

Barcodes for multiparameter persistence

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Multiparameter persistence is a generalization of persistent homology that allows for more than a single filtration function. Such constructions arise naturally when considering data with outliers or variations in density, time-varying data, or functional data.

In single-parameter persistence, the barcode is equivalent to the “rank invariant”: the function that associates the rank of the corresponding linear map to every pair of comparable points. However, nearly all of the tools developed in persistent homology are based on the barcode. This is because it is a concise and geometric descriptor that lends well to data analysis and visualization. Therefore, it is crucial, and perhaps imperative, to construct a generalized barcode to work with the rank-invariant for multiparameter persistence efficiently.

Perhaps surprisingly, recent work has shown that if we allow the elements of the barcode to be signed intervals, then such a generalization is possible. I will discuss how one can use homological algebra to obtain a signed barcode in a stable manner. Furthermore, I will discuss how signed barcodes can be used in machine learning and report on recent computational results.

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