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(G*) POS-J106 – Search for New Physics Inside Boosted Jets at the ATLAS Detector Using Anomaly Detection

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Since the discovery of the Higgs boson at the LHC in 2012, no sign of new physics beyond the Standard Model has been found. The SUSY and exotic particles searches have not uncovered signs of new physics, as the model-dependent searches. In recent years, multiple unsupervised machine learning methods have been proposed to search for new physics at the LHC. This poster will explore the use of a variational auto-encoder (VAE) to perform a general search in proton-proton collisions at the LHC using large radius jets in ATLAS simulation data. To test our workflow, we trained the algorithm on low-level jet information to differentiate between the dominant QCD background and a chosen test signal corresponding to top quark jets. The most anomalous jets predicted by the VAE were selected to plot the invariant mass spectrum and to find the top quark mass peak. Our study found an important correlation between the jet invariant mass and the loss function of the VAE, resulting in a sculpting of our background and preventing the apparition of the top peak. We successfully used a mass-decorrelation method based on Outlier Exposure to prevent this sculpting.

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