## On the Metric Distortion of Embedding Persistence Diagrams into Reproducing Kernel Hilbert Spaces

Ulrich Bauer Technical University of Munich mail@ulrich-bauer.org

Persistence Diagrams (PDs) are important feature descriptors in Topological Data Analysis. Due to the nonlinearity of the space of PDs equipped with their *diagram distances*, most of the recent attempts at using PDs in Machine Learning have been done through kernel methods, i.e., embeddings of PDs into Reproducing Kernel Hilbert Spaces (RKHS), in which all computations can be performed easily. Since PDs enjoy theoretical stability guarantees for the diagram distances, the *metric properties* of a kernel k, i.e., the relationship between the RKHS distance  $d_k$  and the diagram distances, are of central interest for understanding if the PD guarantees carry over to the embedding.

We study the possibility of embedding PDs into RKHS with bi-Lipschitz maps. In particular, we show that when the RKHS is infinite dimensional, any lower bound must depend on the cardinalities of the PDs, and that when the RKHS is finite dimensional, finding a bi-Lipschitz embedding is impossible, even when restricting the PDs to have bounded cardinalities.

Joint work with: Mathieu Carrière (INRIA Paris-Saclay).