

CURSE OF DIMENSIONALITY IN PERSISTENCE DIAGRAMS — HOW TO CHARACTERIZE
TOPOLOGY IN SINGLE-CELL RESOLUTION —

Yasu Hiraoka

Kyoto, Japan

`hiraoka.yasuaki.6z@kyoto-u.ac.jp`

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 and mappers (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 Enhao Liu, Yusuke Imoto and Shu Kanazawa.