**CVI620/ DPS920 Worksheet 6- Sobel Edge Detection - solution**

Given the following 6 x 6 image,

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 1 | 1 | 1 | 0 | 0 | 0 |
| 1 | 1 | 1 | 0 | 0 | 0 |
| 1 | 1 | 1 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
|  |  | **A** |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  | **C** |  |
|  | **B** |  |  |  |  |
|  |  |  |  |  |  |

1. What is the value of the marked pixels after applying the 3x3 Sobel horizontal edge detector?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 1 | 1 | 1 | 0 | 0 | 0 |
| 1 | 1 | 1 | 0 | 0 | 0 |
| 1 | 1 | 1 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 |



In order to find the value at A (or any pixel), we place the center of the kernel on the corresponding pixel in the image.

Gh(A)= (-1) \* 1 + (-2) \* 1 + (-1) \* 0 +

(0) \*1 + (0) \* 1 + (0) \* 0 +

(1) \* 1 + (2) \* 1 + (1) \* 0 = 0

Gh(B)= (-1) \* 1 + (-2) \* 1 + (-1) \* 1 +

(0) \*1 + (0) \* 1 + (0) \* 1 +

(1) \* 1 + (2) \* 1 + (1) \* 1 = 0

Gh(C)= (-1) \* 0 + (-2) \* 0 + (-1) \* 0 +

(0) \*1 + (0) \* 1 + (0) \* 1 +

(1) \* 1 + (2) \* 1 + (1) \* 1 = 4

1. What is the value of the marked pixels after applying the 3x3 Sobel vertical edge detector?



Gv(A)= (-1) \* 1 + (0) \* 1 + (1) \* 0 +

(-2) \*1 + (0) \* 1 + (2) \* 0 +

(-1) \* 1 + (0) \* 1 + (1) \* 0 = -4

Gv(B)= (-1) \* 1 + (0) \* 1 + (1) \* 1 +

(-2) \*1 + (0) \* 1 + (2) \* 1 +

(-1) \* 1 + (0) \* 1 + (1) \* 1 = 0

Gv(C)= (-1) \* 0 + (0) \* 0 + (1) \* 0 +

(-2) \*1 + (0) \* 1 + (2) \* 1 +

(-1) \* 1 + (0) \* 1 + (1) \* 1 = 0

1. What is the edge magnitude at the marked pixels?

(Strong edges at A and C, no edge at B- can use function cv::magnitude ())

1. What is the edge orientation at the marked pixels?

(Results based on output of using atan2(Gh, Gv)\* 180/ PI, or cv::phase())