# Negative

For taking the negative of an input image is useful for being able to highlight light details on a dark background or dark details on a light background. Since the range of the input image is from 0-255 in order to get the negative of the image the values of each pixel are multiplied by negative one and then since the intensity values cannot be negative we have to shift the values to be between 0 and 255 by then adding 255. The resultant histogram is a reflection of the original along the y axis as expected.

# Power law

The power law is used to increase or decrease the brightness of a picture by a nonlinear factor. In the transfer function the output intensity is equal to the input intensity to the power of some specified gamma and multiplied by a constant. For input and output images of the same grayscale I plugged in the maximum for both the input and output, in this case 255, and then solved for the constant at each gamma value. The gamma value is dependant on what is the area of interest for the image, if the gamma value is less than one the image will increase in brightness and for gammas greater than one the brightness will decrease.

# Contrast stretching

Contrast stretching is useful when needing to increase or decrease the brightness of specific regions in an image. This is accomplished by splitting the transfer function into a piecewise function at values of x an y. For choosing the values of the input VS output x’s and y’s I first chose the maximum intensity value of the inputted image which was 209 and mapped that to the maximum intensity of 255. For the second set I chose the intensity value that had the greatest number of pixels and mapped it to an output closer to the middle range of intensities.

# Gray slice

Gray level slicing is very useful when needing to isolate a certain intensity range. There are two different method for gray slicing, the first is adjusting only the range of interest keeping the rest the same, the second is to also adjust the values outside the range of interest. The values that I selected were the intensity values on either side of the largest peak in the input image histogram.

# Histogram Equalization

Histogram equalization works by taking the histogram of the input image and mapping the probability and the cumulative distributive function then spreading out the probability. This in turn spreads the distribution of the image and allows for better visualization between all the gray levels. As seen by the processed image it becomes much easier to see the abnormalities in the chest image.

# Histogram Specification

Histogram specification is useful when needing to adjust the outputted image to make it closer to a desired image. This is very useful when trying to highlight the differences in images such as x-rays. The outputted image is able to highlight the differences between the input image which is very bright and the specified image which is very dark. Specification allowed the outputted image to be more evenly distributed and have better ability to see the differences in the images.