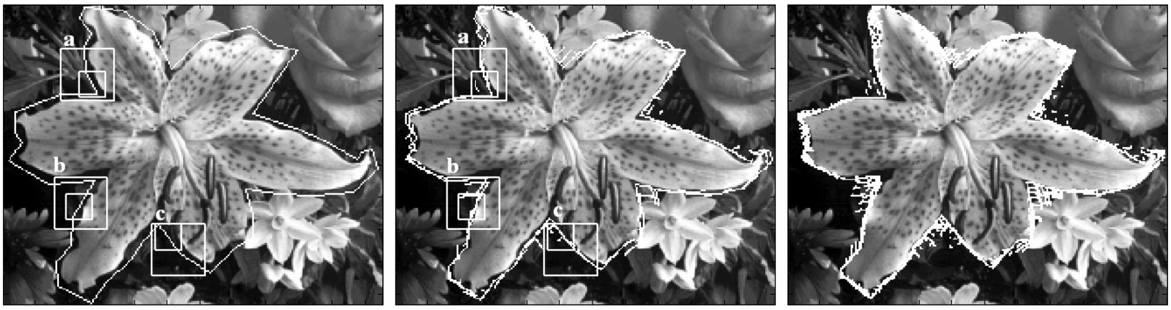

(a) (b) (c)

Figure I. Deformations of the alpha mask foreground during first three steps of Ida's algorithm for the flower image: (a) initial contour, (b) alpha mask foreground after the first iteration, and (c) alpha mask foreground after the second iteration.

Fractal Behavior of Ida's algorithm

In some conditions, Ida's algorithm provides fractal behavior; and the topology of the alpha mask contour is missed (for example see Figure 2-e). That is its most important disadvantage. The fractal behavior occurs when there are some parts of the alpha mask foreground in a large domain M_i with no correspondence in the attached domain W_i. For example, Figure I illustrates deformations of the alpha mask foreground during the first three steps of Ida's algorithm for the Flower image. For the indicated domains b and c in this figure, each larger domain (M) includes two parts of the initial contour while there is only one corresponding part in the attached smaller domain (W). Therefore, as shown in Figures I-b and I-c, fractal patterns occurred in both W_b and W_c after applying self-affine maps.

C. Enhancement

In Ida's algorithm, the alpha mask which simply includes the mapped pixels does not care about the contour topology. In other words, definition of the contour by the alpha mask is not a convenient way to avoid the fractal behavior.

The authors in another work showed that the above shortcoming can be overpowered by defining the contour as a primary parametric curve [27]. In this paper, details of the improved algorithm were discarded for summarization. The results of the enhanced Ida's algorithm for the Tile and Flower images are shown in Figure 3-c and 3-d, respectively. The enhanced algorithm, in contrast to the original one, successfully fitted the contour to the flower boundary and avoided the fractal behavior.

On the other hand, to improve the capture range, instead of increasing the domain size as given in Ida's algorithm, it is possible to use higher image scales provided by the wavelet transform with smaller domains. In this case, three advantages may be achieved: *i)* increasing the capture range, *ii)* decreasing the computational cost, and *iii)* improving the self-similarity condition (Equation 3) due to reducing the domain size.

Consequently, to provide an exhaustive solution for the contour extraction problem, we propose the integration of the self-affine mapping system, parametric active contours (snakes), and wavelet transform to keep their strengths and avoid the weak points.