EE5175: Image Signal Processing

Lab-5

Space-variant blurring

Gaussian Kernel

A & B constant Calculation

The blur is space variant. The standard deviation at each pixel, $\sigma(m,n)$ is given by

$$\sigma(m,n) = Aexp\frac{-((m-\frac{N}{2})^2+(n-\frac{N}{2})^2)}{B}, \quad 0 \leq m,n \leq N-1$$

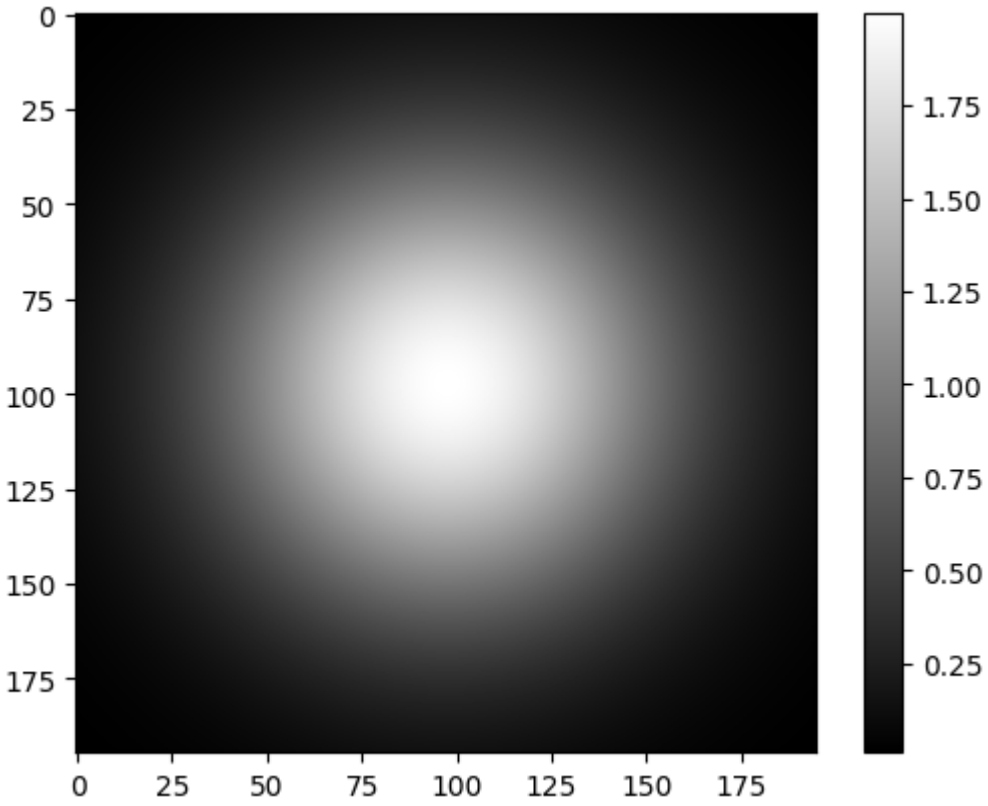
where the image is of the size $N \times N$.

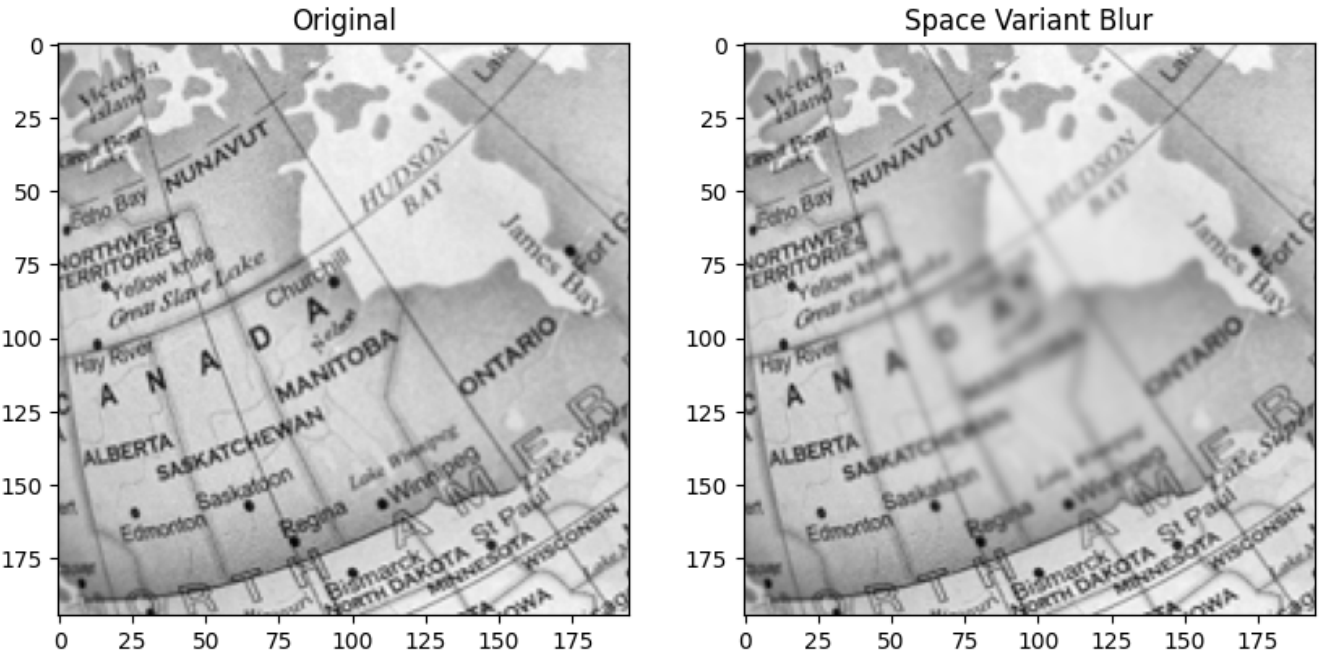
2D convolution

Space Variant Blur

Globe.png

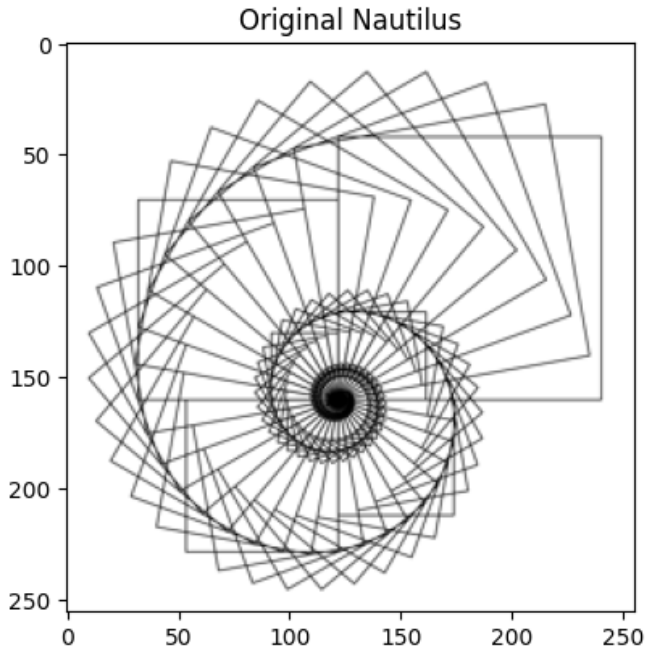
Sigma Matrix Visualization

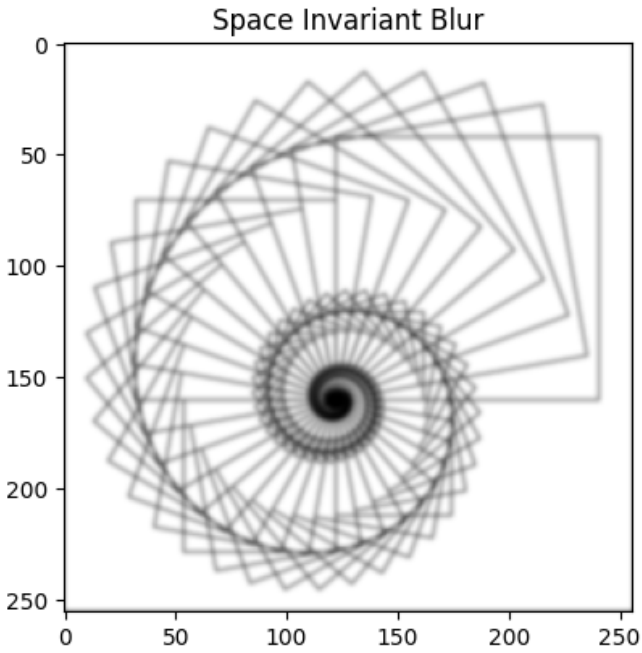




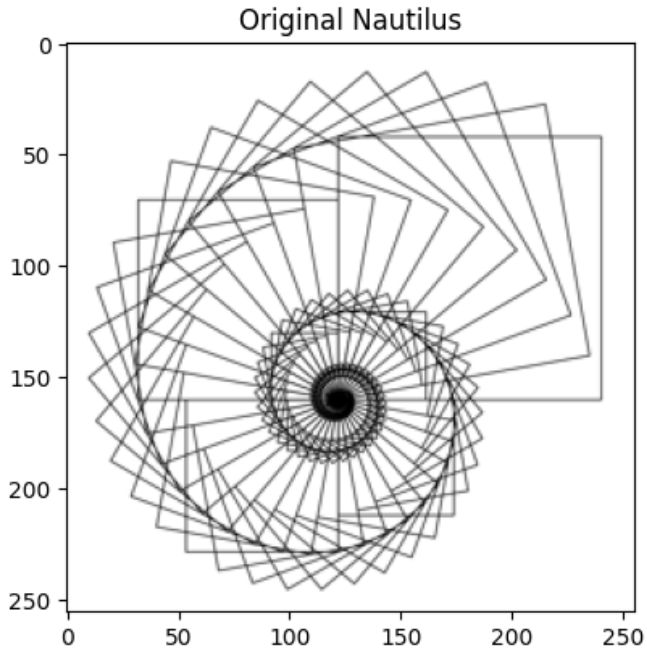
Q_2 Nautilus.png

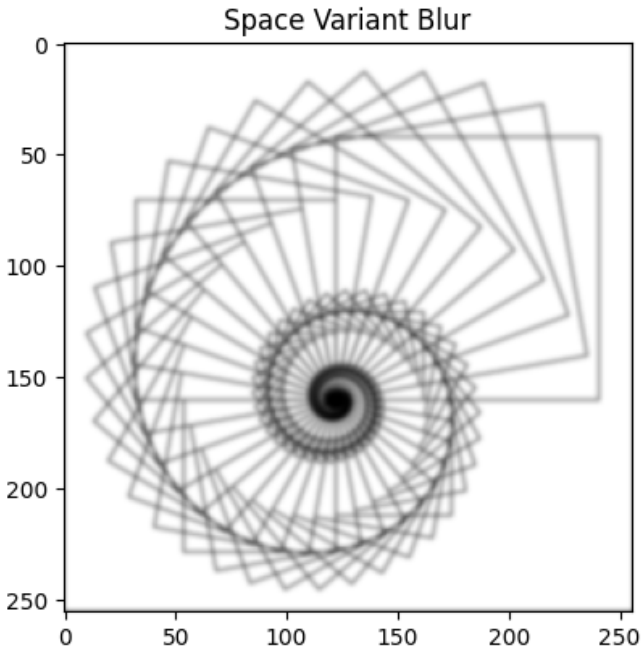
Space Invariant Blur

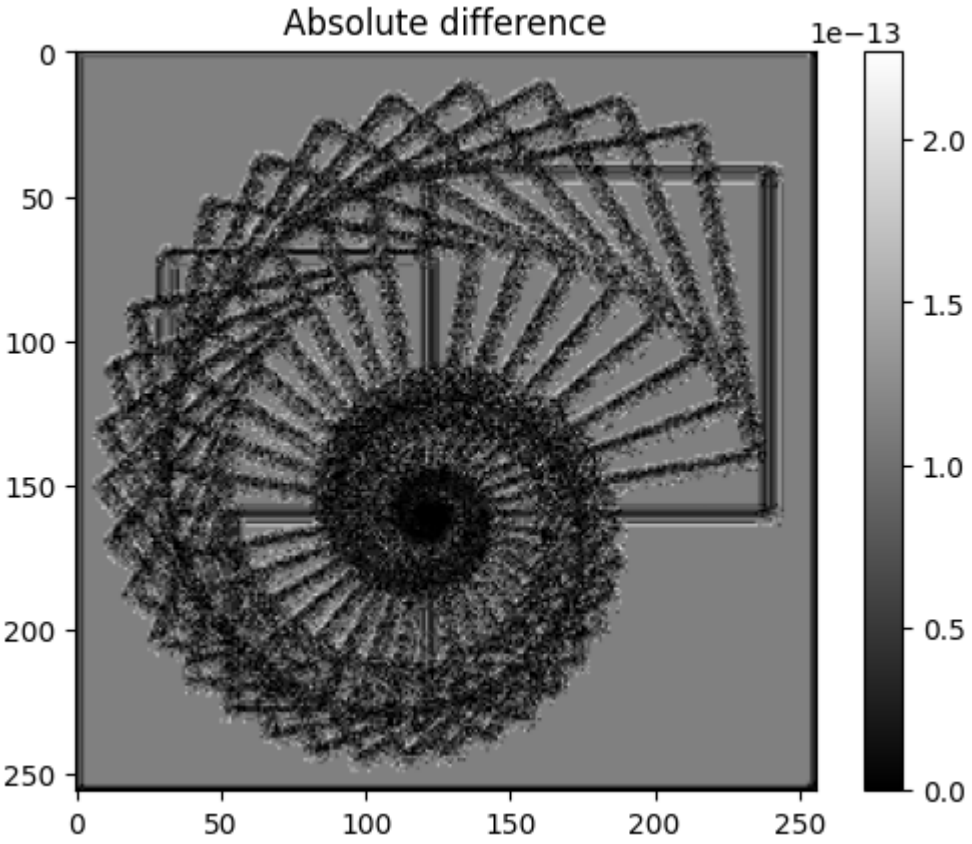




Space Variant







Conclusion

- Visualization of the sigma matrix gives an intuition how the globe is going to be blurred , this is because of the initial

condition we have , (N/2,N/2) max at the centre of the image and less as the image goes towards the edges

- When we change the sigma matrix to a constant , we cannot see much difference between the space variant and invariant images

But the machine is able to give the difference in the order of 10^-13 assuming to the machine precision is 10^-16

- Gaussian Kernel needs to be calculated in the each step , so running Space Varying Blur is taking time shown below.

```
CPU times: total: 9.7 s
Wall time: 9.78 s
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CPU times: total: 375 ms
Wall time: 383 ms
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