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THE SPACE OF PERSISTENCE DIAGRAMS FAILS TO HAVE YU'S PROPERTY A

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ABSTRACT. We define a simple obstruction to Yu's property A that we call k-prisms. This structure allows for a straightforward proof that the space of persistence diagrams fails to have property A in a Wasserstein metric.

1. Introduction

A persistence diagram is one way to visualize the persistent homology of a dataset [5]. Persistent homology allows the power of algebraic topology to be leveraged against problems in diverse disciplines [4], [8].

The space of persistence diagrams can be equipped with several natural metrics, which provide the key feature of persistence diagrams, known as stability: datasets that are close give rise to persistence diagrams that are close. In this brief note, we investigate the coarse geometric properties of persistence diagrams in a family of these natural metrics.

Coarse geometry arose out of the study of metric properties of finitely generated groups. Since M. Gromov's seminal paper [6], coarse geometry has established itself as an interesting subject in its own right. In [13], Guoliang Yu defines a simple condition of discrete metric spaces called property A that implies the existence of a uniform embedding into Hilbert space. Piotr W. Nowak [10] provides a simple example of a space that fails to have property A yet still admits a uniform embedding into Hilbert space.

In Theorem 2.6, we provide a simple obstruction to property A that we call k-prisms. This structure allows for an isometric embedding of the simplest version of Nowak's example into the metric space in question.

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