Mathematics and CS Seminar

GeomTop Seminar: Applying Persistent Homology in Machine Learning

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We present some recent applications of persistent homology in machine learning. First, we introduce a metric shape space based on a topological representation of 2D/3D objects. The metric allows to use classic metric-based machine learning algorithms, e.g., k-nearest neighbors or k-means clustering. Next, we establish a relation between end-to-end learnable deep neural networks and persistence barcodes. The key contribution here is the construction of parametrized vectorization schemes which respect the stability properties of persistent homology computation. These vectorization schemes can be implemented as a learnable input layer for neural networks, yielding an approach for supervised end-to-end learning in the regime of persistence barcodes. Finally, we leverage that Vietoris-Rips persistent homology is locally differentiable and apply this insight to impose topological constraints on the latent representations learned by an autoencoder. These representations show beneficial properties for kernel density based one-class learning.

Wednesday, March 27, 2019 01:00pm - 02:15pm

Mondi Seminar Room 3, Central Building