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Use of kernel density estimation in searches for new resonances at the LHC

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Abstract: A machine learning generative model based on kernel density estimation was used to reproduce the Monte Carlo (MC) datasets. This method estimates the kernel density of the data using the Gaussian kernel and then generates additional samples from the distribution. We demonstrate the ability of this approach to reproduce a set of kinematic features, that are used for the search of new resonances decaying to $Z\gamma$, final states at the LHC. A weak supervision learning classification based on deep neural implementation was used to compare the performance of generated datasets with MC datasets. In this approach, the model is trained on partially labelled datasets. The primary results show that our model generates synthetic data reasonably well. The purpose of the research is to establish the search for heavy resonances beyond the Standard Model (SM) with topological requirements using machine learning techniques.

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