DLCV_hw4　　學號：R06942039 姓名：何明倩　科系：電信所碩一

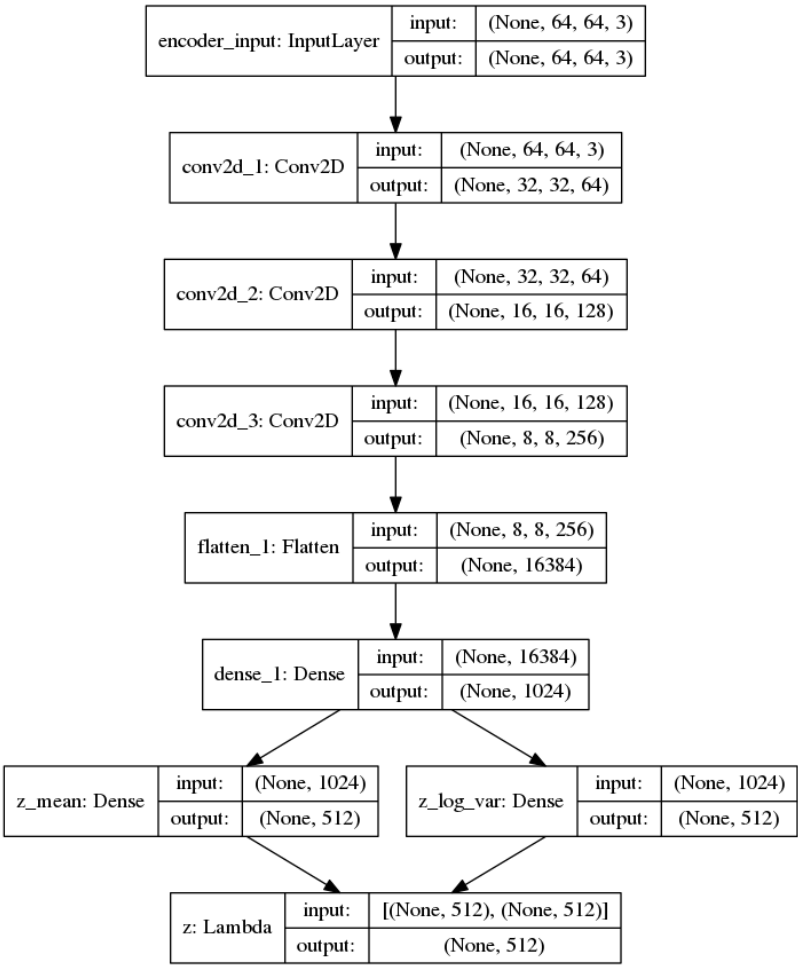
Problem 1. (VAE)

1. Describe the architecture & implementation of your model.

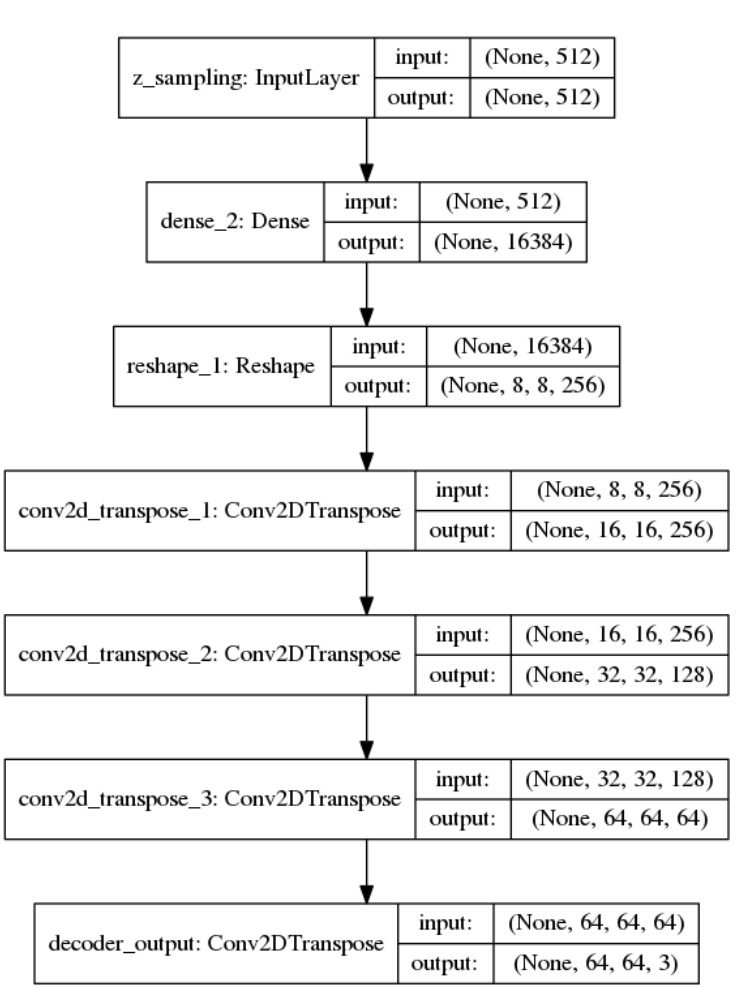
我設我的 encoder 和 decoder 都只有三層 layers，latent space dimension 為 512，並且沒有用到 batchnormalize。但是可以根據第三和四題可以看得出來重建和 random sample 的效果都很好。我選擇 200 個 epoch，batsh_size 為 128，optimizer 選擇 rmsprop。

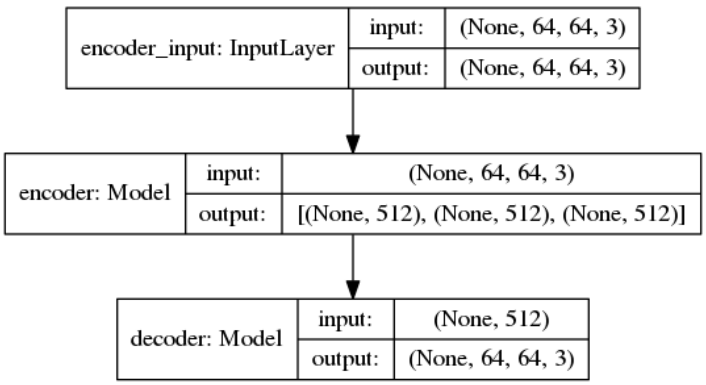
Reference: https://github.com/keras-team/keras/blob/master/examples/variational_autoencoder_deconv.py

encoder

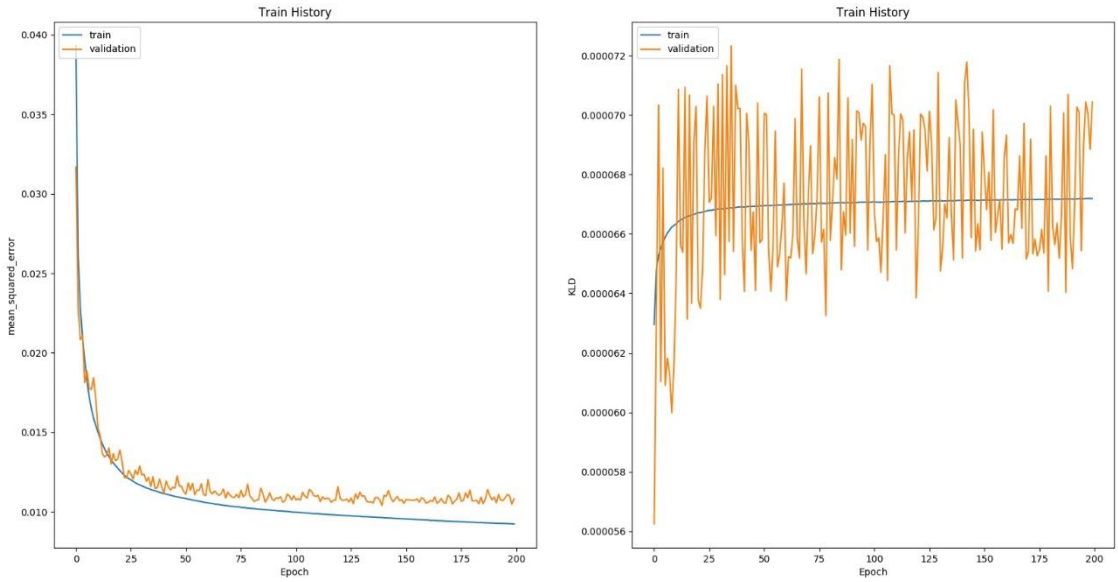


decoder





2. Plot the learning curve (reconstruction loss & KL divergence) of you model[fig1_2.jpg]



3. Plot 10 testing images and their reconstructed result of yourmodel [fig1_3.jpg] and report your testing MSE of the entire test set

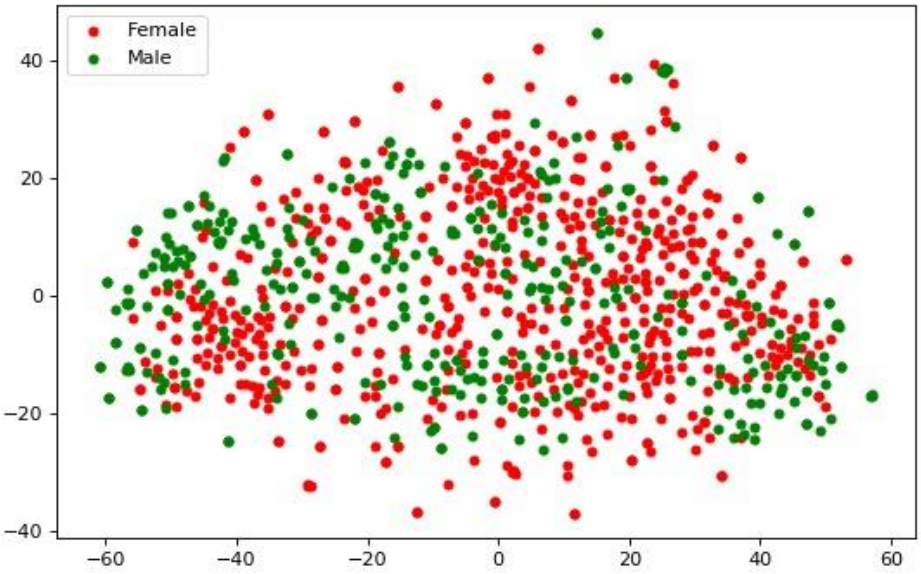
Total MSE loss of testing data = 0.075

Input

Reconstruct

4. Plot 32 random generated images of your model [fig1_4.jpg]

5. Visulize the latent space b mapping test images to 2D space (with T-SNE) and color them with respect an attribute of your choice [fig1_5.jpg]



6. Discuss what you've observed and learned from implement VAE
   我覺得 train VAE 相較於 gan 和 acgan 簡單許多，只是我發現好像 VAE 的層數不要取太多會比較好。而且λ_{KL}越大，reconstruction 會越模糊，但是 ramdon sample 的效果卻會是比較好。像是我用$\lambda_{KL} = 1e-5$ random sample 出來的結果就非常的差看不太出來有人臉。當我調到$\lambda_{KL} = 1e-4$ *或* $1e-3$ 雖然 reconstrution 比較模糊，但是 radom sample 出來的結果都很不錯。

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Problem 2. (GAN)

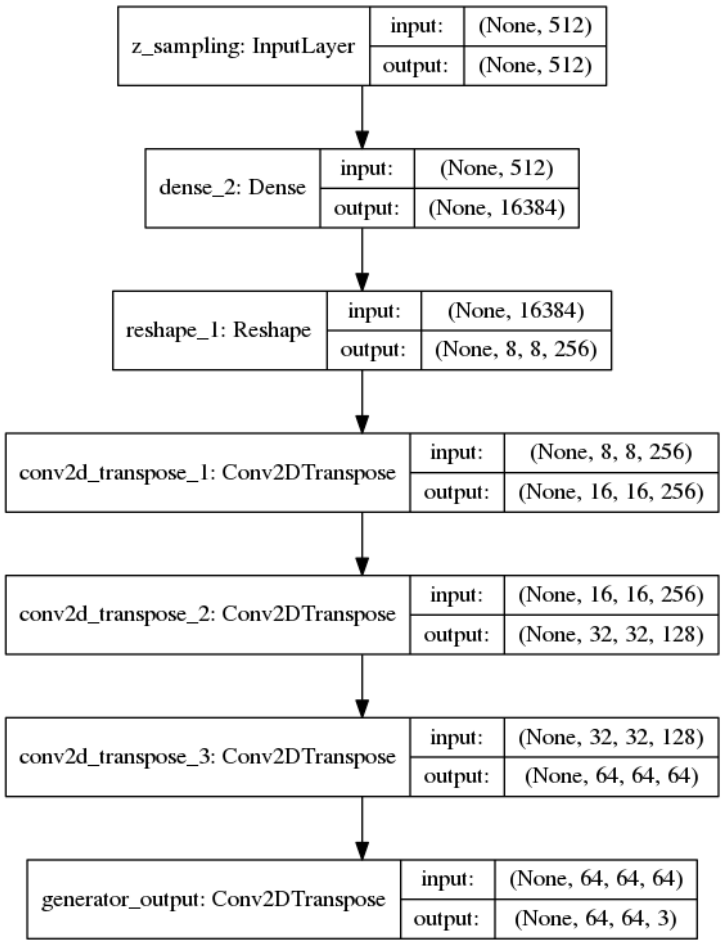
1. Describe the architecture & implementation of your model

   我設我的 encoder 和 decoder 都只有三層 layers，latent space dimension 為 512，並且沒有用到 batchnormalize。但是可以根據第三題可以看得出來 random sample 的效果很好。我選擇 50000 個 training steps，batsh_size 為 128，optimizer 選擇 Adam。

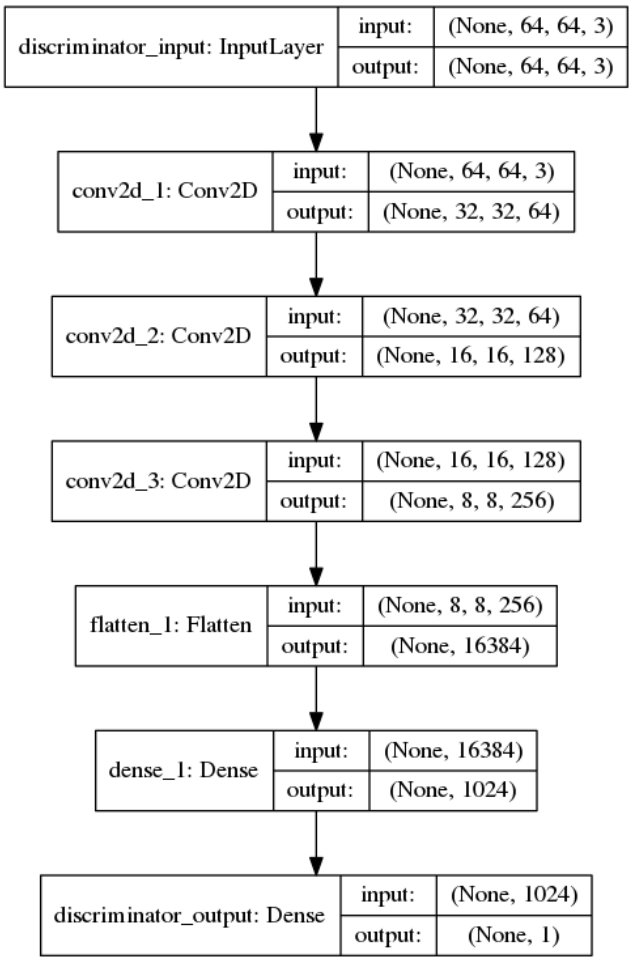
Reference:

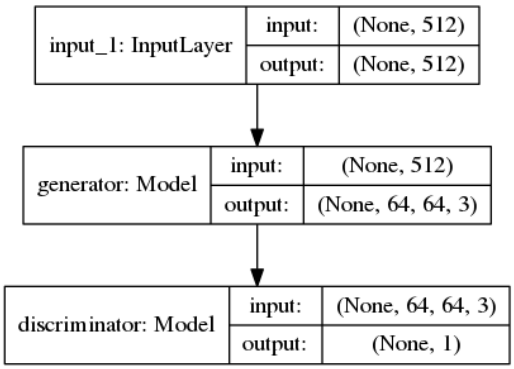
- https://github.com/keras-team/keras/blob/master/examples/variational_autoencoder_deconv.py
- https://github.com/eriklindernoren/Keras-GAN/blob/master/gan/gan.py

generator

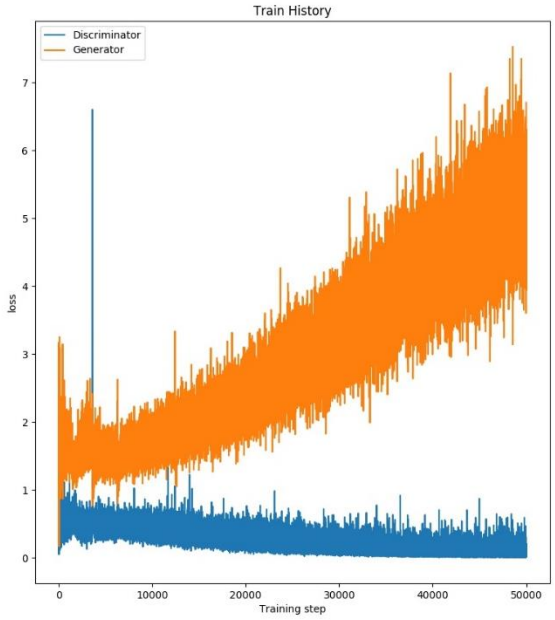


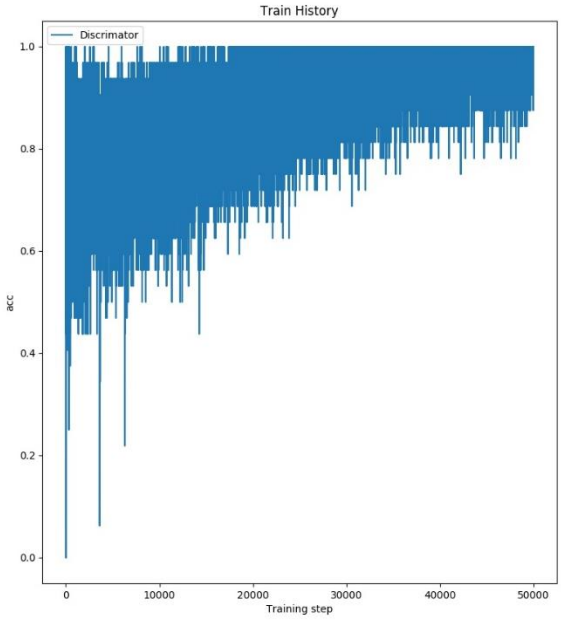
discriminator





2. Plot the learning curve (reconstruction loss & KL divergence) of you model[fig2_2.jpg]





3. Plot 32 random generated images of your model [fig2_3.jpg]

4. Discuss what you've observed and learned from implement GAN
   我發現主要將 VAE 的 decoder 和 encoder 倒過來接就是一個初步的 GAN，只是得很注要在 train generator 的時候要將 discriminator 的 weight fix 住，而 train discriminator 時要將 generator 的 fix 住
5. Compare the difference between image generated by VAE and GAN, discuss what you've observed.
   我會發現用 VAE random sample 出來的 image 都很模糊有一種朦朧美的感覺，但是用 GAN 產生出來的圖片輪廓就非常的清楚，臉部細節也比較明顯。因為 GAN 多了 discriminator 來判斷圖片的真假，所以能讓產生出來的圖片越接近真實的圖片 。

Problem 3. (ACGAN)

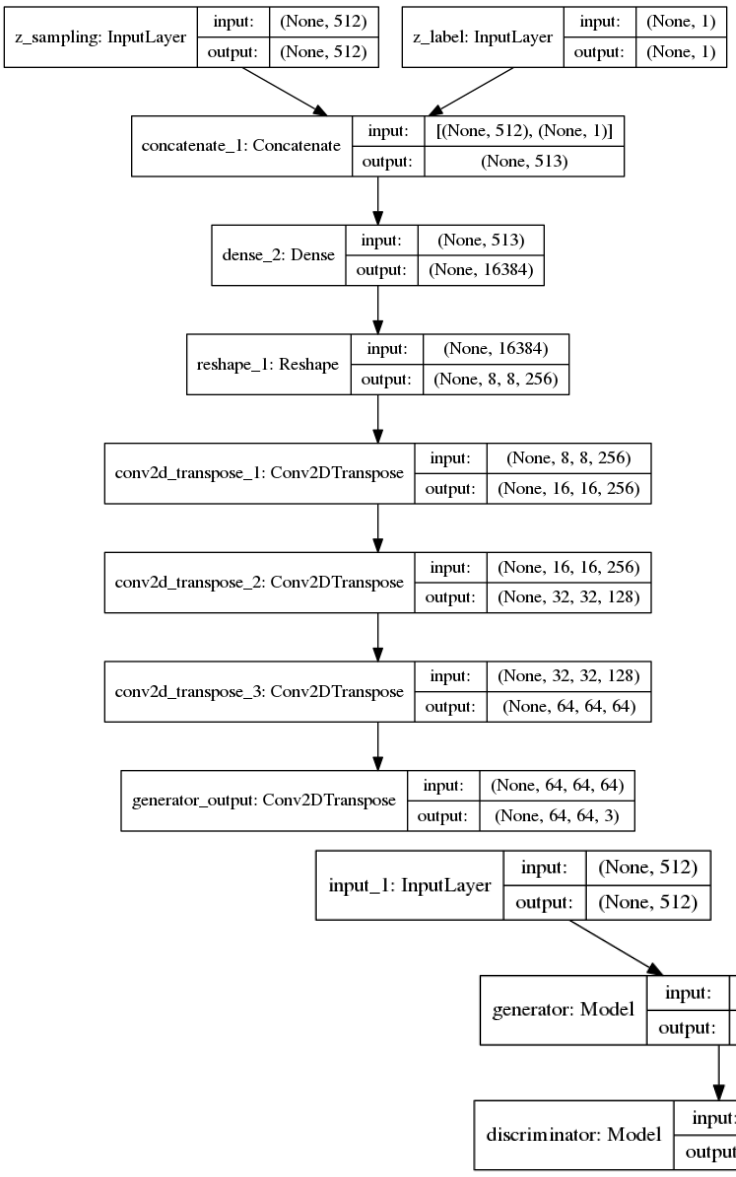
1. Describe the architecture & implementation of your model

   我主要將 VAE 的 decoder 和 encoder 分別拿來當 acgan 的 generator 和 discriminator，並且沒有用到 batchnormalize(我發現多加了 batchnormalize 反而 train 不起來)，針對 attribute label 直接將其 concatenate 在 latent space vector (dim=512)，變成 513 維的 vector 後面。我選擇 15000 個 training steps，batsh_size 為 128，optimizer 選擇 Adam。我發現將 attribute label 作 embedding 反而讓我的 model 無法 train 好。

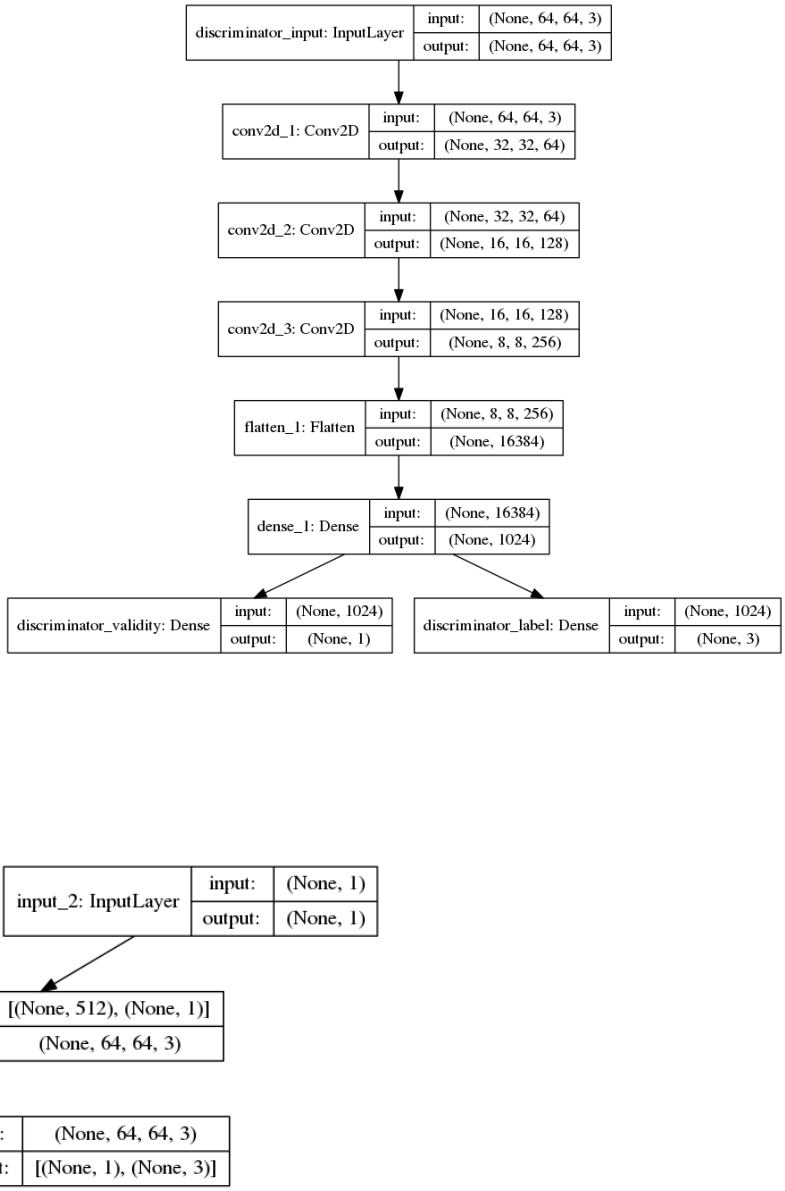
Reference:

- https://github.com/keras-team/keras/blob/master/examples/variational_autoencoder_deconv.py
- https://github.com/eriklindernoren/Keras-GAN/blob/master/acgan/acgan.py

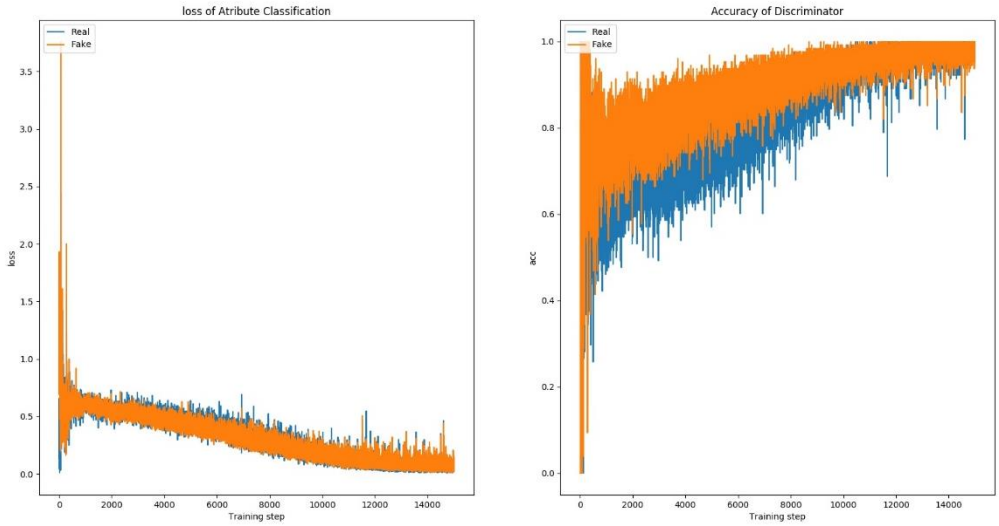
Generator



Discriminator



2. Plot the learning curve (reconstruction loss & KL divergence) of you model[fig3_2.jpg]



3. Plot 10 pair of random generated images of your model, each pair generated from the same random vector input but with different attribute. This is to demonstrate your model's ability to disentangle feature of interest. [fig3_3]

Female

Male