

# Coordinates in Rebinned Images

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This note describes the change of pixel coordinates when an image is rebinned to lower resolution by some integer factor  $M$ .

Suppose we have an image  $\mathcal{I}$ , of  $MN_x \times MN_y$  pixels, where  $M$  is an integer. The coordinates in  $\mathcal{I}$  are  $\mathbf{r} = (x, y)$ , which denote zero offset indices for image pixels. The *center* of the lower left-hand pixel is at  $(0, 0)$ , and the center of the upper right-hand pixel is at  $(MN_x - 1, MN_y - 1)$ .

Now rebin the image to size  $N_x \times N_y$ , forming image  $\mathcal{I}'$ , with its pixel coordinates  $\mathbf{r}'$ . The center of the lower left-hand pixel in  $\mathcal{I}'$  is at  $\mathbf{r}' = (0, 0)$ , and the upper right-hand pixel is at  $(N_x - 1, N_y - 1)$ . However, these do not correspond to the lower left and upper right pixels of the original image  $\mathcal{I}$ . The figure shows image coordinates for several example points. Note how rebinning has moved the origin. Integer coordinates in  $\mathcal{I}'$  do not, in general, correspond to integer coordinates in  $\mathcal{I}$ . The two points at the corners (in black) are easy to work out. From these, it can be shown that

$$\mathbf{r} = M\mathbf{r}' + \frac{M}{2} - \frac{1}{2}, \quad \text{or} \quad \mathbf{r}' = \frac{\mathbf{r}}{M} + \frac{1}{2M} - \frac{1}{2}.$$

