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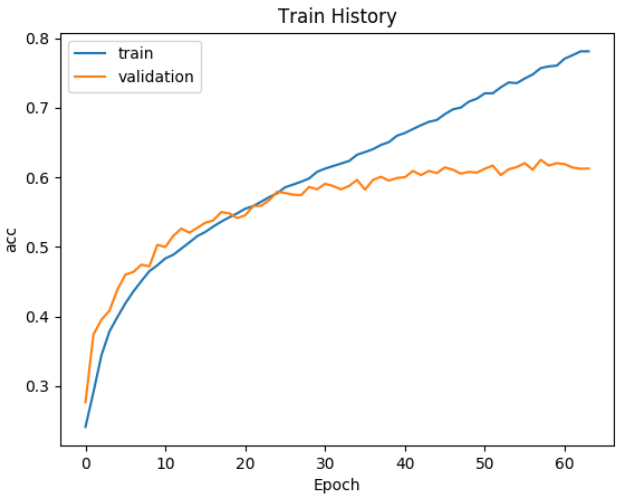
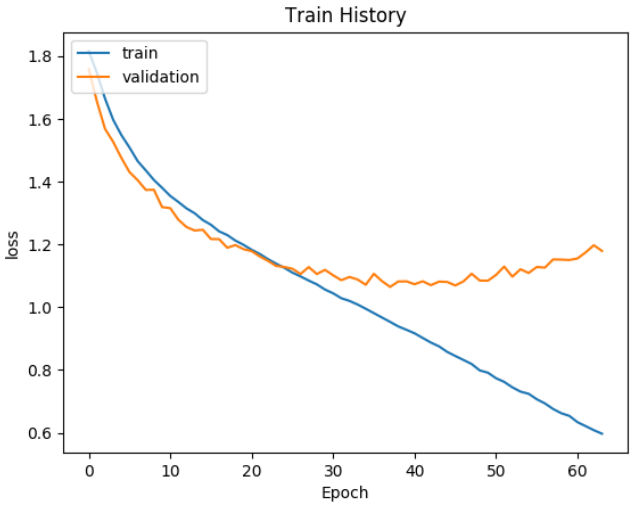
1. (1%) 請說明你實作的 CNN model，其模型架構、訓練過程和準確率為何？(Collaborators:)

答：

Layer (type)	Output Shape	Param #
input_1 (InputLayer)	(None, 48, 48, 1)	0
conv2d_1 (Conv2D)	(None, 44, 44, 64)	1664
zero_padding2d_1 (ZeroPaddin	(None, 48, 48, 64)	0
max_pooling2d_1 (MaxPooling2	(None, 22, 22, 64)	0
zero_padding2d_2 (ZeroPaddin	(None, 24, 24, 64)	0
conv2d_2 (Conv2D)	(None, 22, 22, 64)	36928
zero_padding2d_3 (ZeroPaddin	(None, 24, 24, 64)	0
conv2d_3 (Conv2D)	(None, 22, 22, 64)	36928
average_pooling2d_1 (Average	(None, 10, 10, 64)	0
zero_padding2d_4 (ZeroPaddin	(None, 12, 12, 64)	0
conv2d_4 (Conv2D)	(None, 10, 10, 128)	73856
zero_padding2d_5 (ZeroPaddin	(None, 12, 12, 128)	0
conv2d_5 (Conv2D)	(None, 10, 10, 128)	147584
zero_padding2d_6 (ZeroPaddin	(None, 12, 12, 128)	0
average_pooling2d_2 (Average	(None, 5, 5, 128)	0
flatten_1 (Flatten)	(None, 3200)	0
dense_1 (Dense)	(None, 1024)	3277824
dropout_1 (Dropout)	(None, 1024)	0
dense_2 (Dense)	(None, 1024)	1049600
dropout_2 (Dropout)	(None, 1024)	0
dense_3 (Dense)	(None, 7)	7175
activation_1 (Activation)	(None, 7)	0

Total params: 4,631,559
Trainable params: 4,631,559
Non-trainable params: 0





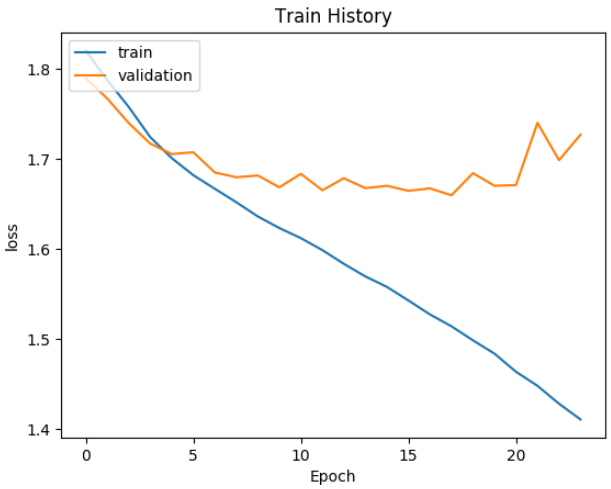
我的 model 的 acc 是 0.6077。

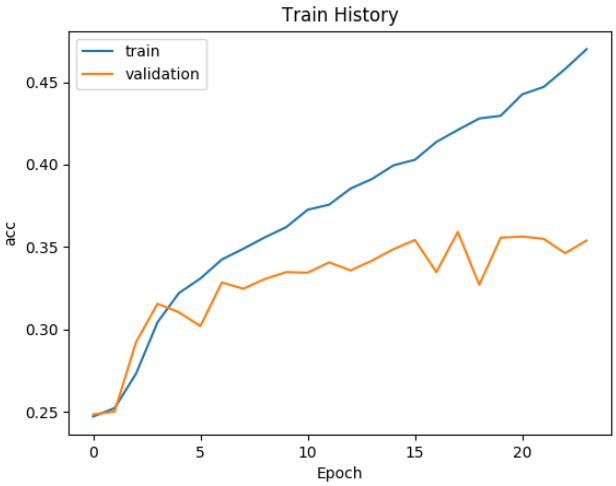
2. (1%) 承上題，請用與上述 CNN 接近的參數量，實做簡單的 DNN model。其模型架構、訓練過程和準確率為何？試與上題結果做比較，並說明你觀察到了什麼？(Collaborators:)

答：

input_1 (InputLayer)	(None, 48, 48, 1)	0
max_pooling2d_1 (MaxPooling2	(None, 22, 22, 1)	0
flatten_1 (Flatten)	(None, 484)	0
dense_1 (Dense)	(None, 128)	62080
dense_2 (Dense)	(None, 128)	16512
dense_3 (Dense)	(None, 128)	16512
dense_4 (Dense)	(None, 256)	33024
dense_5 (Dense)	(None, 256)	65792
dense_6 (Dense)	(None, 512)	131584
dense_7 (Dense)	(None, 512)	262656
dense_8 (Dense)	(None, 1024)	525312
dense_9 (Dense)	(None, 1024)	1049600
dense_10 (Dense)	(None, 1024)	1049600
dropout_1 (Dropout)	(None, 1024)	0
dense_11 (Dense)	(None, 1024)	1049600
dropout_2 (Dropout)	(None, 1024)	0
dense_12 (Dense)	(None, 7)	7175
activation_1 (Activation)	(None, 7)	0

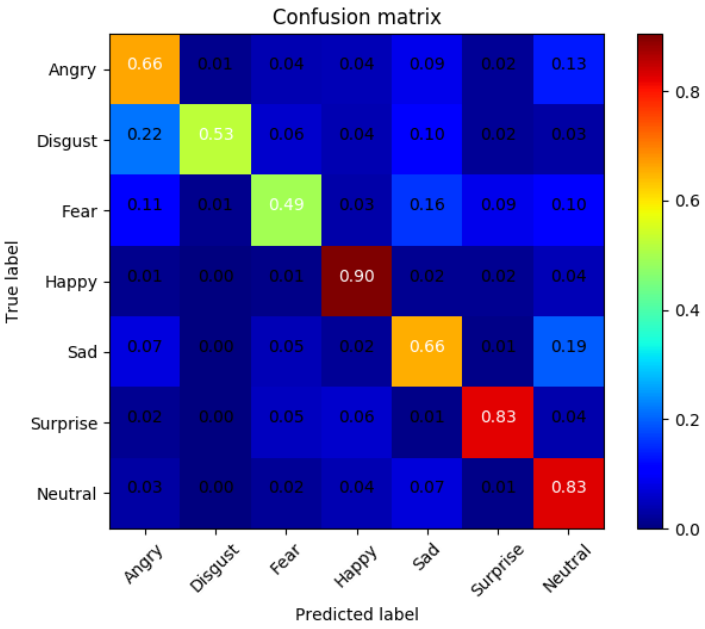
Total params: 4,269,447
Trainable params: 4,269,447





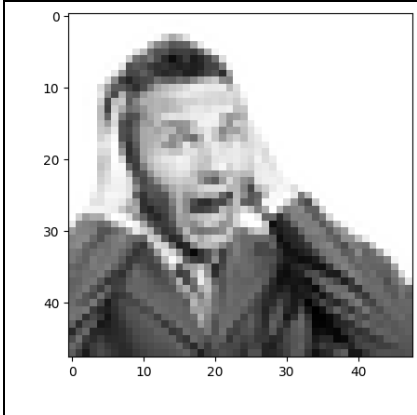
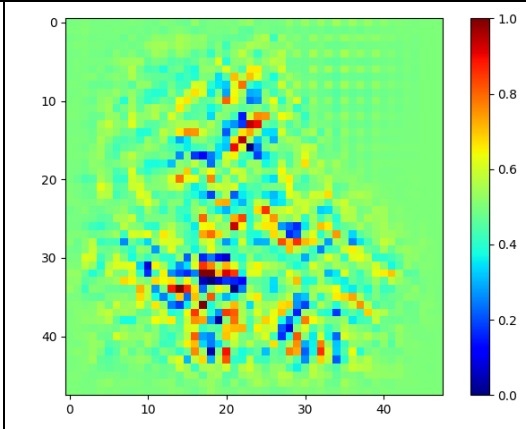
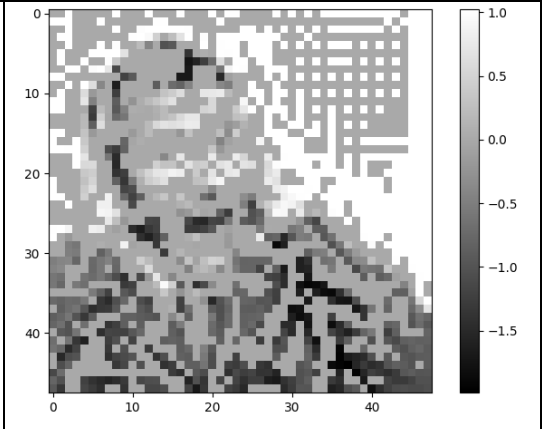
我發現用 DNN 的 model 明顯比 CNN 的 model 效果差很多。它的 val_acc 只有 0.41，而 CNN 的 val_acc 有 0.59，明顯差很多。

3. (1%) 觀察答錯的圖片中，哪些 class 彼此間容易用混？[繪出 confusion matrix 分析]
(Collaborators:)
答：



我發現 sad 會有可能被 label 成 Neutral，Disgust 容易被 label 成 Angry。Fear 容易被誤認成 Sad。

1. (1%) 從(1)(2)可以發現，使用 CNN 的確有些好處，試繪出其 saliency maps，觀察模型在做 classification 時，是 focus 在圖片的哪些部份？

Original image:	saliency maps	Mask 掉 heat 小的部份
		

(Collaborators:)
答：我發現在 classification 會比較 focus 在眼睛、嘴巴、手勢的部分。

2. (1%) 承(1)(2)，利用上課所提到的 gradient ascent 方法，觀察特定層的 filter 最容易被哪種圖片 activate。
   (Collaborators:)
   答：