Fundamentals of Biomedical Image Processing HW 3

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1 Theoretical Questions

To detect a 1-pixel break in a binary line, we can use a directional filter such as [1 -2 1]. When applied to a continuous line (1 1 1), the filter output is zero; when applied to the edge of the break (1 1 0), the output is negative (-1); when applied to a break (1 0 1), the output becomes positive (2). Therefore, pixels with nonzero responses indicate line breaks.

Here are the filters that can detect the 1-pixel break in different directions:

- Vertical:

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & -2 & 0 \\ 0 & 1 & 0 \end{bmatrix}$$

- Horizontal:

$$A = \begin{bmatrix} 0 & 0 & 0 \\ 1 & -2 & 1 \\ 0 & 0 & 0 \end{bmatrix}$$

- +45 degree:

$$A = \begin{bmatrix} 0 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 0 \end{bmatrix}$$

- -45 degree:

$$A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

2 Programming Exercises