R Package TDA:
Statistical Tools for Topological Data Analysis
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Abstract
This poster gives an introduction to the R package TDA, which provides some tools for Topological Data Analysis. The salient topological features of data can be quantified with persistent homology. R package TDA provides an R interface for the efficient algorithms of the C++ libraries GUDHI, Dionysus, and PHAT, including functions for computing the persistent homology. The R package TDA also includes an algorithm for the cluster tree that corresponds to the density clustering.

Distance Functions and Density Estimators
- **R package TDA** provides various distance functions and density estimators computed over a grid of points.

- **gridDiag()** computes the persistent homology of sublevel (and superlevel) sets of the input function.

- **ripsDiag()** computes the persistent homology of the Rips filtration built on top of a point cloud.

- **bootstrapBand()** computes \((1-\alpha)\) bootstrap confidence band.

Persistent Homology
- Persistence homology computes homologies on collection of sets, and tracks when topological features are born and when they die.

- The function gridDiag() computes the persistent homology of sublevel (and superlevel) sets of the input function.

- The function ripsDiag() computes the persistent homology of the Rips filtration built on top of a point cloud.

- The function bootstrapBand() computes \((1-\alpha)\) bootstrap confidence band.

Cluster Trees
- For any function \(f\), the cluster tree of \(f\) is a function \(T_f\), where \(T_f(\lambda)\) is the set of the connected components of the upper-level set \(\{x : f(x) \geq \lambda\}\).

- The function clusterTree() computes the cluster tree.

Reference
Brittany Terese Fasy, Jisu Kim, Fabrizio Lecci, Clément Maria, and Vincent Rouvreau, Introduction to R Package TDA