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Homotopy and persistent homology using closure spaces

I will develop homotopy and persistent homology in the setting of filtrations of Cech's closure spaces. Examples of filtrations of closure spaces include metric spaces, weighted directed graphs, and filtrations of topological spaces. Closure spaces have more products and intervals than topological spaces, giving us six homotopy theories, six cubical singular homology theories, and three simplicial singular homology theories. Applied to filtrations of closure spaces, these homology theories produce persistence modules. I will extend the definition of Gromov-Hausdorff distance from metric spaces to filtrations of closure spaces and use it to prove that any persistence module obtained from a homotopy-invariant functor on closure spaces is stable.

This is joint work with Nikola Milicevic.