

DORETTE PRONK, Department of Mathematics and Statistics, Dalhousie University, Halifax, NS B3H 3J5
Touching Wood—the Shape of Fractal Trees

In this talk we study non-overlapping symmetric binary fractal trees as representations of the free monoid $M(L, R)$ on two generators L and R . Such a tree is determined by an angle θ and a scaling ratio r , such that the interiors of its branches do not overlap.

Motivated by techniques from shape theory and computational topology we consider for each fractal tree the homology of its inverse system of closed ε -neighbourhoods. We show that holes in these ε -neighbourhoods are determined by certain pairs of “contact vertices” on the tree and use this to identify different types of holes.

This leads us to consider a coloured version of the “topological barcode” (as introduced by Carlsson *et al.* in [1]) of a fractal tree. The topological barcode encodes for each hole its persistence interval, that is, the interval of the epsilon values for which this hole exists. Moreover, there is a natural action of the monoid $M(L, R)$ on the coloured barcode. This will lead to several new classifications of symmetric binary fractal trees. Tara Taylor will discuss this in more detail in her presentation in this session, including several interesting “golden” examples.

This is joint work with Tara Taylor (St. Francis Xavier University).

References

- [1] G. Carlsson, A. Zomorodian, A. Collins and L. Guibas, *Persistence barcodes for shapes*. In: Symposium on Geometry Processing, Nice, France, July 8–10, 2004 (can also be found on the website math.stanford.edu/comptop/preprints/).