1. (5%) Print the network architecture of your VGG16-FCN32s model.

將 Pre-trained 好的 VGG model FC layer 換成 Conv layer,做成 VGG16FCN32s, 並將 VGG 的部分設為 untrainable. Data 部分沒有做任何處理, 而事實上實驗後發現不管是 normalize 到 0-1 之間, 或是減去 127 都沒有比較好, 而 improved model 也是 follow 一樣的 setting.

Layer (type)	Output	Shape	Param #
input_1 (InputLayer)	(None,	512, 512, 3)	0
block1_conv1 (Conv2D) A Compar	(None,	512, 512, 64) 3_mas	1792
block1_conv2 _{ts} (Conv2D) _{Combinat}	(None,	512, 512, 64) _{15_mas}	36928
block1_pool (MaxPooling2D)	(None,	256, 256, 64) 7 _{mas}	kong
block2_conv1_(Conv2D) Group Spa	(None,	n256, d 256, 128) mas	73856
block2_conv2"(Conv2D) rradiance	(None,	1256, 256, 128)1_mas	k147584
block2_pool (MaxPooling2D)	(None,	128, 128, 128) ³ mas	k o ng k.png
block3_conv1 (Conv2D) ntu Paper	(None,	128, 128, 256) ^{5_mas}	^k 295168 k.png
block3_conv2 (Conv2D) results Remote Disc Screen Sh	(None,	128, 128, 256) ^{7_mas}	590080 k.png
block3_conv3 (Conv2D) Screen Sh Slides	(None,	128, 128, 256) mas	590080
block3_pool (MaxPooling2D)	(None,	64, 64, 256) _{032_mas}	k png k png
block4_conv1 (Conv2D)	(None,	64, 64, 512)	1180160
block4_conv2 (Conv2D)	(None,	64, 64, 512)	2359808
block4_conv3 (Conv2D)	(None,	64, 64, 512)	2359808
block4_pool (MaxPooling2D)	(None,	32, 32, 512)	0
block5_conv1 (Conv2D)	(None,	32, 32, 512)	2359808
block5_conv2 (Conv2D)	(None,	32, 32, 512)	2359808
blöck5_conv3 (Conv2D) A Compar	(None,	32, 32, 512) _{013_mas}	2359808
block5_pool (MaxPooling2D)	(None,	16, _d 16, 512) _{015_mas}	long
fc1 (Conv2D) exp	(None,	16, 16, 4096) _{17_mas}	102764544
dropout_1 (Dropout) Group Spa	(None,	n16,p.16, 4096)19_mas	kong
fc2 (Conv2D) Is Irradiance	(None,	116, 16, 4096)21_mas	
dropout_2 (Dropout) mses	(None,	16, 16, 4096) ^{23_mas}	
conv2d_1 ((conv2D) ntu	(None,	16, 16, 7) 0025_mas	
conv2d_transpose_1 (Conv2DTr	(None,	N 3 0027 mag	^k 200711 k.png
activation_1 (Activation)	(None,	512, 512, 7)029_mas .03 PM 512, 7)030_mas	k ong k.png
Total params: 134,489,934	6	▶ (0031_mas ▶ (0032_mas	k.png k.png
Trainable params: 119,775,24 Non-trainable params: 14,714		ALC: NAME OF	ME

2. (10%) Show the predicted segmentation mask of validation/0008_sat.jpg, validation/0097_sat.jpg, validation/0107_sat.jpg during the early, middle, and the final stage during the training stage. (For example, results of 1st, 10th, 20th epoch)

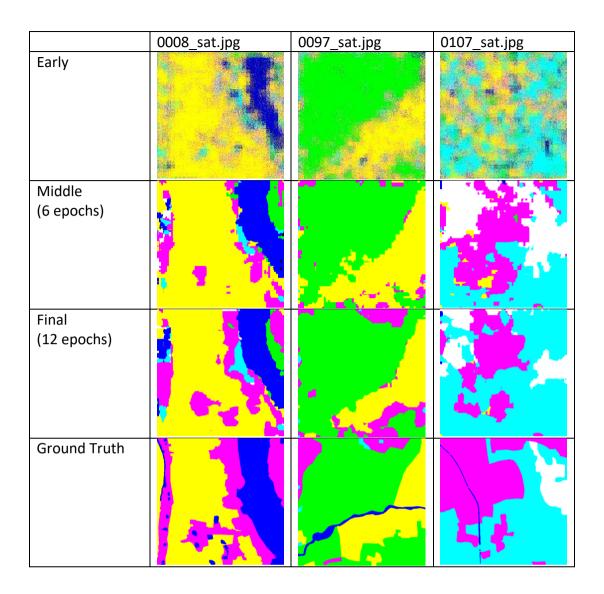
	0008_sat.jpg	0097_sat.jpg	0107_sat.jpg
Early			
Middle (5 epochs)			
Final (10 epochs)			
Ground Truth	471		

3. (15%) Implement an improved model which performs better than your baseline model. Print the network architecture of this model.

將 network 的 output(16*16)先 deconvolution 到 32*32 後,加入倒數第二個 conv block 的 output(32*32), 完成 VGG16FCN16 的實作, 以期將更 fine-grained 的資訊保留下來,可以將細節處還原得更好.

Layer (type)	Output	Shape		Param #	Connected to
input_1 (InputLayer)	(None,	512, 512,	3)	0 Favorites	1038_mask.png
block1_conv1 (Conv2D)	(None,	512, 512,	64)	1792	input_1[0] [0] inparatirehension.pdf
block1_conv2 (Conv2D)	(None,	512, 512,	64)	36928	block1_conv1[0][0]
block1_pool (MaxPooling2D)	(None,	256, 256,	64)	k.png k.png	block1_conv2[0][0]
block2_conv1_(Conv2D) Combinationo	(None,	256, 256,	128)	73856	block1_pool[0][0]
block2_conv2 (Conv2D) exp	(None,	256, 256,	128)	147584	block2_conv1[0][0]
block2_pool (MaxPooling2D)sparsD	(None,	128, 128,	128)	k ong	block2_conv2[0][0]
block3_conv1 (Conv2D) Irradiance Predi	(None,	128, 128,	256)	295168	block2_pool[0][0]
block3_conv2 (Conv2D) mses	(None,	128, 128,	256)	k.png	block3_conv1[0][0] block3_conv1[0][0]
block3_conv3 (Conv2D) ntu	(None,	128, 128,	256)	k.png	block3_conv2[0][0] PNG mage - 4 K8
block3_pool (MaxPooling2D) () Remote Disc	(None,	64, 64,02	56) nas	ko ^{ong} k.png	block3_conv3[0][0] 7:49 AM
block4_conv1 (Conv2D) test_truth	(None,	64, 64, 5	12)	1180160	block3_pool[0][0] ₅₁₂
block4_conv2 (Conv2D) train_imgs	(None,	64, 64, 5	12)	2359808	block4_conv1[0][0]
block4_conv3 (Conv2D)	(None,	64, 64, 5	12)	2359808	block4_conv2[0][0]
block4_pool (MaxPooling2D)	(None,	32, 32, 5	12)	0	block4_conv3[0][0]
block5_conv1 (Conv2D)	(None,	32, 32, 5	12)	2359808	block4_pool[0][0]
block5_conv2 (Conv2D)	(None,	32, 32, 5	12)	2359808	block5_conv1[0][0]
block5_conv3 (Conv2D)	(None,	32, 32, 5	12)	2359808	block5_conv2[0][0]
block5_pool (MaxPooling2D)	(None,	16, 16, 5	12)	0	block5_conv3[0][0]
fc1 (Conv2D)	(None,	16, 16, 4	096)	102764544	block5_pool[0][0] 1038_mask.png
dropout_1 (Dropout)	(None,	16, 16, 4	096)	0 - Ioland De	fc1[0][0] A Comparatirehension.pdf
fc2 (Conv2D)	(None,	16, 16, 4	096)	16781312	dropout_1[0][0]
dropout_2 (Dropout) A Comparatire	(None,	16, 16, 4	096)	k.png k.png	fc2[0][0]
conv2d_1 (Conv2D) Combinationo	(None,	16, 16, ₀ 7	5_mas	28679	dropout_2[0][0]
score_pool4 (Conv2D) exp	(None,	32, 32,07	7_mas	3591	block4_pool[0][0]
score2 (Conv2DTranspose) up SparsD	(None,)9_mas 20_mas		conv2d_1[0] [0]
add_1A (Add) ons Irradiance Prediction Desktop maes mses	(None,	32, 32,07)1_mas 22_mas	k Ø)ng k.png	score_pool4[0][0] score2[0][0]
conv2d_transpose_1 (Conv2DTransp	(None,	512, 512,		50183	add_1[0][0]3_mask.png
activation_1 (Activation)	(None,	512, 512,			conv2d_transpose_1[0][0] (B Today, 7:49 AM
Total params: 134,343,788 Shot	3.04.55 P	M 00:		k.png k.png	Modified Today, 7:49 AM Last opened Today, 7:49 AM Dimensions 512×512 Add Tags

4. (10%) Show the predicted segmentation mask of validation/0008_sat.jpg, validation/0097_sat.jpg, validation/0107_sat.jpg during the early, middle, and the final stage during the training process of this improved model.



5. (15%) Report mIoU score of both models on the validation set. Discuss the reason why the improved model performs better than the baseline one. You may conduct some experiments and show some evidences to support your discussion.

Baseline model – VGG16FCN32s: 0.6436 Improved model – VGG16FCN16s: 0.6485

可以看到如上的 mask,16s 的結果跟 32s 比起來比較細緻,但有許多不連續的地方,可能肇因於 training 時間不夠久,或是 16s 的還不足以保留太 fine-grained 的資訊,但可能因為 mean IOU 兩者幾乎一樣,所以 16s 並沒有看起來比 32s 好太多.

6. (5%) [bonus] Calculate the result of d/dw G(w):

$$\frac{1}{\sqrt{2}} = \frac{1}{\sqrt{2}} \left(\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} \right) = \frac{1}{\sqrt{2}} \left(\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} \right) = \frac{1}{\sqrt{2}} \left(\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} \right) = \frac{1}{\sqrt{2}} \left(\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} \right) = \frac{1}{\sqrt{2}} \left(\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} \right) = \frac{1}{\sqrt{2}} \left(\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} \right) = \frac{1}{\sqrt{2}} \left(\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} \right) = \frac{1}{\sqrt{2}} \left(\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} \right) = \frac{1}{\sqrt{2}} \left(\frac{1}{\sqrt{2}} + \frac$$