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EMD Neural Network Loss for ECON-T ASIC Autoencoder

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The High Granularity Calorimeter (HGCAL) is part of the High Luminosity upgrade of the CMS detector at the Large Hadron Collider (HL-LHC). For the trigger primitive generation of the 6 million channels in this detector, data compression at the front end may be accomplished by using deep-learning techniques using an on-ASICs network. The Endcap Trigger Concentrator (ECON-T) ASIC foresees an encoder based on a convolutional neural network (CNN). The performance is evaluated using the earth mover's distance (EMD). Ideally, we would like to quantify the loss between the input and the decoded image at every step of the training using the EMD. However, the EMD is not differentiable and can therefore not be used directly as a loss function for gradient descent. The task of this project is to approximate the EMD using a separate set of CNNs and then implement the EMD NN as a custom loss for the ASIC encoder training, with the goal of achieving better physics performance.

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