Hierarchic Euclidean skeletons in cubical complexes

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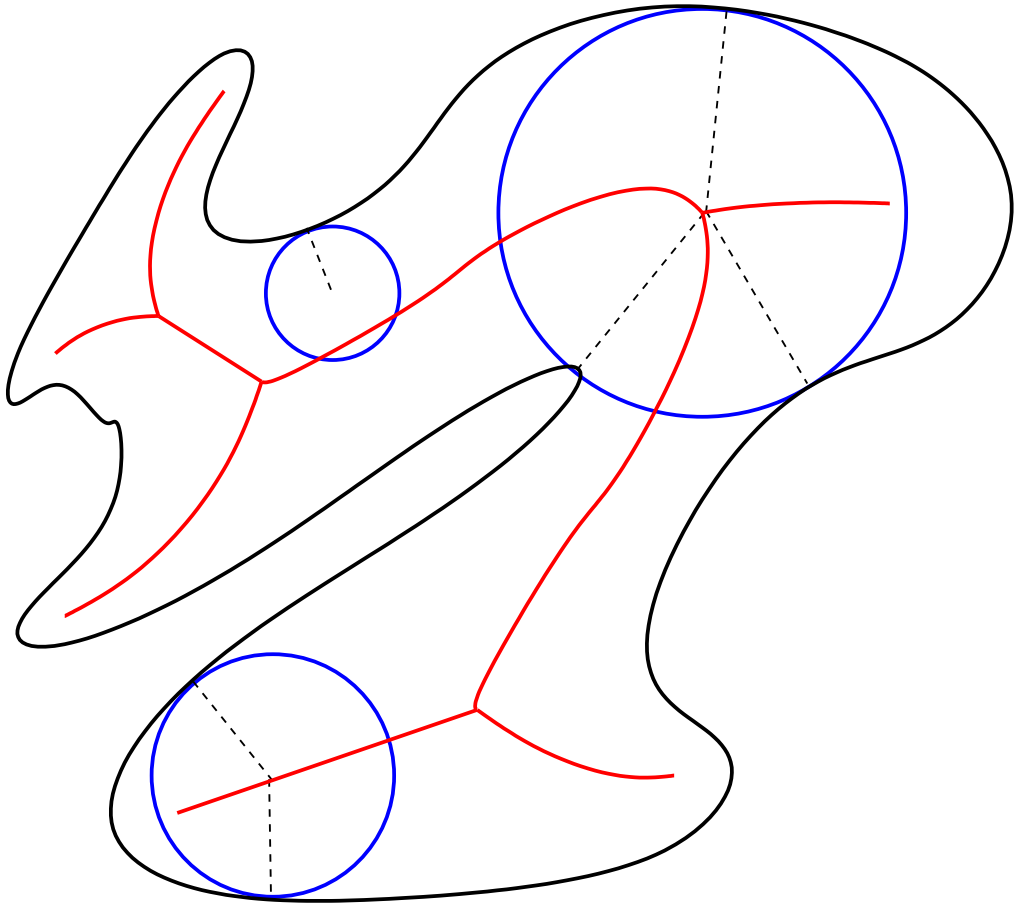
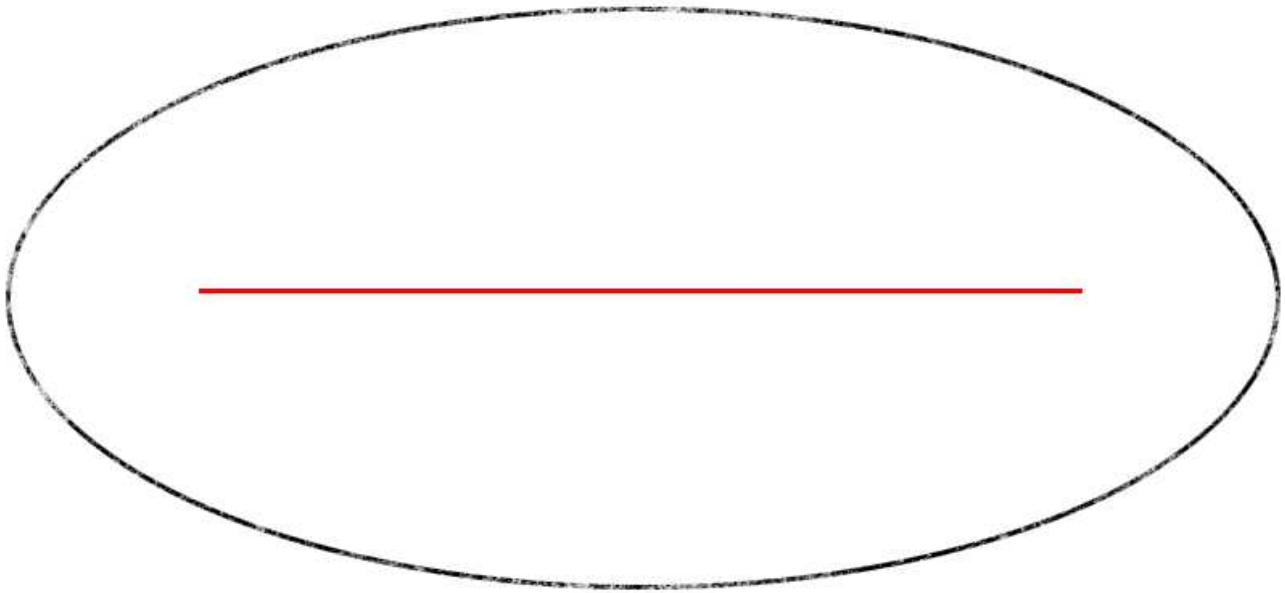
Skeleton - geometrical definition



Unstability of the skeleton



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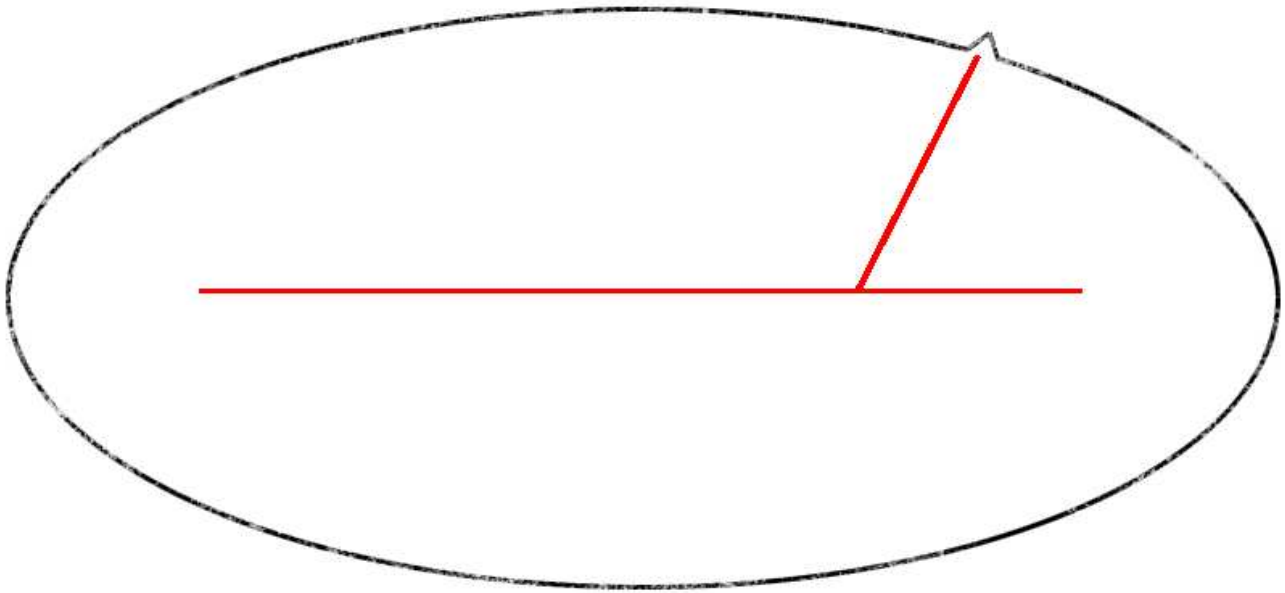
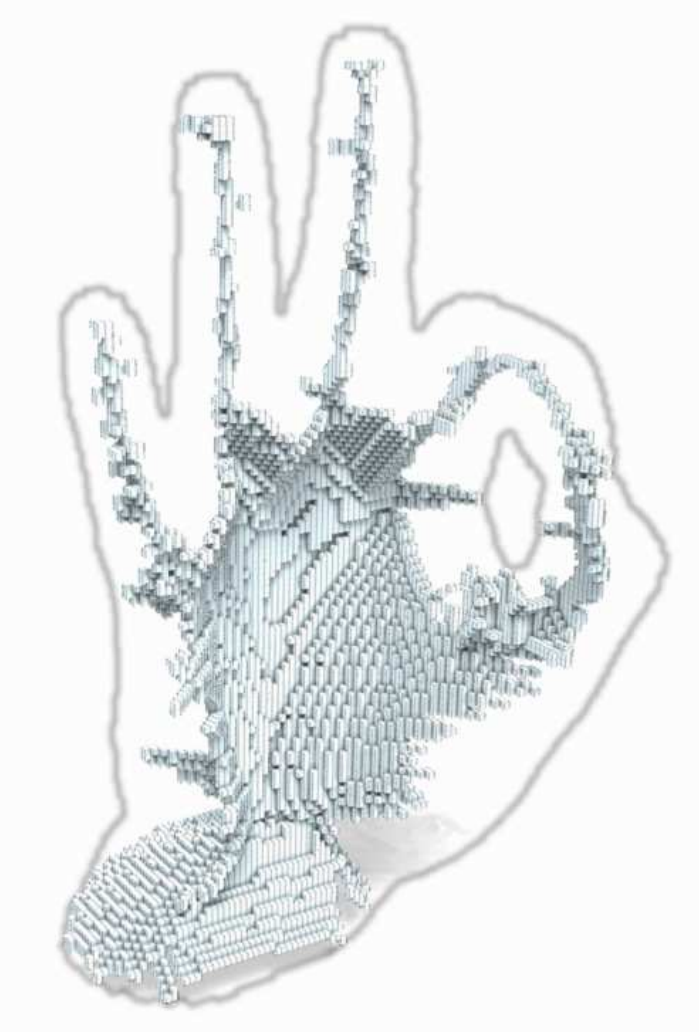
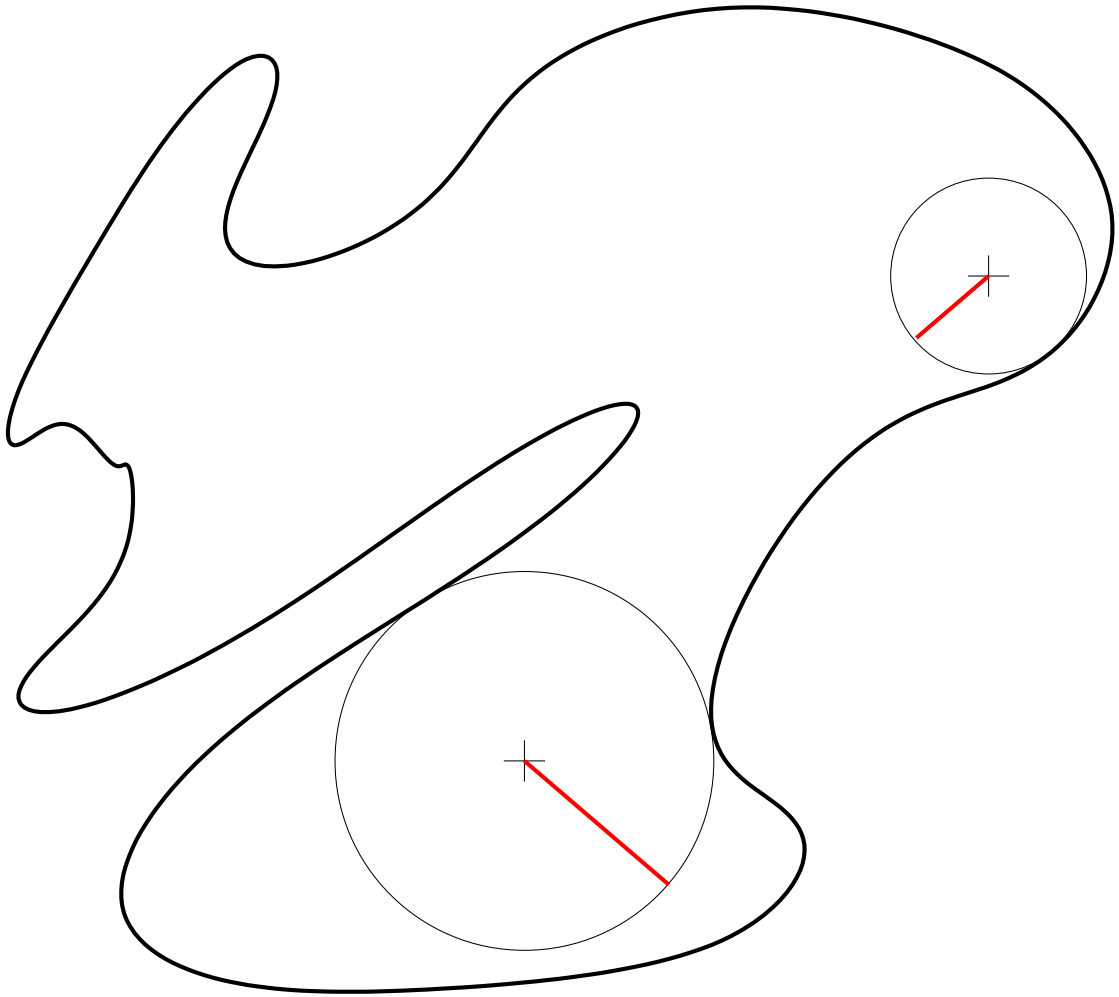


Unstability of the skeleton

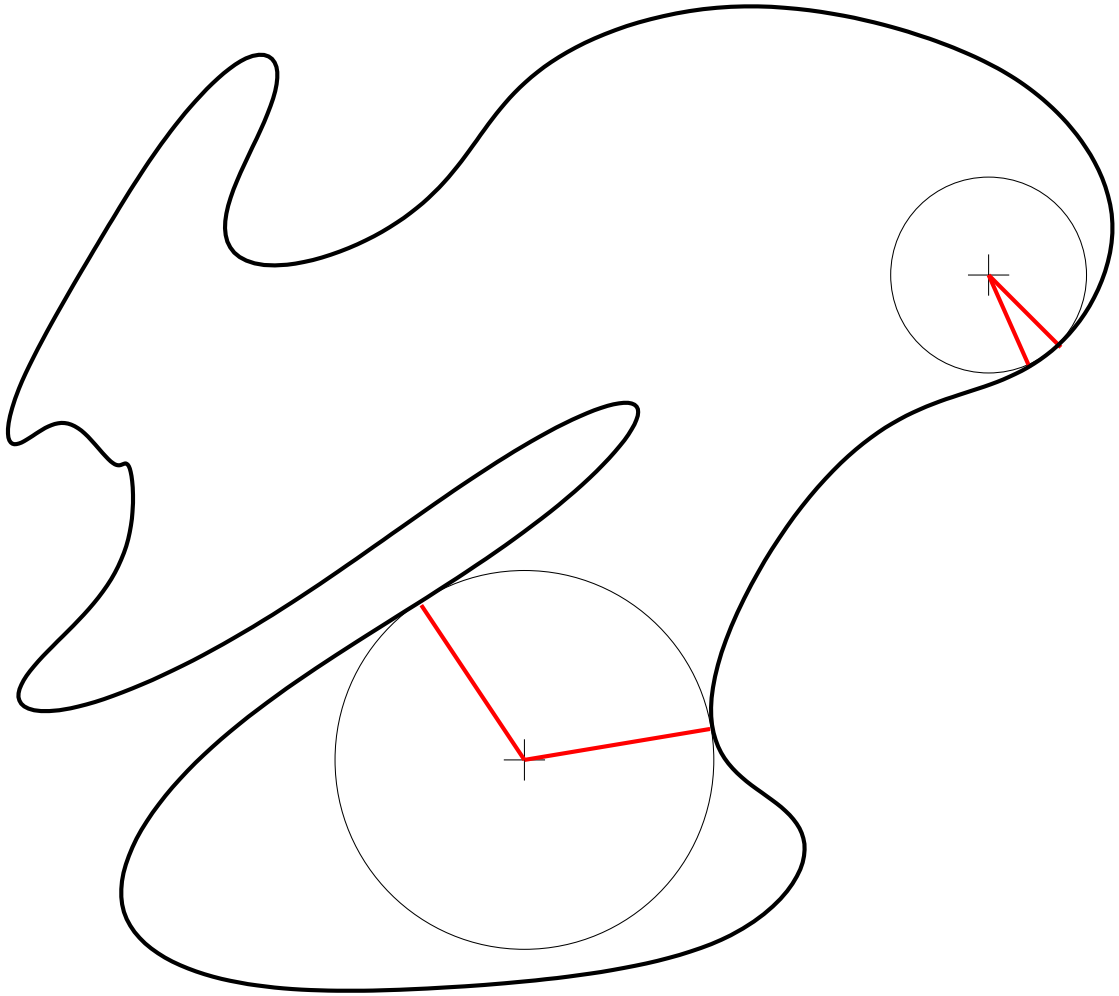


Unstability of the skeleton

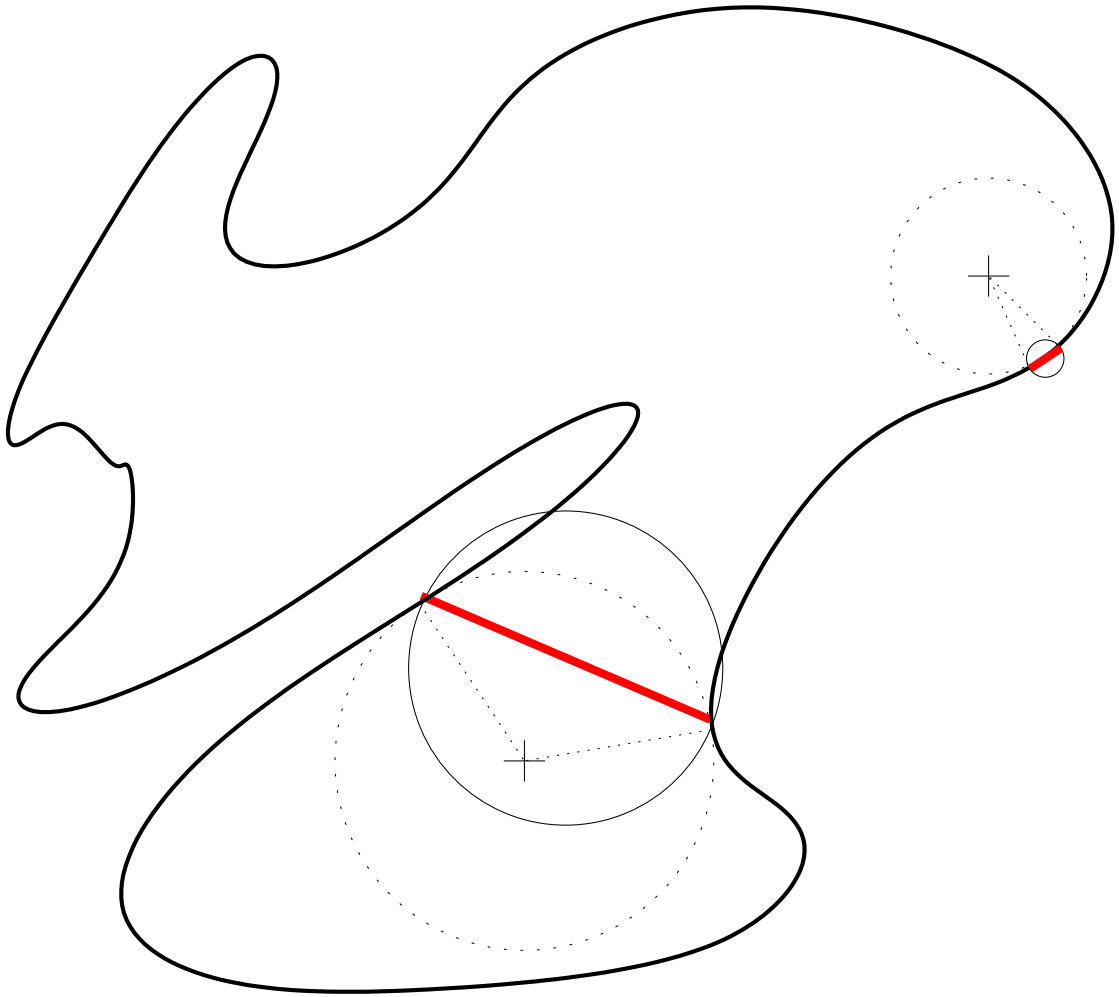
Filtered skeletons 1 (ball radius)



Filtered skeletons 2 (bisector angle)



Filtered skeletons 3a (projection radius)



Filtered skeletons 3b (projection radius)

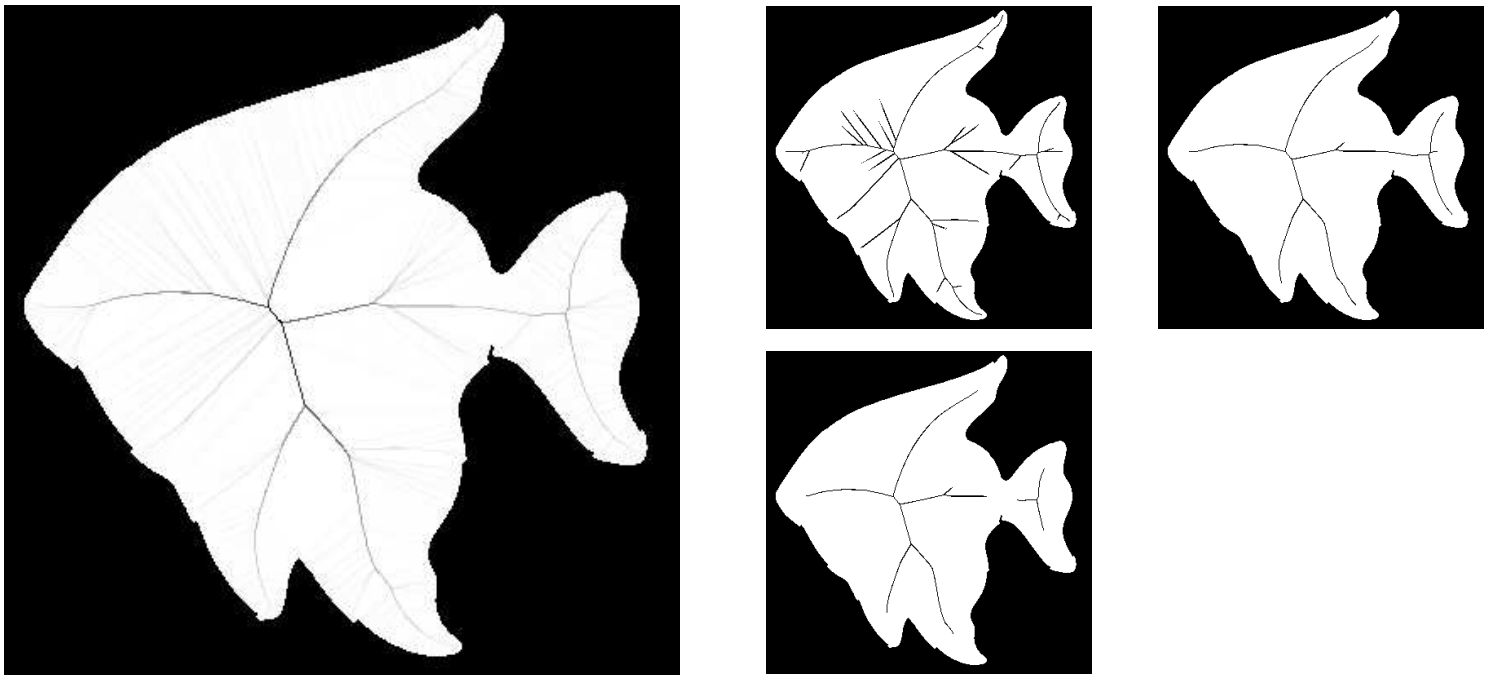
- [Chazal, Lieutier 05] λ-medial axis

Property:
For "regular" values of λ, the λ-medial axis remains stable under perturbations of the shape that are small with regard to the Hausdorff distance

- [Chaussard, Couprie, Talbot 09] Discrete λ-medial axis (DLMA)

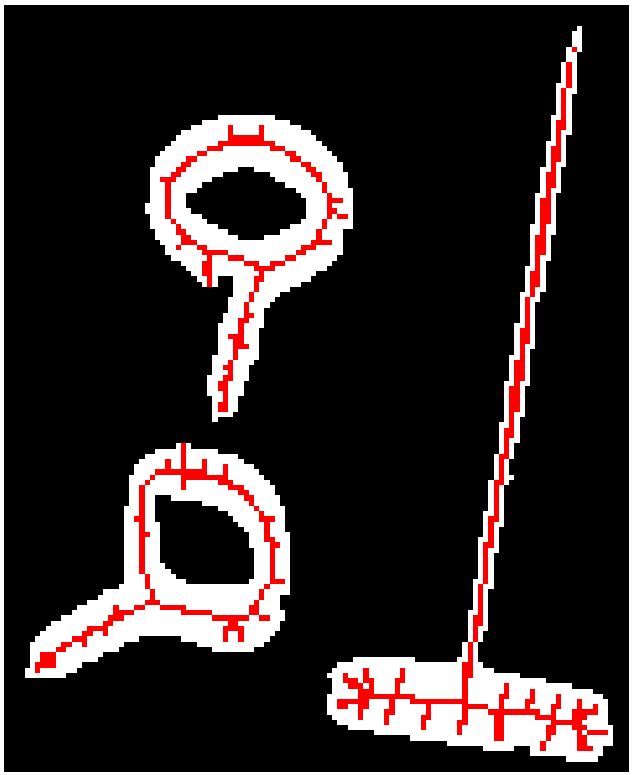
Filtered skeletons 3c (projection radius)

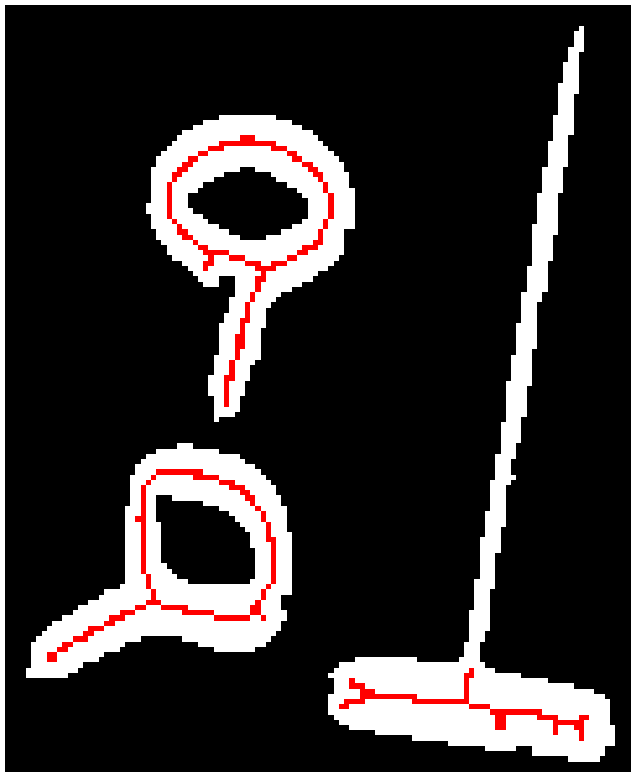
Discrete λ-medial axis (DLMA)



Left: The function PR_S (Projection Radius) superimposed to the shape S.
Right: Any DLMA of S is a level set of this function at a particular value λ.

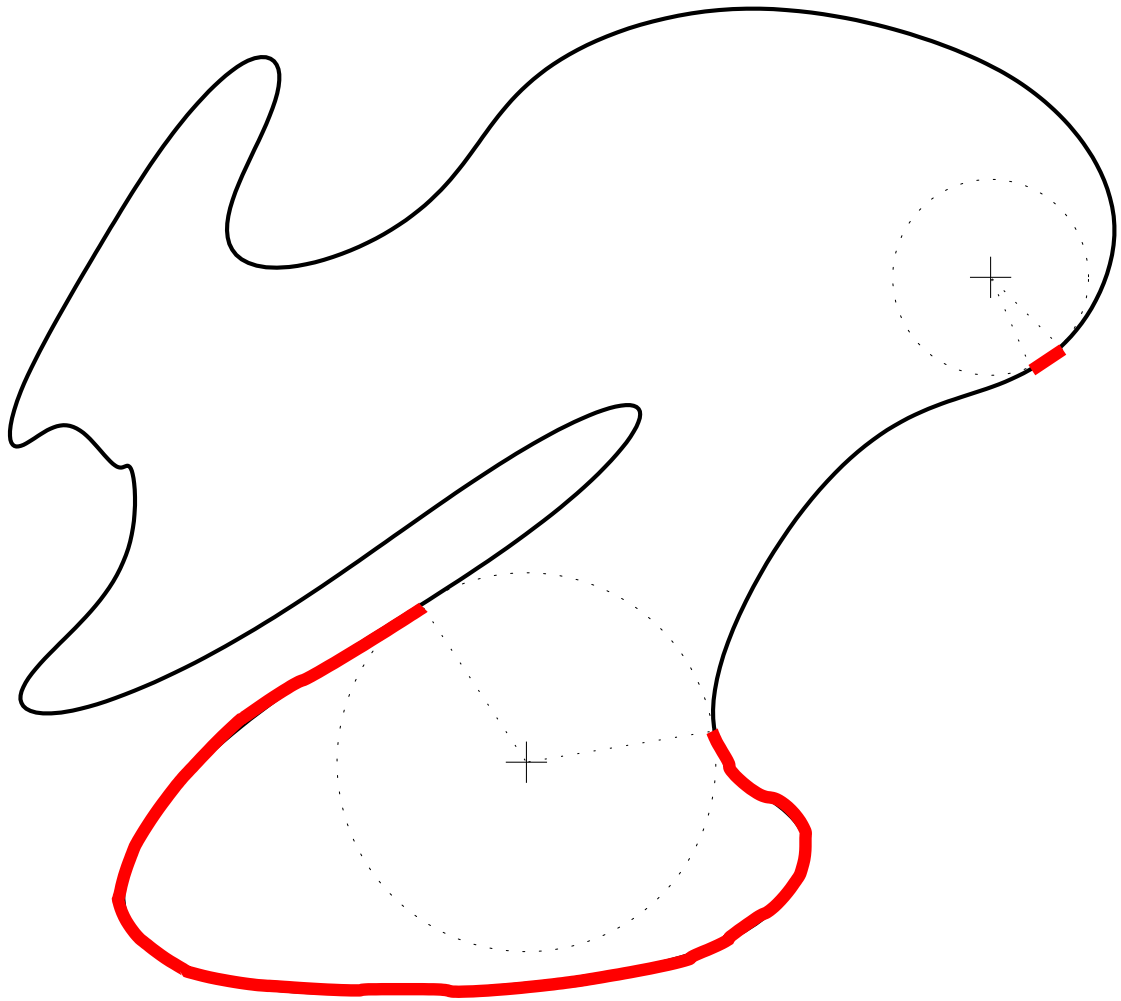
Stability with respect to the filtering parameter





Left: A shape and its λ-medial axis, with $\lambda = 2$.
Right: Idem, with $\lambda = 3$.

Filtered skeletons 4a (border portion length)



Filtered skeletons 4b (border portion length)

- [Ogniewicz, Kübler 95] Hierarchic Voronoi skeletons
- [Pierrot-Desilligny, Stamon, Suen 98] Veinerization
- [Falcao, da Fontoura-Costa, da Cunha 02] Multiscale skeletons

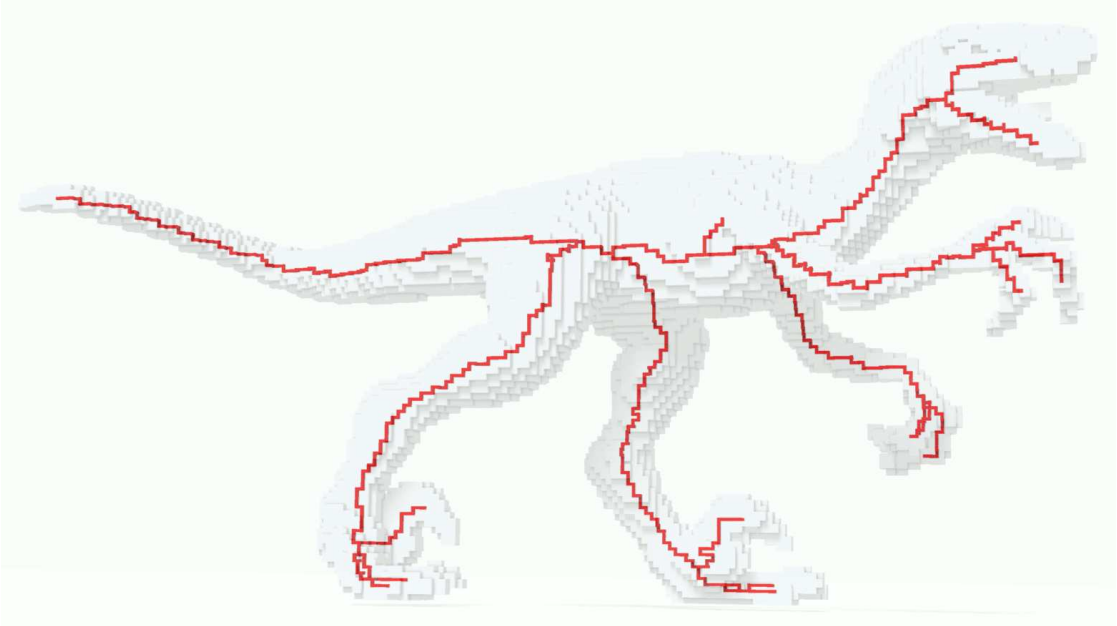
+: stable with respect to the filtering parameter

—: topology preservation not guaranteed in discrete grids

—: limited to 2D

Contributions

- A new framework for hierarchic skeletons
- Purely discrete
- Generalizes previously proposed approaches
- Efficient algorithms
- Proofs of algorithms and properties



Thank you for your attention.

Contact

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