Contribution ID: **55** Type: **Regular talk**

Object condensation for end-to-end reconstruction in high occupancy calorimeters with graph neural networks

Wednesday, 11 May 2022 17:20 (25 minutes)

We present an end-to-end reconstruction algorithm to build particle candidates from detector hits in next-generation granular calorimeters similar to that foreseen for the high-luminosity upgrade of the CMS detector. The algorithm exploits a distance-weighted graph neural network [2], trained with object condensation [1], a graph segmentation technique. Through a single-shot approach, the reconstruction task is paired with energy regression. We describe the reconstruction performance in terms of reconstructed-to-truth matching as well as in terms of energy resolution. In addition, we show the jet reconstruction performance of our method and discuss its inference computational cost. This work is the first-ever example of machine-learning-based single-shot calorimetric reconstruction in high-luminosity conditions with 200 pileup to the best of our knowledge.

[1] https://arxiv.org/abs/2002.03605
[2] https://arxiv.org/abs/1902.07987

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Session Classification: Workshop