

Functional Data Analysis using a Topological Summary Statistic: the Smooth Euler Characteristic Transform

Lorin Crawford, Brown University

In this talk, we introduce a novel statistic, the smooth Euler characteristic transform (SECT), which is designed to integrate shape information into regression models by representing shapes and surfaces as a collection of curves. Due to its well-defined inner product structure, the SECT can be used in a wider range of functional and nonparametric modeling approaches than other previously proposed topological summary statistics. We illustrate the utility of the SECT in a radiomics context by showing that the topological quantification of tumors, assayed by magnetic resonance imaging (MRI), are better predictors of clinical outcomes in patients with glioblastoma multiforme (GBM). We will close by showing that SECT features alone explain more of the variance in patient survival than gene expression, volumetric features, and morphometric features.