Inverse Problem of Lindenmayer Systems on Branching Structures

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Abstract: Lindenmayer Systems (L-Systems) have been used to generate and describe the geometrical structures for example, branching structures, graph structures, both in biology and medicine. L-System consists of a number of iteration n, an initial string ω and set of production rules P. The production rules are a set of predecessor a and successor χ. They are written as the form $a \longleftarrow \chi$. The production rules have been defined and analyzed from the real structure by structure decomposition manually. The rules are compiled and transformed to represent 2D and 3D structure. However, the complicated structures are not easy to decompose and time consuming to get such production rules. In this paper, we propose the algorithm to solve this problem automatically from 2D input images by given initial pixels or voxels. The data acquisition can be retrieved from 2D image scanner, camera, CT-Scanner or MRI. The methods namely "Region and Volume Growing Method" are applied to bound the target object. The skeletonization process is an important part in our reconstruction. The L-System is reconstructed for representing the structure from 2D input image or sliced images of the volume data.

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