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Automatic Model Selection Using Machine Learning Techniques for Event Selection in Particle Physics

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Advances in statistical learning have placed at our disposal a rich set of classification algorithms (e.g., neural networks, decision trees, Bayesian classifiers, support vector machines, etc.) with little or no guidelines on how to select the analysis technique most appropriate for the task at hand. In this paper we present a new approach for the automatic selection of predictive models based on the characteristics of the data under analysis. According to the particular data distribution, our methodology may decide to choose a learning algorithm able to delineate complex decision boundaries over the variable space (but exhibiting an inevitable high variance), or rather instead use an algorithm less complex that delineates coarse decision boundaries (but exhibiting a desirable low bias). Our experimental analysis looks for the identification of stop1 signal at energy of 1.96 TeV. The problem is inherently difficult because of the existence of background data with identical signal signatures. We report results using several metrics (e.g., accuracy, efficiency), and compare the performance of our methodology to a model produced by a domain expert that separates manually signal events from background events.

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