Signal Enhancement Using Multivariate Classification
Techniques and Physical Constraints

Ricardo Vilalta and Puneet Sarda
Department of Computer Science
University of Houston

Gordon Mutchler and Paul Padley
Department of Physics and Astronomy
Rice University

Abstract

We report on an empirical comparison of several multivariate classification techniques (e.g., random forests, Bayesian classification, support vector machines) for signal identification; our experiments use K* mass as a test case. We show 1) the effect of using different cost matrices in generalization performance and 2) how information about physical constraints obtained from kinematic fitting procedures can be used to enhance the original feature representation. The latter step is done through a derivation of Λ particle parameters (e.g., momentum, energy, and mass) using kinematic fitting; the degree of fit using a $\chi^2$ statistic is used as a new feature. Overall, our goal is to investigate how to incorporate physical constraints to improve classification performance.