

Persistent Homology and Applications

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Abstract

Persistence is a recent extension of the classic concept of homology in algebraic topology. Motivated by the instability of homology to slight changes in the space, we start with a filtration and use the induced maps connecting the homology groups to trace the classes. The information is collected in a planar diagram, which is an invariant of the filtration.

Overcoming the instability of the classic theory is one reason why persistence has found many applications in the sciences and engineering, the existence of fast algorithms is another. They take only seconds to compute diagrams of complexes that reach hundreds of thousands or millions of elements, sizes that are not unusual in applications, which we find in geometry processing, data visualization, medical imaging, biological shape analysis, high-dimensional data analysis, and other areas.

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