

Otto-von-Guericke-Universität Magdeburg
Fakultät für Mathematik

Auf Einladung des Institutes für Algebra und Geometrie spricht

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über das Thema

Multiparameter persistent cohomology and local duality

Zeit: Dienstag, 15. Oktober 2024, 13.00 Uhr, G02-210

Zu diesem Vortrag laden wir alle Interessierten herzlich ein.

Prof. Dr. Thomas Kahle

Abstract: Persistent homology, a central tool in topological data analysis, is a multi-scale approach to analyzing the topology of spaces from finite samples. Specifically, persistent homology assigns to data a filtered topological space and computes its homology at different scales simultaneously. The outcome is a simple to grasp descriptor, the so-called barcode, which summarizes the scales along which a specific topological features persist.

In the case of Vietoris-Rips complexes, which is a common choice in the field, computing the barcode is computationally involved, and efficient implementations rely on the fact that there is a one-to-one correspondence between the barcodes of persistent homology and cohomology. While both contain the same information, the standard algorithm of persistence calculates the latter much faster than the former, which is particularly true if the so-called clearing-optimization scheme is applied.

However, it has been unclear for a while how this correspondence between the barcodes of persistent homology and cohomology generalizes to the case of multi-parameter persistence, as there are no barcodes in this setup. Using minimal free resolutions as one possible generalization of barcodes, we show that under mild conditions, there is an analogous correspondence between resolutions of persistent homology and cohomology for any number of parameters. For the two-parameter case, we propose an algorithm for persistent cohomology computation that allows for an optimization similar to clearing. This algorithm is implemented in our publicly available software package 2pac.