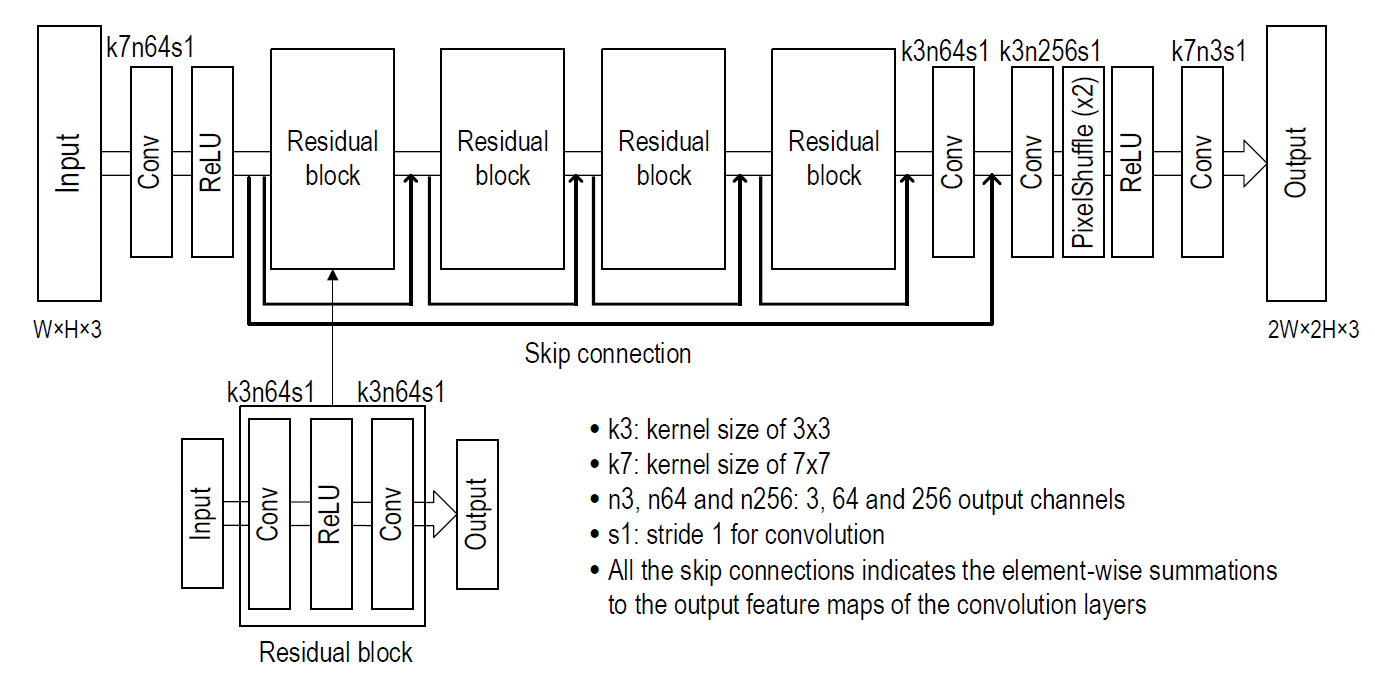
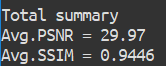
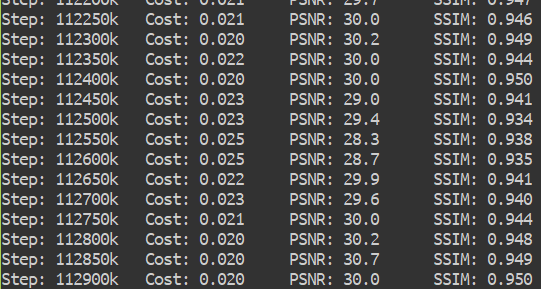
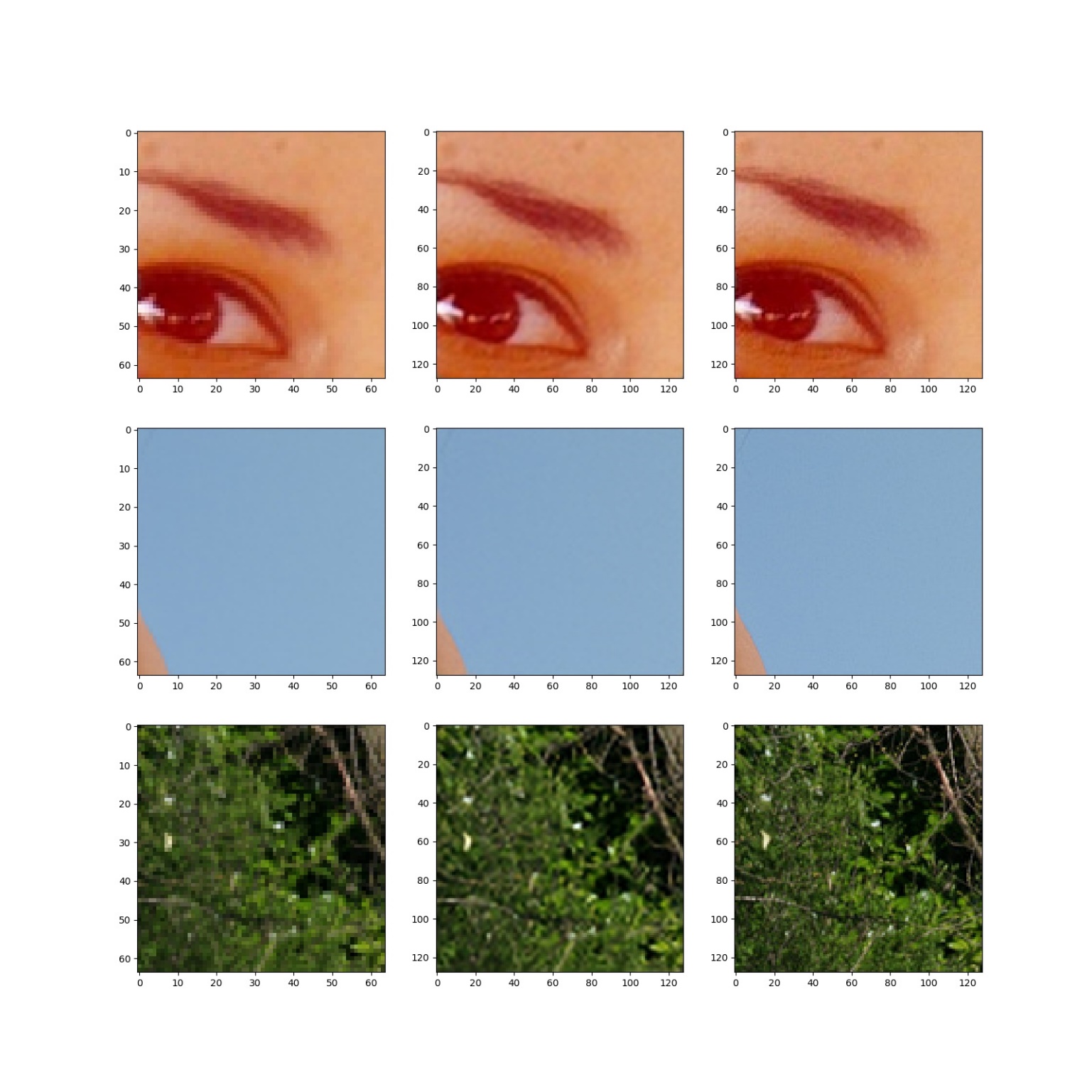
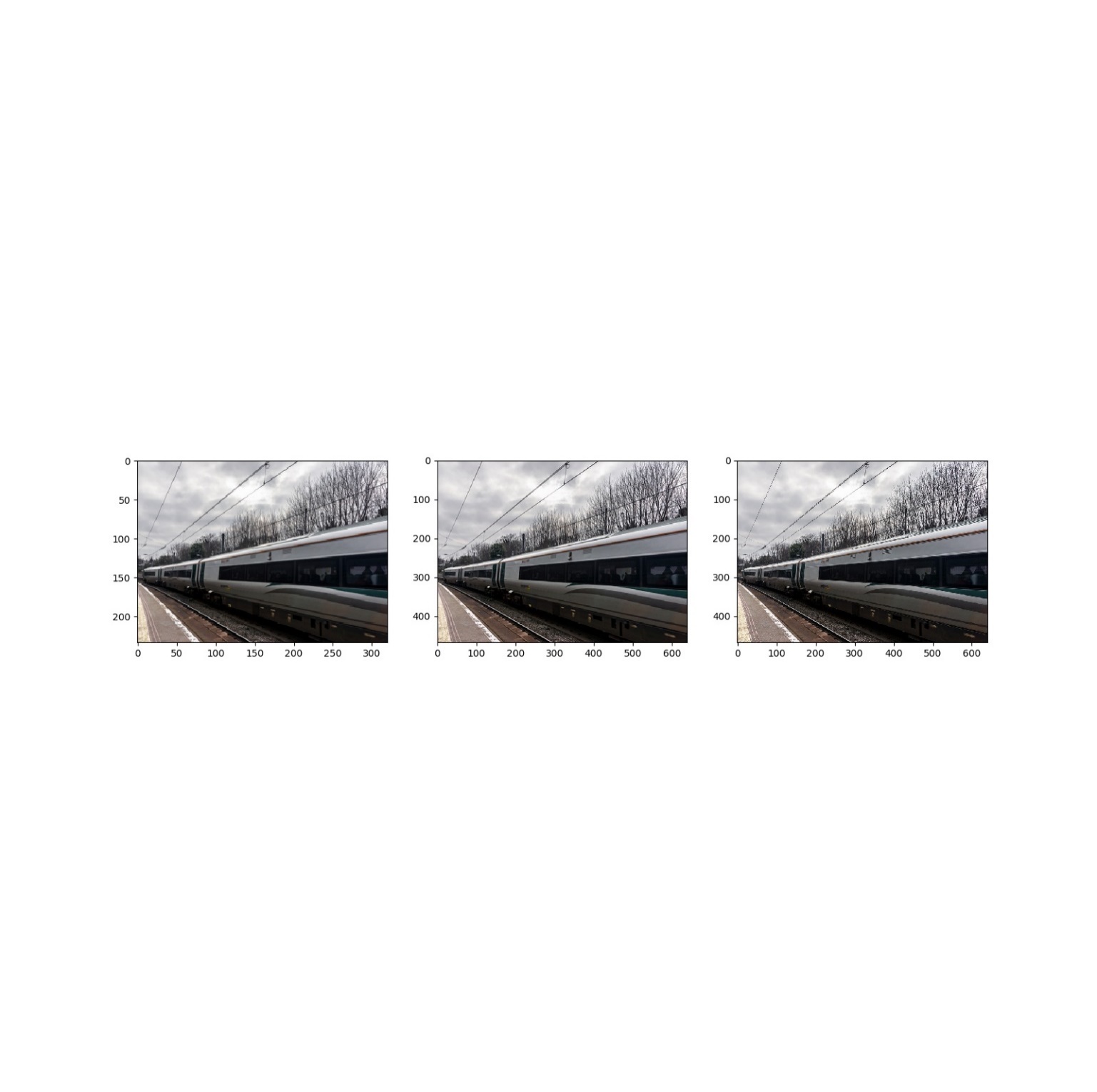
HW1 Report

themis12@kaist.ac.kr / 010 2830 3651  
20184448 Jo MinKi

1. **Introduction**   
   This model conduct the super resolution image generation (translation) task with single image. Similarly to the pix2pix, every input data has the assigned target data. Basically this model make 2x2 bigger image, but it seems recover the resolution more than that. The detail about the implementation are written in the README.md and in the python files.
2. **Environment**



* L1 loss for the cost
* Adam optimizer (epsilon = 0.002)
* Learning rate: 0.0005

1. **Result**   
     
   After 112k step,   
   Average training cost: 0.02  
   Average PSNR = 30.3   
   Average SSIM = 0.947  
     
   For the validation data,  
   Average PSNR = 29.97   
   Average SSIM = 0.9446   
     
     
   Training example (Left is input(64x64) middle one is output, and right one is the target)  
     
     
   Example recovery for the training set  
     
   First column is the input data, second column is the output (recovered) data, and the last column is the target.  
     
     
     
   Example recovery for the validation (test) set  
     
   File: 0015.png PSNR: 25.2 SSIM: 0.888  
     
     
     
     
     
     
     
     
   File: 0035.png PSNR: 31.3 SSIM: 0.957  
     
     
     
   File: 0055.png PSNR: 29.2 SSIM: 0.926  
     
     
     
     
     
   File: 0075.png PSNR: 22.0 SSIM: 0.867  
     
     
     
     
   #95 (PSNR = 30.5, SSIM = 0.961)  
     
   

1. **Discussion**

The model make the LR image more smoother such like a bilinear or bicubic interpolation. In addition, compare to those mathematical interpolation method (average PSNR = 27.6) the neural network model infer better for the invisible pixel.

Furthermore, according to the observation, there was a tendency that the image with simple texture shows good performance while the image with complex texture shows bad performance.

Figure Recovered Image with complex texture(#57),   
PSNR = 21.4, SSIM = 0.743  
The stripe at the head of the zebra and leaves are still blurry.

Figure Image with simple texture(#21)   
PSNR = 37.0, SSIM = 0.979

Input, recovered, target image in order.   
  
The model cannot recover the texture very well because there is no way to training method that make the model learn about the pattern of the texture. The model easily learn to regress the small pixel value based on the bigger pixel so make the LR image smoother, but the complex texture or pattern is not the case.   
However, in case of GAN, there is a way that measure the quality of the recovered texture and pattern called discriminator, which make possible to train the model to recover the complex pattern for with high resolution.   
  
In addition, it seems to converge in some point (where L1 loss is around 0.04) fast, but it took a lot of time to reach to the final converging point (where L1 loss is around 0.02). At the first converging point, it produces kind of blurry image and the model stuck in there for a long time. I have tried some changes for the learning schedule such like learning rate decade, but most of work does not worked.   
However, at the end it can be able to learn the