

Practise session 9: Morphological Image Processing.

1. Basic morphological operations. (1p)

If Fig. 1, the set A and the structuring elements B^1 , B^2 , B^3 , and B^4 are given. What is the output from the morphological operations

- a) $(A \ominus B^4) \oplus B^2$
- b) $(A \ominus B^1) \oplus B^3$
- c) $(A \oplus B^1) \oplus B^3$
- d) $(A \oplus B^3) \ominus B^2$

Use Matlab in the implementation. Define the set A using the information in Fig. 1 and then define the structuring elements of proper sizes.

2. Boundary detection. (1p)

A binary image in Fig. 2 is given. Using morphological operations, find the boundary for the white area.

3. Noise removal. (1p)

Morphological operations can be used for noise removal. Test a set of disk structuring elements of various sizes (e.g. a disk of radius 1, 3, or 5) for the X-ray image in Fig. 3.

4. Visual quality control. (1p)

A visual quality control system (VQCS) in a candy factory should detect irregularities in the shapes from the products. The products are circular and some variations in sizes are accepted. The first steps for VQCS is to find the distribution of the sizes of the candies on the conveyor belt. A typical, preprocessed image for VQCS is given in Fig. 4.

Granulometry is a field in image analysis where the distribution of sizes (e.g of grains, candies etc.) is of importance. See one application in Matlab documentation, find topic "Granulometry of Snowflakes". Then apply the approach to the image in Fig. 4.

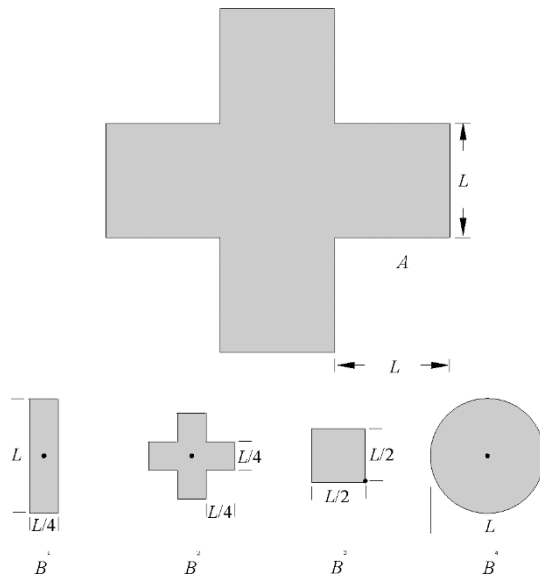


Fig.1. Figure A with the structuring elements B^1 , B^2 , B^3 , and B^4 .



Fig. 2. A binary image.

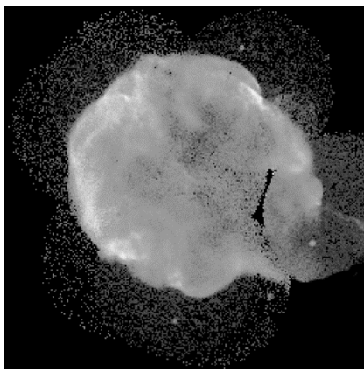


Fig. 3. Noisy X-ray image.



Fig. 4. Candies on a conveyor belt.