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Clustering with adaptive similarity measure for track reconstruction

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The track reconstruction task of ATLAS and CMS will become computationally increasingly challenging with the LHC high luminosity upgrade. In the context of taking advantage of machine learning techniques, a clustering algorithm is proposed to group together hits that belong to the same particle. Clustering is referred to as unsupervised classification and is widely applied to big data. The unsupervised aspect in clustering allows it to generalize to any track size or properties as there are no defined classes.

The dataset considered is generated from ACTS fast simulation (A common tracking software) which provides simple and efficient event data modeling.
The algorithm uses the 3D spatial coordinates to group hits and uses the known detector geometry to exclude incompatible grouping. To efficiently cluster hits together which originate from a common particle, we define an adaptive distance which improves by adding more hits and quantifies how far a hit is from the particle's current reconstructed trajectory.
We show that the algorithm is able to adapt and generalize to kinematic range of interest for the tracks.

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