A2I2 – Basic Image Processing Exercise

Technische
Hochschule
Rosenheim

Filter

1. The following values represent a row of pixels of a grayscale image:

   1, 0, 2, 2, 2, 8, 2, 3, 6, 6, 6

   Compute the convolution (filter) of this image row using a 1D filter mask:

   a. mask 1/3 [1 1 1]

   b. mask   [1 0 -1]

   c. use a 1x3 sized Median filter

2. The following table shows a small grayscale image. Filter the image and fill in the result in the empty tables below.

   [handwritten: durchm → 1, 1, 1, 1, (1), 1, 4, 4, 4   mitte]

1	1	4	4
1	1	4	4
1	1	4	4
1	1	4	4

   a. apply a 3x3 mean filter

	2	3	
	2	3	

   b. apply a 3x3 Median

	1	4	
	1	4	

3. The following table shows a small grayscale image. Filter the image and fill in the result in the empty tables below.

(handwritten:) -1 $-1 \cdot 1 + (-2) \cdot 1 + (-1) \cdot 1 +$
$0 + 0 + 0 +$
$1 \cdot 4 + 2 \cdot 4 + 1 \cdot 4 =$
$-4 + 16 = 12$

1	1	1	1	4	4	4	4
1	1	1	1	4	4	4	4
1	1	1	1	4	4	4	4
1	1	1	1	4	4	4	4
1	1	1	1	4	4	4	4
1	1	1	1	4	4	4	4

a. apply a 3x3 Sobel (derivative in x-direction)

(handwritten:)
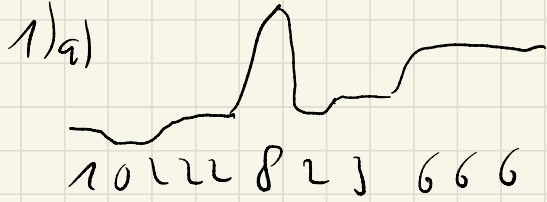$$\begin{pmatrix} 1 & 0 & -1 \\ 2 & 0 & -2 \\ 1 & 0 & -1 \end{pmatrix}$$
(Spiegel)

	0	0	12	12	0	0	
	0	0	12	12	0	0	
	0	0	12	12	0	0	
	0	0	12	12	0	0	

b. apply a 3x3 Sobel (derivative in y-direction)

(handwritten:)
$$\begin{pmatrix} 1 & 2 & 1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{pmatrix}$$
(Spiegel)

	0	0	0	0	0	0	
	0	0	0	0	0	0	
	0	0	0	0	0	0	
	0	0	0	0	0	0	

1) a)

1 0 1 2 2 8 2 3 6 6 6

$$\left(\frac{1}{3}\ \frac{1}{3}\ \frac{1}{3}\right) \xrightarrow{\text{Spiegeln}} \left(\frac{1}{3}\ \frac{1}{3}\ \frac{1}{3}\right)$$

$x, 1, \frac{4}{3}=1, 2, 4, 4, \frac{13}{3}=4, \frac{11}{3}=4, 5, 6, x$

b)

$$(1\ 0\ -1) \xrightarrow{\text{Spiegeln}} (-1\ 0\ 1)$$

$x, 1, 2, 0, 6, 0, -5, 4, 3, 0, x$

c) $x, 1, 2, 2, 2, 2, 3, 3, 6, 6, x$