

# CS517: Digital Image Processing & Analysis

Semester I, 2021 – 2022

Programming Assignment 1:

(Due Date/Time: Tuesday, 14<sup>th</sup> Sep 2021, Midnight)

## Question 1: [10 Points]

Image resizing is a widely used operation in image processing. Either for scaling up or for scaling down, we use interpolation to find the corresponding pixel intensity in the resulting image. Choice of interpolation method is important as it directly affects the quality of the resulting image. The following interpolation methods were mentioned in class:

- Nearest neighbor
- Bilinear
- Bicubic

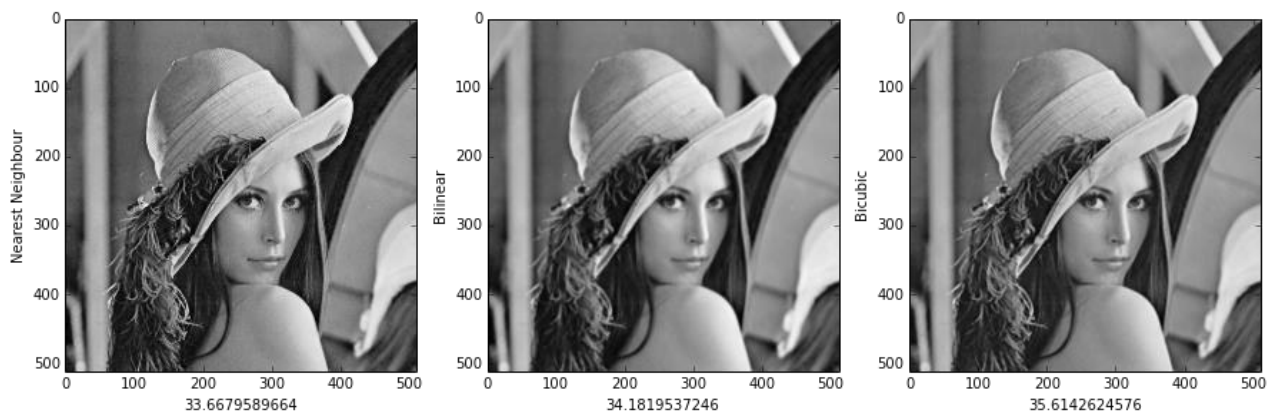
If you look at PILLOWS reference page you can see that the `resize()` function has predefined resampling functions:

- `PIL.Image.NEAREST`
- `PIL.Image.BILINEAR`
- `PIL.Image.BICUBIC`
- `PIL.Image.LANCZOS`

*LANCZOS is a more sophisticated method which gives better results compared to first three methods. If you're interested search the internet for more details on **LANCZOS Resampling Method**.*

For this question, you will implement a jupyter notebook script and it will perform these operations:

1. Read color version of the image "`lena.png`", Convert colored `lena` image to grayscale image.
2. Resize (scale down) the grayscale `lena` image to half its original size. Then, resize (scale up) it up back to the original size using `resize()` with `PIL.Image.NEAREST`
3. Resize (scale down) the grayscale `lena` image to half its original size. Then, resize (scale up) it up back to the original size using `resize()` with `PIL.Image.BILINEAR`
4. Resize (scale down) the grayscale `lena` image to half its original size. Then, resize (scale up) it up back to the original size using `resize()` with `PIL.Image.BICUBIC`
5. Your script should display the results as follows using `matplotlib` along with the PSNR values w.r.t original image below the result image.



*PSNR (Peak signal to Noise Ratio): PSNR computes the peak signal-to-noise ratio, in decibels, between two images. This ratio is used as a quality metric between the original and a reconstructed image. The higher the PSNR value, the better the quality of the reconstructed image.*

*The following function can be used to calculate PSNR between a source (im1) and target (im2) image.*

```
def PSNR(im1,im2):  
    R2 = np.amax(im1)**2  
    MSE = np.sum(np.power(np.subtract(im1,im2),2))  
    MSE /= (im1.size[0]*im1.size[1])  
    PSNR = 10*np.log10(R2/MSE)  
    return PSNR
```

### Question 2: [5 Points]

1. Define a generic function (**ImNegative**) that takes an image as input and returns the corresponding photographic negative image as an output
2. Read color version of the image "**lena.png**", convert colored **lena** image to grayscale image,
3. Create a photographic negative of the grayscale **lena** image using the **ImNegative** function
4. Using **matplotlib plot**, display the original and negative images side-by-side.

### Question 3: [10 Points]

1. Define a generic function (**ChSwap**) that takes a color image as input and returns the corresponding output image in which the R,G,B channels are swapped as follows:
  - Splits the input image into R, G, B Channels
  - Red (Out) = Blue (In)
  - Green (Out) = Red (In)
  - Blue (Out) = Green(In)
  - Combine the new channels to create the new image and return
2. Read color version of the image "**lena.png**".
3. Use function **ChSwap** to create a color band swapped version of **lena**
4. Using **matplotlib plot**, display the original and new images side-by-side.

### ASSIGNMENT SUBMISISON GUIDELINES

The assignment submission guidelines are very important for this course. Improper submissions will not be graded.

1. Rename your notebook file (ipnyb) accordingly. It should have both your Student Entry Number and the corresponding assignment number. For example, if your entry number is 2008CS1001, then the file should be named **2008CSB1001-PA1.ipnyb**
2. Use / add text sections to clarify the question number, provide detailed comments, etc.
3. Submit your assignment on Google Classroom.
4. Plagiarism is strongly prohibited!
5. Try to submit before the announced deadline or 25% penalty will be applied for the next day.
6. Assignments submitted later than one day will not be graded!