TD4 - Morphologie Mathématique
Hit-or-Miss Transform
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Introduction

The objective of this assignment is to learn to apply the hit-or-miss transform and its derivatives to binary images. First you will work on homotopic thinnings and their application to skeletons. Second, you will discover the notion of pruning. Third you will have to classify objects according to morphological features. One .m file is provided.

1 Homotopic thinnings and skeletons

1. Open the .m file corresponding to part 1. Run the first cell to observe the studied image utk.tif.

2. Before running the rest of the code, draw on paper the expected skeleton of the reduced image.

3. Skeleton:

   - Open function *tse_bwthinning.m* and answer the following questions:
     – which structuring element family is used ?
     – what is the purpose of the for loop ?
     – which ending condition is used ?
   - Run the fuction with nb = 3 and nb = Inf
     – comment the result
     – what is the connexity of the result ?
   - Use the bwmorph function with the skel option as proposed in the .m file. Comment the result and compare it with the previous one.

4. Pruning:
   Pruning is a transformation that removes the endpoints of an image and proceeds until stability is reached. It is used mainly to clean unsignificant skeleton branches. In fact, it is just another sort of thinning with particular structuring elements.
   Pruning is normally carried out for only a limited number of iterations to remove short spurs, since pruning until convergence will actually remove all pixels except those that form closed loops. As a result, a parametric pruning of a given size n consists in removing n pixels of each branch of the skeleton, starting from each endpoint.

   - Find the Matlab command (using bwmorph) to apply pruning.
   - Apply it to the skeleton of the studied image.

5. Conclusion. Is the skeleton of a shape unique ?

2 Application 1

The objective is to classify objects according to their length. Our goal here is to extract the 6 longest objects of the image elipses.bmp, the principal feature is the length.

1. Open the image elipses.bmp.

2. Propose a method to detect the 6 longest objects using skeletons and image reconstruction. (Your method has to be based on bwmorph).

3 Application 2

The objective is to classify objects according to their shape morphological features. Objects are Rings, T-pins and Nails (pieces.bmp). The idea is to use the following features : Rings have holes, T-pins have a 'T' like crossing in its skeleton and the Nails are the rest.

1. Open the image pieces.bmp.

2. Propose a method to detect the ring pieces.

3. Propose a method to select T-pins (you can try to use the convex hull).

4. Propose a method to get the Nails.
   For each type of object, your algorithm must be based on the bwmorph function.