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Course Work 1: Image Super-resolution Using Deep Learning

1. Suppose the settings of a SRCNN as: f1=9, f2=3, f3=5, how many pixels of the low-resolution image are utilized to reconstruct a pixel of the high-resolution image with the SRCNN? (10% of CW1)

   (f1 + f2 - 1 + f3 - 1)^2
   (9 + 3 - 1 + 5 - 1)^2
   225
   Thus, 255 are the number of pixels of the low-resolution image are utilized to reconstruct a pixel of the high-resolution image with the SRCNN.

2. Why the deep convolutional model is superior to perform image super-resolution? Give one reason to explain it. (10%of CW1)

   The deep convolution model or Super resolution convolution neural network model (SRCNN) gives end-to-end mapping between low and high resolution images. This is achieved implicitly via the hidden layers of CNN rather explicitly in tradition example based methods. The patch extraction and aggregation is done entirely in the neural network layers, thus, it requires less pre and post processing of input and output image and works relatively fast. SRCNN works well for more than one channel with good performance metrics and has light weight structure. This is the reason why the deep convolution models are superior in performance. For example, an SRCNN network for basic setting of f1=9, f2=1, f3=5 and n1=64 and n2=32, would require 169 pixels ((9+5-1)^2) whereas, traditional example based method would require 81 pixels ((5+5-1)^1) to construct SR image, thus, traditional SR image will have less PSNR value, as less information is collected for SR image and would require more time. [1]

3. Please explain the physical meaning of peak signal-to-noise ratio (PSNR) in the context of image super-resolution. PS: place here the ground truth (GT) image, and the high-resolution images by SCRNN (HR-SRCNN) and bicubic interpolation (HR-BI) for reference. Also put the PSNR value below the high-resolution images. (10% of CW1)

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GT

HR-BI (PSNR=20.453967418499577)

HR-SRCNN (PSNR=21.77124773032378)

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[1]Chao Dong, Chen Change Loy, Kaiming He, Xiaoou Tang. Learning a Deep Convolutional Network for Image Super-Resolution, in Proceedings of European Conference on Computer Vision (ECCV), 2014