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Machine learning for particle flow reconstruction at CMS

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The particle-flow (PF) algorithm at CMS combines information across different detector subsystems to reconstruct a global particle-level picture of the event. At a fundamental level, tracks are extrapolated to the calorimeters and the muons system, and combined with energy deposits to reconstruct charged and neutral hadron candidates, as well as electron, photon and muon candidates.

In light of the upcoming Run 3 as well as the future Phase-2 running conditions with increased pileup and a more fine-grained detector, it is necessary to revisit both the physics and computational performance of the PF algorithm.

We study a machine-learned approach for PF (MLPF) reconstruction in CMS with possible application in offline reconstruction at CMS towards the end of Run 3. The tracks and calorimeter clusters in the event are processed by a graph neural network to reconstruct the full list of PF candidates. Training is carried out on simulated samples created using the CMS software framework (CMSSW) and the full detector simulation model.

We report the technical details of the simulation and training setup, as well as initial physics and computational performance characteristics when the MLPF model is used for inference in CMSSW and interfaced with the downstream reconstruction of high-level objects such as jets and missing transverse momentum.

Significance

References

Speaker time zone

No preference

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