EE838B

Special Topic on Image Engineering: Advanced Image Restoration and Quality Enhancement

Homework Assignment 2

Implementation and Verification of deep learning based image deblurring networks

The second home assignment is to implement a given deep neural network for single image deblurring and to train it properly. After training, the performance verification is required for test images by providing the performance measures in terms of PSNR, SSIM and MS-SSIM (Multi-scale SSIM).

The data set for experiments is provided via the below Dropbox link where the two sets of training and validation images are found. The evaluation of the submitted trained networks for Homework Assignment 2 will be performed based on the correct implementation and performance of the given network.

Dataset

- Training samples: GOPRO dataset (2,103 pairs) (Input: blur folder, GT: sharp folder)
- Validation samples: GOPRO dataset (1,111 pairs) (Input: blur folder, GT: sharp folder)
- Download links:
  - Training/Validation data: https://www.dropbox.com/s/u842yorwmap7xij/GOPRO_Large.zip?dl=0
  - You should use the previous skeleton code.

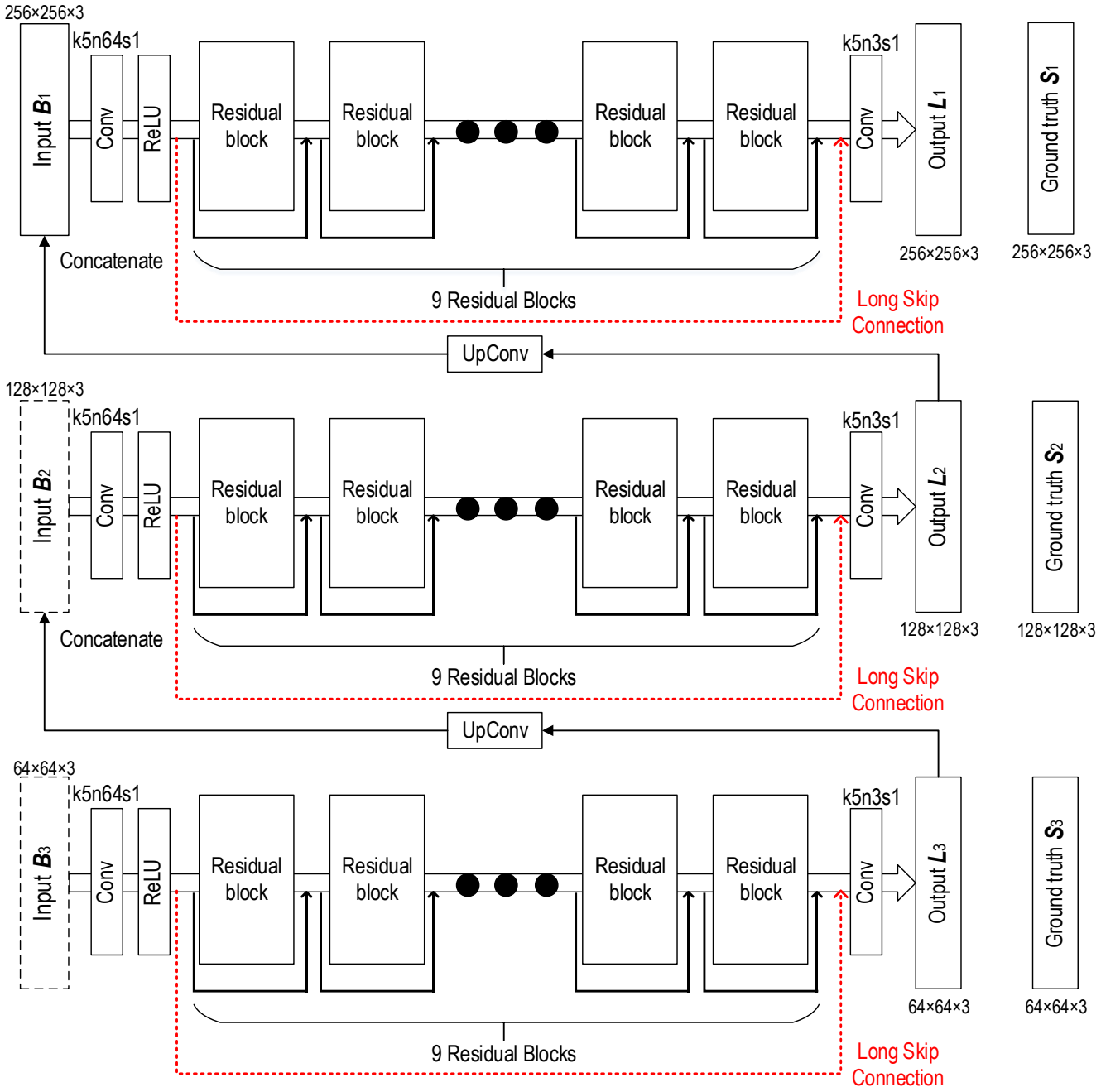
Implementation

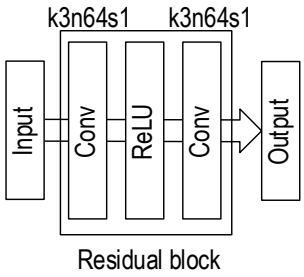
- Adam Optimizer
- Multi-scale content loss function

$$L = \frac{1}{2K} \sum_{k=1}^{K} \frac{1}{c_k w_k h_k} \left\| L_k - S_k \right\|^2$$

  where k is the pyramid level index with $K = 3$, $c_k = 3$ is the number of the output channels at the at the k-th pyramid level, and w_k (h_k) is the width (height) of the outputs at the k-th pyramid level.

- Training patch size : 256×256×3 RGB images
- Batch size : any number (defined by users)
- You can use several data augmentation techniques such as randomly flipping horizontally and vertically, and rotating by 90 degrees etc.
- Other hyper-parameters for training can be freely selectable.
- The multi-scale network architecture for image deblurring is supposed to implement:





- k5: kernel size of 5x5
- n3, n64: 3, 64 output channels
- s1: stride 1 for convolution
- UpConv: any transposed convolution filter
- All the skip connections indicate the element-wise summations to the output feature maps of the convolution layers
- Input $\boldsymbol{B}_2$ and $\boldsymbol{B}_3$ are produced by Bicubic downsampling of original input $\boldsymbol{B}_1$.

The following deliverables must be submitted:

- Both training and test codes (Pytorch)
- Readme.txt describes how to run your code, information of your code structure.
- You can use any libraries for calculation of SSIM and MS-SSIM, but you have to explain the libraries in Readme file.

- Report
  - Experimental conditions
  - The deblurred images produced by your test code for the three validation images
    - GOPR0384_11_00/blur/000001.png
    - GOPR0384_11_05/blur/004001.png
    - GOPR0385_11_01/blur/003011.png
  - The analysis of your results and a simple code description for each component of the neural network
  - **You have to analyze the difference between the results of single scale network and the results of multi-scale network in terms of the objective quality and perceptual quality.**
  - **You have to analyze the difference between the results of the network with long skip connection and the results of the network without long skip connection in terms of the objective quality and perceptual quality.**

Submission

- Due date: **2020-10-16 23:59 2020-11-9 (Monday) 23:59**
- Submission should go to the class TAs at: jhoh94@kaist.ac.kr
- Submission format
  - Your report must include your name, student ID and e-mail
  - Your report must be in ZIP format with following directories:
    - ✓ **Do not** include the train and test **data** in your ZIP file.
    - ✓ `source` where readme.txt, training code and test code must reside
    - ✓ `report` where your report is put
  - The file name of your submission should be "HW2_studentID_YourName.zip".
  - **<NOTE: If your train and test code are not working, your implementation score is zero!!!>**