Making the skeletons of shapes dance.

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Motivation

- Shapes are all around us. Topology is the mathematical study of shapes
- To better understand shapes we will build a bridge from topology to graph theory, by approximating shapes via their 1-skeletons.

Project Description

Topology is continuous and infinite (like calculus). Graph theory is finite and combinatoric (like a computer program).

By approximating shapes via their skeletons we can bring tools from one domain to bear on the other.

The aim of the project is to build the bridge, and to map out future work in which the bridge can be exploited.

It is intended that this future work would enable progress both in theoretical topology, but also in data analysis.

Context

- Graph theory has seen recent rapid progress., in part driven by the demands of data analysis.
- Applying these modern graph theory tools to understanding topological shapes will be innovative and impactful.

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A **bridge** will be built between the continuous, infinite world of **shapes** and the Finite, discrete domain of **graphs** via **shape-skeletons.**

Project Deliverables

- A mathematical connexion will be constructed between shapes and graphs. This will likely lead to published papers.
- The PI (an expert in topology) will deepen their skills in the relevant areas of graph theory.
- A plan will be developed mapping out future applications and developments. Funding applications will be made based on this plan.

Potential Impact

- Shapes are all around us – not just physical 3-d shapes, but also in data from simulations, or even more abstractly, in real-world data. Better understanding of shapes impacts us all.
- The proposed bridge, combined with the new tools now available to graph theorists, could result in an entirely new and novel of topology, indeed of how we do topology.
- Because the bridge connects topology to graph theory – which is finitistic and `computable', topologyy, to, will become `computable', opening up completely new applications.