**LAPORAN PRAKTIKUM PENGOLAHAN CITRA DIGITAL**

**9. CONVOLUTION AND CORRELATION**



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**TUTORIAL : CONVOLUTION AND CORRELATION**

**Goal**

The goal of this tutorial is to learn how to perform a correlation and convolution

calculations in MATLAB.

**Objectives**

* Learn how to perform a correlation of two (1D and 2D) matrices.
* Learn how to perform a convolution of two (1D and 2D) matrices.
* Explore the imfilter function to perform correlation and convolution in MATLAB.

**Procedure**

We shall start by exploring convolution and correlation in one dimension. This can be achieved by means of the imfilter function.

1. Specify the two matrices to be used.



1. Perform convolution, using a as the input matrix and f as the filter.



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**Question 1** What is the relationship between the size of the output matrix, the size of the original matrix, and the length of the filter?

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| Ukuran matriks output saat menggunakan opsi "full" dalam fungsi imfilter ditentukan oleh rumus.  Ukuran Output=(Panjang Matriks Asli+Panjang Filter)−1  Ukuran Output=(7+5)−1=11  Mangkanya (g) panjangnya sampai 11 |

**Question 2** How does changing the third parameter from ’full’ to ’same’ affect the output?

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| Hasil nya berbeda dengan ‘full’ karena ‘same’ ambil dari ukuran asli yaitu a dengan ukuran 7 |
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1. Perform correlation on the same set of matrices.



The results from the previous step should confirm that convolution is related to correlation by a reflection of the filter matrix, regardless of the number of dimensions involved. Let us see how correlation works on a small window of size 3 × 3. Consider the window of values extracted from a larger image in Figure 9.1. The correlation of two matrices is a sum of products. Numerically, the calculation would be as follows:



Here, we specify the image (which in our case will be the image region as in

Figure 9.1) and the mask from Figure 9.2. We will also explicitly tell the function to use correlation, as it can perform both correlation and convolution.

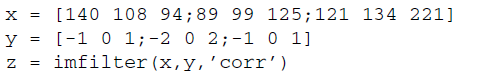


**FIGURE 9.1** A 3 × 3 image region.



**FIGURE 9.2** A 3 × 3 mask.

1. Clear all workspace variables.
2. Use imfilter to perform a correlation of the two matrices.



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**Question 3** In the resulting matrix (z), we are interested only in the center value. How does this value compare with our calculation illustrated above?

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**Question 4** What are the other values in the resulting matrix?

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| Nilai lain dalam matriks z adalah hasil dari operasi korelasi antara matriks x dan y pada berbagai posisi. |

**Question 5** Note in the last step we did not specify if the output should be ’full’ or ’same’. What is the default for this setting if it is not specified?

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| Pengaturan default untuk fungsi imfilter adalah 'same'. |

To perform convolution,weuse the same technique as in correlation. The difference here is that the filter matrix is rotated 180◦ before performing the sum of products. Again, the calculation of the convolution of the given image region and mask is performed as follows:



1. Use imfilter to perform a convolution of the two matrices.



**Question 6** How does the center value of the resulting matrix compare with our calculation above?

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