About Shape Detection of the Objects in Computerized Precincts

L.M.Matica* , A.Pavel*, A. Abrudan-Purece*, V.Stroian**
*University of Oradea,
Faculty of Electrical Engineering and Information Technology
Str.Universitatii, nr.1, Oradea, Romania,
e-mail : lmatica@uoradea.ro
**Ecole Supérieure de Technologie, Canada

Abstract.

To define a trajectory, in computerized precincts, is necessary to study some aspects as shape of the objects, the form representation and also to make some obstacle shape measurements. Because of sampling, we do not observe the true contour but a version approaches for various types of connexity on the same grid of sampling, which succeeds has to define different contours for the same object.

We will analyze two categories of form description:

- the linear descriptors – they describe the form step by step, according to its contour;
- the surface descriptors – they operate by elements of surface.

1. General consideration

To tackle the question of the image processing, the following elements are distinguished:

- the perception of an image - it is articulated around the visual system characteristics which is sensitive to certain frequencies of the electromagnetic spectrum;
- the representation of an image – means the representation of a physical entity under a data-processing form, fig.1;
- the image processing – there are operations which interpret or affect the representation of an image. We will consider below only the image processing sampled, fig.2.

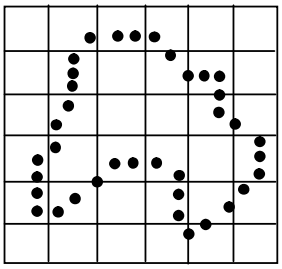


Fig.1. A contour

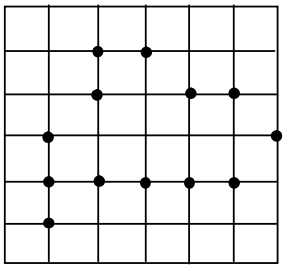


Fig.2. Sampling on a grid

2. *Linear description of the form*

2.1. The chain code

It consists in being defined a set of directions and has to follow the points of contours gradually, until returning to the starting point.

A contour is defined as a doublet containing the co-ordinates of the starting point and a list of direction to be followed. Next figures show examples of chain code in 4 connexity (fig.3) and 8 connexity (fig.4).

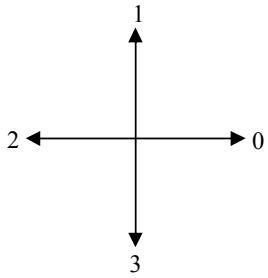


Fig.3. Direction chain code in 4 connexity

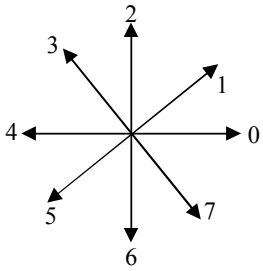
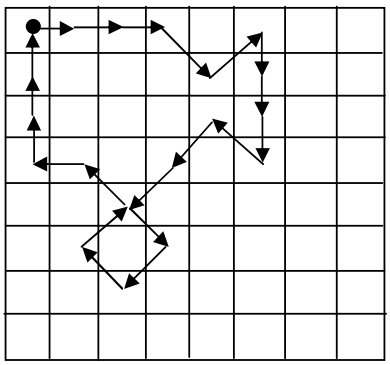


Fig.4. Chain code in 8 connexity

A typical problem of coding in chain intervenes at the time when points of graining appear. The same point of contour is described several times.



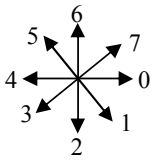


Fig. 5. Contour with points of graining

The code is: 00017222533135754666

A different descriptor on a more complex form is a lancet. The lancet is a succession of directions which indicate each time the position of a nearby point, until returning to the starting point; we speak about *`chain code '.*

3. *Descriptor of FOURIER*

A contour consists of a series of co-ordinate of the type (xi; yi). Considering a series of points from the contour whose co-ordinate is represented in complex form:

$$s\{n\} = x[n] + j \cdot y[n] \qquad (1)$$

The discrete Fourier transformation of this signal is:

$$s[u] = 1/N \cdot \sum_{j=0}^{N-1} s[n] \cdot e^{-2\pi jun/N} \qquad (2)$$

The coefficients s[u] is called contour descriptors of Fourier.

4. Descriptor by elements of surface

The quaternary tree is a convenient form of description tool. This tree consists of leaves, whose union reconstitute a unit and it's complementary.

As figure 6 shows**,** the quaternary structure tree allots a single value to a whole of homogeneous values. Into the absence of homogeneity, the zone is again divided into four equal parts.

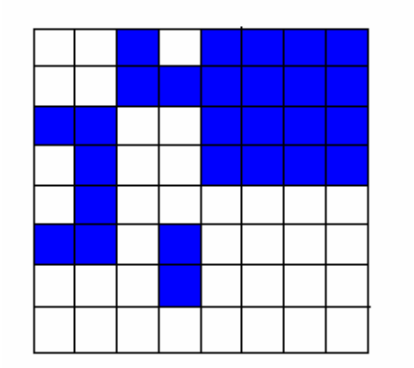


Figure 6. Cutting of a quaternary tree image

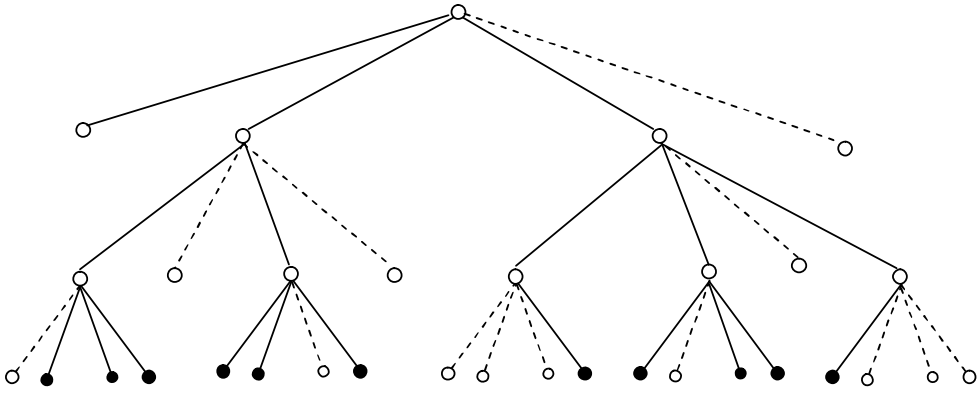


*Figure 7***.** Form descriptor by a quaternary tree

We can just easily choose a family of structuring elements unspecified and describe an object like the union of these elements posted at the right places. An object is obtained by the superposition of three structuring elements, the form description as the union of a rectangle (R), a triangle (T) and a rhombus (C).

5. Measurements

The measurements taken on the images are multiple and very different. Basically, there are tree main measurements characterizing a form: the perimeter, surface and the Euler-Poin carre number.

The perimeter of a figure is easily calculated starting from a contour description by a coding in chain. Indeed, it is enough to count the number of points to this coding in chain by considering a multiplicative factor 2 for the diagonal directions. Considering N_p and N_i the number of even respectively odd elements contents in 8 connexities chain code of a contour C, the perimeter is:

$$P(C) = N_p + \sqrt{2} \cdot N_i \qquad (3)$$

The surface of an object is obtained simply by counting out the number of pixels which make it up.

From a practical point of view, a direct sweeping of the image is enough for calculation of the surface.

6. Conclusion

The image analysis aims at the description as complete as possible of the image characteristics. But an image is made by objects. To extract quantitative information of these objects, several attitudes are possible: to adopt a relatively passive step by determining all the parameters relating to this image – this step leads to an informative surplus or then to be satisfied with some parameters sufficient to characterize the image like codifying the existence of an obstacle and its measurements.

References:

[1]Liliana Marilena MATICA, Sisteme informatice industriale. Editura Universitatii din Oradea, 2002

[2]Van Droogenbroeck, M., Traitement Numerique des Images. Institut MonteFiore, Universite de Liege, 2003

[3] Liliana Marilena MATICA, Roxana MATICA, OPC ca metodă de interconectare în timp real a sistemelor automatice. Editura Universității din Oradea, 2006