Extraction of tubular and tree structures biomedical images using minimal paths and tubular models.

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Tubular and tree structures appear very commonly in biomedical images like vessels, microtubules or in different imaging of neuron cells. Minimal paths have been used for long in order to segment these structures. They are a way to find a (set of) curve(s) globally minimizing the geodesic active contours energy. It can be solved by the fast and efficient Fast Marching method. The user usually provides start and end points and gets the minimal path as output.

In the past years we have introduced different extensions of these minimal paths that improve either the interactive aspects or the results. For example, we proposed a way to obtain a closed curve from a single initial point by adding iteratively what we called the keypoints. The result is then a set of minimal paths between pairs of keypoints. This can also be applied to branching structures in both 2D and 3D images. We also proposed different criteria to obtain automatically a set of end points of a tree structures by giving only one starting point. More recently, we proposed a method that takes into account both scale and orientation of the path. This leads to solving an anisotropic minimal path in a 2D or 3D+radius space.

The work we will present involved as well F. Benmansour, Y. Rouchdy and J. Mille at CEREMADE.