Coding Assignment 4

Department of Electronics & Electrical Communication Engineering, IIT Kharagpur.

Course: EC60002, Computer Vision

Academic Term: Spring 2020-21

Maximum Marks: 20 (8% of Total)

Deadline: 13th March, 2021, 10pm

Instructions:

- Do not use downloaded or inbuilt functions (other than the very basic) related to the implementations required in order to get proper results.
- You are free to use any coding language provided that it can be run in Google Colab.
- All the deliverables must be submitted in a single zip file at the relevant Google form.
- Solutions will be discussed in the Q&A session immediately after the deadline.

Data Supplied:

- 3 Grayscale Images

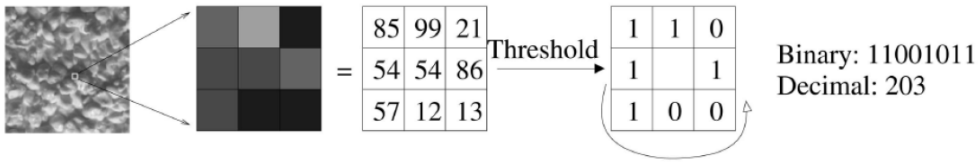
Relevant Expressions:

Gabor filter:

$$\exp\left(-\frac{x_o^2+\gamma^2 y_o^2}{2\sigma^2}\right)\cos\left(\frac{2\pi x_o}{\lambda}\right); x_o = xcos\theta + ysin\theta, y_o = -xsin\theta + ycos\theta$$

Consider kernel /window size: ceil ($6\sigma_2$) x ceil ($6\sigma_2$) for convolution

Local binary pattern (simple, no invariance related steps):



Task:

(a) Consider 4 appropriate different combinations of λ, σ values in a 2D Gabor filter with $\gamma = .5, \theta = 0$ and discuss the low pass nature of the filtering in the 4 cases without either applying them on images or looking at its frequency magnitude spectra.

(b) Consider 4 Gabor filters with $\lambda = 5\text{pw}, \sigma = 3\text{pw}, \gamma = .5$ ('pw' means pixel widths) and $\theta \in \{0^\circ, 45^\circ, 90^\circ, 135^\circ\}$. Apply them on an image to get 4 different outputs, from which label each pixel with its dominant orientation. Consider the dominant orientation at a pixel as the orientation corresponding to the maximum absolute value among the 4 Gabor output values at that pixel. Further, totally unrelated to the above, compute the decimal LBP values at each pixel in the image.

Next, generate 4 different histograms of LBP values in the image, considering LBP values at pixels with different dominant orientation separately. Let us call them 'Hist_LBP_0deg', 'Hist_LBP_45deg', 'Hist_LBP_90deg' and 'Hist_LBP_135deg'. Visually compare these histograms for every image supplied and also visually compare the histograms related to the same orientation across the images, and discuss whether LBP as computed above holds any signature of pattern orientation (hint: check if distributions of LBPs at pixels of same orientation are similar than distributions of LBPs at pixels of different orientations).

Note: As flat regions are not interesting ones, for proper analysis, while computing the histograms you may want to ignore all the pixels having absolute Gabor output value at the dominant orientation less p% (say, p=10) of the maximum of the same in the entire image.

Deliverables (in a single .zip file):

1. A document containing all the findings (figures /plots) asked under the tasks given along with discussion using not more than 100 words in part (a) and 200 words in part (b).
2. Codes used to generate the findings along with a command sequence to generate all the findings.