17 September 2020

1.9 Image Processing

Post-lab:

- Comparative:

  For the first lab session, we measured the resolution power of a CCD digital camara. With 3 sample pattern and the results obtained, I calculated that resolution power of the camara was 179.59” in radius. I cannot obtain the theoretical resolution power of the camara. Based on the documents from lab and Sony Inc., the focus length of the lens could not be obtained.

  The possible sources of error might be that:

  - CCD sensor is made by semi-conductor, in a dusty environment, there might be some impurities getting into the sensor and causing noise.
  - Sensor is like film, which receive the information of outside light focused by group of lenses. If the light axis of each lens has a small difference with others, or when the camara adjust the focus point the distances between lenses were not perfect, fuzzy would appear at the edges of the patterns, bringing error when reading the resolution chart.
  - The print mechanics might also affect the resolution charts readings.
  - When calculating, I roughly keeping 2 float digits.

  For the second lab session, we gave presentations about our code to deal image filter. As our kernels of filters were very close, the processed images were similar. The possible sources of small difference:

  - When applying convolution to image and output the results, we might use different way to keep the integer part as the final result discarding the float part.
  - When apply Gaussian filter, the kernel could be that of those open source documents from internet and also could be calculated by given size and standard deviation.
  - The size of kernel will affect a little on image.

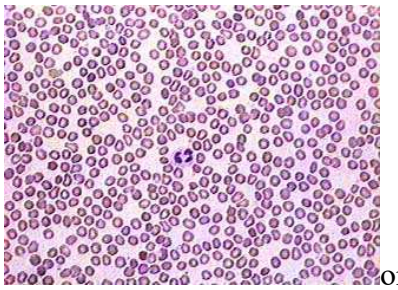
- Discussion of terms and questions:

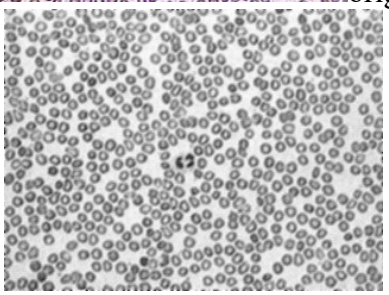
  Spatial frequency is the frequency that how many times a geometric structure appears in unit length. This term is used to describe the noise in an image. By zoom image to a larger size, in most situation, we can observe the background noise. Those noise is high frequency noise and can be removed by low-pass filter, as the filter will set the average value of the adjacent pixels to center pixel. Simultaneously, if high-pass filter is applied to image, even the result image will be sharpened, but there might be high frequency noise appear.

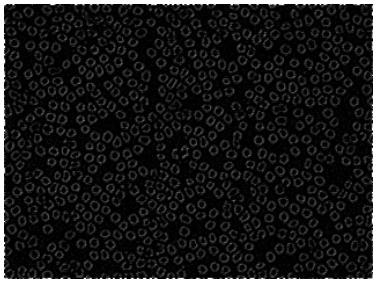
Image enhancement methods could be applied in various situations. To enlarge an image needs not plot the original pixels to new positions, but details to fix image. By enhancing image, people can easily distinguish the elements in an image. Therefore, the methods are widely accepted by researchers who need to do statics or find specific pattern hidden in other shape figures. As these methods can also make details more clear or fuzzy, even some can change the look of images, many young people use these filters, encapsuled in mobile applications or professional program, like Photoshop, to beatify pictures.

Theoretically, the light with different color will affect the resolution power, as the refractive index of optics material will be affected by the light wavelength. When light pass lenses there might be a small distance between two light beams with different wavelength. However, the small difference is negligible, we can ignore the effects. Thus, when calculate the resolution power of camara, we do not mention different color.

I searched on Google and downloaded a picture of blood cells under microscope. After processed by low pass filter and Laplacian filter, I can count the number.


original image


Low filter processed


Laplacian filter processed