Activity 5 - Enhancement by Histogram Manipulation

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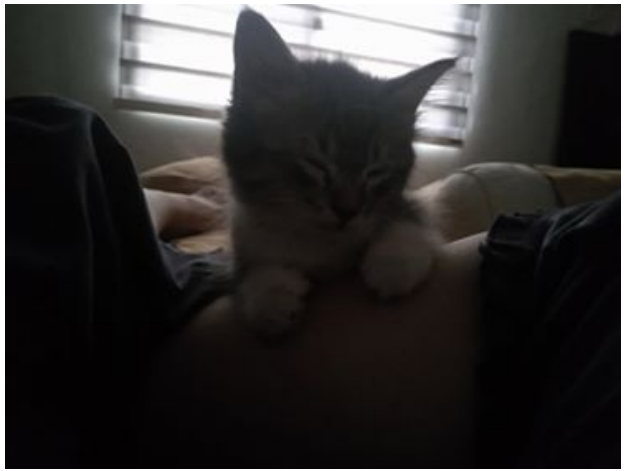
Contrast Stretching



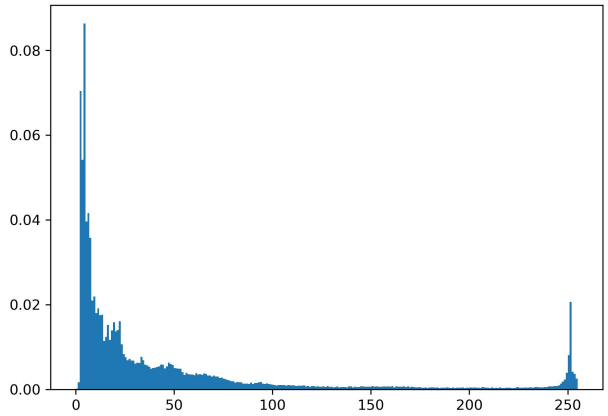
original RGB

original grayscale

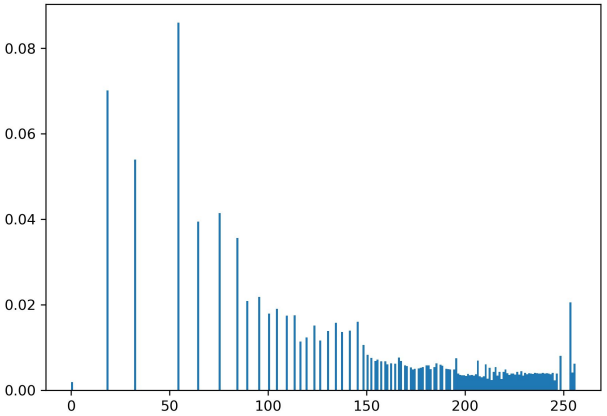
after contrast stretching

Contrast stretching the grayscale image has no effect, because its global minimum is 0 and its global maximum is 255. Thus, this step was skipped.

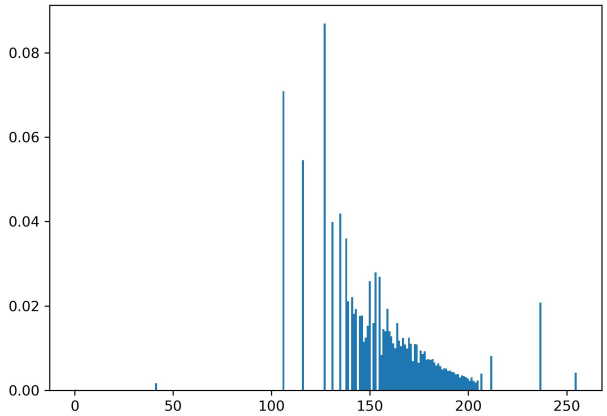
Normalized Grayscale Histogram of Image



original



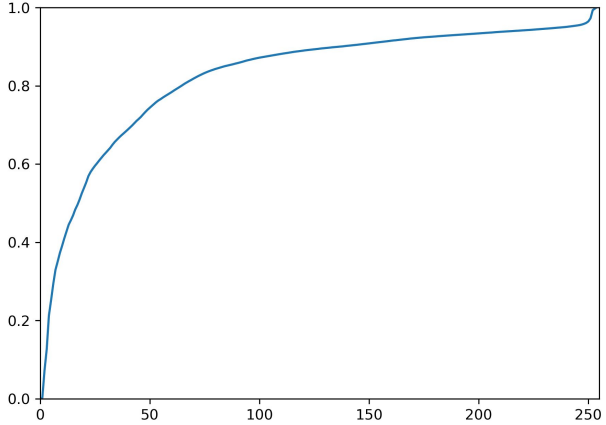
equalized



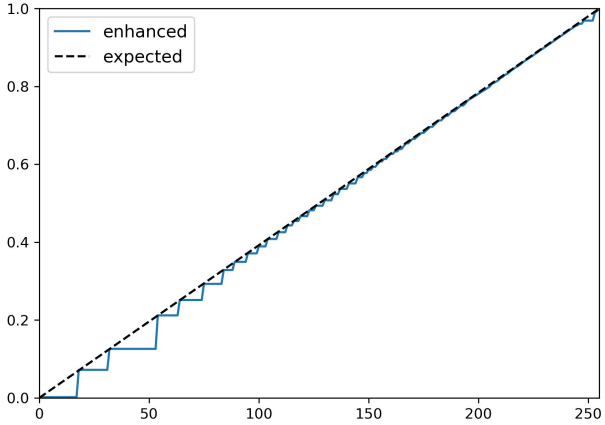
nonlinear CDF

The original image is skewed to the right meaning there are more dark regions. The small spike in the bright region came from the bright window light. The equalized histogram is not perfectly uniform. It starts to become uniform at around 150, with stray high values in the darker regions. The histogram of the nonlinear CDF should look like a Gaussian distribution. However, only the darker regions manifest any likeness to a Gaussian distribution. The darker regions have almost 0 values.

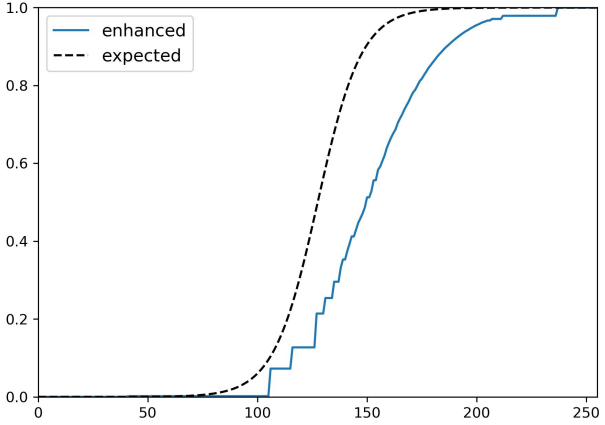
Cumulative Distribution Function of Image



original



equalized



nonlinear CDF

The original CDF follows a logarithmic growth. It has a sudden increase because of the high values of the brighter graylevels as seen in the histogram. On the other hand, the CDF of the equalized image follows a semi-linear plot. The clear linearity begins at around 100. The nonlinear CDF was obtained using a sigmoid function. The enhanced CDF looks similar to the expected, but the expected plot has a steeper increase. It still follows the general trend.

Modified Image vs Original

original grayscale

equalized grayscale

modified grayscale

In the original image, some details weren't that visible because the image was taken against the light from the window. However, after histogram manipulation, more information was made visible such as my cat's face (his fur patterns) and paws, and my pajamas. If a nonlinear CDF is used, some of the information still becomes visible, but the image becomes "foggy." The equalized image is clearer.