267: Homework #6

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1. Dataset

The dataset contains 20,000 images of people, cities, fruits, animals and etc in three formats (.jpg, .bmp, .png). Considering the size of dataset (1.8 GB), training the model is slow and it is suggested to apply the pretrained model. Although we have trained the model, to study the code. we have chosen 616 images as training set. As we know, the quality of image file affects the training performance, hence the computed residual images are stored in MAT files as type double. After converting the images to YCbCr, downsizing the luminance, and calculating the difference between the pristine and resized images, the resized and residual images are saved.

To increase the model accuracy, we have applied standard data augmentation. Images are randomly selected to rotate 90 degrees or randomly reflected in the x-direction. We have also provided mini-batches for the training epochs.

2. Model

The Very Deep Super Resolution (VDSR) model is implemented by 41 individual layers, including:

- Input layer
- Convolutional layer (2D)
- ReLU layer
- Output (regression) layer

Considering the patch size, the input layer size is 41x41x1 and there are 20 2-D convolutional and ReLU layer as hidden layers containing 64 filters of size 3x3. The weights are initialized by He initializer and the padding size is one.

After designing the hidden layers, the regression layer is defined as the output layer and all the layers are concatenated to build the model.

Next step is training the designed network. The training parameters include number of epochs, regularization parameters, mini batch size, learning rate and its decay, regularization rate, and etc. Also, we should choose the regularization and optimization method. Stochastic Gradient Descent with Momentum has been chosen as our optimization method. In order to regularize the weights, we have applied L2 -also known as Ridge- Regression.

3. Results

To compare the super resolution method, we have chosen 21 images out of the training set, to decrease their resolution. The images are shown in Figure 1.

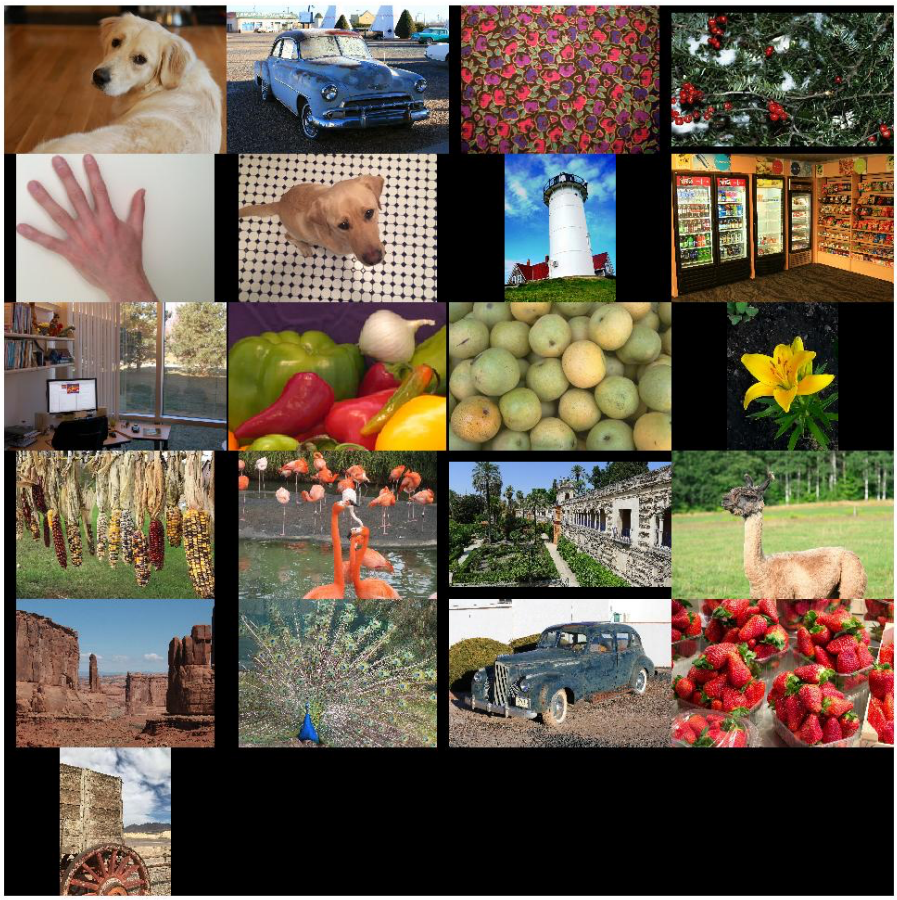

Figure 1: Low-Resolution images

Let’s compare the High-Resolution and Low-Resolution images in Figure 2 and 3.

Figure 2: High-Resolution chosen image

Figure 3: Low-Resolution chosen image

As can be seen in figure 2 and 3, the Low-Resolution image is blurry and not as high quality as the High-Resolution chosen image.

To study the performance of our model, we have compared the results of our model to High-Resolution images obtained by Bicubic Interpolation (Figure 4).

Figure 4: High-Resolution image obtained by Bicubic Interpolation

Figure 5: High-Resolution image obtained by VDSR

As shown in Figure 4, 5 and 6, the resolution of the reconstructed image by VDSR is higher and we have achieved better quality.

Figure 6: High-Resolution images using Bicubic Interpolation (left) VS. VDSR (right)

Let's compare two methods quantitatively. Table 1 shows the

	PSNR	SSIM	NIQE
Bicubic	23.7935	0.9427	6.2859
VDSR	24.2602	0.9498	6.0551

Table 1: Quantitative Comparison of Bicubic Interpolation and VDSR

The figures and the table prove the superiority of VDSR over the Bicubic Interpolation.