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Jet Response Prediction Using Jet Images (15'+5')

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Understanding and appropriately correcting for the detector response on any observable of interest is an important chore for experimentalists. Such a procedure is ultimately necessary to remove the impact of the finite detector and to facilitate direct comparisons with theoretical predictions. All current experiments take on this major task by generating Monte Carlo samples and running them through a detector simulation in GEANT. In the case of reconstructed jets, one often ends up with a parametrized extraction of the jet energy scale and resolution as function of the jet's transverse momenta and rapidity. With the recent push towards new jet observables that involve the jet structure and fragmentation, a better representation of detector driven correction is paramount to better parameterize the energy resolution and hence the inherent smearing. Since the jet image contains the full jet fragmentation and energy distribution on the incident detector, we train a deep convolutional neural network to extract the jet energy response from a given jet image. This method is shown to effectively reproduce the parametrized input and as an additional feature, capture the dependence on the energy scale on the jet's internal structure observables. We show comparisons of our model with standard multi-variable machine learning techniques and highlight the importance of such an unbiased extraction on jets in data, with the near future goal of reduced jet energy resolution uncertainties on a jet-by-jet basis.

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