

# 結果

訓練資料準確度 91% · 測試資料準確度 87%

## DO NOT MODIFY CODE BELOW!

Please screen shot your results and post it on your report

```
In [17]: y_pred = model.predict(x_test)
y_pred = np.argmax(y_pred, axis=1)

In [18]: assert y_pred.shape == (10000, )

In [19]: y_test = np.load("y_test.npy")
print("Accuracy of my model on test set: ", accuracy_score(y_test, y_pred))

Accuracy of my model on test set:  0.8749
```

# 模型架構

參考 [cifar10-cnn repo](#) · 使用 Residual-Network · 不過直接照著上面做完後得到的準確度比它上面寫的低了不少 · 所以我有自己改一些參數

Model: "model"

Layer (type)	Output Shape	Param #	Connected to
<hr/>			
input_1 (InputLayer)	[None, 32, 32, 3]	0	
conv2d (Conv2D)	(None, 32, 32, 16)	448	input_1[0][0]
batch_normalization (BatchNorm)	(None, 32, 32, 16)	64	conv2d[0][0]
activation (Activation)	(None, 32, 32, 16)	0	batch_normalization[0][0]
conv2d_1 (Conv2D)	(None, 32, 32, 16)	2320	activation[0][0]
batch_normalization_1 (BatchNor)	(None, 32, 32, 16)	64	conv2d_1[0][0]
activation_1 (Activation)	(None, 32, 32, 16)	0	batch_normalization_1[0][0]
conv2d_2 (Conv2D)	(None, 32, 32, 16)	2320	activation_1[0][0]
add (Add)	(None, 32, 32, 16)	0	conv2d_2[0][0] conv2d[0][0]
batch_normalization_2 (BatchNor)	(None, 32, 32, 16)	64	add[0][0]
activation_2 (Activation)	(None, 32, 32, 16)	0	batch_normalization_2[0][0]
conv2d_3 (Conv2D)	(None, 32, 32, 16)	2320	activation_2[0][0]
batch_normalization_3 (BatchNor)	(None, 32, 32, 16)	64	conv2d_3[0][0]
activation_3 (Activation)	(None, 32, 32, 16)	0	batch_normalization_3[0][0]
conv2d_4 (Conv2D)	(None, 32, 32, 16)	2320	activation_3[0][0]
add_1 (Add)	(None, 32, 32, 16)	0	conv2d_4[0][0] add[0][0]
batch_normalization_4 (BatchNor)	(None, 32, 32, 16)	64	add_1[0][0]
activation_4 (Activation)	(None, 32, 32, 16)	0	batch_normalization_4[0][0]
conv2d_5 (Conv2D)	(None, 32, 32, 16)	2320	activation_4[0][0]
batch_normalization_5 (BatchNor)	(None, 32, 32, 16)	64	conv2d_5[0][0]
activation_5 (Activation)	(None, 32, 32, 16)	0	batch_normalization_5[0][0]
conv2d_6 (Conv2D)	(None, 32, 32, 16)	2320	activation_5[0][0]

add_2 (Add)	(None, 32, 32, 16) 0	conv2d_6[0][0]
	add_1[0][0]	
batch_normalization_6 (BatchNor	(None, 32, 32, 16) 64	add_2[0][0]
activation_6 (Activation)	(None, 32, 32, 16) 0	batch_normalization_6[0][0]
conv2d_7 (Conv2D)	(None, 32, 32, 16) 2320	activation_6[0][0]
batch_normalization_7 (BatchNor	(None, 32, 32, 16) 64	conv2d_7[0][0]
activation_7 (Activation)	(None, 32, 32, 16) 0	batch_normalization_7[0][0]
conv2d_8 (Conv2D)	(None, 32, 32, 16) 2320	activation_7[0][0]
add_3 (Add)	(None, 32, 32, 16) 0	conv2d_8[0][0]
	add_2[0][0]	
batch_normalization_8 (BatchNor	(None, 32, 32, 16) 64	add_3[0][0]
activation_8 (Activation)	(None, 32, 32, 16) 0	batch_normalization_8[0][0]
conv2d_9 (Conv2D)	(None, 32, 32, 16) 2320	activation_8[0][0]
batch_normalization_9 (BatchNor	(None, 32, 32, 16) 64	conv2d_9[0][0]
activation_9 (Activation)	(None, 32, 32, 16) 0	batch_normalization_9[0][0]
conv2d_10 (Conv2D)	(None, 32, 32, 16) 2320	activation_9[0][0]
add_4 (Add)	(None, 32, 32, 16) 0	conv2d_10[0][0]
	add_3[0][0]	
batch_normalization_10 (BatchNo	(None, 32, 32, 16) 64	add_4[0][0]
activation_10 (Activation)	(None, 32, 32, 16) 0	batch_normalization_10[0][0]
conv2d_11 (Conv2D)	(None, 16, 16, 32) 4640	activation_10[0][0]
batch_normalization_11 (BatchNo	(None, 16, 16, 32) 128	conv2d_11[0][0]
activation_11 (Activation)	(None, 16, 16, 32) 0	batch_normalization_11[0][0]
conv2d_12 (Conv2D)	(None, 16, 16, 32) 9248	activation_11[0][0]
conv2d_13 (Conv2D)	(None, 16, 16, 32) 544	activation_10[0][0]
add_5 (Add)	(None, 16, 16, 32) 0	conv2d_12[0][0]
	conv2d_13[0][0]	
batch_normalization_12 (BatchNo	(None, 16, 16, 32) 128	add_5[0][0]
activation_12 (Activation)	(None, 16, 16, 32) 0	batch_normalization_12[0][0]
conv2d_14 (Conv2D)	(None, 16, 16, 32) 9248	activation_12[0][0]
batch_normalization_13 (BatchNo	(None, 16, 16, 32) 128	conv2d_14[0][0]
activation_13 (Activation)	(None, 16, 16, 32) 0	batch_normalization_13[0][0]
conv2d_15 (Conv2D)	(None, 16, 16, 32) 9248	activation_13[0][0]
add_6 (Add)	(None, 16, 16, 32) 0	conv2d_15[0][0]
	add_5[0][0]	
batch_normalization_14 (BatchNo	(None, 16, 16, 32) 128	add_6[0][0]
activation_14 (Activation)	(None, 16, 16, 32) 0	batch_normalization_14[0][0]
conv2d_16 (Conv2D)	(None, 16, 16, 32) 9248	activation_14[0][0]
batch_normalization_15 (BatchNo	(None, 16, 16, 32) 128	conv2d_16[0][0]
activation_15 (Activation)	(None, 16, 16, 32) 0	batch_normalization_15[0][0]
conv2d_17 (Conv2D)	(None, 16, 16, 32) 9248	activation_15[0][0]
add_7 (Add)	(None, 16, 16, 32) 0	conv2d_17[0][0]
	add_6[0][0]	
batch_normalization_16 (BatchNo	(None, 16, 16, 32) 128	add_7[0][0]
activation_16 (Activation)	(None, 16, 16, 32) 0	batch_normalization_16[0][0]
conv2d_18 (Conv2D)	(None, 16, 16, 32) 9248	activation_16[0][0]
batch_normalization_17 (BatchNo	(None, 16, 16, 32) 128	conv2d_18[0][0]

activation_17 (Activation)	(None, 16, 16, 32)	0	batch_normalization_17[0][0]
conv2d_19 (Conv2D)	(None, 16, 16, 32)	9248	activation_17[0][0]
add_8 (Add)	(None, 16, 16, 32)	0	conv2d_19[0][0] add_7[0][0]
batch_normalization_18 (BatchNo)	(None, 16, 16, 32)	128	add_8[0][0]
activation_18 (Activation)	(None, 16, 16, 32)	0	batch_normalization_18[0][0]
conv2d_20 (Conv2D)	(None, 16, 16, 32)	9248	activation_18[0][0]
batch_normalization_19 (BatchNo)	(None, 16, 16, 32)	128	conv2d_20[0][0]
activation_19 (Activation)	(None, 16, 16, 32)	0	batch_normalization_19[0][0]
conv2d_21 (Conv2D)	(None, 16, 16, 32)	9248	activation_19[0][0]
add_9 (Add)	(None, 16, 16, 32)	0	conv2d_21[0][0] add_8[0][0]
batch_normalization_20 (BatchNo)	(None, 16, 16, 32)	128	add_9[0][0]
activation_20 (Activation)	(None, 16, 16, 32)	0	batch_normalization_20[0][0]
conv2d_22 (Conv2D)	(None, 8, 8, 64)	18496	activation_20[0][0]
batch_normalization_21 (BatchNo)	(None, 8, 8, 64)	256	conv2d_22[0][0]
activation_21 (Activation)	(None, 8, 8, 64)	0	batch_normalization_21[0][0]
conv2d_23 (Conv2D)	(None, 8, 8, 64)	36928	activation_21[0][0]
conv2d_24 (Conv2D)	(None, 8, 8, 64)	2112	activation_20[0][0]
add_10 (Add)	(None, 8, 8, 64)	0	conv2d_23[0][0] conv2d_24[0][0]
batch_normalization_22 (BatchNo)	(None, 8, 8, 64)	256	add_10[0][0]
activation_22 (Activation)	(None, 8, 8, 64)	0	batch_normalization_22[0][0]
conv2d_25 (Conv2D)	(None, 8, 8, 64)	36928	activation_22[0][0]
batch_normalization_23 (BatchNo)	(None, 8, 8, 64)	256	conv2d_25[0][0]
activation_23 (Activation)	(None, 8, 8, 64)	0	batch_normalization_23[0][0]
conv2d_26 (Conv2D)	(None, 8, 8, 64)	36928	activation_23[0][0]
add_11 (Add)	(None, 8, 8, 64)	0	conv2d_26[0][0] add_10[0][0]
batch_normalization_24 (BatchNo)	(None, 8, 8, 64)	256	add_11[0][0]
activation_24 (Activation)	(None, 8, 8, 64)	0	batch_normalization_24[0][0]
conv2d_27 (Conv2D)	(None, 8, 8, 64)	36928	activation_24[0][0]
batch_normalization_25 (BatchNo)	(None, 8, 8, 64)	256	conv2d_27[0][0]
activation_25 (Activation)	(None, 8, 8, 64)	0	batch_normalization_25[0][0]
conv2d_28 (Conv2D)	(None, 8, 8, 64)	36928	activation_25[0][0]
add_12 (Add)	(None, 8, 8, 64)	0	conv2d_28[0][0] add_11[0][0]
batch_normalization_26 (BatchNo)	(None, 8, 8, 64)	256	add_12[0][0]
activation_26 (Activation)	(None, 8, 8, 64)	0	batch_normalization_26[0][0]
conv2d_29 (Conv2D)	(None, 8, 8, 64)	36928	activation_26[0][0]
batch_normalization_27 (BatchNo)	(None, 8, 8, 64)	256	conv2d_29[0][0]
activation_27 (Activation)	(None, 8, 8, 64)	0	batch_normalization_27[0][0]
conv2d_30 (Conv2D)	(None, 8, 8, 64)	36928	activation_27[0][0]
add_13 (Add)	(None, 8, 8, 64)	0	conv2d_30[0][0] add_12[0][0]
batch_normalization_28 (BatchNo)	(None, 8, 8, 64)	256	add_13[0][0]
activation_28 (Activation)	(None, 8, 8, 64)	0	batch_normalization_28[0][0]

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conv2d_31 (Conv2D)	(None, 8, 8, 64)	36928	activation_28[0][0]
batch_normalization_29 (BatchNo	(None, 8, 8, 64)	256	conv2d_31[0][0]
activation_29 (Activation)	(None, 8, 8, 64)	0	batch_normalization_29[0][0]
conv2d_32 (Conv2D)	(None, 8, 8, 64)	36928	activation_29[0][0]
add_14 (Add)	(None, 8, 8, 64)	0	conv2d_32[0][0]
			add_13[0][0]
batch_normalization_30 (BatchNo	(None, 8, 8, 64)	256	add_14[0][0]
activation_30 (Activation)	(None, 8, 8, 64)	0	batch_normalization_30[0][0]
global_average_pooling2d (Globa	(None, 64)	0	activation_30[0][0]
dense (Dense)	(None, 10)	650	global_average_pooling2d[0][0]

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Total params: 470,218  
Trainable params: 467,946  
Non-trainable params: 2,272

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## Data Augmentation 參數

- rotation\_range: 15
- zoom\_range: 0.1
- horizontal\_flip: True
- fill\_mode: nearest

## Optimizer

SGD · 參數如下

- learning\_rate: 0.005
- momentum: 0.9
- nesterov: True

## Fit Data

- batch\_size: 32
- epochs: 200
- callback: 使用 EarlyStopping · 參數如下

- o monitor: accuracy
- o mode: max
- o verbose: 1
- o patience: 10
- o min\_delta: 0.01