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# Using Unsupervised Machine Learning to Rediscover Standard Model Physics at CMS

Despite extensive search efforts at the LHC, no clear evidence of physics beyond the Standard Model (BSM) has emerged. This raises the possibility that either new physics lies beyond the LHC's reach or we are not searching in the right places. The CMS Level-1 Trigger (L1T) serves as the first step in selecting events for further analysis. If L1T algorithms fail to select events containing new physics, that data will never be analyzed. The CMS experiment has recently implemented CICADA, a novel L1T algorithm that uses machine learning-based anomaly detection to identify and store atypical events based on calorimeter deposit patterns. Any physics process—Standard Model or BSM—with a detector signature that differs from the majority of LHC events can be flagged by CICADA. We present the first studies using CICADA to analyze CMS Run 3 data. As a case study, we focus on top-antitop quark pair production—a Standard Model process that is relatively rare at the LHC which can register as anomalous to the CICADA algorithm. We demonstrate how CICADA can be used to select for this process from QCD background. By showing how an unsupervised trigger can rediscover known phenomena, we highlight CICADA's potential to uncover unknown physics.

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