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Identification of top quark pair event from dileptonic decay channel by machine learning

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To measure the properties of top quark, it is crucial to identify events containing top quark pair first by using discriminators. Currently cut-based discriminators are used to identify such events. This, however, may lead to inaccuracy due to the fact that cut-based discriminators might exclude collision events including top quark pair, or, even worse, include background events in which top quark pair is not present. Thus, we believe machine learning (ML) techniques can be applied to make a more sophisticated discriminator, which can lead to more accuracy on top quark pair identification. A discriminator with a purpose of classifying collision events into signal events including top quark pair and background events in dilepton channel has been developed based on ML techniques. In this project, available Monte-Carlo simulated datasets at CERN Open Data Portal, including signal ($t\bar{t}$ dilepton) and background (Drell-Yan, single top, and diboson), are used to train the discriminator with various ML techniques, such as Boosted Decision Tree, Support Vector Machine, etc. The performance of the discriminator after being trained with several ML techniques are then compared in this project, and are used to classify collision events from data collected by CMS in pp collisions at $\sqrt{s}$ = 7 TeV, also available from CERN Open Data Portal. The result of top quark mass reconstruction where ML-based discriminator is used are also compared to the result where cut-based discriminator is used.

Keywords: ttbar, dilepton channel, machine learning

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