Topology-Driven Learning for Biomedical Imaging Informatics

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Abstract

Thanks to decades of technology development, we are now able to visualize in high quality complex biomedical structures such as neurons, vessels, trabeculae and breast tissues. We need innovative methods to fully exploit these structures, which encode important information about underlying biological mechanisms. In this talk, we explain how topology, i.e., connected components, handles, loops, and branches, can be seamlessly incorporated into different parts of a learning pipeline. Under the hood is a formulation of the topological computation as a differentiable operator, based on the theory of topological data analysis. This leads to a series of novel methods for segmentation, generation, and analysis of these topology-rich biomedical structures.

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