Principles and Applications of Digital Image Processing

Fall, 2021

Homework 3

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Part 1:

3.22

(a)

Yes, it is separable. It can be separated to two column vectors’ (v and w) outer product.

(b)

3.27

(a)

According (3-38), (3-39) in textbook, the single kernel size is

kernel size is 11x11.

(b)

According Table 3.6, standard deviation of convolution of two Gaussian functions is

So the standard deviation of the single kernel will be

3.38

If the order is reversed, the detail and the noise will be enhanced first by Laplacian kernel, then the smoothing kernel can only blur all the detail and noise. With the first order we can get clean and fine detailed image, however, with the reversed order, we get blurred image with somewhat mess.

4.3

(a)

Convolution in the frequency domain is analogous to multiplication in the spatial domain, so I first transform two functions

Because the first one equals 1, the result of convolution is .

(b)

Same process with (a)

The result of convolution is .

4.32

(a)

Origin sequence of array is even. Insert 0’s in center of array become

The new array still has evenness.

(b)

Origin sequence of array is odd. Insert 0’s in center of array become

The new array still has oddness.

(c)

Origin sequence of array is even. Insert 0’s become

The new array still has evenness.

(d)

Origin sequence of array is odd. Insert 0’s in center of array become

The new array still has oddness.

Part 2: