The Hit-or-Miss Transformation

The hit-or-miss transformation of an image A by B is denoted by $A \circledast B$.

B is a pair of structuring elements $B=(B_1,B_2)$ rather than a single element.

$B1$: set of elements of B associated with an object

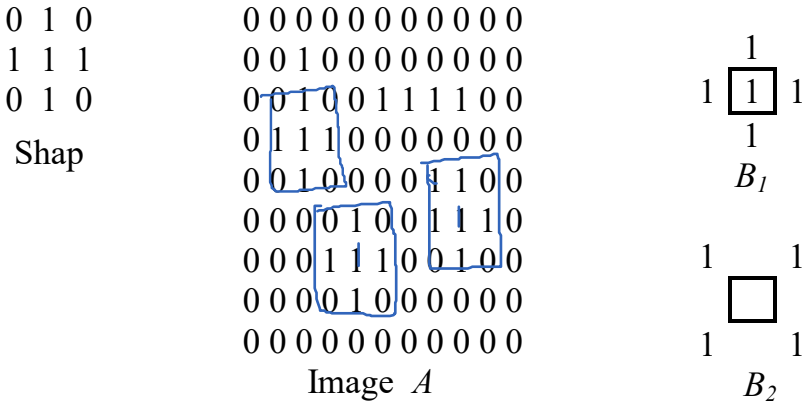
$B2$: set of elements of B associated with the background

The hit-or-miss transform is defined as follows:

$$A \circledast B = (A \ominus B_1) \cap (A^c \ominus B_2)$$

This transform is useful in locating all pixel configurations that match the B_1 structure (i.e a hit) but do not match that of B_2 (i.e. a miss). Thus, the hit-or-miss transform is used for shape detection.

Example: Use the hit-or-miss transform to identify the locations of the following shape pixel configuration in the image below using the two structuring elements $B1$ and $B2$.



Solution:

$A \ominus B_1 =$

0 0 0 0 0 0 0 0 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 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 0 0
0 0 0 0 1 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0

$A^c =$

1 1 1 1 1 1 1 1 1 1
1 1 0 1 1 1 1 1 1 1
1 1 0 1 1 0 0 0 1 1
1 0 0 0 1 1 1 1 1 1
1 1 0 1 1 1 1 0 1 1
1 1 1 1 0 1 1 0 0 1
1 1 1 0 0 0 1 1 0 1 1
1 1 1 1 0 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1

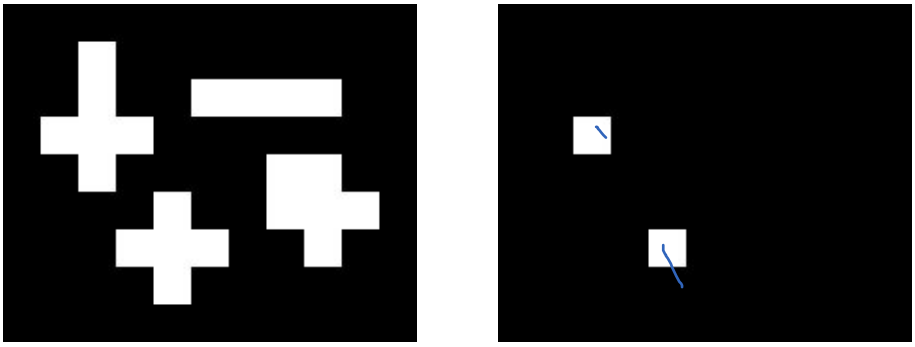
$A^c \ominus B_2 =$

1 0 1 0 1 1 1 1 1 1
1 0 1 0 0 0 0 0 0 1
0 0 0 0 0 1 1 1 1 1 1
1 0 1 0 0 0 0 0 0 1
0 0 0 0 0 0 0 0 0 0
1 0 0 0 0 0 0 0 0 1
1 1 1 0 1 0 0 0 0 0
1 1 0 0 0 0 0 0 1 0 1
1 1 1 0 1 0 1 1 1 1 1

$A \circledast B =$

0 0 0 0 0 0 0 0 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** 0 0 0 0 0 0 0
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** 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0

The figure below shows an example of applying the hit-or-miss transform on the image in the previous example.



(a) (b)

Figure 11.1 (a) Binary image. (b) Result of applying hit-or-miss transform.