

EE5175: Image Signal Processing

Lab-3

Space-invariant and space-variant blurring

1. **Space-invariant blurring** Perform Gaussian blurring on `Mandrill1.pgm` with standard deviation σ . Assume space-invariant blur and a kernel of size $[6\sigma + 1] \times [6\sigma + 1]$. Observe the outputs for these values of σ : 1.6, 1.2, 1.0, 0.6, 0.3 and 0.1.
2. **Space-variant blurring** Now assume the blur to be space-variant, i.e. the standard deviation varies for each pixel. Consider the distribution of σ to be

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

with

$$\sigma\left(\frac{N}{2}, \frac{N}{2}\right) = 2.0 \text{ and } \sigma(0, 0) = 0.01,$$

where $N \times N$ is size of the image and pixel indices are in the range $[0, N - 1] \times [0, N - 1]$. Find A and B , and create the matrix σ . Perform Gaussian blurring on `Globe.pgm` using the values of $\sigma(m, n)$.

3. Blur `Nautilus.pgm` using
 - (a) space-invariant blur code of part 1 with $\sigma = 1.0$, and
 - (b) space-variant blur code of part 2 with $\sigma(m, n) = 1.0$ for $0 \leq m, n \leq N - 1$.

Verify that the blurred images of the above two steps are same.

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