Programming Assignment 2

1 Problem 1

The code file include 1 item

Q1.m, implement it with method stated in the textbook.

(i) your color face image

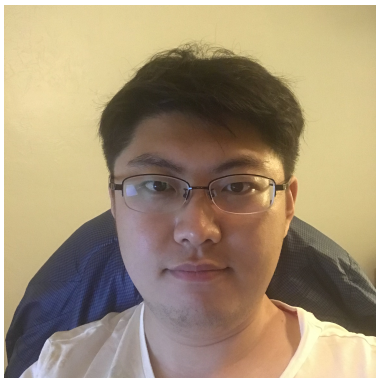

Figure 1: original image

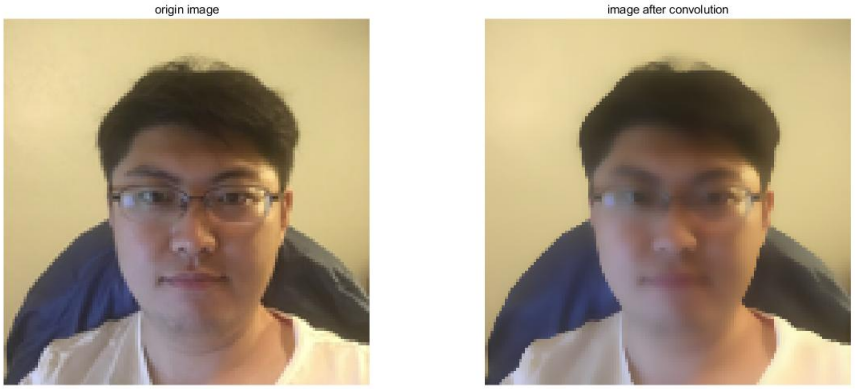

Figure 2: resize to [64,64] and bilateral filter applied result

(ii) a color image of the french fries in front of the CISE building.

Figure 3: original image

Figure 4: resize to [64,64] and apply bilateral filter to it

(iii) a color image of the UF century tower building.

Figure 5: original image

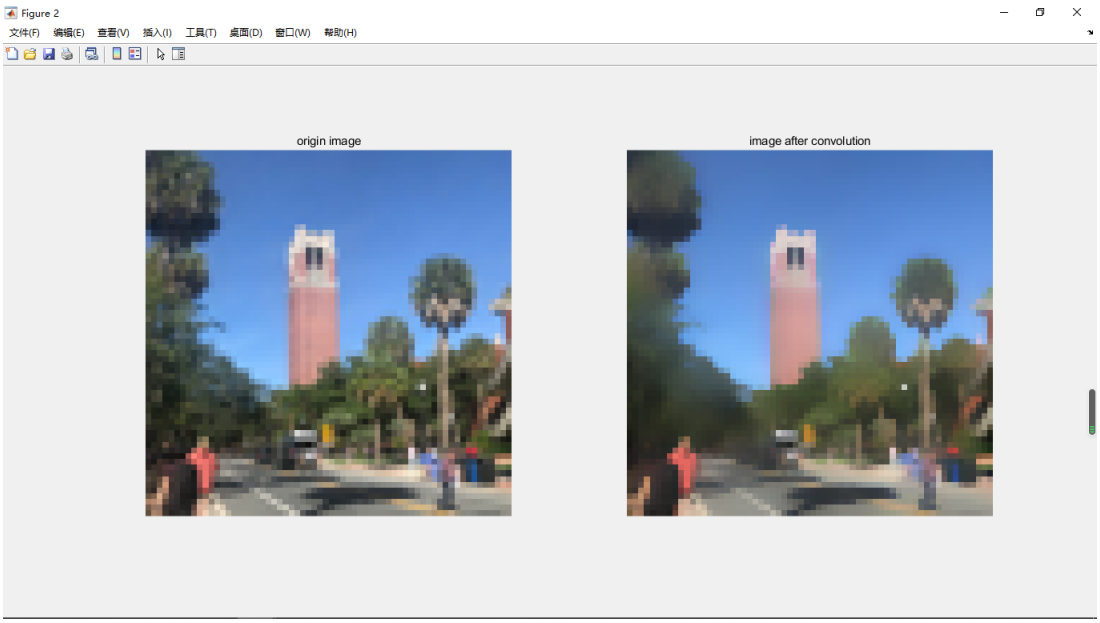

Figure 6: resize to [64,64] and apply bilateral filter to it

2 Problem 2

2.1 Program illustration

The code includes 7 items.

1. *blendEye.m*, the main program. It blends images based on laplacian pyramids and mask. After converting images to double format, generate the Laplacian pyramids for the two images. A mask is needed to blend image, I design it specified for my pictures so that it can blend my eyes and hand. The mask is of same size as the two images after it is resized, 256×256. The pixel values of the mask is set to 0 in the part of my right eye and the pixel values in the remaining half fades to 255. Then the two Laplacian images and the mask are passed to the function *blendImgs* to generate blended pyramid. Then the blended image is reconstructed by passing the blended Laplacian pyramid to reconstructImg function. In the function*blendImgs*, it generates Gaussian pyramid of the mask and generates the blended images at each level of the two Laplacian pyramids to generate Laplacian pyramid of blended images. The formula which is used to blend the images is:
$$Lfig = Gfig. * Lfig1 + (1 - Gfig). * Lfig2 \tag{1}$$
Gfig is gaussian of mask.

2. *reconstructImage.m*, reconstruct the image just upsample and smooth each level of Laplacian pyramid.

3. *getPyr.m*, it takes *image*, *type* and *number of levels* as arguments, and returns a cell array of images. The image can be color or gray scale, type can be 'gauss' or 'laplace'. *numLevels* indicates the number of levels in the image pyramid. For drawing the picture, we set it to 6. In case of Gaussian pyramid, at each level, the image is smoothed and then is down-sampled to half its size by calling.

   In case of Laplacian pyramid, first, the Gaussian pyramid is generated and we show the image of Gaussian pyramid at G1, G3, G5. Next, at each level of generation of Laplacian pyramid, the image from the coarsest level(which is level 5) of Gaussian pyramid is upsampled to twice its size, and then it is smoothed. Gaussian at the same level subtracts it, then we get the Laplacian pyramid at the same level. We show the image of Laplacian pyramid at L0, L2, L4, pay attention that the last level of Gaussian and Laplacian pyramid should be level 5. they are the same as each other.

4. *smoothenImg.m*, generate X^TX kernel for Gaussian pyramid and $4*X^TX$ for Laplacian pyramid, and convolve the kernel with the image.

5. *downsampleImg.m*, reduce input image to half its size by choosing every second pixel along the width and height of the image.

6. *upsampleImg.m*, scale input image to twice the size of the image by inserting zeros at every second row or column of the image.

Note: The upsampled operation needs to insert zeros in every second row and column of the image. Thus, the image size is increased by 4 times and the pixels are spread across 4 times the area of original image. Now, If we smoothen the picture with Gaussian kernel, the image looks dull compared to the original image because of the missing pixels. To estimate the value of the missing pixels so that and improve its contrast and brightness we scale the smoothing kernel 4 times. It should be set 4 because only by setting it as 4 can I get the perfect result.

2.2 Result

(I)The original images (my face, my palm and the binary mask)

Figure 7: Oringinal image of my face.

Figure 8: Oringinal image of my palm.

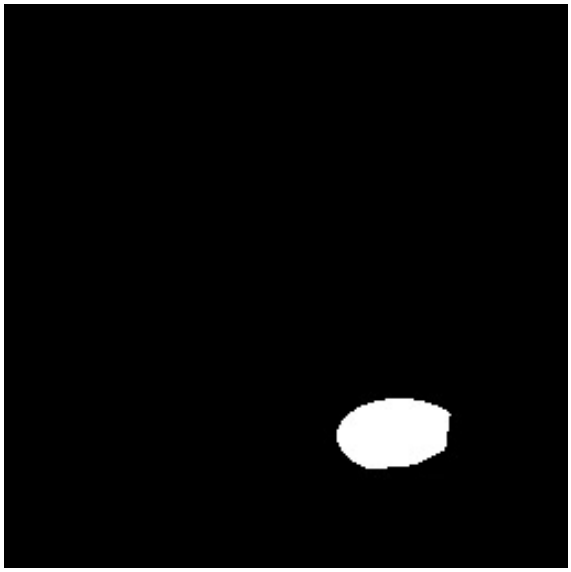

Figure 9: Oringinal image of the mask.

(ii) three images showing the images from the low, mid and high levels of the Gaussian and Laplacian pyramids in two rows. Top row showing the Gaussian and the bottom row showing the Laplacian pyramid images.

Figure 10: Gaussian Pyramid of my.jpg at level 1, 3 and 5. Laplace Pyramid of my.jpg at level 0, 2 and 4

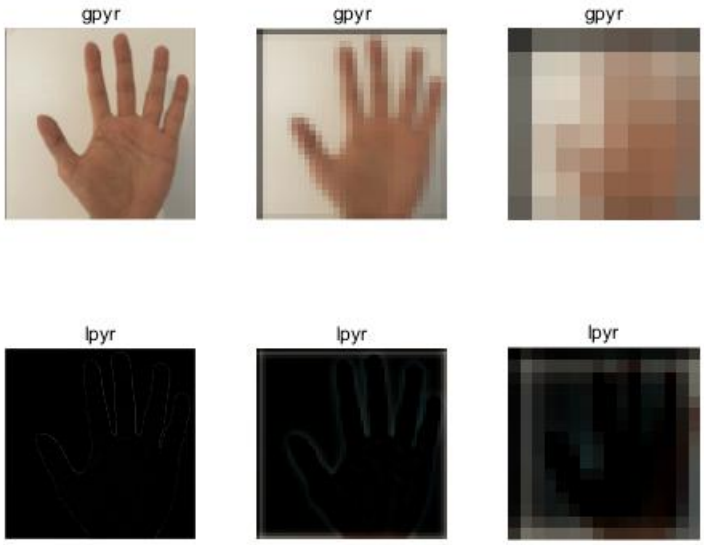

Figure 11: Gaussian Pyramid of myhand.jpg at level 1, 3 and 5. Laplace Pyramid of myhand.jpg at level 0, 2 and 4

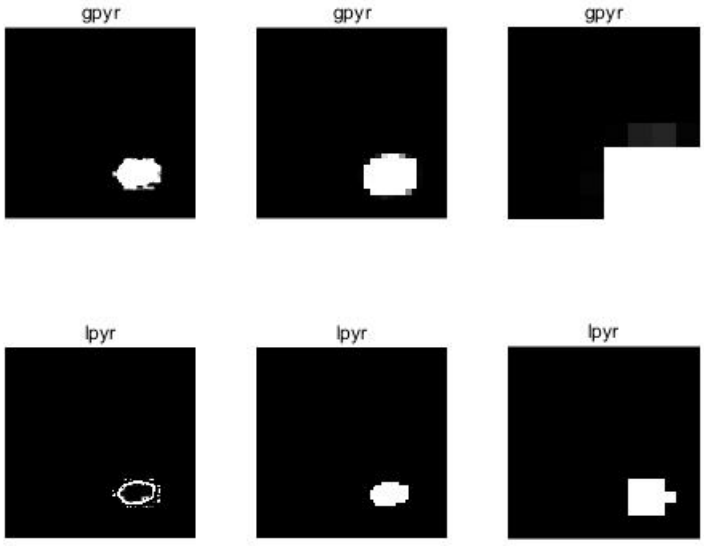

Figure 12: Gaussian Pyramid of mask.jpg at level 1, 3 and 5. Laplace Pyramid of mask.jpg at level 0, 2 and 4

(iii)The blended image at the original resolution of the face and palm images.

Figure 13: The blended image