

GRAY TO BINARY UPSCALING

As mentioned above (Class 4), it is useful to convert a low resolution grayscale or color image to a higher resolution binary image for printing, as most printers have binary output at the pixel level. (They can print gray appearance by applying a halftone mask to the grayscale or color image.)

To achieve smooth results, this should be implemented using an interpolated grayscale scaling function that is followed by binarization. Further, to limit the amount of allocated memory, it is best not to generate the full higher resolution grayscale or color image, but instead, use a minimum-sized buffer from which the binary pixels are immediately produced. Such an implementation is quite tricky for arbitrary size expansion, but it is relatively simple for 2x and 4x expansions.

Fortunately, these two handle many common requirements.

Binarization can be produced by thresholding, error diffusion dithering, or ordered dithering using a halftone cell. For images of text, thresholding is fine, but if there are gray image regions, the results are far better with some type of dithering.

Further, depending on the printer, a gamma factor should be applied to the grayscale image before dithering an image area, and for typical write-black laser printers, a gamma factor of between 2.0 and 2.7 is typically used to lighten the resulting printed image.

We provide two integrated scale-to-binary operations, with 2x linear interpolated scaling followed by binarization, in `scale.c`. The upscaled grayscale image pixels are kept in a buffer of not more than 3 lines, and binarization is performed by either thresholding or error-diffusion dithering. Low-level functions are in `binarizelow.c`.

We also provide two integrated scale-to-binary operations, with 4x linear interpolated scaling followed by binarization. The upscaled grayscale image pixels are generated 4 lines at a time, for binarization by either thresholding or error-diffusion dithering. For thresholding, the buffer size is 4 lines, and for error-diffusion dithering the buffer size is 5 lines. The source is also in `scale.c`, with the lowest level functions in `binarizelow.c`.

Source: <http://www.leptonica.com/scaling.html>