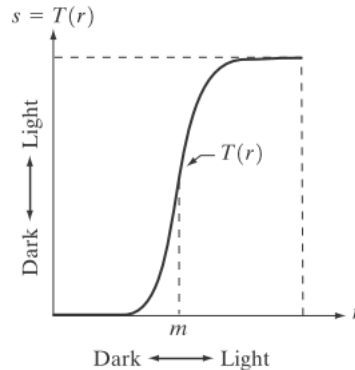


1. Suppose that you form a low pass spatial filter that averages the four immediate neighbors of a point but excludes the point itself. Find the equivalent $H(u,v)$ filter in frequency domain and show that it is a low pass filter.
2. Give a continuous function for implementing the contrast stretching transformation shown below. Your function must include a parameter, E , for controlling the slope of the function as it transitions from low to high gray-level values. Your function should be normalized so that its minimum and maximum values are 0 and 1, respectively.



3. Image subtraction is used often in industrial applications for detecting missing components in product assembly. The approach is to store a "golden" image that corresponds to a correct assembly; this image is then subtracted from incoming images of the same product. Ideally, the differences would be zero if the new products are assembled correctly. Difference images for products with missing components would be nonzero in the area where they differ from the golden image. What conditions do you think have to be met in practice for this method to work?
4. Suppose that a digital image is subjected to histogram equalization. Show that a second pass of histogram equalization will produce exactly the same result as the first pass.
5. In an automated assembly application, three classes of parts are to be color coded in order to simplify the detection. However, only a monochrome camera is available. Propose a technique for using this camera to detect the objects.
6. Hough transform is used for detecting lines in an image. Explain how Hough transform can be used to detect ellipses (Use a pseudo-code)
7. In an industrial application, images taken from products are used for detecting cracks. Which morphological operators can be used for this application?