Digital Image Processing – Spring 2017

Assignment No. 1- Remove Elements From An Image

Due date: March 29

Keyword: Cubic Interpolation, image pyramid (multi-resolution hierarchy), In-painting

Programming Language: C++/Python with OpenCV

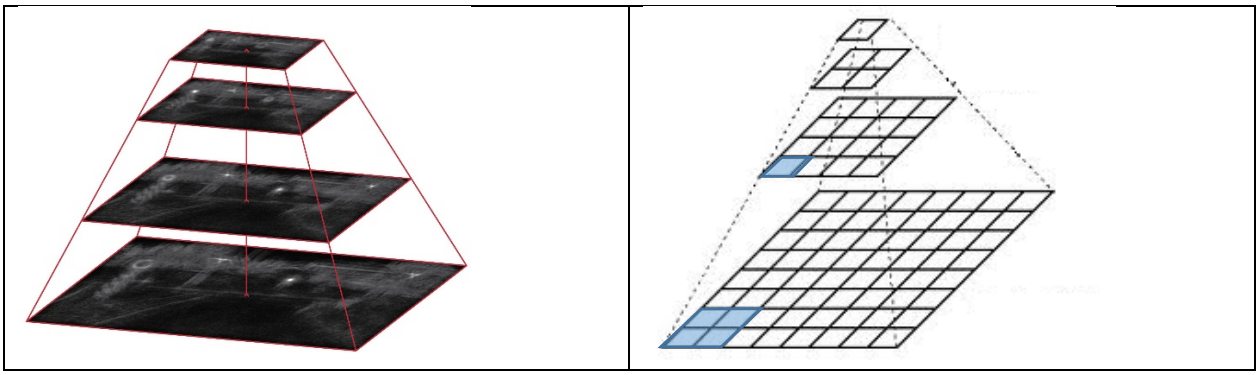
In this assignment you are required to provide a standalone application that removes elements from a given **gray scale** image. The elements to be removed are defined as a connected region with a predefined gray value (color). Toward this task you are required to write two auxiliary functions: ComputeCubicInterpolationCoefficients and BuildImagePyramid.

void ComputeCubicInterpolationCoefficients(double coefficient[][][]);

This function computes the 4x4 = 16 cubic coefficients for each quarter of a pixel using a cubic approximation of a Gaussian function. For more detail, please refer to the course slides.

void BuildImagePyramid(Mat image, int n, vector<Mat>& pyramid);

This function accepts an image and builds n levels image pyramid (multi-resolution hierarchy). A level i+1 is $1/4^{th}$ (half the width and half the height) of level I and the value of a pixel on level i+1 is the average of its 4 corresponding pixels on the level i, as depicted in the figure below (The pixel at level 1 and its corresponding pixels at level 0 are marked with blue color).



To fill the hole you need to implement the following Inpaint function, which accepts an image with a set of elements to be removed and return an image without these elements. The inpainting algorithm builds an image pyramid, and starts at the top level, where the element's diameter is between 1-2 pixels. It iteratively applies cubic interpolation on the element pixels until there is no change on these pixels. It then projects the computed colors of the element's pixels to the corresponding pixels and repeat the iterative cubic interpolation procedure, until it reaches level 0.

Mat RemoveElements(Mat image, vector<unsigned char> colors);

This function accepts an image with the list of colors that determine the elements to be removed and return an image without these elements.