

CoE 3SK3 Course Project 2

Image Interpolation

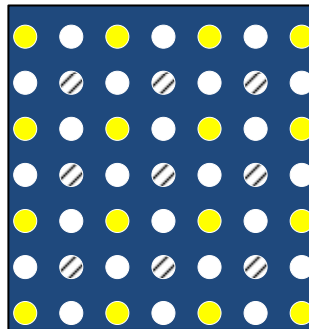
Due date: April 9, 2010.

When displaying low-resolution images on high-resolution monitors, for example, watching standard definition TV programs on high definition TV sets, the viewers or players have to interpolate the missing pixels as illustrated by the following figure. In the figure, the yellow dots are the pixels of the low-resolution image and the white dots are the missing pixels to be interpolated.

- a) Derive the bi-cubic interpolation algorithm that is described by the following formula:

$$f(x, y) = \sum_{i=0}^3 \sum_{j=0}^3 a_{i,j} x^i y^j$$

where $a_{i,j}$ are the coefficients of the bi-cubic interpolation function. The two-dimensional function $f(x, y)$ interpolates the low-resolution pixels, and it is used to estimate the missing pixels.



- b) Explain the difference(s), if any, between the interpolation of the center missing pixels (the hashed white dots) and the interpolation of the other missing pixels (the empty white dots).
- c) Write a program (either in C or in Matlab) to read an image, perform image interpolation using the bi-cubic algorithm, and then display the interpolated image.
- d) Make your bi-cubic algorithm as efficient as possible. What is the average number of operations needed to interpolate a missing pixel?

