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Evaluation and Optimisation of a Generative-Classification Hybrid Variational Autoencoder in the Search for Resonances at the LHC

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The Standard Model (SM) of particle physics was completed by the discovery of the Higgs boson in 2012 by the ATLAS and CMS collaborations. However, the SM is not able to explain a number of phenomena and anomalies in the data. These discrepancies to the SM motivate the search for new bosons. In this paper, searches for new bosons are completed by looking for $Z\gamma$ resonances in $Z\gamma$ ($pp \rightarrow H \rightarrow Z\gamma$) fast simulation events. This research makes use of a Variational Autoencoder (VAE), in the search for new bosons. The functionality of a VAE to be trained as both a generative model and a classification model makes the architecture an attractive option for aiding the search. The VAE is used as a generative model to increase the amount of $Z\gamma$ fast simulation Monte Carlo data whilst simultaneously being used to classify samples containing injected signal events that differ from the Monte Carlo events on which the model was trained. This presentation concentrates on the final evaluation and optimisation of the VAE for both generative and classification purposes.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

MSc

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