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APPLICATION OF VARIATIONAL AUTOENCODERS TO GENERATE D0 MESON KINEMATICS AT THE LHC

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We develop a neural network based on variational autoencoders to generate D0 meson kinematics, i.e., transverse momentum, pseudorapidity, and azimuthal angle. The input dataset is a Monte Carlo (MC) simulation of the D0 meson production and the CMS detector at the LHC in PbPb collisions at 5.02 TeV. For training the method, a n-tuple with the kinematics of the D0 meson daughters (in the decay channel into charged pions and kaons) is used. The variational autoencoder method is based on dimensionality reduction of an input vector to the dimension of a latent vector that possesses the same probability distribution of the input one, then, the information is reconstructed and a new distinct vector with the same probability is created. The neural network architecture is composed of convolutional layers that are adjusted by hyperparameters, which must have values that optimize the network efficiency to perform the assigned task. The neural network efficiency is verified by a loss function that is calculated from a Kullback-Leibler divergence. The main goal of this work is to prove that this method can generate D0 meson kinematics compatible with the ones from the MC simulation. In this case, in the future, we can train the method based on real data events at the LHC.

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