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Unsupervised tagging of semivisible jets with normalized autoencoders in CMS

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A particularly interesting application of autoencoders (AE) for High Energy Physics is their use as anomaly detection (AD) algorithms to perform a signal-agnostic search for new physics. This is achieved by training AEs on standard model physics and tagging potential new physics events as anomalies. The use of an AE as an AD algorithm relies on the assumption that the network better reconstructs examples it was trained on than ones drawn from a different probability distribution, i.e. anomalies. Using the search for non resonant production of semivisible jets as a benchmark, we demonstrate the tendency of AEs to generalize beyond the dataset they are trained on, hindering their performance. We show how normalized AEs, specifically designed to suppress this effect, give a sizable boost in performance. We further propose a different loss function and using the Wasserstein distance as a metric to reach the optimal performance in a fully signal-agnostic way. Extension of this method to graph representation of the jets in the Lund jet plane are discussed.

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