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Edge Detecting New Physics the Voronoi Way

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Interesting features in high energy physics data can be determined from properties of Voronoi tessellations of the relevant phase space. We focus on the detection of kinematic “edges” in two dimensions, which may signal physics beyond the standard model. After deriving some useful geometric results for Voronoi tessellations on perfect grids, we propose several algorithms for tagging the Voronoi cells in the vicinity of kinematic edges in real data. In addition, we show that how Voronoi based methods help to find the available phase space boundary which can be utilized for mass measurement of new physics particles.

Summary

We argue that the discovery of new kinematic features is an essential step in the discovery of physics beyond the standard model and advocate the use of Voronoi methods for this purpose. The great flexibility of Voronoi methods is a blessing for the experimentalist; many useful properties of the Voronoi cells can be used to construct powerful variables tailored to specific new physics scenarios.

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