Subimage Extraction Given the Center Coordinates

The concept of extracting a subimage from a larger image is straightforward, but how it is to be executed depends on the size of the subimage desired, and the reference location (i.e., given the center location or the upper left corner location). There are essentially three cases to be examined, as follows.

Case 1: Subimage is of odd dimensions

When the subimage is to have an odd number of rows and an odd number of columns, the center location sits in the exact center of the subimage. The number of rows in the subimage above the center pixel = the number of rows below the center, and the number of columns to the left of the center pixel = the number of columns to the right of the center pixel. If the desired subimage is R x C, and both R and C are odd, then the subimage will have (R-1)/2 rows above and below, and (C-1)/2 columns to the left and to the right. For example, if it is desired to extract a 3x3 subimage from a 10x10 image, given center coordinates (row center, column center)=(5,4), the situation is as shown in Fig. 1.

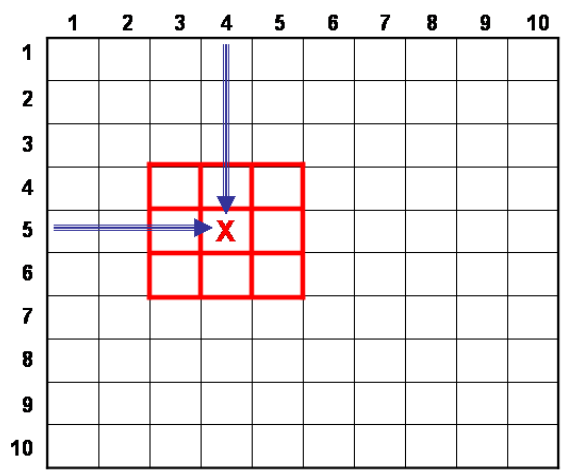

Figure 1: A 3x3 subimage in a 10x10 image centered at (5,4)

In this case, the row numbers to be extracted lie (3-1)/2 = 1 row above and below the center row, and the column numbers to be extracted lie (3-1)/2 = 1 column left and right of the center column. In MATLAB, if the image array is called *A* and the subimage array is called *B*,

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>>B=A(4:6,3:5).
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If we desired a 7x5 subimage, the row numbers to be extracted lie (7-1)/2 = 3 rows above and below the center row, and the column numbers to be extracted lie (5-1)/2 = 2 columns left and right of the center column.

Case 2: Subimage is of even dimensions

When the subimage is to have an even number of rows and an even number of columns, there is no exact center location of the subimage. If a center location is desired, we must specify how to carry out the extraction. In our class, we will have one more row above the center location than below, and one more column to the left than to the right. If the desired subimage is *R* x *C*, and both *R* and *C* are even, then the subimage will have *R*/2 rows above and *R*/2-1 rows below, and *C*/2 columns to the left and *C*/2-1 columns to the right. For example, if it is desired to extract a 4x4 subimage from a 10x10 image, given center coordinates (row center, column center)=(8,8), the situation is as shown in Fig. 2.

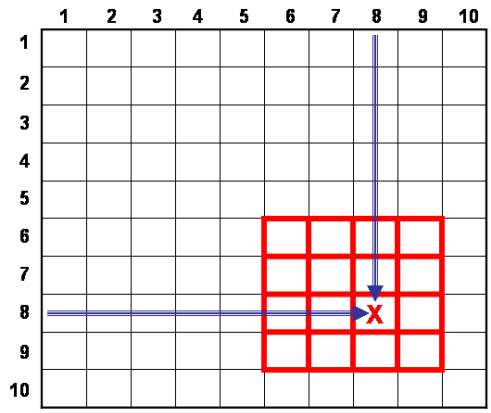

Figure 2: A 4x4 subimage in a 10x10 image centered at (8,8)

In this case, the row numbers to be extracted lie 4/2 = 2 rows above and 4/2-1 = 1 row below the center row, and the column numbers to be extracted lie 4/2 = 2 columns left and 4/2-1 = 1 column to the right of the center column. In MATLAB, if the image array is called *A* and the subimage array is called *B*,
>>B=A(6:9,6:9).

If we desired a 6x10 subimage, the row numbers to be extracted lie 6/2 = 3 rows above and 6/2-1 = 2 rows below the center row, and the column numbers to be extracted lie 10/2 = 5 columns left and 10/2-1 = 4 columns to the right of the center column.

Case 3: Subimage is of a mix of odd and even dimensions

In this case, the methods used above for odd or even dimensions apply individually. For example, if it is desired to extract a 3x4 subimage from a 10x10 image, given center coordinates (row center, column center)=(3,4), the situation is as shown in Fig. 3.

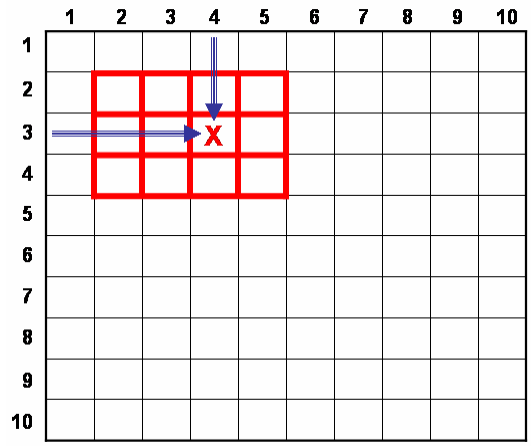

Figure 3: A 3x4 subimage in a 10x10 image centered at (3,4)

In this case, the number of rows of the subimage is odd, so the row numbers to be extracted lie (3-1)/2 = 1 row above and (3-1)/2 = 1 row below the center row. The number of columns is even, so the column numbers to be extracted lie 4/2 = 2 columns left and 4/2-1 = 1 column to the right of the center column. In MATLAB, if the image array is called *A* and the subimage array is called *B*,
>>B=A(2:4,2:5).