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Loops in hierarchical channel networks[1] ELENI KATIFORI, MARCELO MAGNASCO, Rockefeller University — Nature provides us with many examples of planar distribution and structural networks having dense sets of closed loops. An archetype of this form of network organization is the vasculature of dicotyledonous leaves, which showcases a hierarchically-nested architecture. Although a number of methods have been proposed to measure aspects of the structure of such networks, a robust metric to quantify their hierarchical organization is still lacking. We present an algorithmic framework that allows mapping loopy networks to binary trees, preserving in the connectivity of the trees the architecture of the original graph. We apply this framework to investigate computer generated and natural graphs extracted from digitized images of dicotyledonous leaves and animal vasculature. We calculate various metrics on the corresponding trees and discuss the relationship of these quantities to the architectural organization of the original graphs. This algorithmic framework decouples the geometric information from the metric topology (connectivity and edge weight) and it ultimately allows us to perform a quantitative statistical comparison between predictions of theoretical models and naturally occurring loopy graphs.

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