Università della Svizzera italiana

Faculty of Informatics

Computer Vision & Pattern Recognition

Spring 2025

Assignment 4

March 21, 2025

Problem 1 [5 points]

Let A be a colour image with red, green, and blue components R, G, and B and let g_x and g_y be the 3×3 kernels of the vertical and the horizontal Sobel operator. One might think that a logical approach for defining the gradient of A at any pixel (i, j) would be to compute the gradient vector of each component as

$$\begin{aligned} \nabla R &= (R_x, R_y), & R_x &= g_x \star R, & R_y &= g_y \star R, \\ \nabla G &= (G_x, G_y), & G_x &= g_x \star G, & G_y &= g_y \star G, \\ \nabla B &= (B_x, B_y), & B_x &= g_x \star B, & B_y &= g_y \star B \end{aligned}$$

and then form a gradient vector for the colour image by summing the three individual gradient vectors,

$$\nabla A = \nabla R + \nabla G + \nabla B.$$

Unfortunately, this method can at times yield erroneous results. Specifically, it is possible for a colour image with clearly defined edges to have a zero gradient if this method were used. Give an example of such an image.

Problem 2 [5 points]

Implement Otsu's method for optimal global thresholding and test it with the image `houses.pgm`, which you can find in iCorsi.

Solutions must be returned on April 1, 2025 via iCorsi