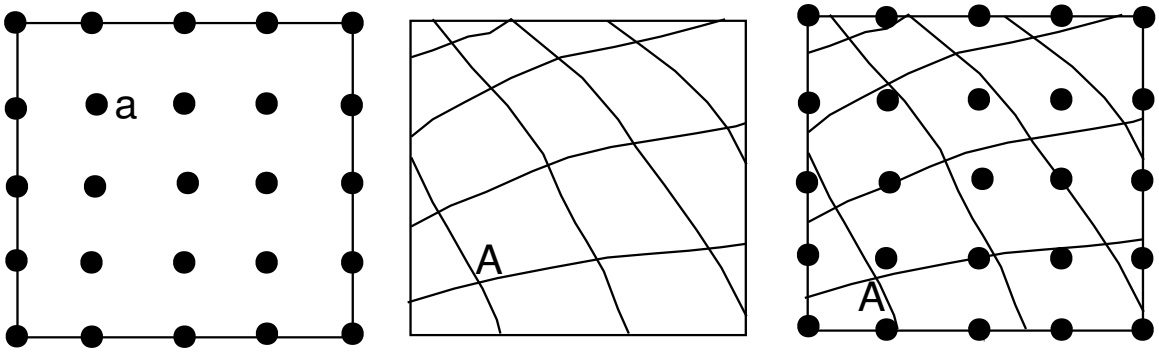
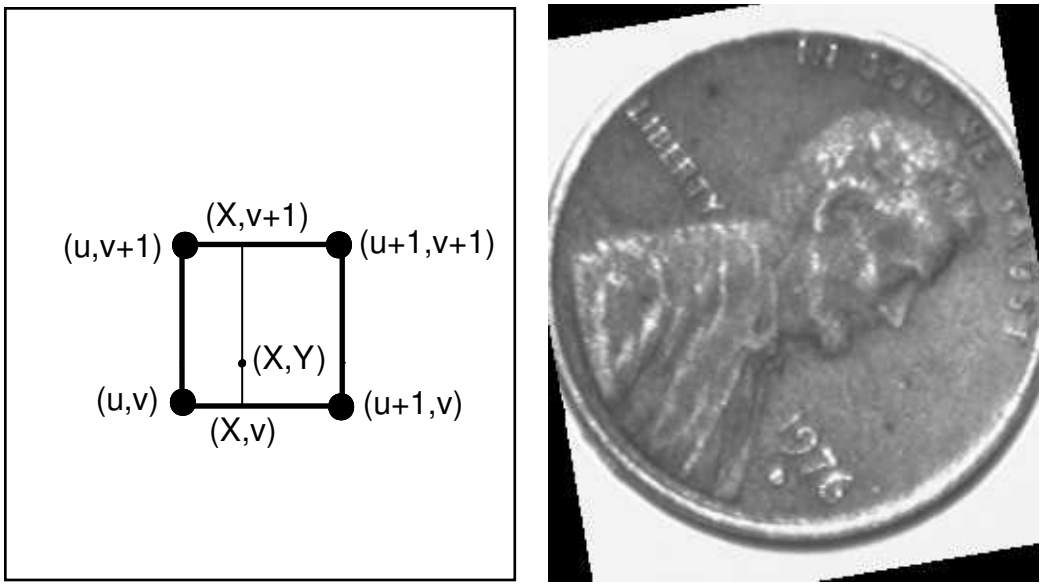


(a) (b) (c)

Fig. 6.1 The resampling process. (a) Pixels in the reference image. (b) A continuous sensed image. The grid points in this image correspond to the pixels in the reference image. (c) Overlaying of the continuous and discrete sensed images. The continuous sensed image is determined from intensities in the discrete sensed image. Resampling involves scanning the reference image and, for each pixel a, determining the intensity of the corresponding grid point A in the continuous sensed image. Intensity at A in the continuous image is estimated from the intensities of a small number of pixels surrounding A in the discrete sensed image.

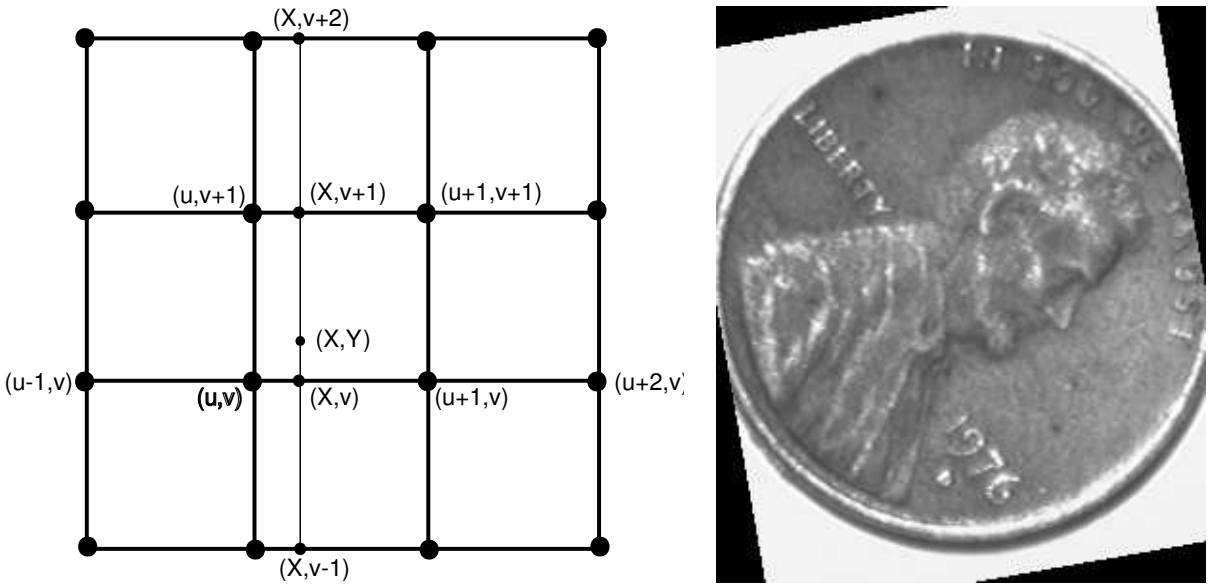
(a) (b)

Fig. 6.2 A penny (a) before and (b) after rotation by 10 degrees counterclockwise and resampling by the nearest-neighbor method.



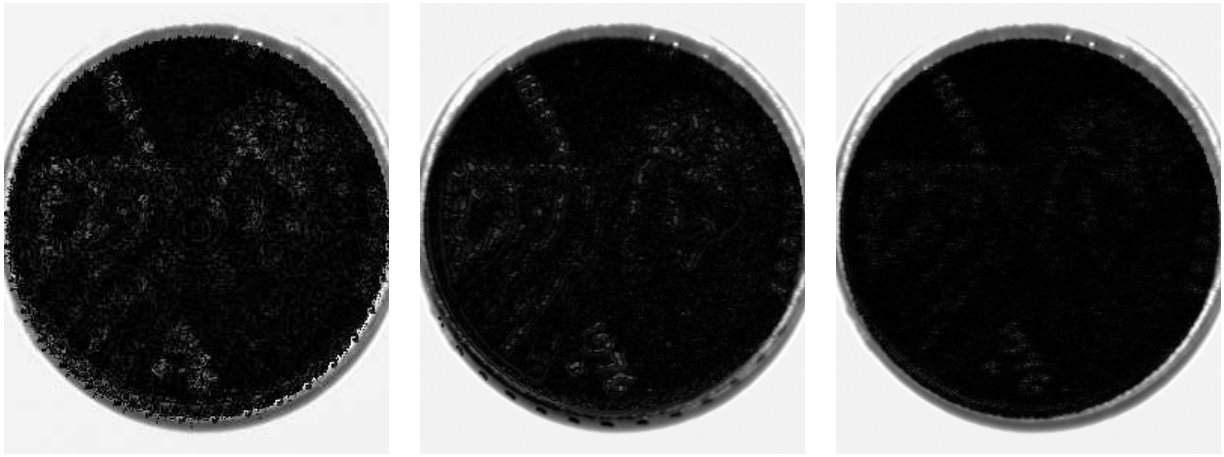
(a) (b)

Fig. 6.3 (a) Estimating the intensity at (X, Y) from intensities at (u, v), $(u+1, v)$, $(u, v+1)$, and $(u+1, v+1)$ by bilinear interpolation. (b) The penny shown in Fig. 6.2a after rotation by 10 degrees counterclockwise about the image center and resampling by bilinear interpolation.



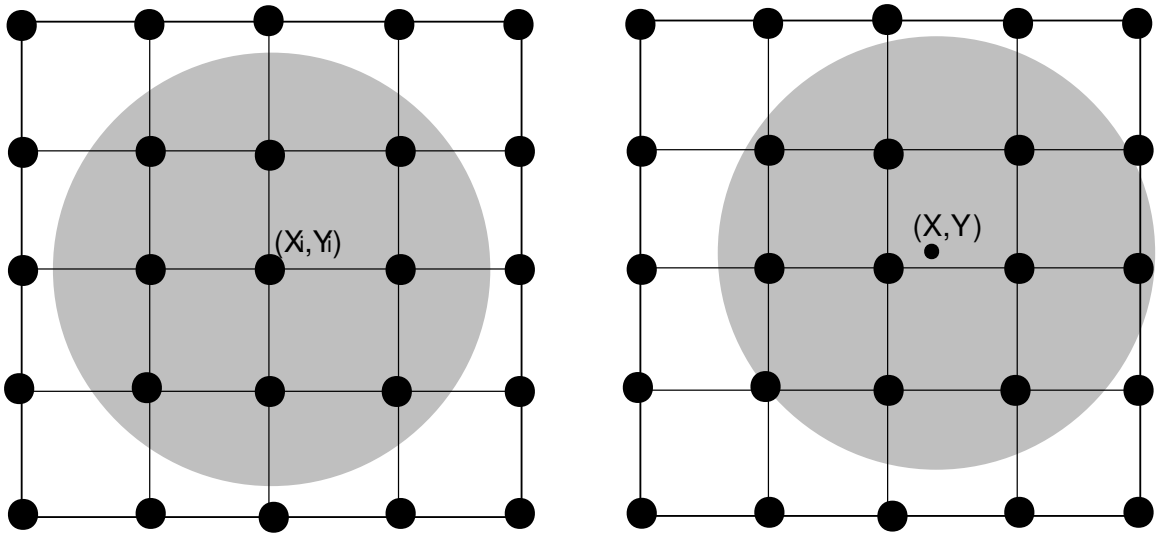
(a) (b)

Fig. 6.4 (a) Cubic convolution uses intensities in a 4×4 neighborhood to estimate the intensity at a point. To determine the intensity at (X, Y), first 1-D interpolation is carried out along the 4 rows to determine intensities at X in each row. Then 1-D interpolation is carried out along column X to determine the intensity at (X, Y). (b) Resampling of Fig. 6.2a by cubic convolution.



(a) (b) (c)

Fig. 6.5 (a)–(c) Resampling errors when rotating the image in Fig. 6.2a 36 times with 10-degree increments and computing the absolute different between corresponding pixels in the original and resampled images using nearest-neighbor, bilinear interpolation, and cubic convolution, respectively. Higher intensities show larger errors.



(a) (b)

Fig. 6.6 (a) A radial function with local support of radius 1.8 pixels centered at pixel (X_i, Y_i). This function keeps the influence of pixel (X_i, Y_i) on the interpolating function within the shaded area shown. (b) The intensity at (X, Y) is estimated from the intensities of pixels whose distances to (X, Y) are less than a. The pixels used in the calculation are those falling in the shaded area in this figure when $a = 1.8$ pixels.