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Michael Lesnick* (mlesnick@princeton.edu) and **Andrew Blumberg**. *Universality of the Homotopy Interleaving Distance*.

As a step towards establishing homotopy-theoretic foundations for the theory of persistent homology, we introduce and study *homotopy interleavings* between filtered topological spaces. These are homotopy-invariant analogues of *interleavings*, objects commonly used in topological data analysis to articulate stability and inference theorems. Whereas ordinary interleavings can be interpreted as pairs of “approximate isomorphisms” between filtered spaces, homotopy interleavings can be viewed as pairs of “approximate weak equivalences.”

Our main results are that homotopy interleavings induce an extended pseudometric d_{HI} on filtered spaces, and that this is the universal pseudometric satisfying natural stability and homotopy invariance axioms. We also show that d_{HI} (or more generally, any pseudometric satisfying these two axioms and an additional “homology bounding” axiom) can be used to formulate lifts of several fundamental topological data analysis theorems from the algebraic (homological) level to the level of filtered spaces. (Received September 18, 2016)