Stephen Ferro

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Machine Problem 3

Introduction:

The goal of this assignment was to create a function for performing histogram equalization on a binary image with low contrast. The function increases the contrast in the image to make destails more apparent.


Algorithm:

1. Create a histogram of the pixels in the image by counting the number of each pixel value (e.g the number of pixels with a value of 0).
2. Create a cumulative distribution function by summing each bin in the histogram with all the bins below it.
3. Calculate the new value for each pixel using the equation below and output the new image.

$$output\ pixel\ value\ = round\left(\frac{255 \cdot CDF(input\ pixel\ value)}{total\ number\ of\ pixels} \right)$$

Results:

Below is the image output by the function and the input image for comparison:
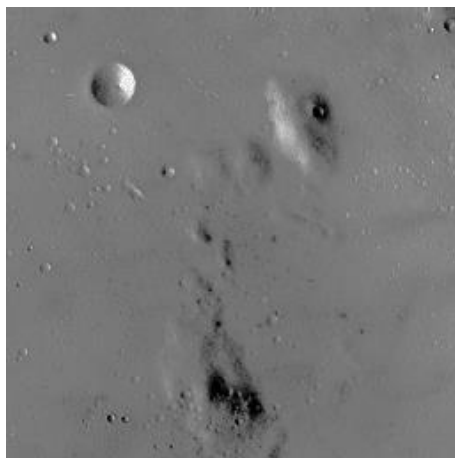
Input Image   Output Image

Clearly, contrast has been increased by applying histogram equalization. The details in the terrain are much more visible – there are several craters and rocks that can clearly be seen in the output image but are nearly invisible in the input image.

Below are the histograms for the input and output images. As expected, the input image has all the pixels in a small cluster in the middle of the value range. This is why the image looks very gray. The output histogram has a much wider range of values, with pixels from 0-255. The pixels in the middle of the value range (from ~20-~225) are spaced apart because a small number or bins in the input image are being scaled to a large range.