

High Dimensional Data Analysis and Exploration

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In the age of ever large simulations, more sophisticated experiments and pervasive logging of information finding and exploring complex non-linear relationships in large, multi-variate data is one of the key challenges to derive new insights. In practice, the challenge is two-fold: First, to develop new analysis techniques that can discover local, non-linear relationships between variables; and Second, how to convey the results to non-expert stakeholders and policy makers. One attractive strategy is to use topological techniques which provide abstract yet powerful concepts to explore large data sets. In this talk we show how formulating problems in terms of analyzing high dimensional functions leads to novel analysis techniques and intuitive visualizations. We will present a number of case studies from high energy physics where topological techniques have provided unique insights. Furthermore, we show how topology can both enhance traditional visualizations like scatterplots as well as provide new intuitive visual metaphors like topological spines.