Image Processing and Computer Vision 1

3 – Intensity Transformation – week 3

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1 Book

1.1 Book by Gonzalez and Woods, 3.1

Give a single intensity transformation function for spreading the intensities of an image so that the lowest intensity becomes 0 and the highest becomes $L-1$. Let f denote the original image with its lowest intensity $f_{\min}$ and highest intensity $f_{\max}$.

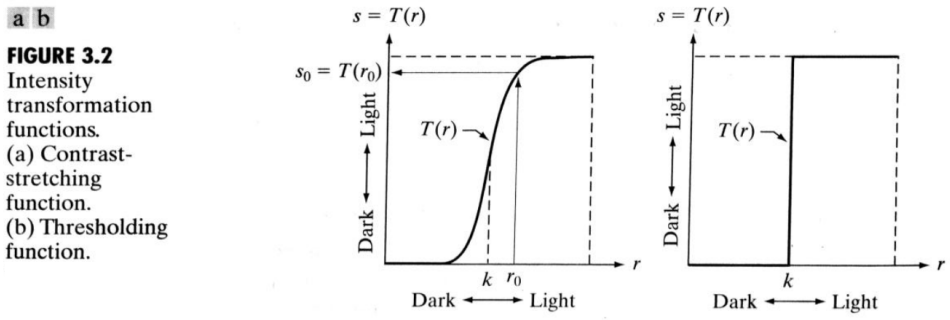
1.2 Gamma Transform

Assume you want to apply the gamma transform $s = T(r) = c \cdot r^{\gamma}$. Find the proper value for the constant c such that $T(0) = 0$ and $T(L-1) = L-1$ for $L = 256$

1.3 Book by Gonzalez and Woods, 3.2a

Give a continuous function $s = T(r)$ for implementing the contrast stretching transformation shown in Fig. 3.2(a). In addition to k, your function must include a parameter, E, for controlling the slope of the function as it transitions from low to high. Your function should be normalized so that its minimum and maximum values are 0 and 1, respectively.

Hint: $\frac{1}{2} = T(k), 0 = T(0), 1 = T(\infty)$



1.4 Book by Gonzalez and Woods, 3.5a

What effect would setting to zero the lower-order bit planes have on the histogram of an image in general?

1.5 Book by Gonzalez and Woods, 3.6

Explain why the discrete histogram equalization technique does not, in general, yield a flat histogram.

2 Practical Exercise

Write a program which calculates the normalized histogram (an estimate of the probability density function) of an 8 bit grayscale image and displays it. Display also the cumulative probability density function estimate.

(a) Solve it **without** using the predefined command `histogram()` (Python ⇒ `numpy.histogram()`)

(b) Compare the solution from (a) with `histogram()`. Perhaps the results are not identical. If this is the case, what is the reason?

Additional Exercise

Use the script `webcam.*` to read images from the webcam. Convert the color images of the camera to grayscale images. Implement an intensity transformation of the grayscale images. Play with different transformation functions $s = T(r)$.