Title: A representation of the topological complexity of a 2D binary digital image using Homological Spanning Forests.

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ABSTRACT: The topological structure of a binary 2D image based on square pixel vary according to the adjacency criterium among its pixels. The most common adjacency criterium are those of 4 and 8-connectivity, that is, the socalled Moore and Von Neumann neighborhoods. Here we propose a graph structure containing both the (4,8) and the (8,4) adjacency trees and their corresponding connected-component inclusion relationships. This graph can be obtained by relating the Homological Spanning Forests (HSF) of both the image and its complementary. Due to this, the time complexity of the algorithm is near to the logarithmic of the number of pixels because of the inherent parallel nature of the HSF computing. The solid definition of this graph structure allows to compress the image in a topological down-sampling form, that is, reducing the image to a smaller one having the same set of 4 and 8-regions and their complete adjacency relations than the original one. Different measures can be quickly computed from that structure, which promise to be useful to topologically distinguish binary patterns.