

Smoothing of Images

In an averaging filter, pixel intensity is equally dependent on its original intensity and each of the neighboring pixels. Its mask is as follows:

$$\begin{bmatrix} 1/9 & 1/9 & 1/9 \\ 1/9 & 1/9 & 1/9 \\ 1/9 & 1/9 & 1/9 \end{bmatrix}$$

On the other hand, a Gaussian filter smoothens, but by giving more importance to the original centre pixel intensity than its neighboring intensities. Therefore, Gaussian smoothing is more realistic than simple averaging. For a variance of 1, a 3x3 Gaussian mask will be of this form:

$$\begin{bmatrix} 16 & 26 & 16 \\ 26 & 41 & 26 \\ 16 & 26 & 16 \end{bmatrix}$$

Note that the sum of mask values is always ensured to be 1, so that the smoothed image intensity is equal to the original image intensity in a uniform intensity region. So, the above Gaussian mask must be scaled by a factor of 1/209.

Effect of kernel size:

Having a bigger kernel size makes computations faster at the expense of greater smoothing. This is because, in the latter case, the intensity of one pixel is dependent on more number of neighboring pixels.