Topological Signal Processing Definitions and random thoughts

Mauricio Montes

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1 Introduction

This document is for me to keep track of the definitions and ideas I have about topological signal processing. This will probably get long, so maybe we can chunk it later. I'm not sure if I want to start all the way with the definition of a topological space. But I think I can start with the ideas of homology and cohomology.

2 Definitions

2.1 Simplicial Homology

The central objects of simplicial homology are simplicial complexes.

- A k-**simplex** is the convex hull of a set of $k+1$ points in some Euclidean space. We can think of a 0-simplex as a vertex. A 1-simplex is an edge, a 2-simplex is a triangle, and so on.
- A **simplicial complex** is a collection of simplices such that the intersection of any two simplices is either empty or another simplex.
- The **dimension** of a simplicial complex is the maximum dimension of any of the simplices in the complex.

We can count the holes of these simplicial