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Super-resolution for calorimetry

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Super-resolution algorithms are commonly used to enhance the granularity of an imaging system beyond what can be achieved using the measuring device.
We show the first application of super-resolution algorithms using deep learning-based methods for calorimeter reconstruction using a simplified geometry consisting of overlapping showers originated by charged and neutral pions events.
The task of the presented ML algorithms is to estimate the fraction of charged and neutral energy components for each cell of the super-calorimeter, which represents the reconstructed calorimeter system whose granularity is up-scaled up to a factor of 4 compared to the original one. We show how the finer granularity can be used to unveil effects that would remain otherwise elusive, such as the reconstructed mass of the pi0 which is strictly connected to an unbiased estimation of the opening angle between the two photons. The performance is evaluated using several ML algorithms, including graph- and convolutional-neural networks.

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