From persistent homology to machine learning

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Persistent homology measures both the global topology and the local geometry of a dataset.
Global topology
Global topology

Topology of cyclo-octane energy landscape
Martin, Thompson, Contsias, Watson, 2010
Global topology

Topology of cyclo-octane energy landscape
Martin, Thompson, Coutsias, Watson, 2010
Global topology

On the local behavior of natural images
Carlsson, Ishkhanov, de Silva, Zomorodian, 2008
Local geometry

Measures of order for nearly hexagonal lattices
Motta, Neville, Shipman, Pearson, Bradley, 2018
Local geometry

Persistent homology analysis of brain artery trees
Bendich, Marron, Miller, Pieloch, Skwerer, 2014
Local geometry

Persistent homology analysis of brain artery trees
Bendich, Marron, Miller, Pieloch, Skewer, 2014
Local geometry

Collective motion, self-organization
Local geometry

Collective motion, self-organization

Topological data analysis of biological aggregation models
Topaz, Ziegelmeier, Halverson, 2015
Local geometry

Collective motion, self-organization

Topological data analysis of biological aggregation models
Topaz, Ziegelmeier, Halverson, 2015
Local geometry

Analysis of Kolmogorov flow and Rayleigh–Bénard convection using persistent homology
Kramár, Levanger, Tithof, Suri, Xu, Paul, Schatz, Mischaikow
Local geometry

Statistical topological data analysis using persistence landscapes
Bubenik, 2015
Local geometry

Persistence images: A stable vector representation of persistent homology. Adams, Chepushanova, Emerson, Hanson, Kirby, Motta, Neville, Peterson, Shipman, Ziegelmeier, 2017
Local geometry

Answer: (from left) r = 1.75, 2, 1.75, 2, 2.

Persistence images: A stable vector representation of persistent homology. Adams, Chepushtanova, Emerson, Hanson, Kirby, Motta, Neville, Peterson, Shipman, Ziegelmeier, 2017
Local geometry

Persistence images: A stable vector representation of persistent homology. Adams, Chepushtanova, Emerson, Hanson, Kirby, Motta, Neville, Peterson, Shipman, Ziegelmeier, 2017
Local geometry

Persistence images: A stable vector representation of persistent homology. Adams, Chepushtanova, Emerson, Hanson, Kirby, Motta, Neville, Peterson, Shipman, Ziegelmeier, 2017
Local geometry

Persistent homology detects curvature
Bubenik, Hull, Patel, Whittle, 2019
Local geometry

A fractal dimension for measures via persistent homology
Adams, Aminian, Farnell, Kirby, Peterson, Mirth, Neville, Shonkwiler, 2020
Local geometry

A fractal dimension for measures via persistent homology
Adams, Aminian, Farnell, Kirby, Peterson, Mirth, Neville, Shonkwiler, 2020
Local geometry

On the choice of weight functions for linear representations of persistence diagrams
Divol and Polonik, 2019
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