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FACULTY OF EGINEERING

Digital Image Processing
LECTURE-27

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OUTLINE

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The Hit-or-Miss Transformation

•A basic morphological tool for shape detection.

•Let the origin of each shape be located at its center of gravity.

•If we want to find the location of a shape , say – X ,

at (larger) image, say – A :

•Let X be enclosed by a small window, say – W.

•The local background of X with respect to W is defined as the set difference (W - X).

•Apply erosion operator of A by X, will get us the set of locations of the origin of X, such that X is completely contained in A.

•It may be also view geometrically as the set of all locations of the origin of X at which X found a match (hit) in A.

The Hit-or-Miss Transformation

•Apply erosion operator on the complement of A by the local background set (W – X).

•Notice, that the set of locations for which X exactly fits inside A is the intersection of these two last operators above.

This intersection is precisely the location sought.

Formally:

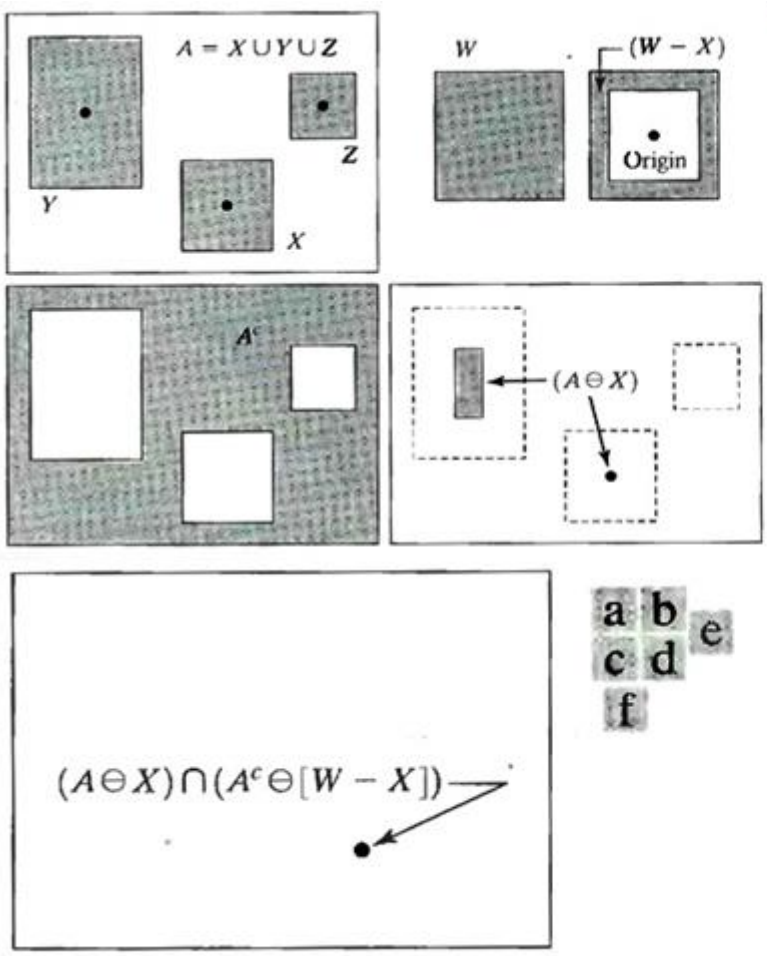
If B denotes the set composed of X and it's background –

B = (B1,B2) ; B1 = X , B2 = (W-X).

The match (or set of matches) of B in A, denoted $A \circledast B$ is:

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

Hit-or-Miss exp



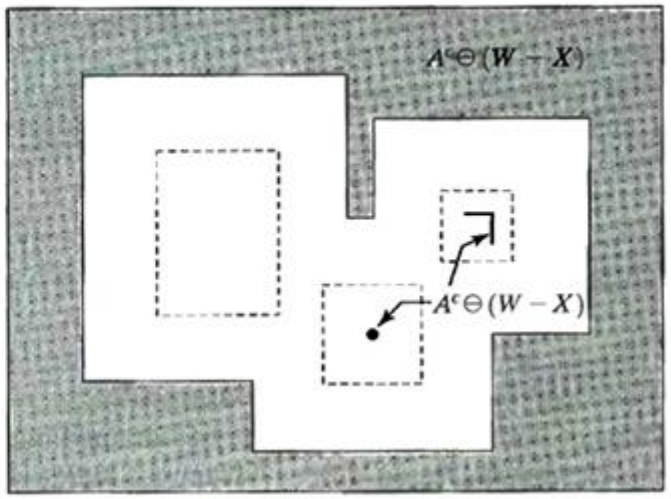


FIGURE 9.12
(a) Set A. (b) A window, W, and the local background of X with respect to W, $(W - X)$. (c) Complement of A. (d) Erosion of A by X. (e) Erosion of A^c by $(W - X)$. (f) Intersection of (d) and (e), showing the location of the origin of X, as desired.

Hit-or-Miss Transformation

•The reason for using these kind of structuring element – B = (B1,B2) is based on an assumed definition that, two or more objects are distinct only if they are disjoint (disconnected) sets.

•In some applications , we may interested in detecting certain patterns (combinations) of 1's and 0's. and not for detecting individual objects.

•In this case a background is not required. and the hit-or-miss transform reduces to simple erosion.

•This simplified pattern detection scheme is used in some of the algorithms for – identifying characters within a text.

MCQ

1. What kind of relation can be obtained between first order derivative and second order derivative of an image on the response obtained by encountering an isolated noise point in the image?
   a) First order derivative has a stronger response than a second order
   b) Second order derivative has a stronger response than a first order
   c) Both enhances the same and so the response is same for both first and second order derivative
   d) None of the mentioned
2. What kind of relation can be obtained between the response of first order derivative and second order derivative of an image having a transition into gray-level step from zero?
   a) First order derivative has a stronger response than a second order
   b) Second order derivative has a stronger response than a first order
   c) Both first and second order derivative has the same response
   d) None of the mentioned
3. If in an image there exist similar change in gray-level values in the image, which of the following shows a stronger response using second order derivative operator for sharpening?
   a) A line
   b) A step
   c) A point
   d) None of the mentioned

MCQ

4. The objective of sharpening spatial filters is/are to _____

a) Highlight fine detail in an image

b) Enhance detail that has been blurred because of some error

c) Enhance detail that has been blurred because of some natural effect of some method of image acquisition

d) All of the mentioned

5. Sharpening is analogous to which of the following operations?

a) To spatial integration

b) To spatial differentiation

c) All of the mentioned

d) None of the mentioned

References

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