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Improving Signal Significance of SUSY Compressed Scenarios by Machine Learning Algorithms

Monday 14 November 2022 17:00 (15 minutes)

In this study we evaluate the performance of various machine learning (ML) algorithms for discriminating a SUSY signal from its standard model backgrounds in order to enhance the significance of finding these hypothetical particles. For this aim, we use a case of study of Monte Carlo production of SUSY top squarks from proton collisions at $\sqrt{s} = 13$ TeV with a luminosity of 140 fb^{-1}, following the LHC-Run2 data-taking conditions. We focus on the semileptonic channel of the top squark decay, with mass points along the so-called compressed scenarios. Four ML algorithms have been probed trying to cover different mathematical approaches, for instance: a Logistic Regression (LR), a Random Forest (RF), a Gradient Boost (GB) and a neural network (NN). We compare the performance at maximizing the significance of these ML classifiers with respect to a standard cut-and-count method. As a result we observe that the NN and XG have the best performances with $\sim$17\% improvements followed by the RF algorithm. On the other hand, the LR shows the poorest performance with significances even lower than the reported by the cut-and-count method.

This work has been submitted for publication to International Journal of Modern Physics A (IJMPA) and a preprint has been uploaded to \hyperlink{https://arxiv.org/abs/2106.06813}{arXiv:2106.06813}

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