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A Statistician's View on Model-Independent Searches of New Physics at the Large Hadron Collider

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A central goal in experimental high energy physics is to detect new signals that appear as deviations from known Standard Model physics in high-dimensional particle physics data. To do this, one seeks to determine whether there is a statistically significant difference between the distribution of Standard Model background samples and the distribution of the experimental observations, which are a mixture of the background and a potential new signal. Traditionally, this is done by assuming access to reliable samples from both the Standard Model background and the hypothesized signal distribution. In recent years, model-independent searches, where this assumption is relaxed, have gained widespread attention within HEP in order to increase the sensitivity of LHC experiments to unexpected new physics signals. In this talk, I will give an overview of the role that model-independent searches play at the LHC with a specific focus on the statistical and methodological challenges involved in these searches. I will focus on cases where these searches are performed in a high-dimensional space with the help of machine learning classifiers and draw connections with the wider literature on anomaly detection and two-sample testing.

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Classification de Session: Invited