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Search for new physics using unsupervised machine learning for anomaly detection in $\sqrt{s}$ = 13 TeV pp collisions recorded by the ATLAS detector at the LHC

Searches for new resonances in two-body invariant masses are performed using an unsupervised anomaly detection technique in events produced in pp collisions at a center-of-mass energy of 13 TeV recorded by the ATLAS detector at the LHC. An autoencoder network is trained with 1% randomly selected collision events and anomalous regions are then defined which contain events with high reconstruction losses.Studies are conducted in data containing at least one isolated lepton. Nine invariant masses (m_{jX}) are inspected which contain pairs of one jet (b-jet) and one lepton (e, μ), photon, or a second jet (b-jet). No significant deviation from the background-only hypothesis is observed after applying the event-based anomaly detection technique. The 95% confidence level upper limits on contributions from generic Gaussian signals are reported for the studied invariant masses. The widths of the signals range between 0% and 15% of the resonance mass and masses range from 0.3 TeV to 7 TeV. The obtained model-independent limits are shown to have a strong potential to exclude generic heavy states with complex decays.

Collaboration / Activity

ATLAS

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