

Is the persistence diagram really a stable data descriptor?

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Abstract

It is well known that persistence diagrams stably behave under small perturbations to the input data. This is the consequence of stability theorems, firstly proved by Cohen-Steiner, Edelsbrunner, and Harer (2007), and then extended by several researchers. On the other hand, if the input data is realized in a high-dimensional space with a small noise, the curse of dimensionality (CoD) causes serious adverse effects on data analysis, especially leading to inconsistency of distances. In this talk, I will show several examples of CoD appearing in persistence diagrams (e.g., from single-cell RNA sequencing data in biology). Those examples demonstrate that the classical stability theorems are not sufficient to guarantee stable behaviors of persistence diagrams for high-dimensional data. Then I will show several mathematical results about the existence and the (partial) resolution of CoD in persistence diagrams. This is a joint work with Liu Enhao, Yusuke Imoto and Shu Kanazawa.