資訊網路與多媒體研究所

博士班基本學科考試：數位影像處理

2005 年 3 月 11 日

1. (15%) What is "high dynamic range image"? How can we obtain high dynamic images with the regular commercially available cameras? Describe the methods or algorithms that you know.
2. (20%)
   (a) What is alpha-trimmed mean filter?
   (b) What is adaptive mean filter?
3. (15%) Image enhancement can be achieved by subtracting from an image its Laplacian. Show that this operation is proportional to unsharp masking. Here, the Laplacian is defined as:

$$\nabla^2 f = [f(x+1,y)+f(x-1,y)+f(x,y+1)+f(x,y-1)]-4f(x,y)$$

and the unsharp masking can be expressed as

$$f_s(x,y) = f(x,y) - \alpha\, \bar{f}(x,y)$$

where α is a constant.

4. (15%) Suppose we know a certain X-ray imaging system produces a blurring degradation that can be modeled in the frequency domain by the following expression

$$H(u,v) = -\sqrt{2\pi}\sigma(u^2+v^2)\, e^{-2\pi^2\sigma^2(u^2+v^2)}$$

Write down the expression for a Wiener filter, assuming that the ratio of power spectra of the noise and undegraded signal is a constant K.

5. (15%) In an automated assembly application, three classes of parts are to be color coded in order to simplify detection. However, only a monochrome TV camera is available to acquire digital images. Propose a technique for using this camera to detect the three different colors.
6. (20%)
   (a) What is binary dilation and binary erosion? Try to write down their definitions.
   (b) How about gray-scale dilation and erosion?