Part IV
Persistence

Persistent homology addresses a major weakness of homology, namely its instability under small changes. Reconstructing a tire by scanning its surface and connecting the millions of points into a triangulation, we expect a torus, but if we miss only one percent of one percent of the triangles, the first Betti number will be in the hundreds rather than equal to two. The theory of persistence is inspired by Morse theory and related to spectral sequences, both topics studied in topology. It adds a quantitative component to the Betti numbers that is stable under perturbations. Perhaps most importantly, it captures the various scales under which a dataset can be interpreted in one consistent formalism.