

Weekly report

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Working status

DGCNN clustering

• Check with event display:



2 photons



Loss: cross entropy $H(p,q) = -\Sigma_x[p(x) \cdot \log(q(x))]$

4 photons

Suitable for classification, but not for clustering. Need to use another loss.

Working status

• Mean standard deviation loss:

• Define the loss:
$$L = \frac{1}{N_{cluster}} \Sigma_{\alpha}^{cluster} \Sigma_{i}^{hit} \sqrt{(x - \bar{x})^2} / N_{hit}$$

- Truth tag is not used in this loss.
- Don't work.





Working status

• The loss function used by others:

- 2 overlapped shower separation [1902.07987]:
 - Model output: p_{ik} : probability of hit *i* belongs to cluster *k*.

$$L = \sum_{k} rac{\sum_{i} \sqrt{E_i t_{ik}} (p_{ik} - t_{ik})^2}{\sum_{i} \sqrt{E_i t_{ik}}}, \quad p_{ik} \neq t_{ik}$$
: predicted / truth shower fraction.

- Multi-object reconstruction [2002.03605]:
 - Model output: $[x, y, \beta, \vec{f}]$ per hit.
 - (x, y): position in clustering space: L_V .
 - β : score that hit *i* is a condensation point: L_{β} .
 - \vec{f} : other features, e.g. cluster energy, probability to be a noise hit: L_p .

$$L = L_p + s_c (L_\beta + L_V).$$

$$L_\beta = \frac{1}{K} \sum_{k=1}^{K} (1 - \beta_{\alpha k}) + s_B \frac{1}{N_B} \sum_{i=1}^{N} n_i \beta_i$$

$$L_V = \frac{1}{N} \sum_{j=1}^{N} q_j \sum_{k=1}^{K} \left(M_{jk} \check{V}_k(x_j) + (1 - M_{jk}) \hat{V}_k(x_j) \right)$$

$$L_\beta = \frac{1}{K} \sum_{i=1}^{K} (1 - \beta_{\alpha k}) + s_B \frac{1}{N_B} \sum_{i=1}^{N} n_i \beta_i$$

$$L_\gamma = \frac{1}{N} \sum_{j=1}^{N} q_j \sum_{k=1}^{K} \left(M_{jk} \check{V}_k(x_j) + (1 - M_{jk}) \hat{V}_k(x_j) \right)$$

$$L_\beta = \frac{1}{K} \sum_{i=1}^{K} (1 - \beta_{\alpha k}) + s_B \frac{1}{N_B} \sum_{i=1}^{N} n_i \beta_i$$