

Supplement to Chapter 3 of *The Science of Digital Media* – Digital Image Processing

Worksheet – Digital Imaging > Interpolation for Resampling¹

The purpose of this exercise is to observe how the nearest-neighbor, bilinear, and bicubic interpolation algorithms can be applied to enlarge an image.

Assume that you want to enlarge a 6 x 6 area of pixels to 11 x 11. (This is just a small example for demonstration.) Find the value of the pixel (6,5) in the new image, using nearest-neighbor interpolation, bilinear interpolation, and bicubic interpolation, and show the matrix \mathbf{h}_{bl} for all three.

227	156	238	207	69	118
194	201	233	2	50	106
116	235	104	35	3	215
4	188	227	51	190	133
209	44	14	50	113	51
113	103	89	153	237	171

1. What position does point (6,5) scale to using the scale factor of 6/11?
2. What is the neighborhood used for nearest-neighbor and bilinear interpolation?
3. What is \mathbf{h}_{bl} for nearest-neighbor interpolation?

4. What is the value for pixel (6,5) in the resampled image using nearest-neighbor interpolation?
5. What is \mathbf{h}_{bl} for bilinear interpolation?

6. What is the value for pixel (6,5) in the resampled image using bilinear interpolation?

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7. What is the neighborhood for bicubic interpolation?

8. What is $t(m)$ for bicubic interpolation?

9. What is $u(n)$ for bicubic interpolation?

10. What are the formulas for f and g ?

11. What is \mathbf{h}_{bl} for bicubic interpolation?

12. What is the value for pixel (6,5) in the resampled image using bicubic interpolation?