Local image structures and morphology
Computer Vision 2006, Lab Exercise 2
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Abstract

1 Problem specification

2 Theory and implementation

2.1 Gaussian

The intresting parts of an image are the bars and blobs. But is't impossible to say how big and where the blobs and bars are. Therefore we need an scalable function that we could use to search those bars and blobs. A good way to find the color-edges is by using a Gaussian function (called the Gaussian kernel)

2.1.1 Gaussian kernel

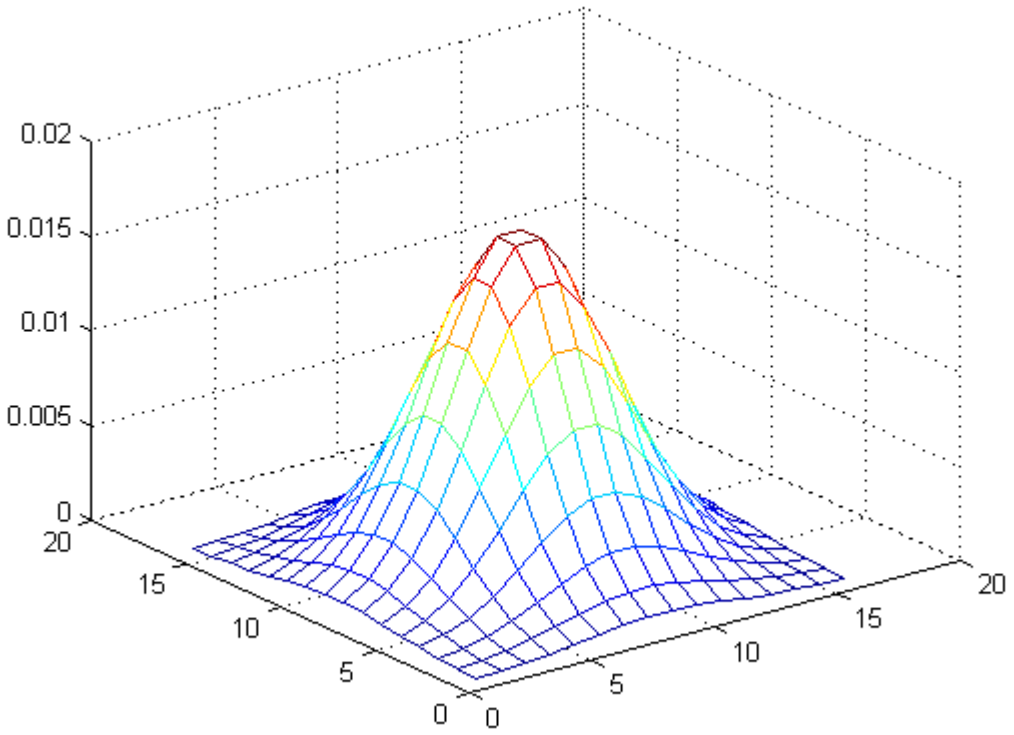
The Gaussian kernel is an equation that looks like blurring an image. But it actually calculates the local differences between different colors. The scale of the local diffenrences depends on the variable σ. If the variable is a small number, than the the local scale is small and the blurring is quite subtile.

$$G_d(x, y, \sigma) = \frac{1}{\sqrt{2\pi}\sigma}_d \; e^{-\frac{x^2+y^2}{2\sigma^2}} \tag{1}$$

This function returns a grid of values wich are scaleable by the σ. The grid that has been generated is an multiplication of 2,5 times the sigma. (WHY 2,5 ??). Because the Gaussian function is sommage of:

$$\frac{1}{\sqrt{2\pi}\sigma} \tag{2}$$

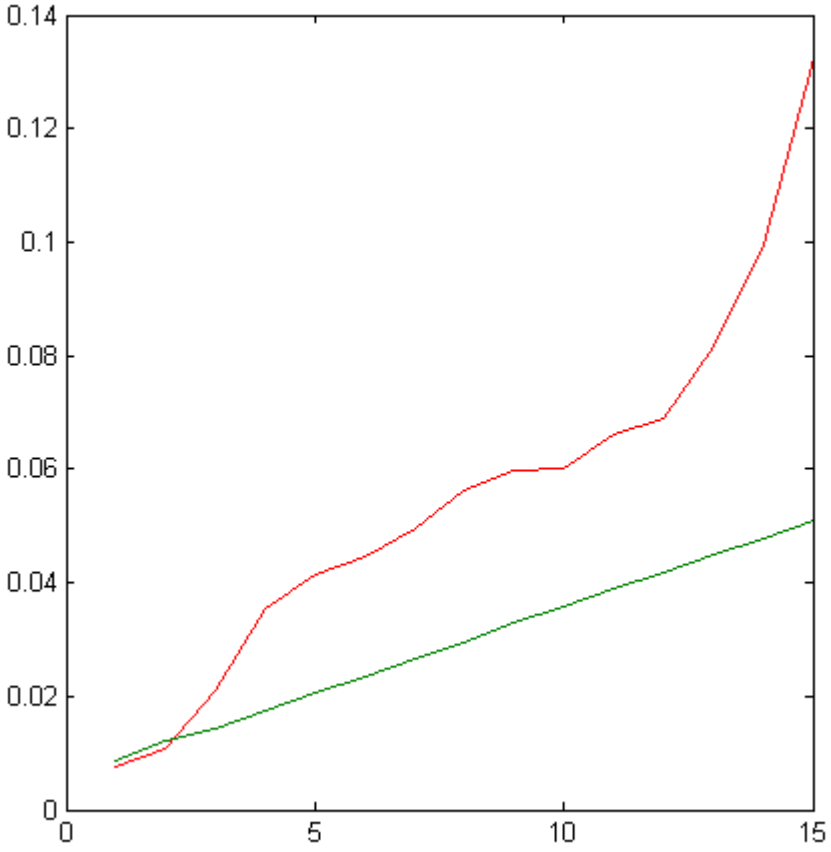
The result of this equation should be close to 1. Not quite 1 because the exponential part removes a small part. The Gaussian grid with an sigma of 3 looks like this:



So far, the Gaussian kernel has been calculated in 2 dimensions. It‘s also possible to rewrite the kernel to 1 dimension. For example only the x dimension:

$$G(x,\sigma) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{x^2}{2\sigma^2}} \tag{3}$$

This calculation is much faster, because it only ”loops” in x-dimension (1D) instead of the x,y dimensions (2D). The next graph shows two Gaussian kernels on the same image, both kernels calculate the image 15 times (from 1 to 15).



2.1.2 Gaussian derivatives

The Gaussian kernel discussed so far, has the shape of an "mountain" and represents a blob on the image. It's also possible to calculate the derivatives of the Gaussian kernel wich has a different shape and represents other shapes on the image. The derivatives sharpens the edges on an image.

3 Optimizations

4 Usage

5 Conclusion

6 References