

Coding Assignment 3

Department of Electronics & Electrical Communication Engineering, IIT Kharagpur.

Course: EC60002, Computer Vision

Academic Term: Spring 2020-21

Maximum Marks: 20 (8% of Total)

Deadline: 4th March, 2021, 10pm

Instructions:

- Do not use downloaded or inbuilt functions 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 Color Images

Relevant Expressions:

Difference of Gaussian (DoG):

$$\frac{1}{2\pi} \left[\frac{1}{\sigma_1^2} \exp\left(-\frac{(x - \mu_x)^2 + (y - \mu_y)^2}{2\sigma_1^2}\right) - \frac{1}{\sigma_2^2} \exp\left(-\frac{(x - \mu_x)^2 + (y - \mu_y)^2}{2\sigma_2^2}\right) \right], \sigma_1 < \sigma_2$$

Kernel /window size: $\text{ceil}(6\sigma_2) \times \text{ceil}(6\sigma_2)$ for convolution.

Task:

- (a) Neither by considering the frequency magnitude spectra nor by application on a signal, show through computation that the above DoG filter is indeed a Band Pass filter. [Hint: consider its spatial domain properties]
- (b) Consider the following 3 cases of the above DoG filter:
1. $\sigma_1 \ll \sigma_2$; σ_1 is small, about a few pixel widths.
 2. $\sigma_1 \approx \sigma_2$; σ_1 is large, about many pixel widths.
 3. $\sigma_1 \approx \sigma_2$; σ_1 is small, about a few pixel widths.

Apply the DoG filters generated related to the above cases on the supplied images, and through observations from the outputs, comment on the following aspects of the DoG filtering in all the 3 cases:

1. Blob detection.
2. Edge detection.
3. Edge localization.

Note: Apply means 2D convolution with each image channel and output means sum of the absolute of the convolution outputs of each channel.

Deliverables (in a single .zip file):

1. A document containing all the findings (including results of image processing) asked under the tasks given along with discussion using not more than 50 words in part (a) and 300 words part (b).
2. Codes used to generate the findings along with a command sequence to generate all the findings.