EE5175: Image Signal Processing - Lab 5 report

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Contents

1 Space-variant blurring

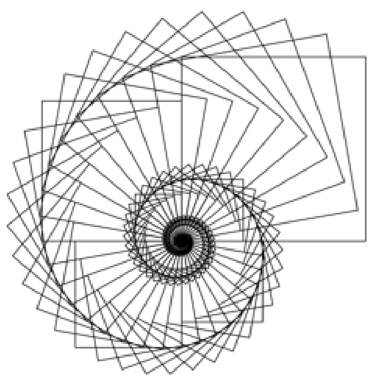
Aim: To blur the given image `Globe.png` using space-variant Gaussian kernel where the standard deviation $\sigma(m,n)$ is given as:

$$\sigma(m,n) = Aexp\frac{-((m-\frac{N}{2})^2+(n-\frac{N}{2})^2)}{B}$$

where $0 \leq m,n \leq N-1$, $\sigma(\frac{N}{2},\frac{N}{2}) = 2.0$ and $\sigma(0,0) = 0.01$. (N is the input image size).

Globe image

Also, the image `Nautilus.png` must be blurred using a Gaussian kernel of $\sigma = 1$ with both the space-invariant blurring code (Written in the last assignment) as well as using the space-variant blurring code written as part of this assignment and compare the results.



Nautilus image

2 Space-variant Gaussian kernel:

Space-variant blurring is an image processing technique in which depending on the pixel location, different blurring kernels are used. In this assignment, we've been asked to use a Gaussian kernel of varying standard deviation. Since the kernel length $l = \lceil 6\sigma + 1 \rceil$ also changes with σ, we have to re-define the kernel each time for every pixel of the input image.

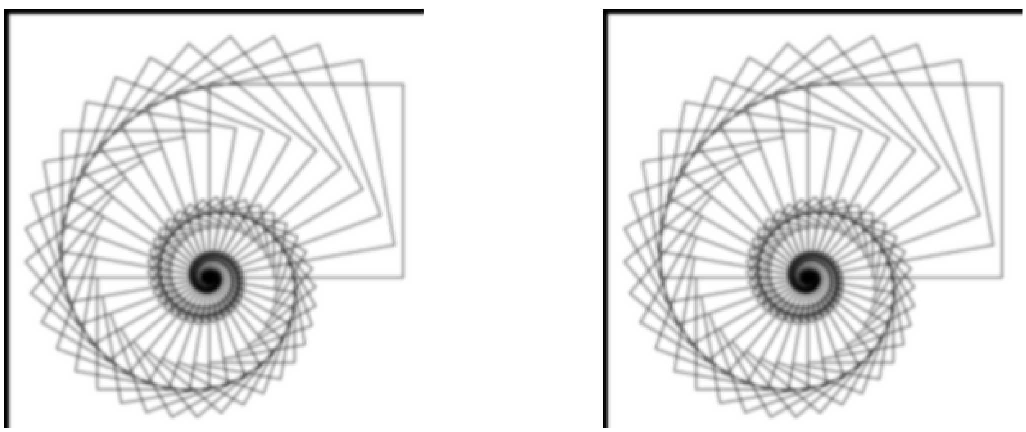
This type of space-variant blurring helps us to selectively focus certain parts of the image and heavily blur other parts of the image which we don't want to focus. We can create an artificial 3-D depth map on a 2-D image using this LSV blurring.

3 Results:

As asked in the aim, the `Globe.png` image is LSV blurred and the output image is given below:

Nautilus image

As expected, the image is heavily blurred in the center (where σ is high) and looks almost focused at the image edges and corners (where σ is low). The image `Nautilus.png` is also blurred using both LSI and LSV blurring codes and the results are given below:



(a) LSI blurred

(b) LSV blurred

Both the images look very similar with no noticeable difference. The dark edges at the left and the top are due to the edge effects of convolution.

4 Observations and Conclusions

1. The blurred globe image looks convincing and follows the theory properly.
2. Both the LSI and LSV blurring codes produce the same result when the LSV code is used for LSI blurring, i.e, σ is same for all pixel locations.
3. Dark edges are obtained due to edge effects of convolution which can be manually cropped out if required.