

Assignment

1. Binarize the benchmark image Lena as in HW2 by 128
2. using 8x8 blocks as a unit, take the topmost-left pixel as the down-sampled data, Down-sample Lena from 512x512 to 64x64
3. Count the Yokoi connectivity number
4. Result of this assignment is a 64x64 matrix. Please align the matrix within 1 single A4 page (using 4-connected).

Introduction

B06507002_HW6_ver2.zip contains

1. HW6_B06507002.pdf
2. HW6_B06507002.py

where 1. is the report and 2. is my source code.

One can reproduce this assignment by putting "lena.bmp" and "HW6_B06507002.py" in the same folder and running "HW6_B06507002.py". Then, "yokoi.txt" will be dumped, which is equivalent to the image in this report.

Original Lena



Original Lena

Result (at the next page)

I use python 3 as my programming language, where I import numpy, opencv to do matrix calculation and image IO.

Since binarization part is the same as hw2 and down-sample part is trivial, I will only talk about the Yokoi connectivity number.

In the slide of chapter 6, we know that for 4-connectivity,

$$h(b, c, d, e) = \begin{cases} q & \text{if } b = c \text{ and } (d \neq b \vee e \neq b) \\ r & \text{if } b = c \text{ and } (d = b \wedge e = b) \\ s & \text{if } b \neq c \text{ and } (d = b \wedge e = b) \end{cases}$$

Besides, for the four corner at a given point in the image: a_1, a_2, a_3, a_4 .

$$\begin{aligned} a_1 &= h(x_0, x_1, x_6, x_2) & a_2 &= h(x_0, x_2, x_7, x_3) \\ a_3 &= h(x_0, x_3, x_8, x_4) & a_4 &= h(x_0, x_4, x_5, x_1) \end{aligned}$$

For a pixel centered at (1,1) the labels of its neighbors will be:

x_7 (0,0)	x_2 (0,1)	x_6 (0,2)
x_3 (1,0)	x_0 (1,1)	x_1 (1,2)
x_8 (2,0)	x_4 (2,1)	x_5 (2,2)

Then, the output will be

$$f(b,c,d,e) = \begin{cases} 5 & \text{if } a_1 = a_2 = a_3 = a_4 = r \\ n & \text{where } n = \# \{a_k | a_k = q\}, \text{ else} \end{cases}$$

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15555551 115555555511 2 11 11 115555555511 1
15555551 1 2115555112 21112221 15555555551 1
15555551 1 2 155112 22221511 155555555511 1
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11 151 115555555555555511 1
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