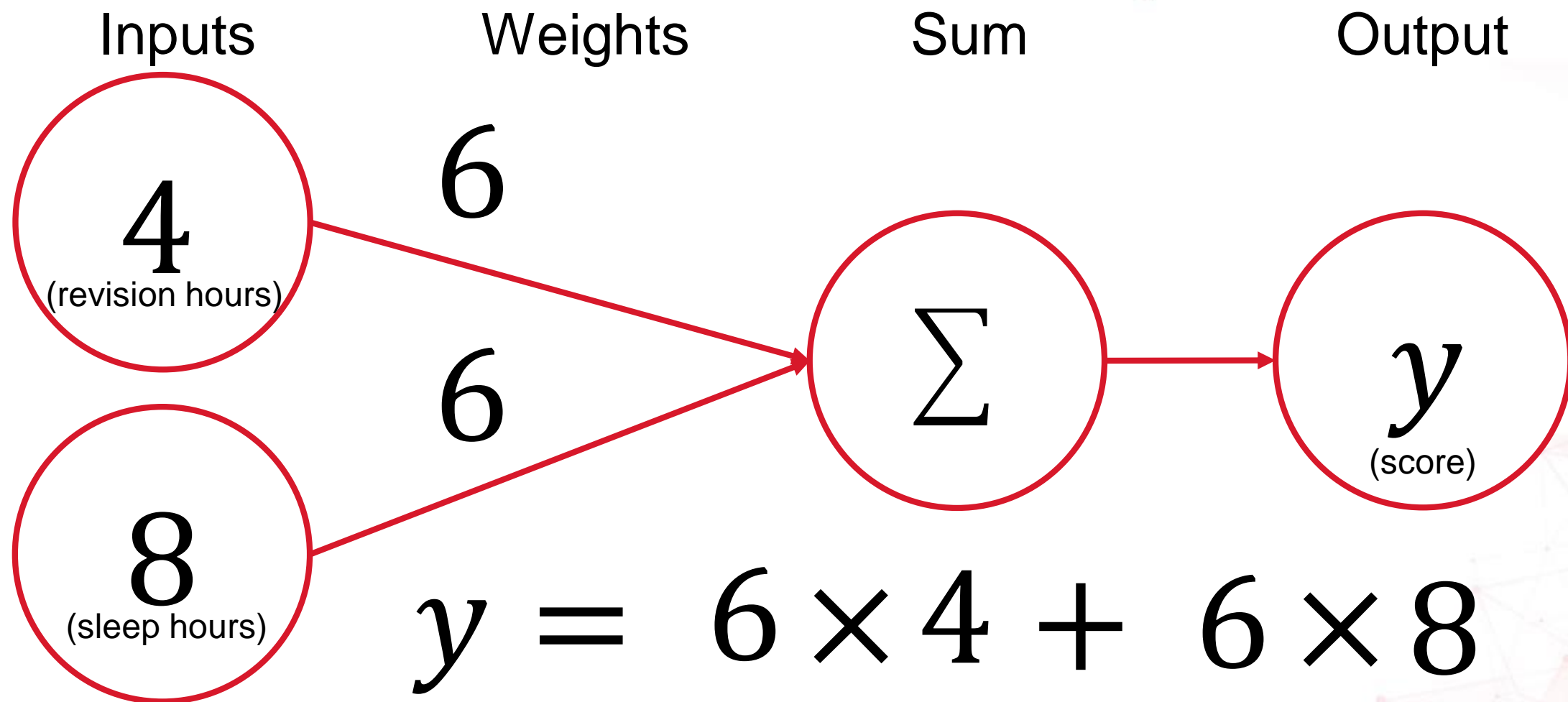
$$y = w \times x +$$

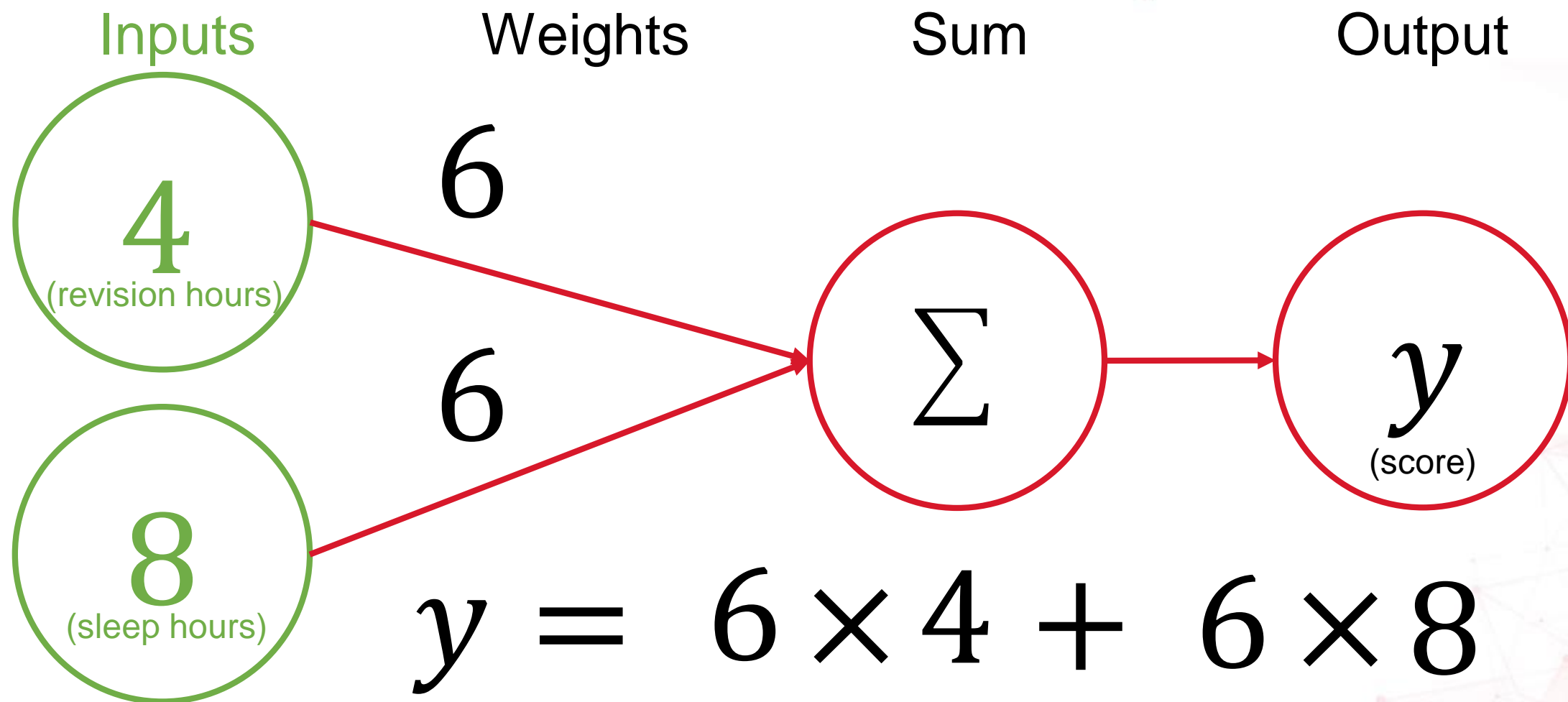


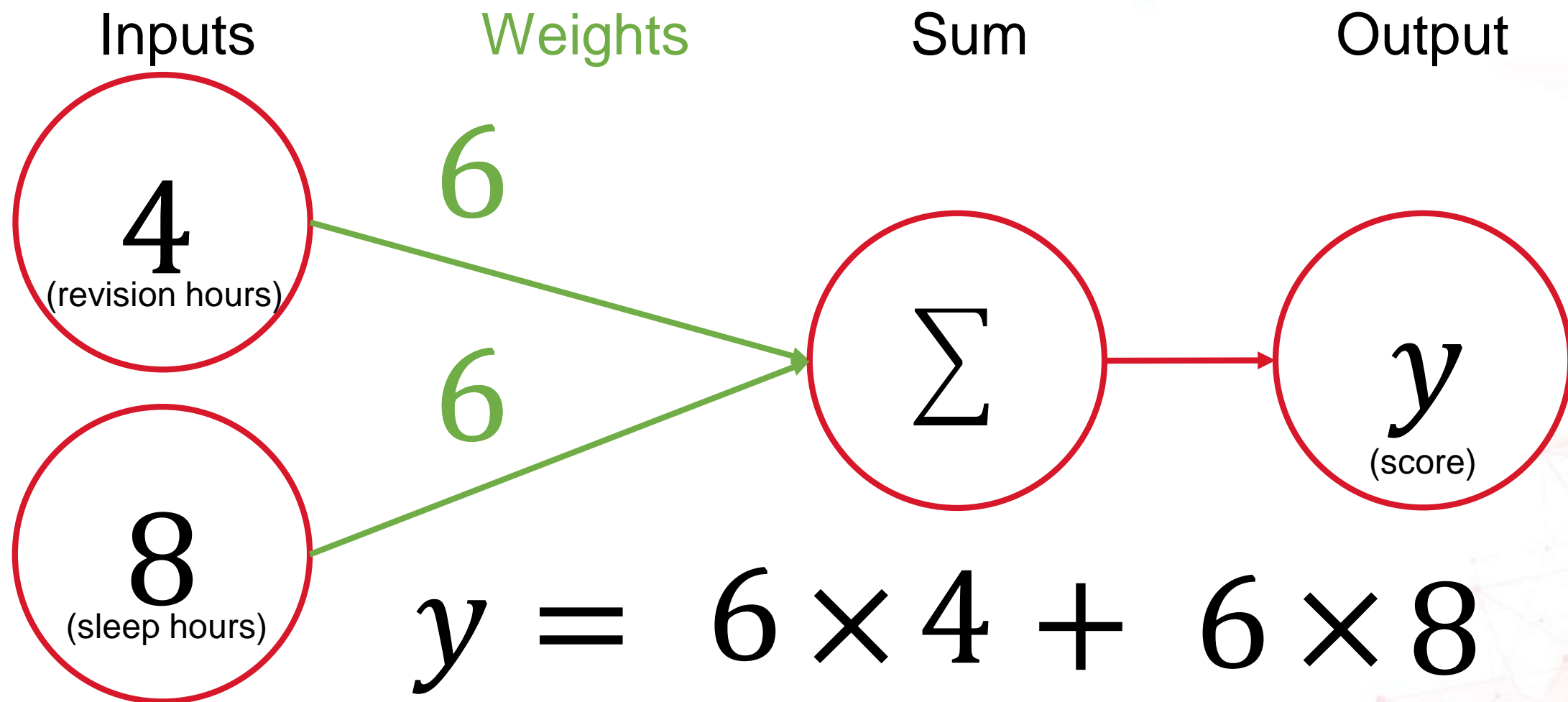
$$y = w \times x +$$

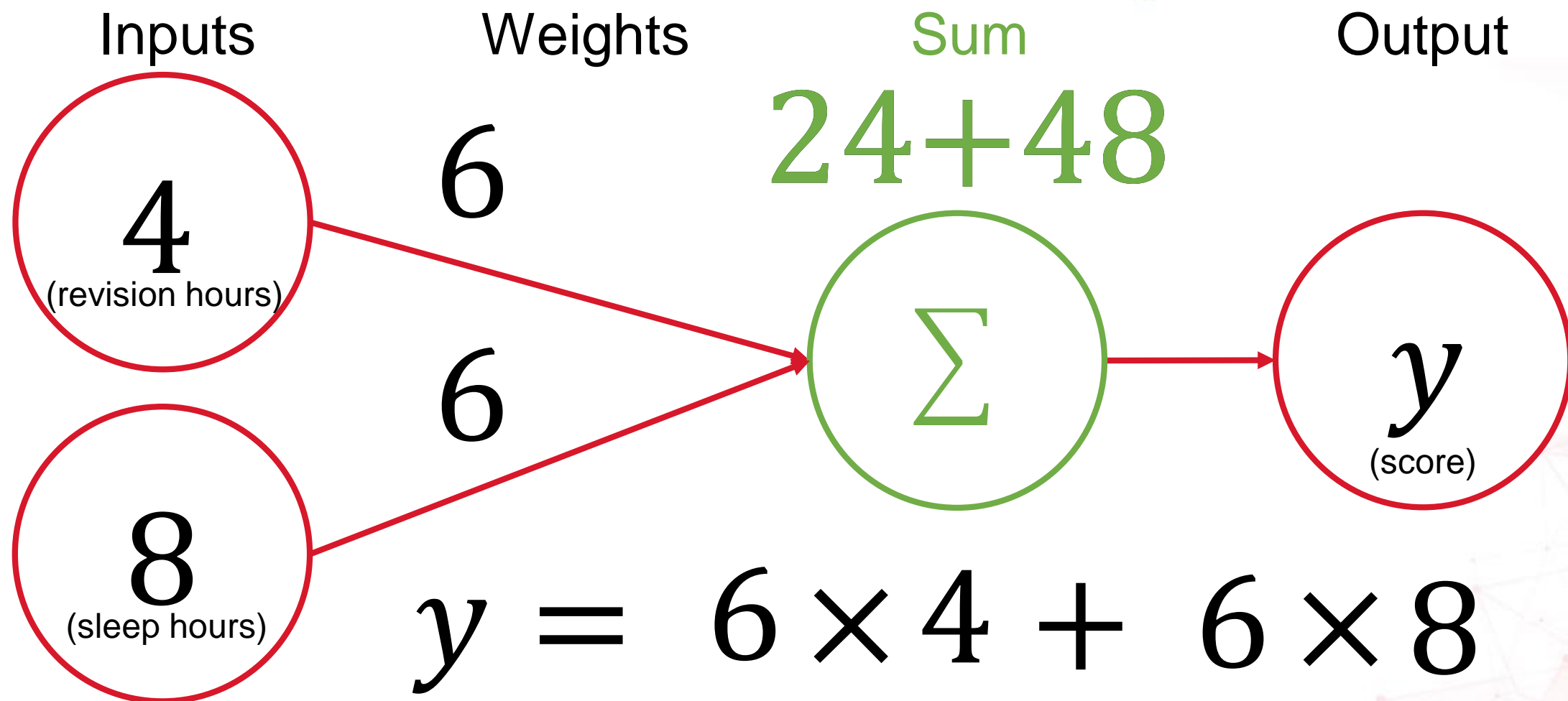


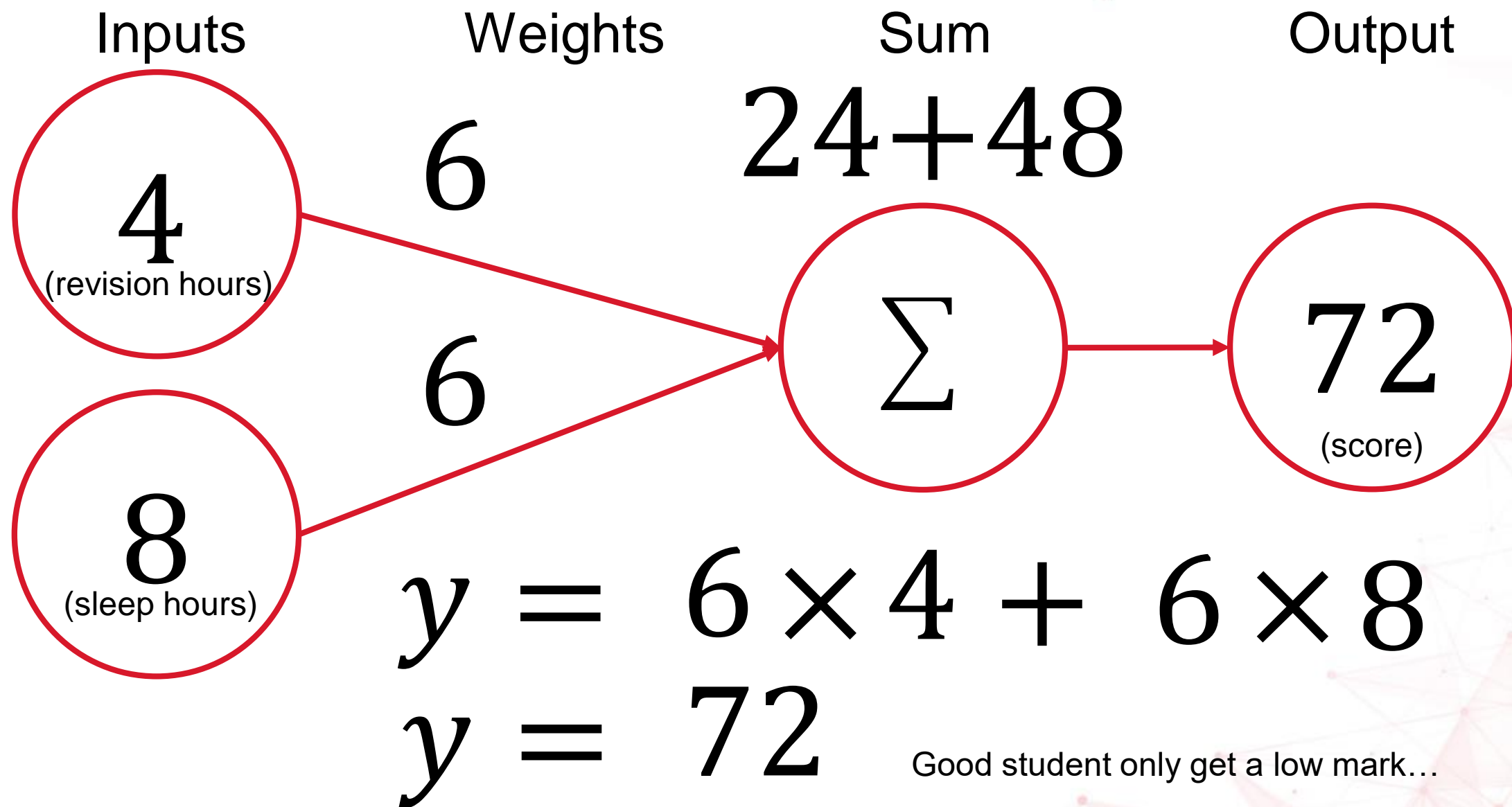




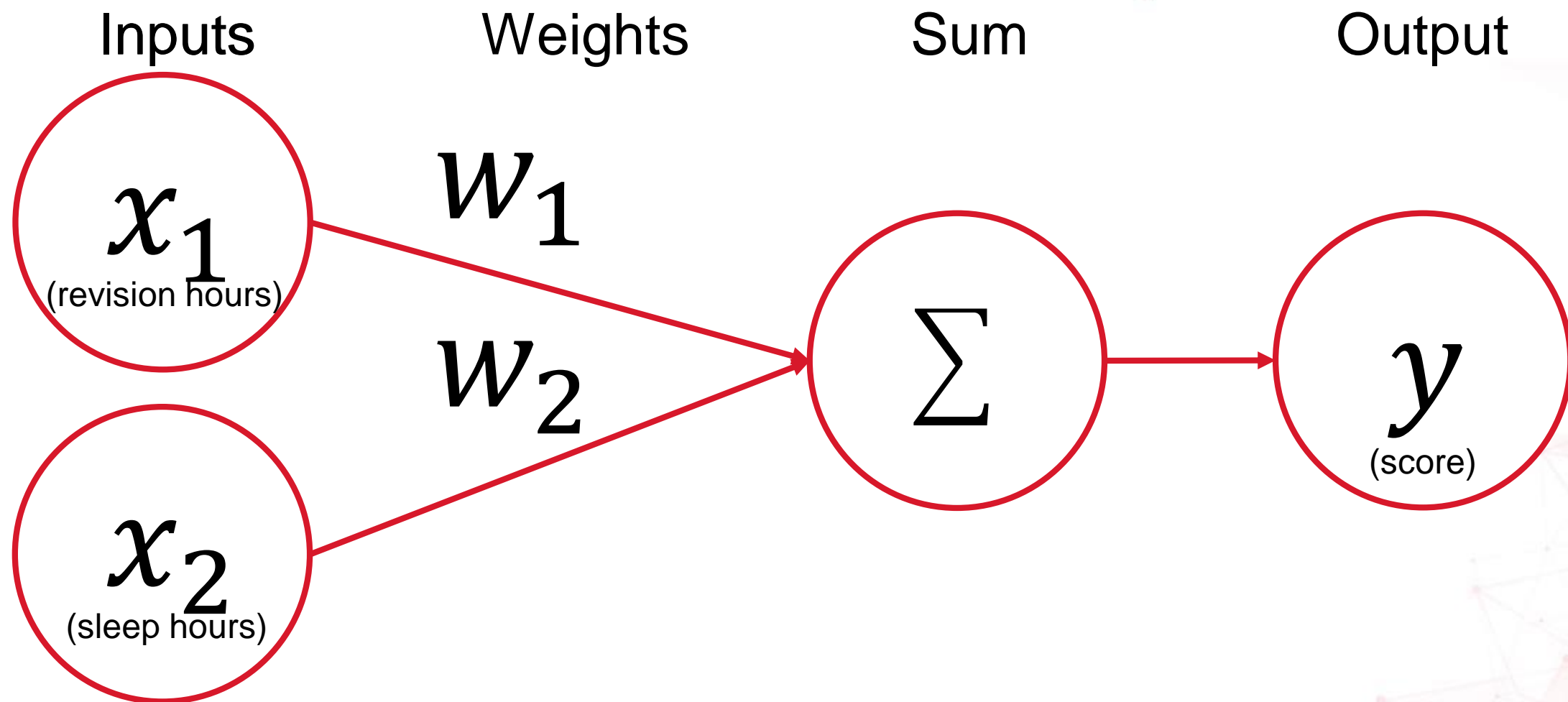




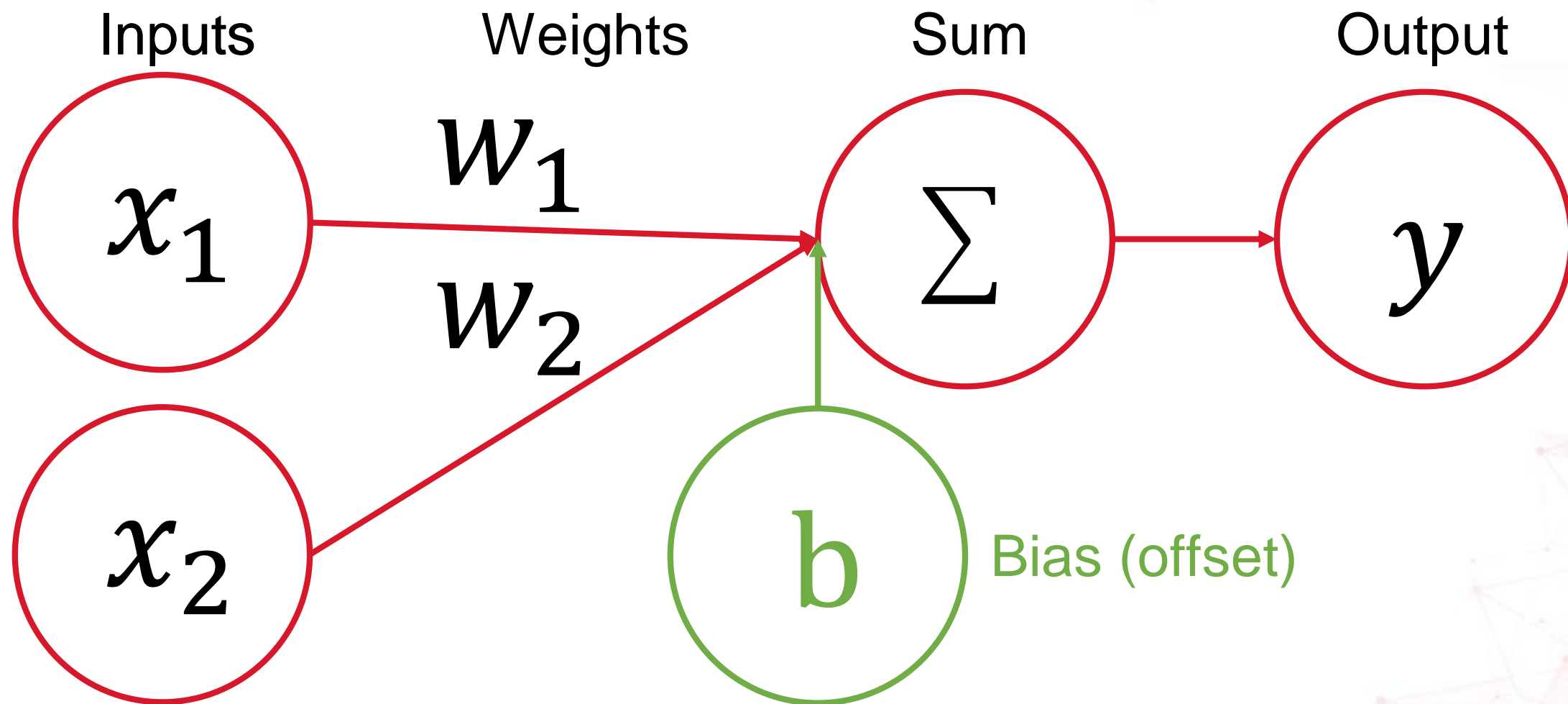




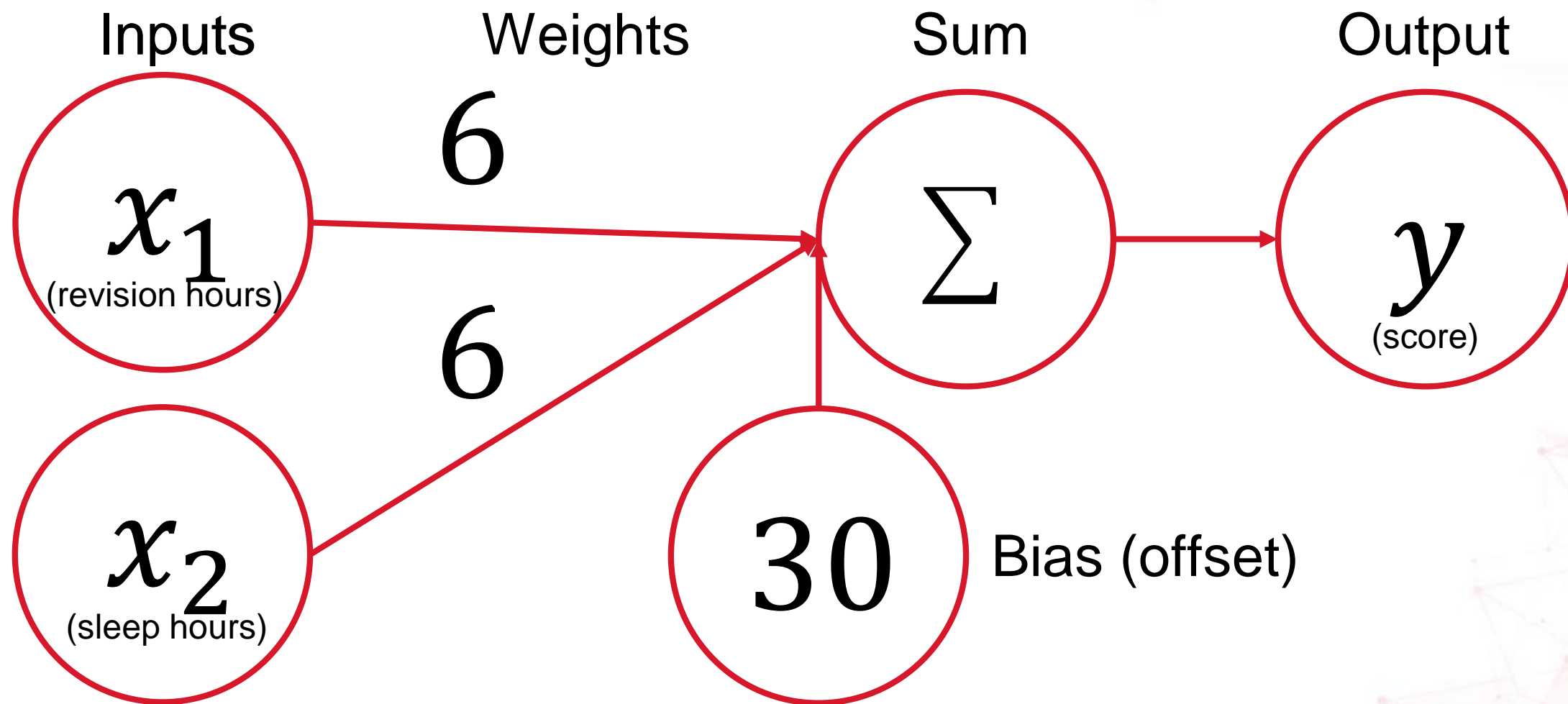
Good student only get a low mark...



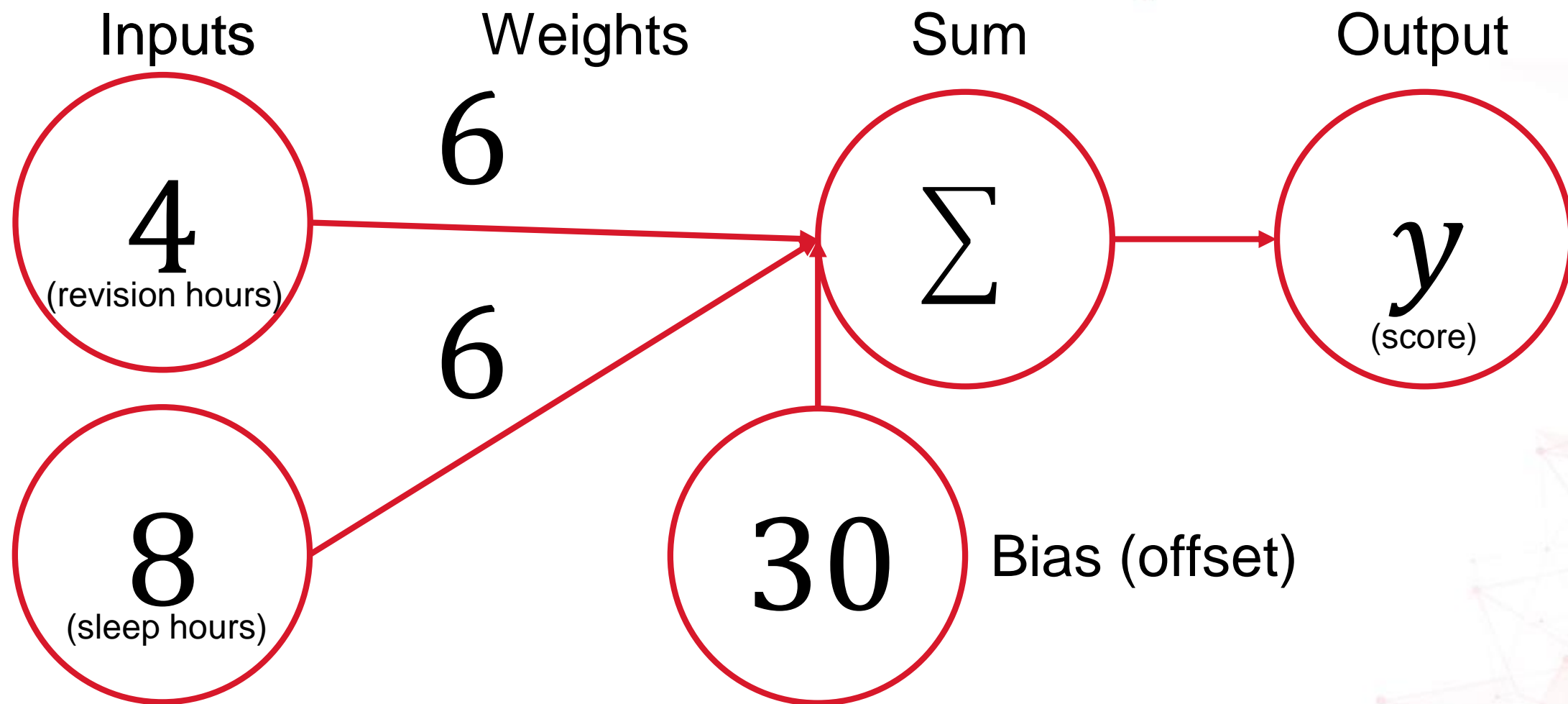
$$y = w_1 \times x_1 + w_2 \times x_2$$



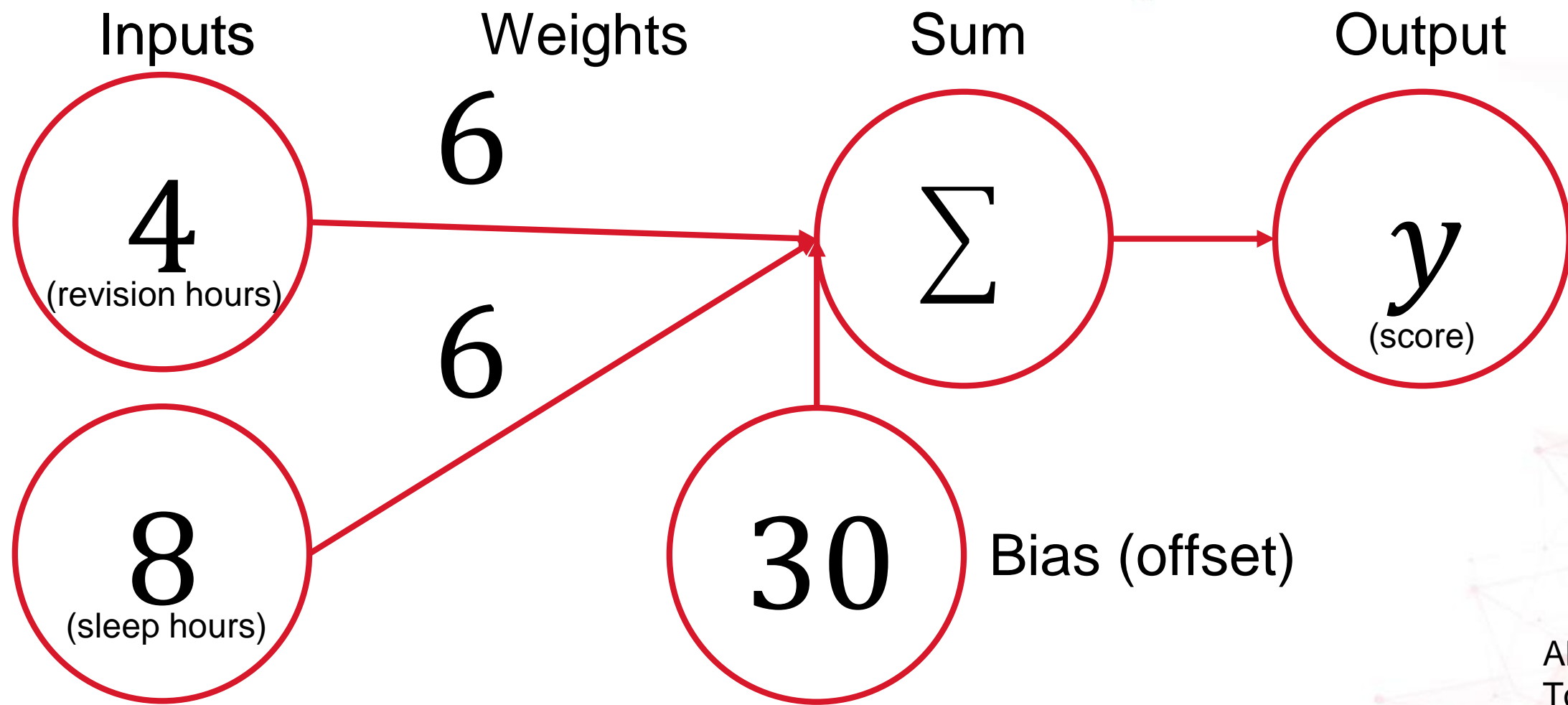
$$y = w_1 \times x_1 + w_2 \times x_2 + b$$



$$y = 6 \times x_1 + 6 \times x_2 + 30$$

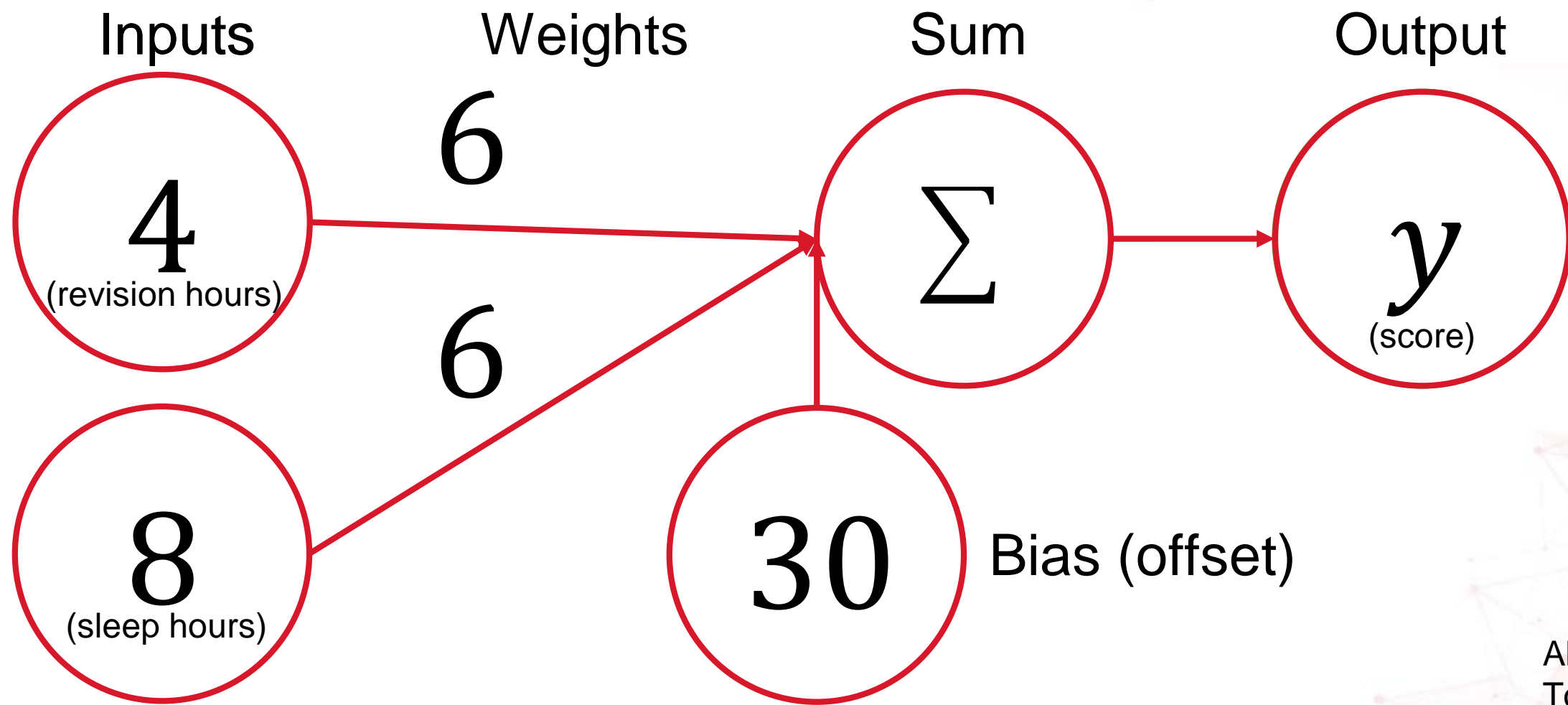


$$y = 6 \times 4 + 6 \times 8 + 30$$



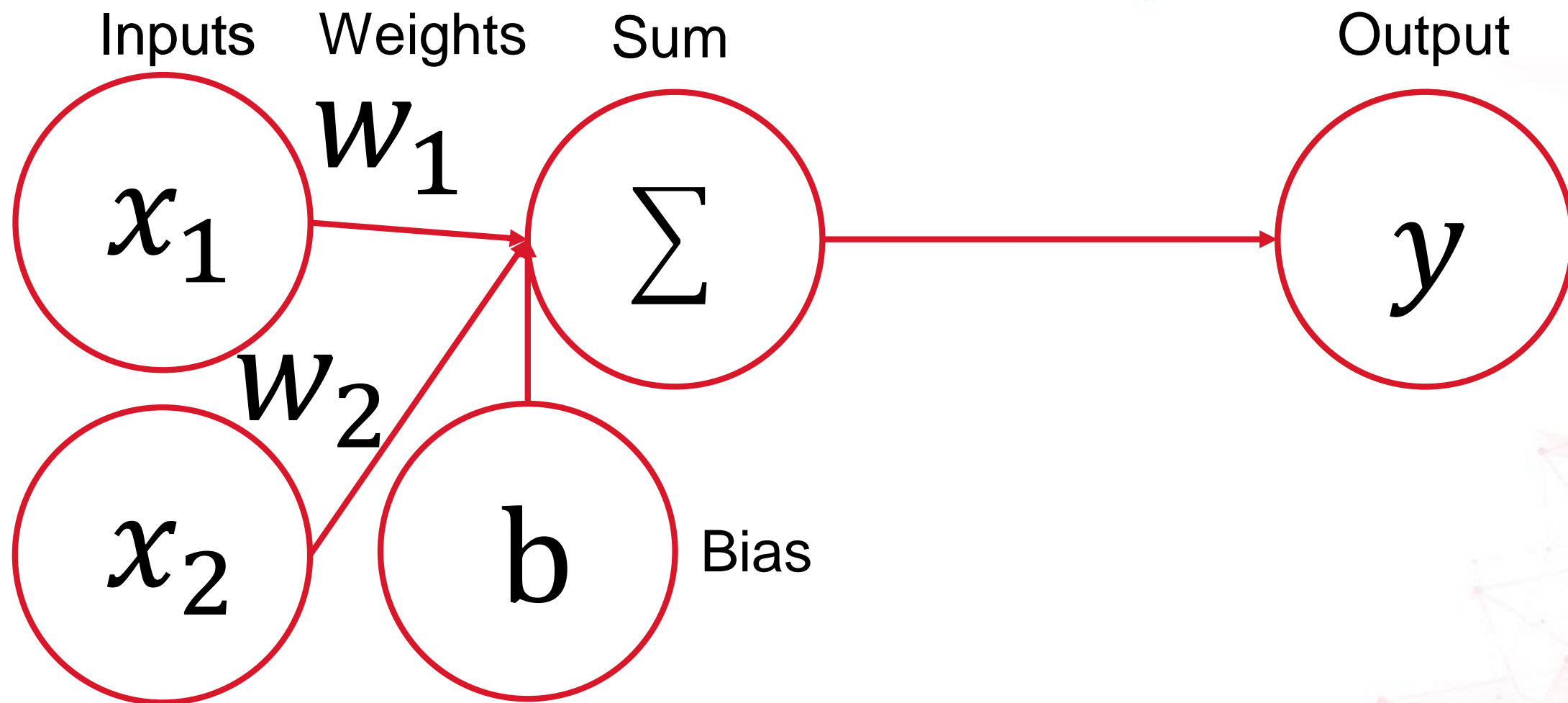
$$y = 6 \times 4 + 6 \times 8 + 30 = 102$$

Above 100
Too high!

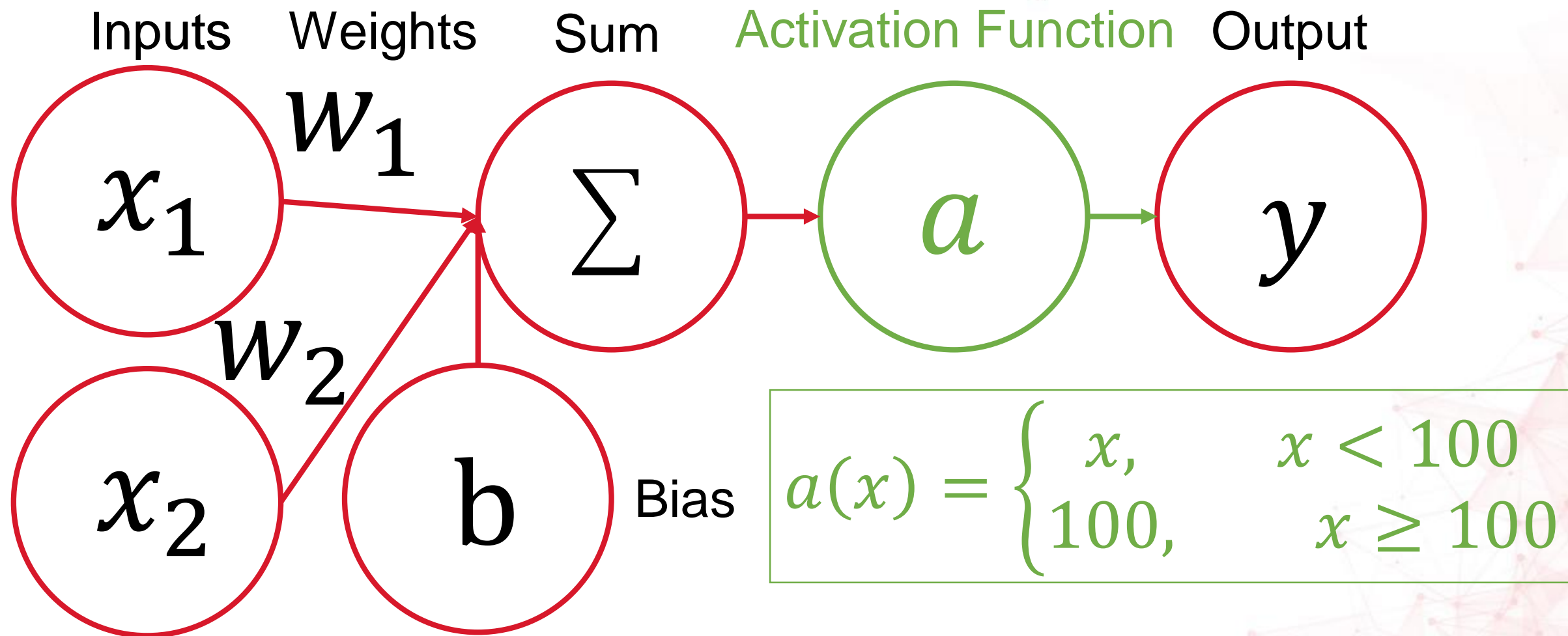


$$y = 6 \times 4 + 6 \times 8 + 30 = 102$$

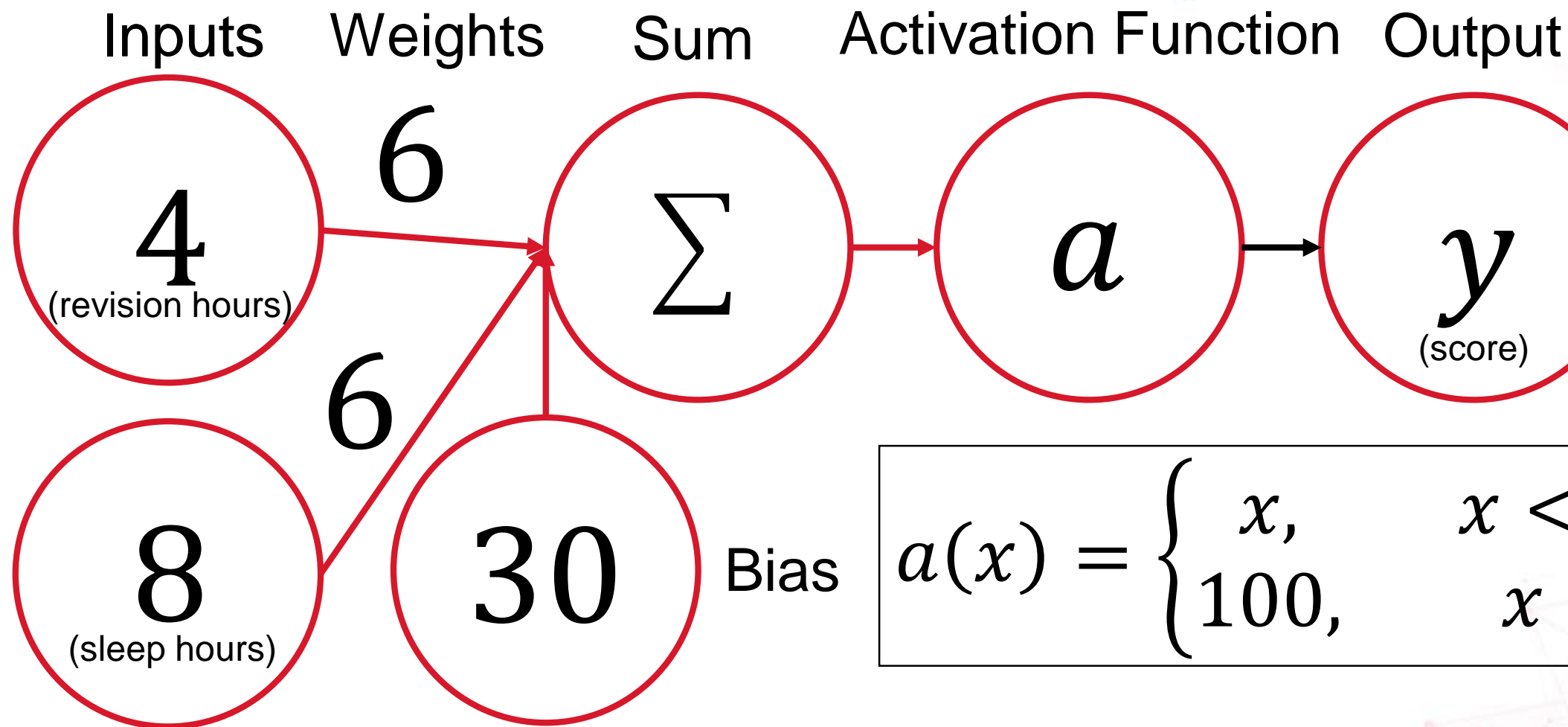
Above 100
Too high!



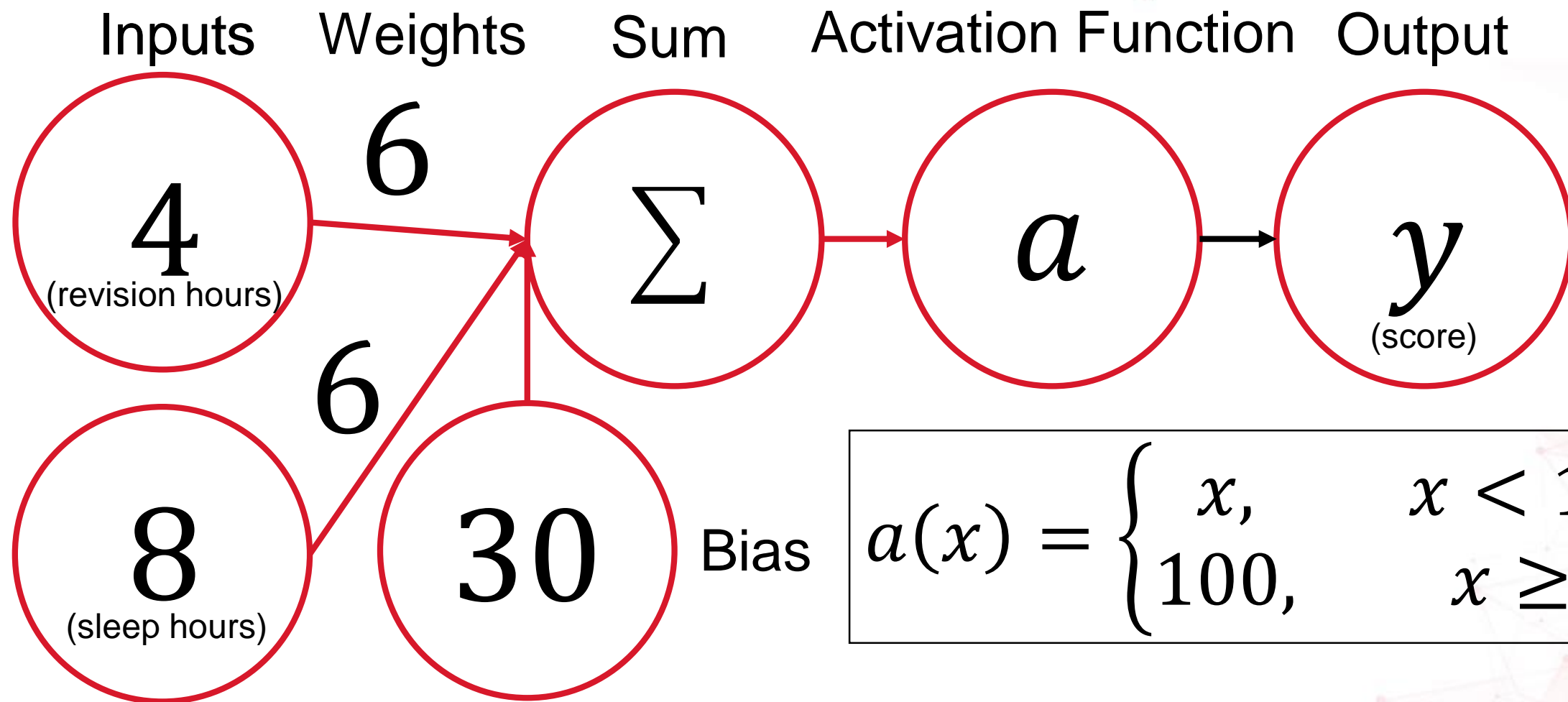
$$y = w_1 \times x_1 + w_2 \times x_2 + b$$



$$y = a(w_1 \times x_1 + w_2 \times x_2 + b)$$



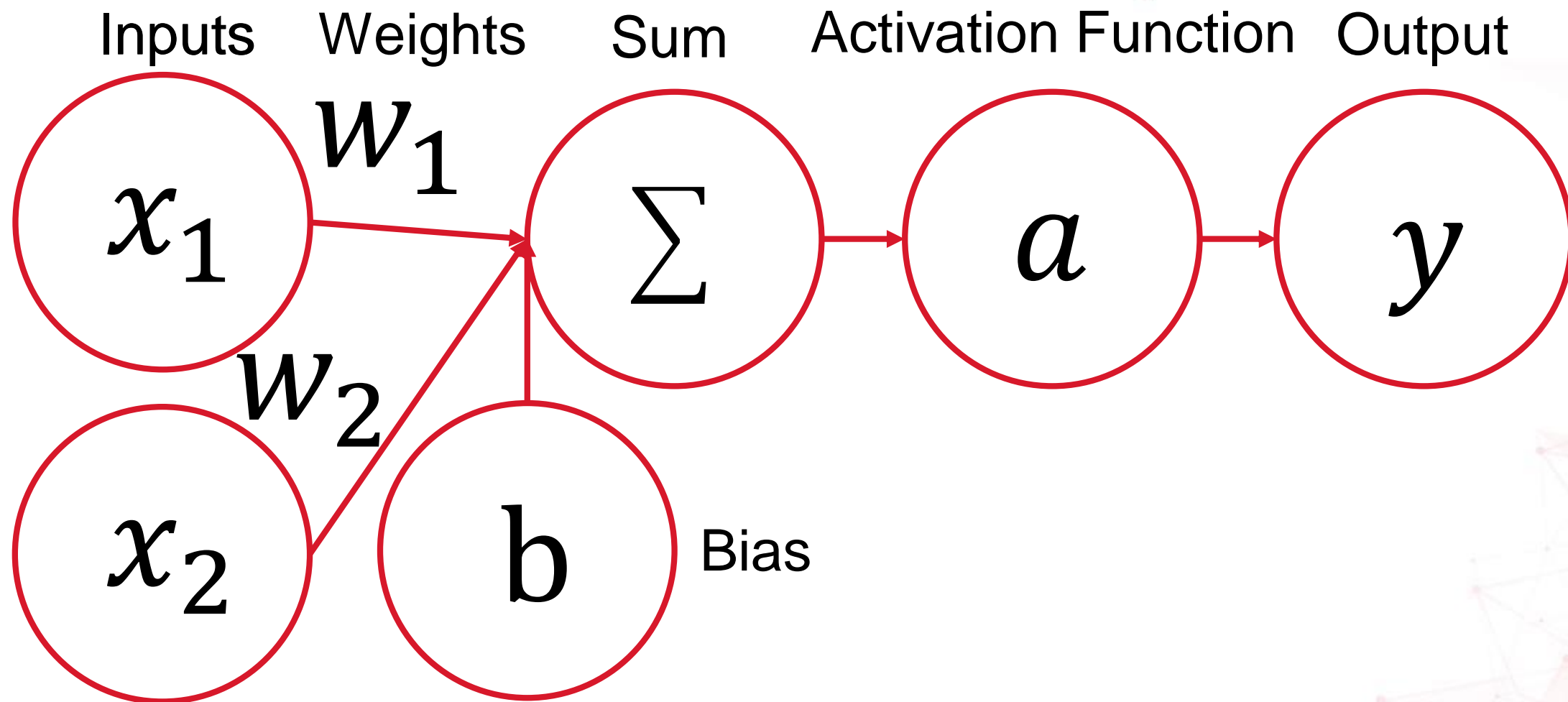
$$y = a(6 \times 4 + 6 \times 8 + 30)$$

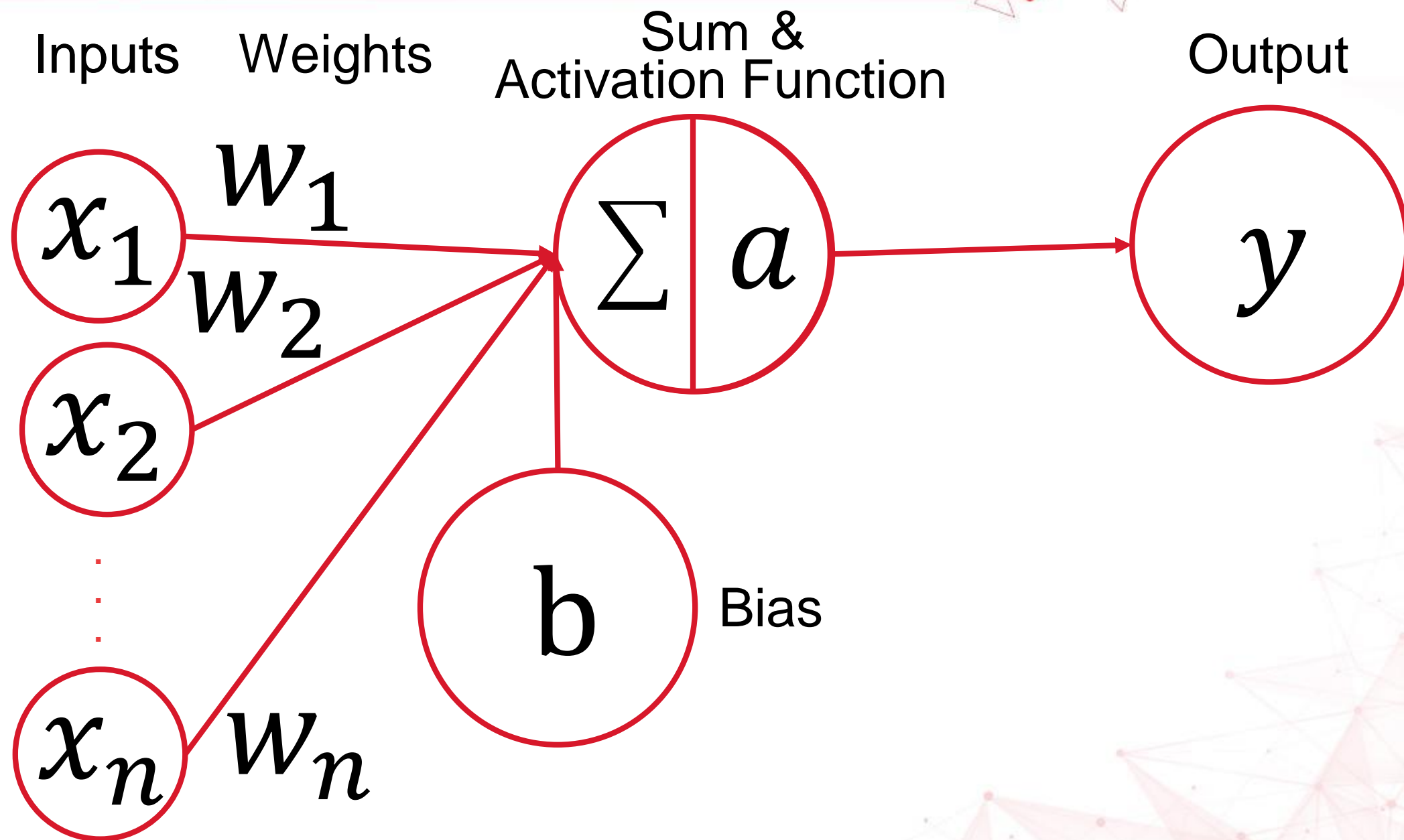


$$a(x) = \begin{cases} x, & x < 100 \\ 100, & x \geq 100 \end{cases}$$

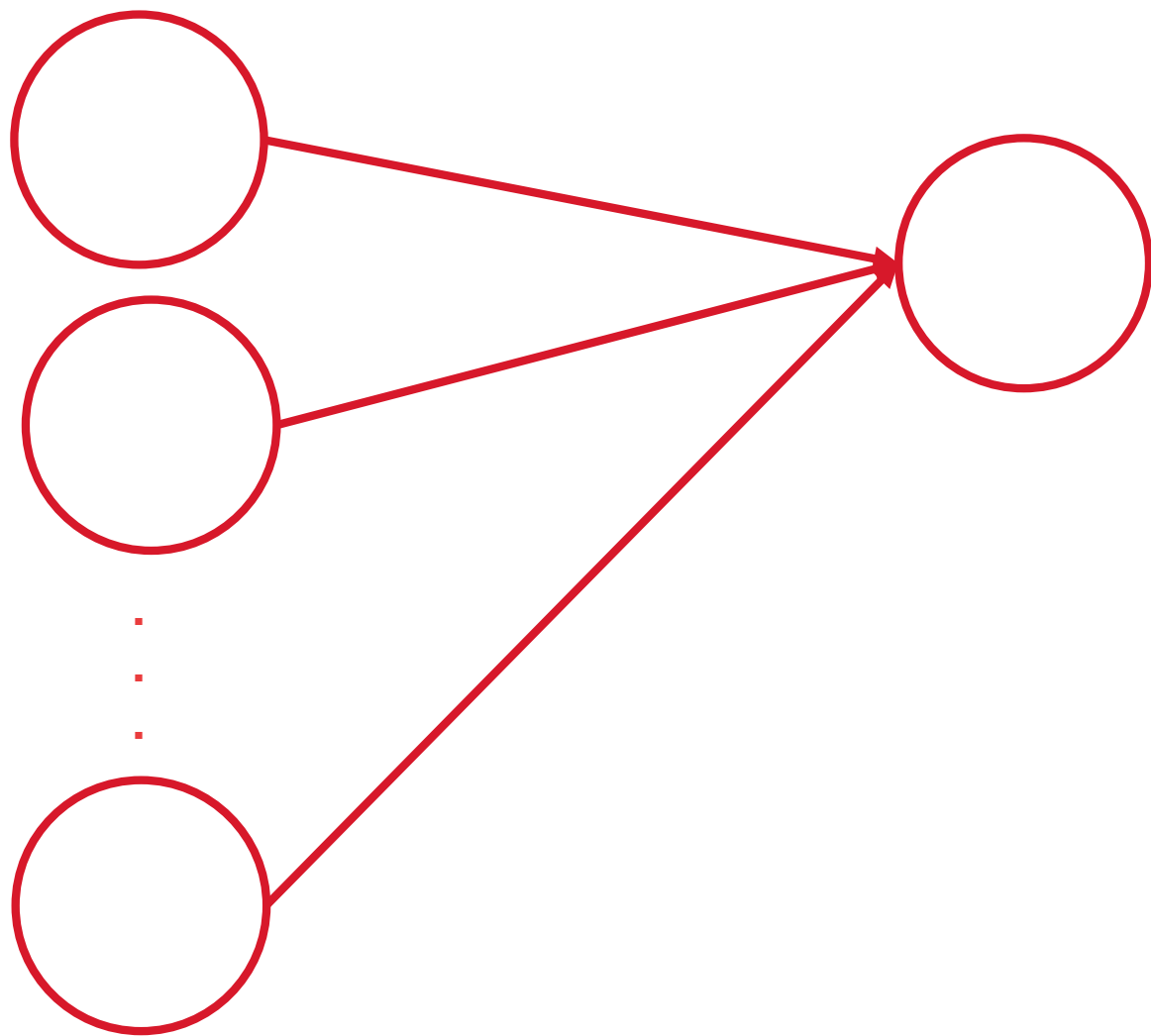
$$y = a(102) = 100$$

Yeah you got full marks!

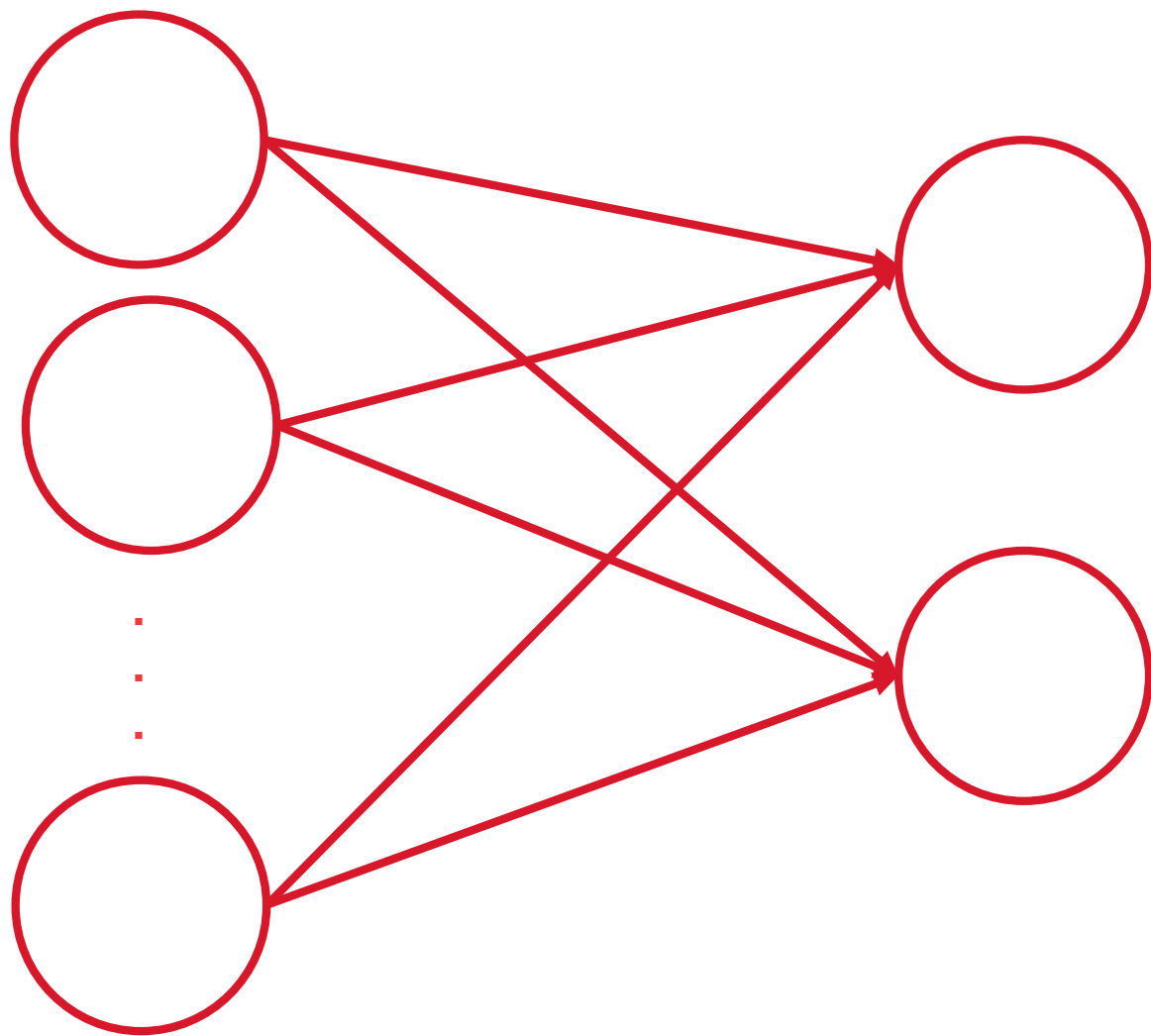




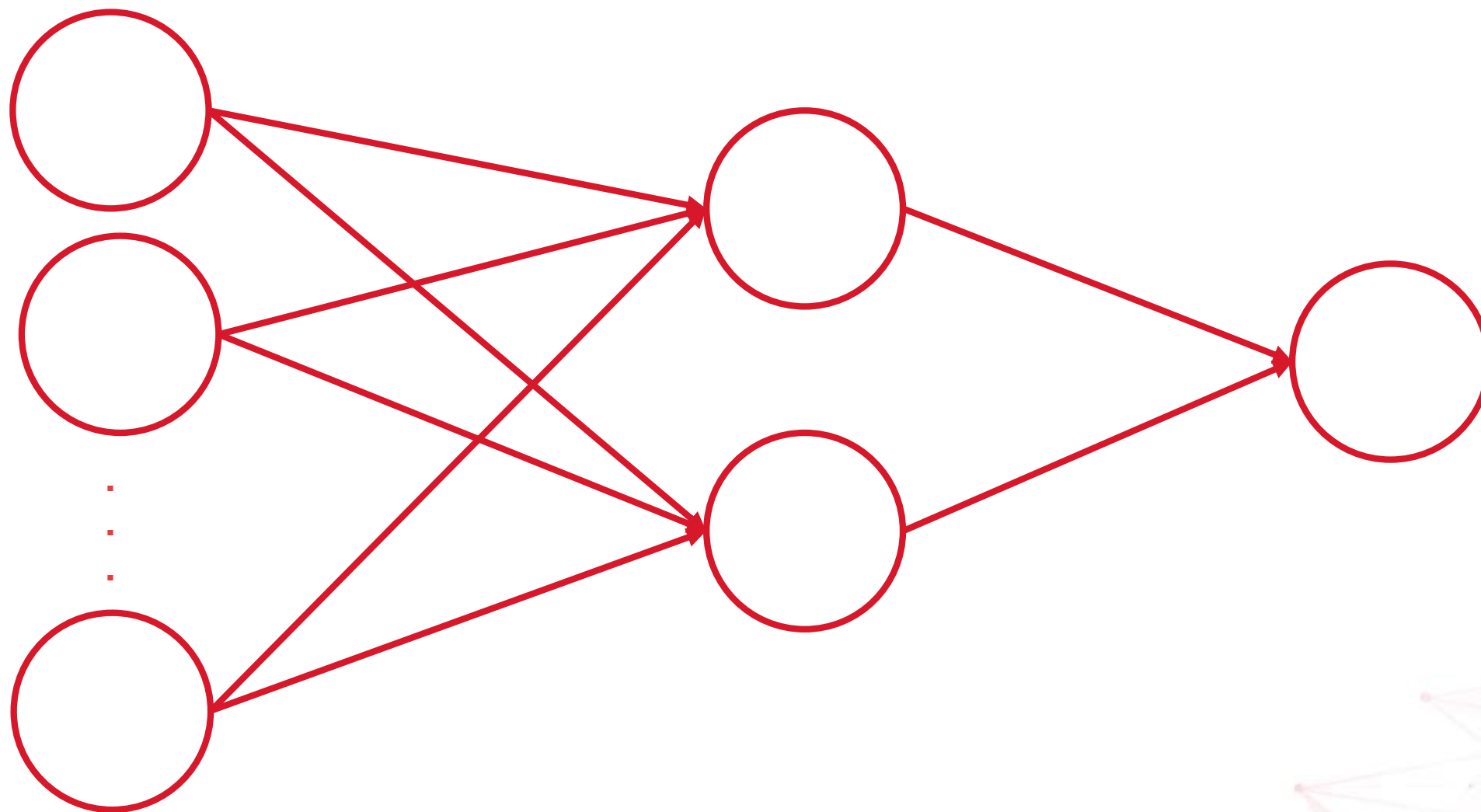
From 神經元 To Neural Network

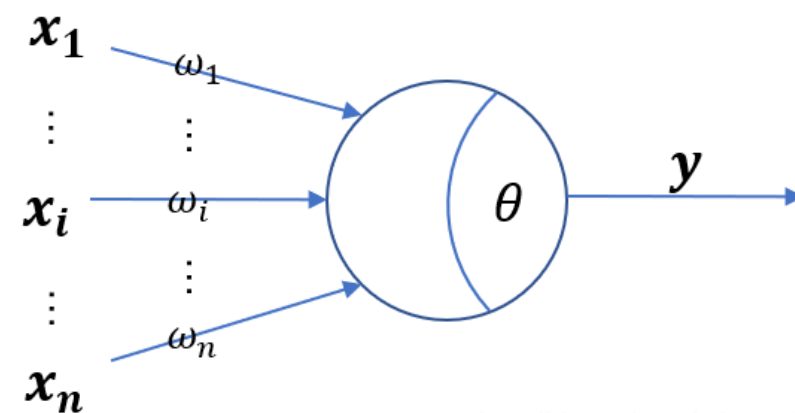
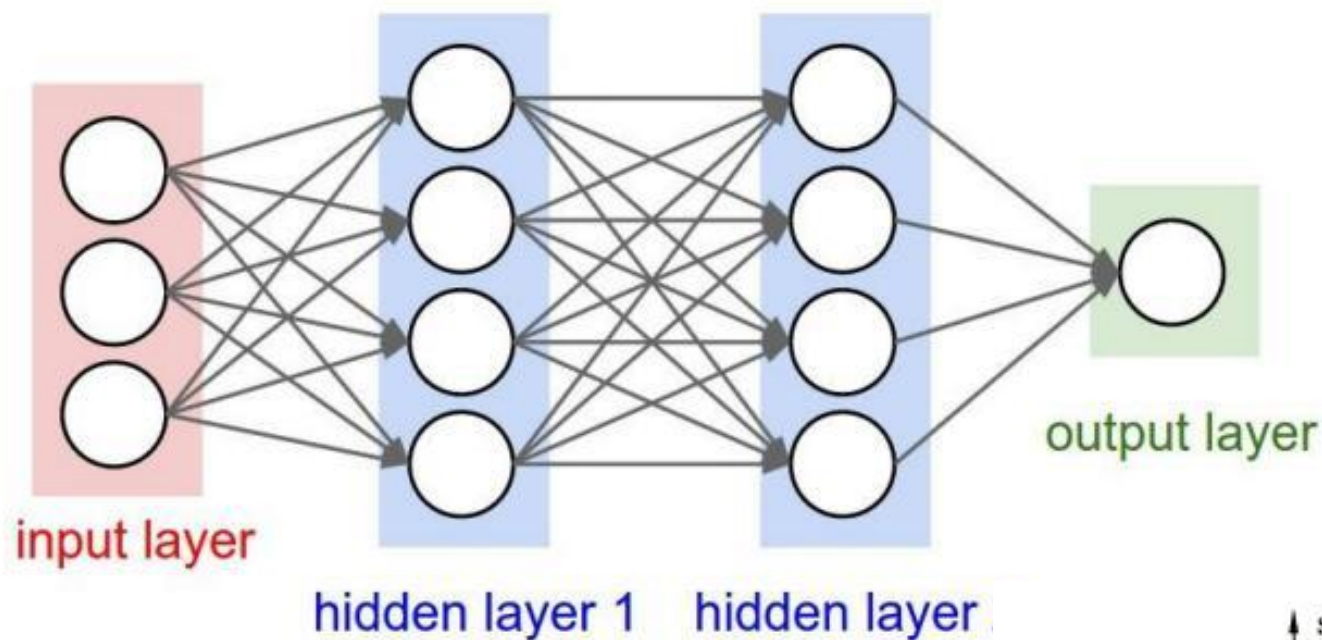


From 神經元 To Neural Network



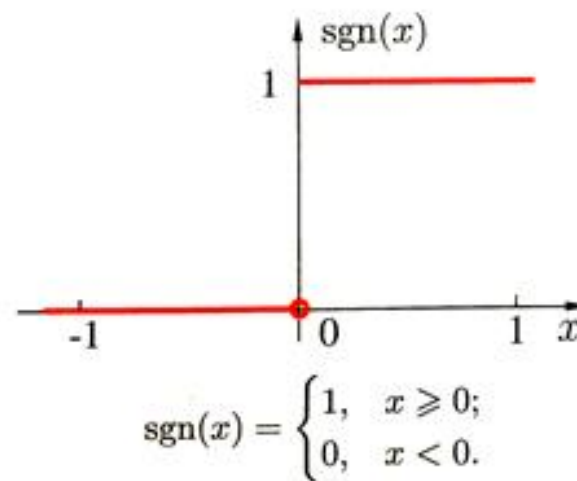
From 神經元 To Neural Network



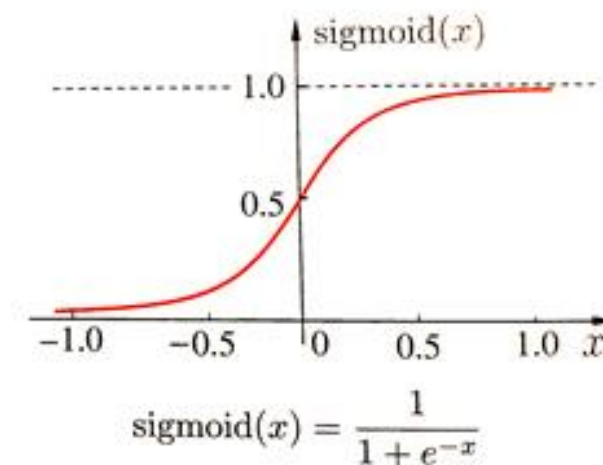


<https://blog.csdn.net/cuiyuan605>

$$y = \text{Act} \left(\sum_{i=1}^n \omega_i x_i + \theta \right)$$

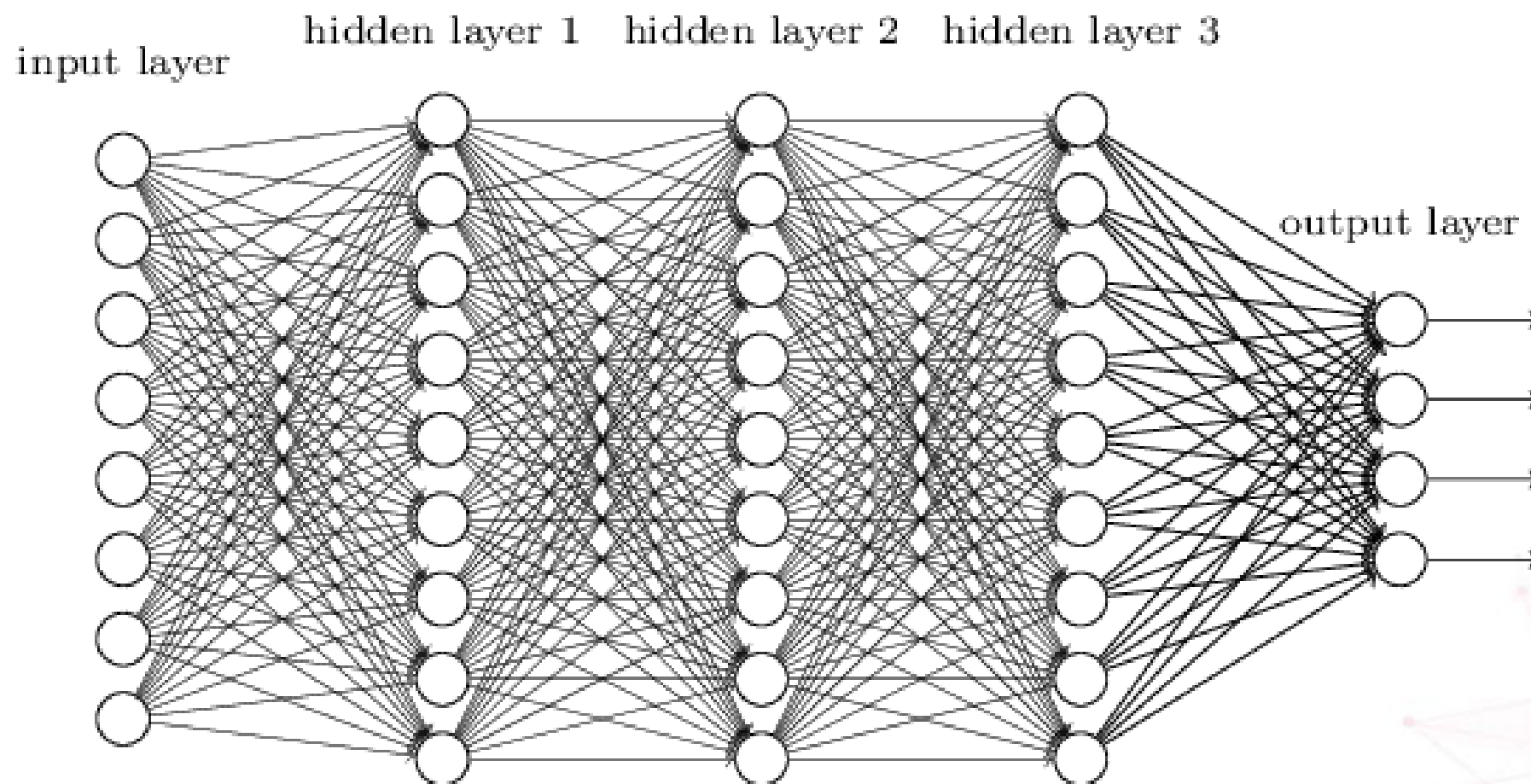


(a) 阶跃函数



(b) Sigmoid 函数

<https://blog.csdn.net/cuiyuan605>



SenseStudy課程平臺 “人工智能入門（下）”

實驗7 – 2 深度學習體驗: 深度學習-人工神經網路

```
x_train, y_train, l_train = load_dataset("data/train.npz")  
fig() + scatter(x_train, y_train, c=l_train)
```

```
model = DeepLearning([2,4,4,1])  
fig() + structure(model)  
f_train = merge_features([x_train, y_train])  
model.demo_train('business')  
model.show_learning_curve()
```

```
x_test, y_test, l_test = load_dataset("data/test.npz")  
f_test = merge_features([x_test, y_test])  
pred = model.predict(f_test)  
print(accuracy(pred > 0.5, l_test))
```



SenseStudy課程平臺 “人工智能入門（下）”

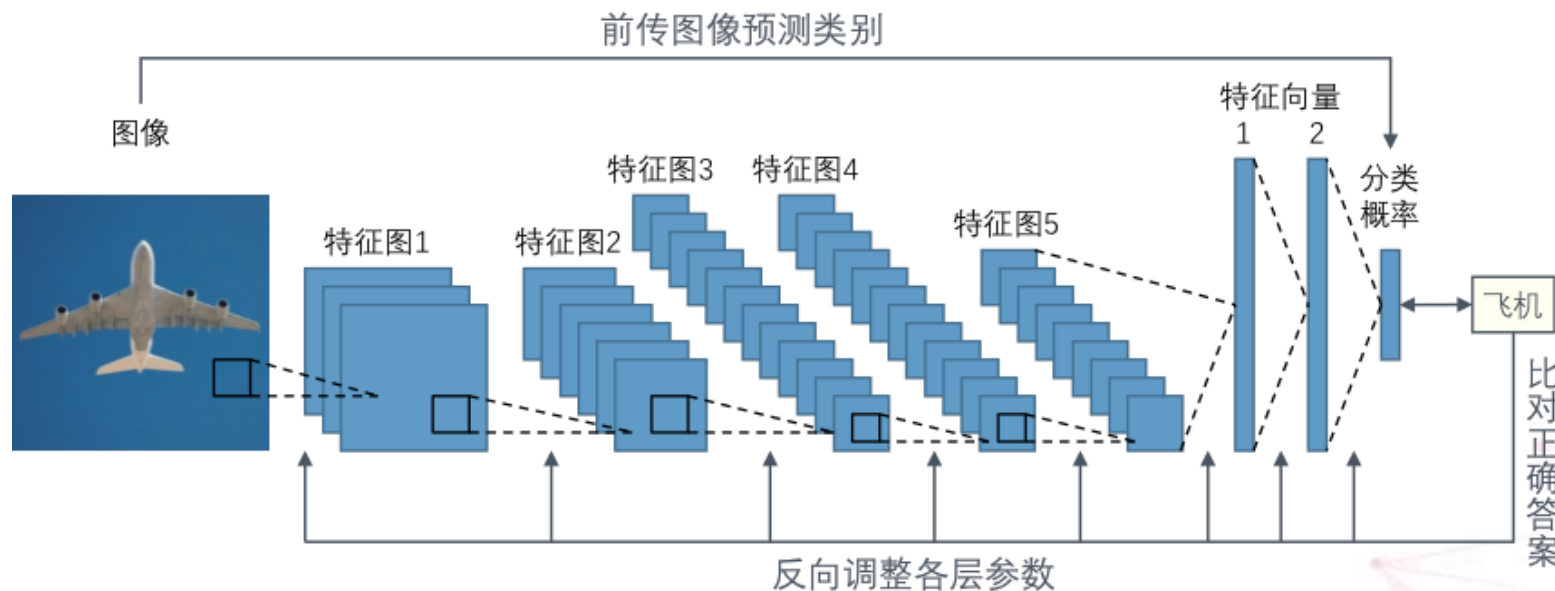
實驗7 – 3 神經網路回歸-基於身高預測體重

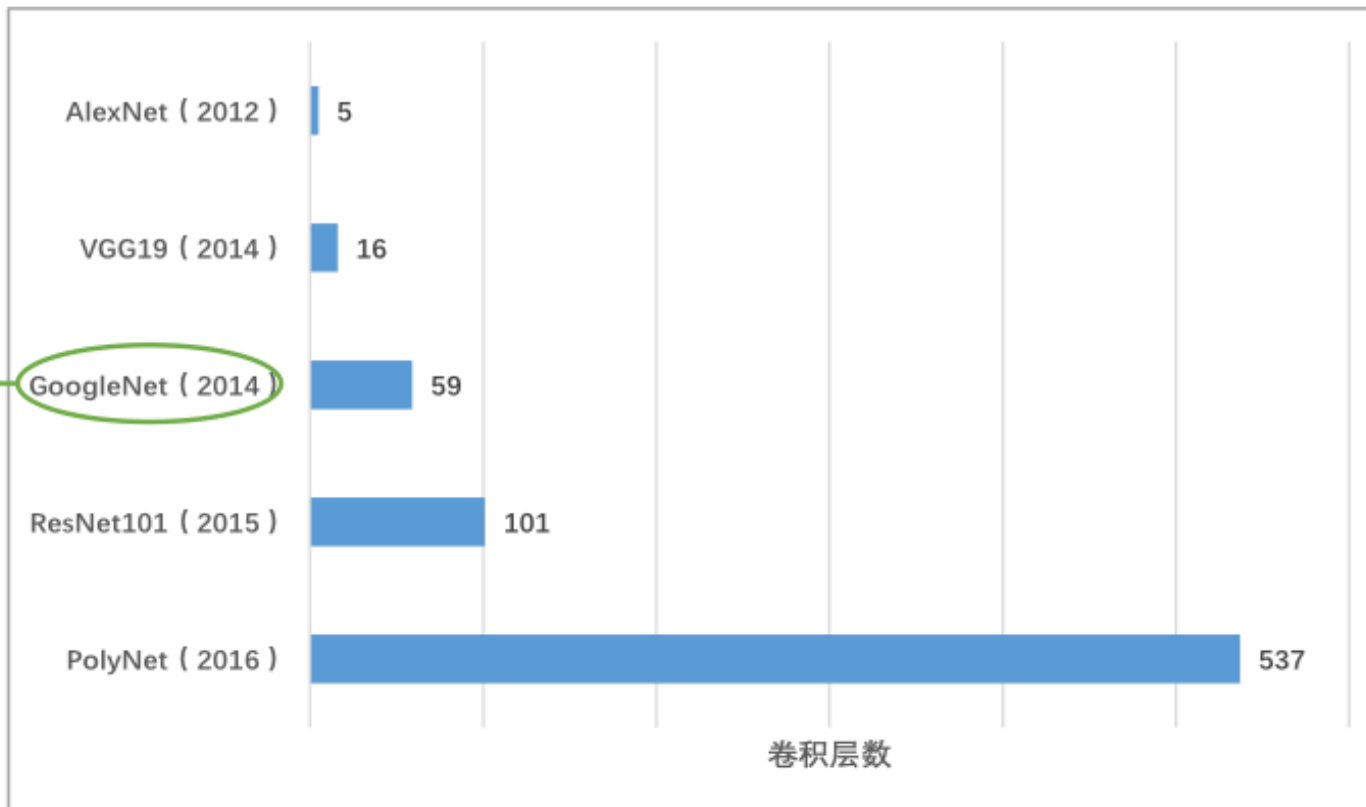
```
train_x, train_y = load('hw.train')
test_x, test_y = load('hw.test')
fig() + scatter(train_x, train_y)

net=MLP([1,4,4,1])
fig()+structure(net)
net.train(train_x,train_y)
pred=net.predict(data=test_x)
fig()+scatter(test_x, test_y)+scatter(test_x, pred)
error=net.compute_error(pred,test_y)
print("test error = %f" % error)
```



- 深度神經網路的訓練本質上就是尋找最佳參數的過程，參數包括：卷積層中所有卷積核的元素值、全連接層中所有內積運算的係數等。
- 僅僅在非常簡單的深度網路AlexNet 中，需要學習的參數多達六千多萬個，其難度遠高於線性分類器的訓練。
- 科學家們提出了反向傳播演算法。直到今天為，仍是訓練神經網路最有效的手段之一。

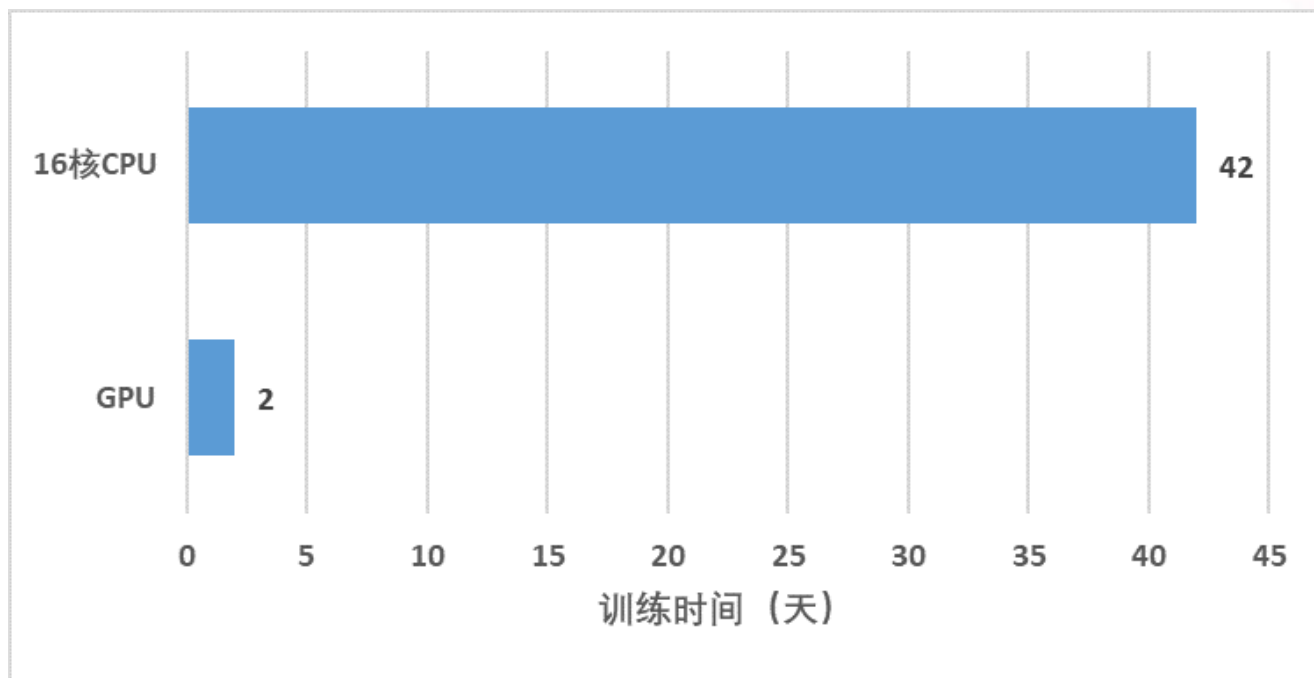




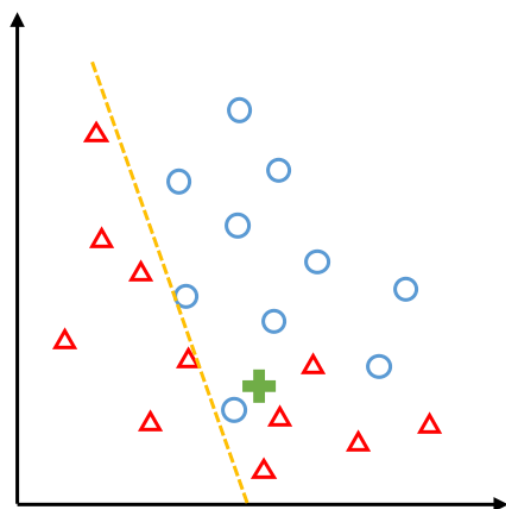
Deeper & Better

深度學習的“深”其實就表徵著神經網路的層數之多, 更進一步就代表著模型參數之多。一個參數更多的模型, 其可學習和調整的空間就更大, 表達能力就更強。

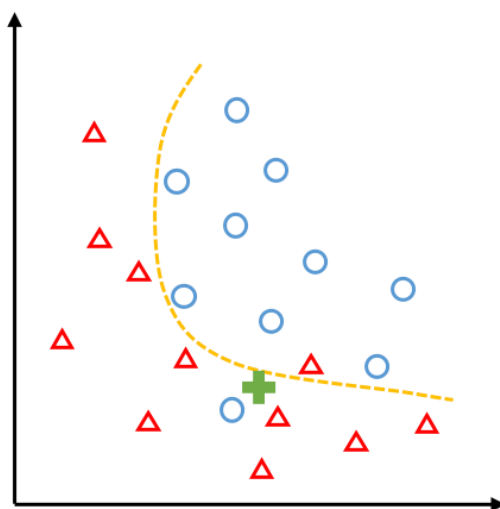
以Alex Net為例，為完成ImageNet分類模型的訓練，CPU和GPU有顯著的區別



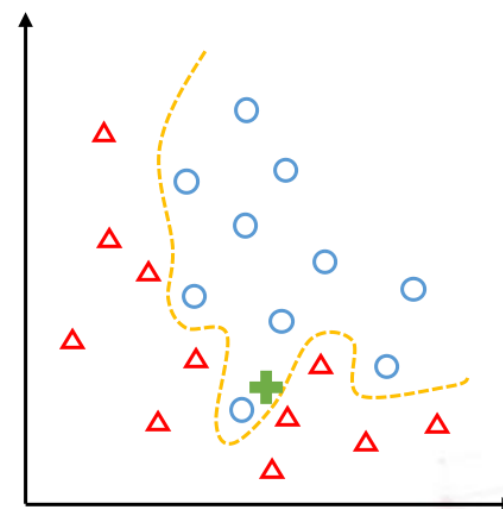
欠拟合是指訓練資料集和測試資料集上表現都很差的現象。這種差主要來自於網路本身的學習能力不足導致的。



欠拟合



拟合



过拟合

過拟合是指在訓練資料集上表現很好，但是在測試資料集上，也就是新資料上面表現很差的現象。

MNIST: handwritten digits

MNIST: handwritten digits: 手寫數位圖集，最常用的完整的檢查。這個資料庫主要包含了60000張的訓練圖像和10000張的測試圖像，資料庫的裡的圖像都是28*28大小的**灰度圖像**，每個圖元是一個**八位元位元組 (0~255)**

MNIST資料庫是由Yann提供的手寫數位資料庫檔



CIFAR10 / CIFAR100

CIFAR10：由10個類的60000個32x32彩色圖像組成，每個類有6000個圖像。有50000個訓練圖像和10000個測試圖像。

飞机

汽车

鸟

猫

鹿

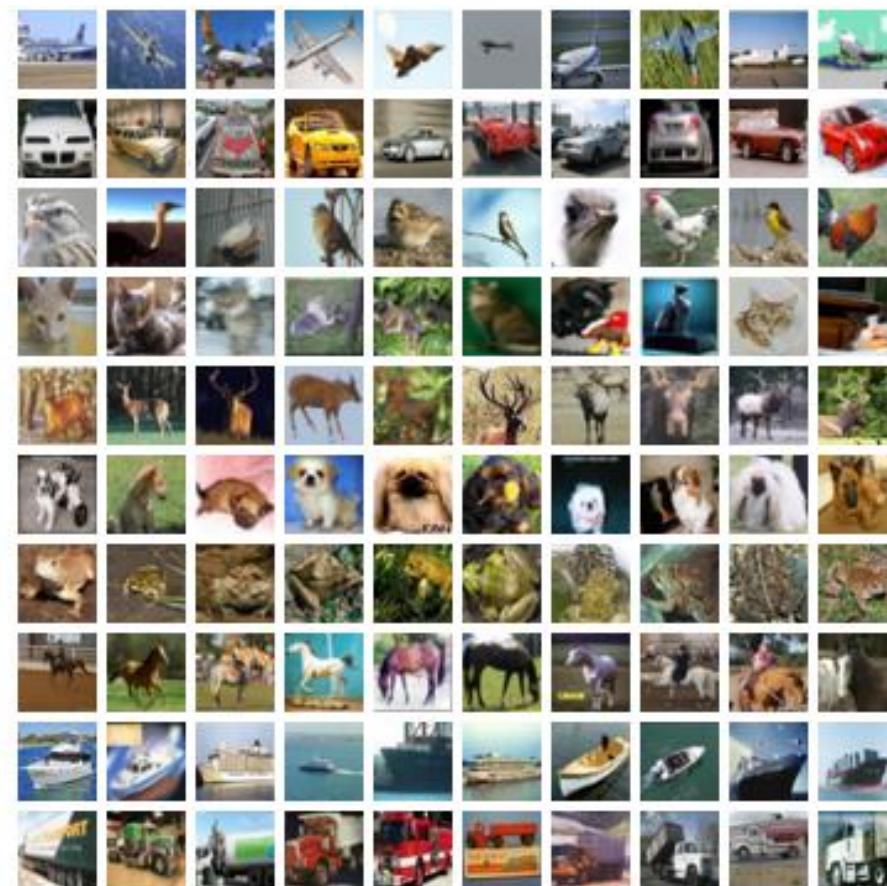
狗

青蛙

马

船

卡车



他們由Alex Krizhevsky, Vinod Nair和Geoffrey Hinton收集。

ImageNet

ImageNet是一個電腦視覺系統識別專案，是目前世界上圖像識別最大的資料庫。是美國斯坦福的電腦科學家李飛飛類比人類的識別系統建立的。



ImageNet資料集有1500多萬幅圖片，涵蓋2萬多個類別；其中有超過百萬的圖片有明確的類別標注和圖像中物體位置的標注。