The multi-cover persistence of Euclidean balls

Herbert Edelsbrunner[1] and Georg Osang[2]

[1]IST Austria, edels@ist.ac.at
[2]IST Austria, Georg.Osang@ist.ac.at

Given a locally finite set X in $\mathbb{R}^d$ and a positive radius, the k-fold cover of X and r consists of all points that have k or more points of X within distance r. The order-k Voronoi diagram decomposes the k-fold cover into convex regions, and we use the dual of this decomposition to compute homology and persistence in scale and in depth.

The persistence in depth is interesting from a geometric as well as algorithmic viewpoint. The main tool in understanding its structure is a rhomboid tiling in $\mathbb{R}^{d+1}$ that combines the duals for all values of k into one. We mention a straightforward consequence, namely that the cells in the dual are generically not simplicial, unless $k = 1$ or $d = 1, 2$.