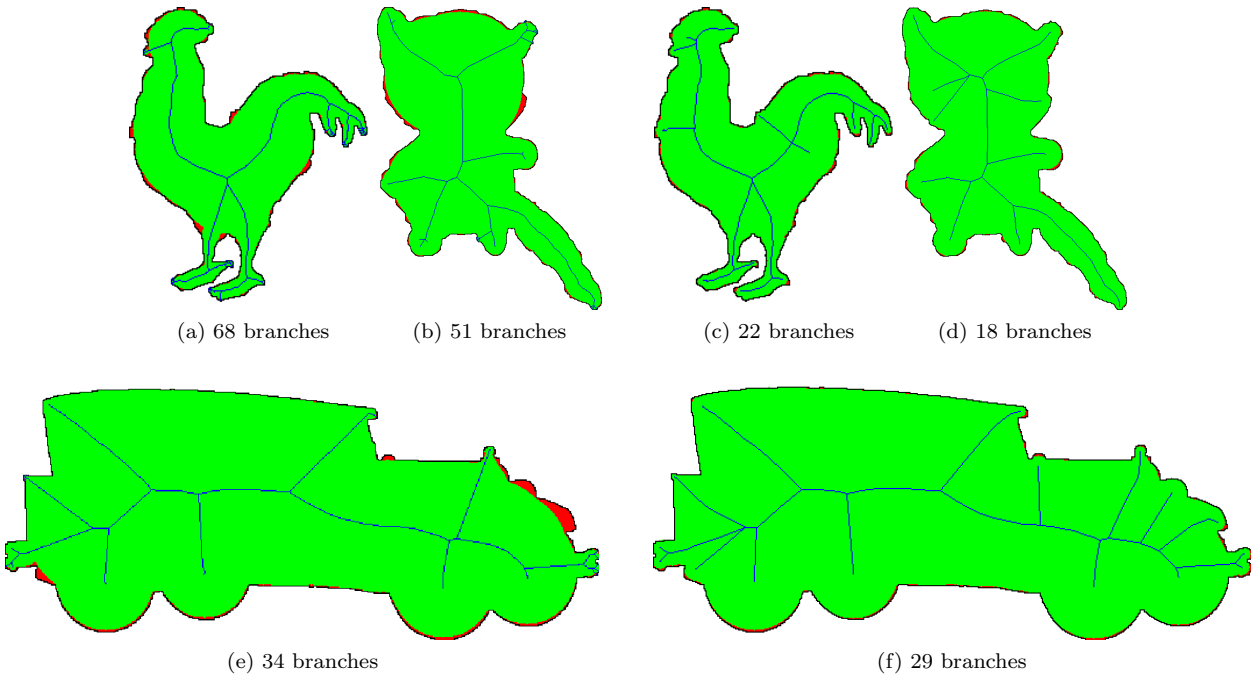
Skeletonization by circle propagation: A computation robust to boundary noise and preserving shape details

Bastien Durix
IRIT, University of Toulouse
bastien.durix@enseeiht.fr

Skeletons are thin structures, centered inside a 2D or 3D shape. They provide an intuitive shape descriptor, particularly in 2D, where they are used in shape matching and recognition. The estimation of a skeleton from a shape, which is called skeletonization, produces a skeleton modeling the shape with its details. However, skeletonization may generate uninformative branches that do not describe the global shape of the object but only arbitrarily small oscillations on the contour of the shape. Subsequently, numerous pruning methods have been developed to simplify skeletons, but they need to adjust parameters (not always related to a geometric criteria) that are difficult to automatically determine; as a consequence, important details of the shape may be removed from its skeleton model. In this article, we propose a novel 2D skeletonization method which does not need a pruning post-processing step, and that is able to distinguish between noise and details of the shape. It is based on specific property of the points of the skeleton: the propagation of a circle inside of the shape is performed while maintaining a contact with the boundary. The resulting skeleton provides an efficient description of the shape but with a limited number of branches compared to other classical approaches. Experiments (qualitative and quantitative results) show that our method offers the best existing compromise between morphological details and a low number of branches, for a given 2D discrete shape.

Joint work with: Géraldine Morin, Sylvie Chambon, Kathryn Leonard, Jean-Luc Mari.



(a) 68 branches (b) 51 branches (c) 22 branches (d) 18 branches

(e) 34 branches (f) 29 branches

Figure 1: Comparison between Voronoï skeletonization (on the left), pruned by scale-axis transform, and our method (on the right). The green part of the shape is the part modeled by the skeleton; the red parts show the difference between the original shape and the modeled shape.