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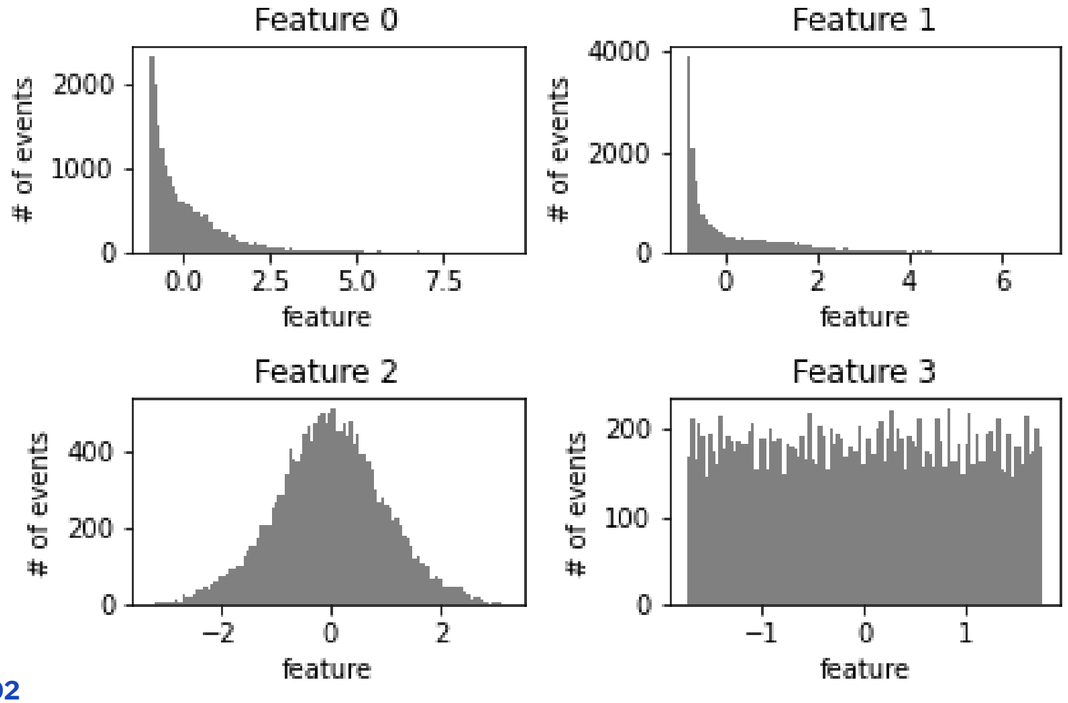
Evaluation exercise report for GSoC - ATLAS autoencoders

Google Summer of Code

Data preprocessing

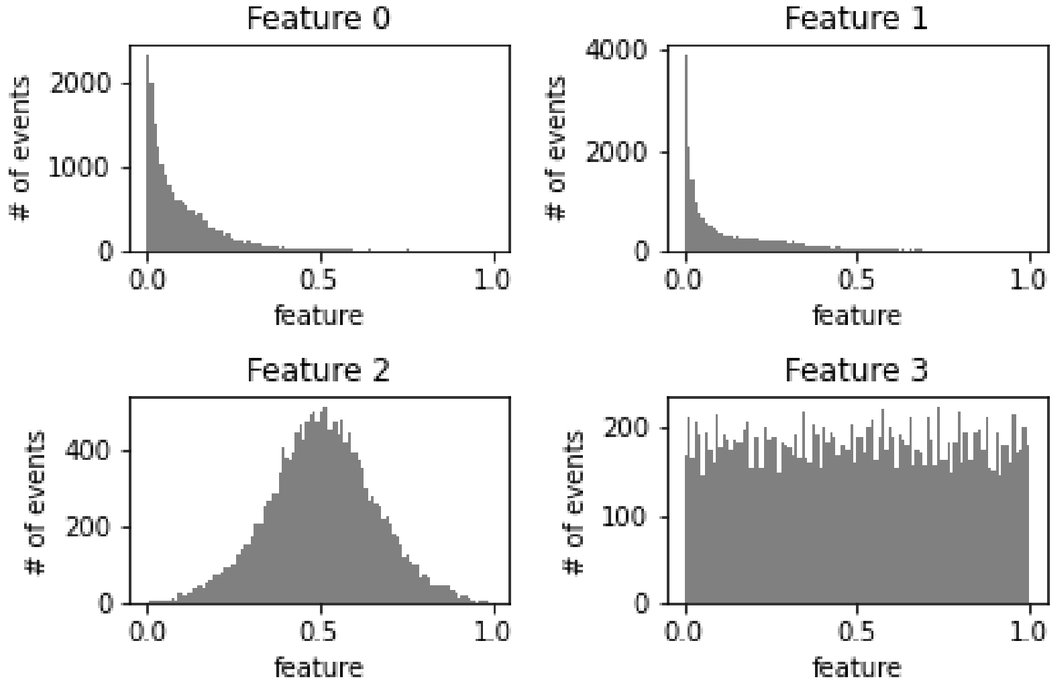
Standard normalization

$$\mathbf{z} = \frac{\mathbf{x} - \mu}{\sigma}$$

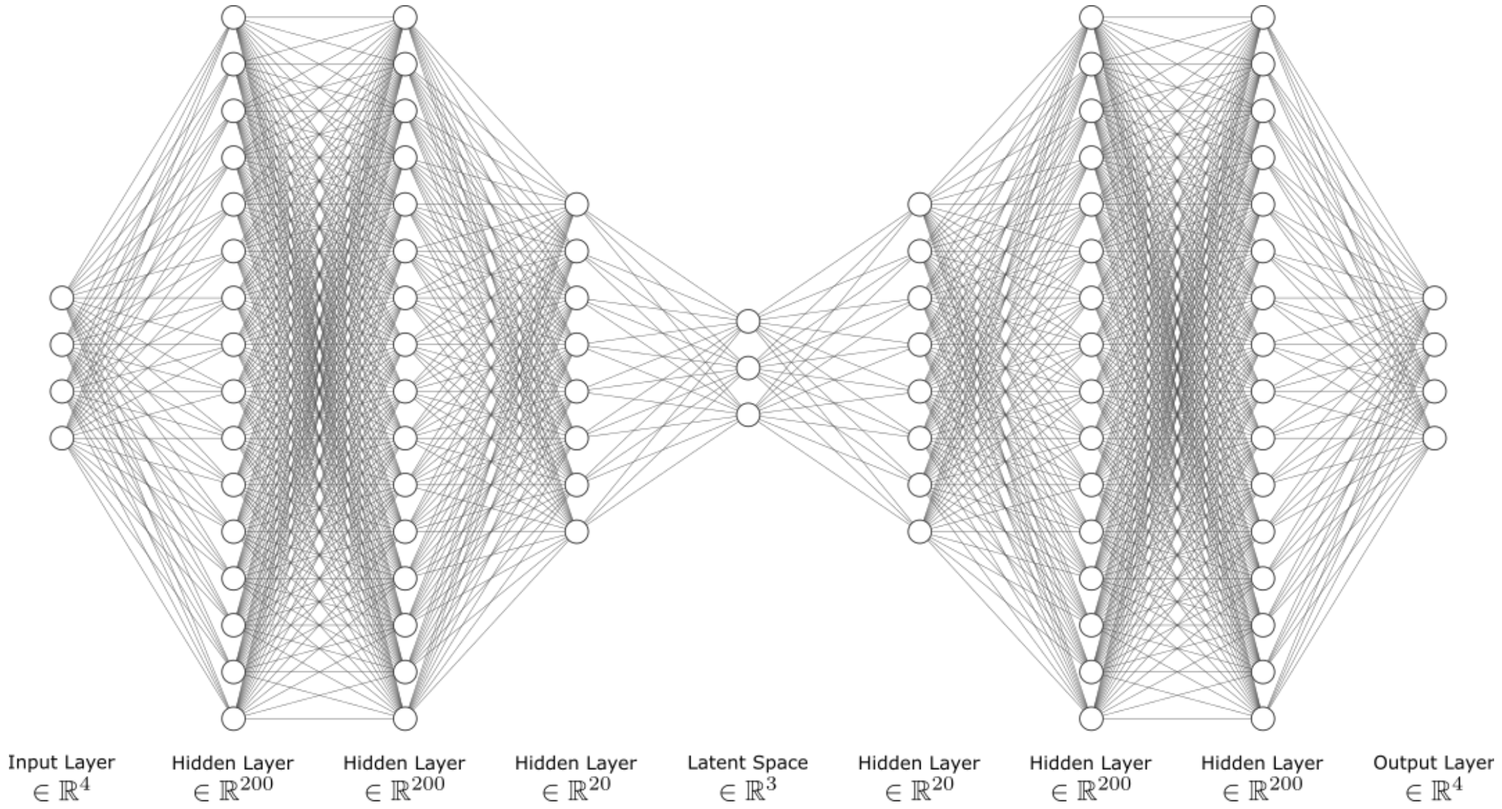


MinMax normalization

$$\mathbf{z} = \frac{\mathbf{x} - min(\mathbf{x})}{max(\mathbf{x}) - min(\mathbf{x})}$$



Autoencoder Model



Loss function:

$$MSE = \frac{1}{N}\sum_{i=1}^{N}(\hat{x}_i - x_i)^2$$

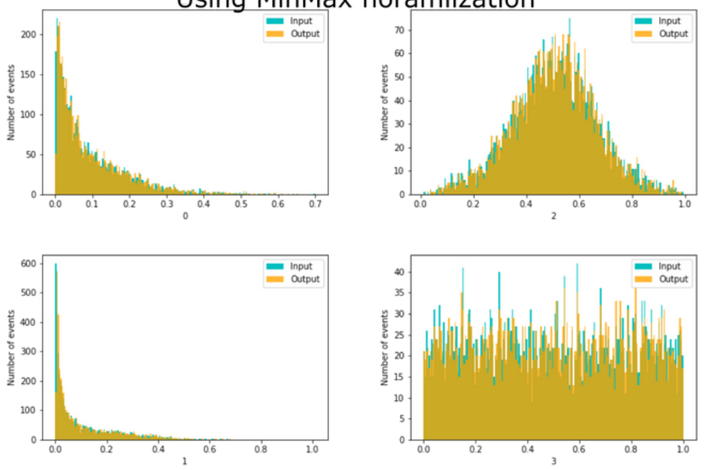
Aditional metric:

$$PSNR = 20log_{10}\left(\frac{MAX\_RANGE}{\sqrt{MSE}}\right)$$

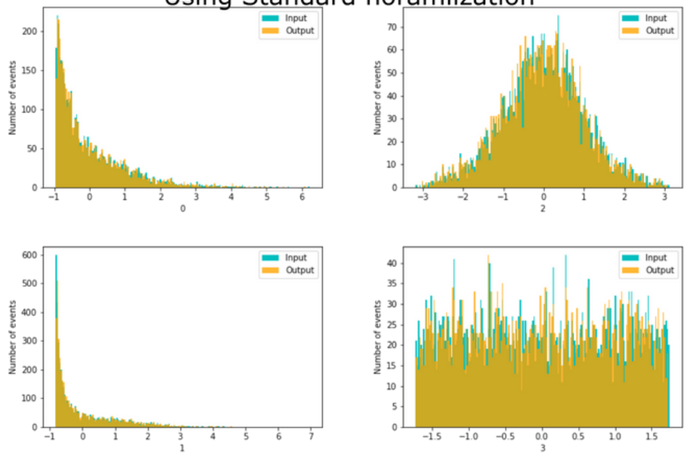
Using Leaky Relu as an activation function in every layer

Results

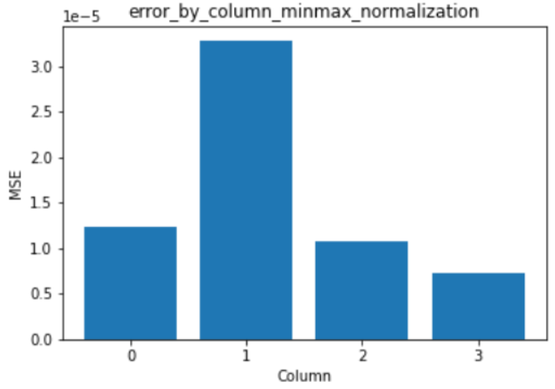
Histogram of each element in the 4D data
Using MinMax noramlization

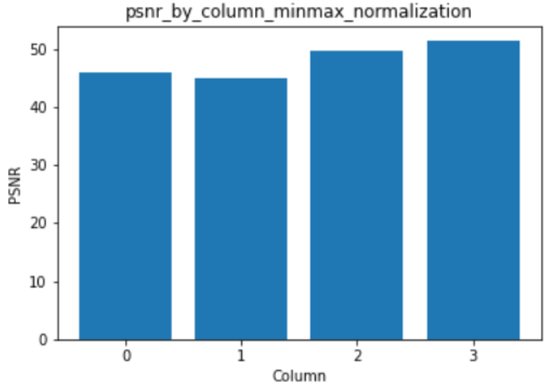


Histogram of each element in the 4D data
Using Standard noramlization

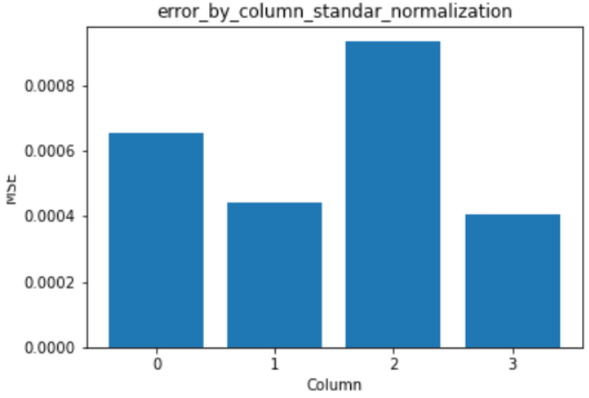


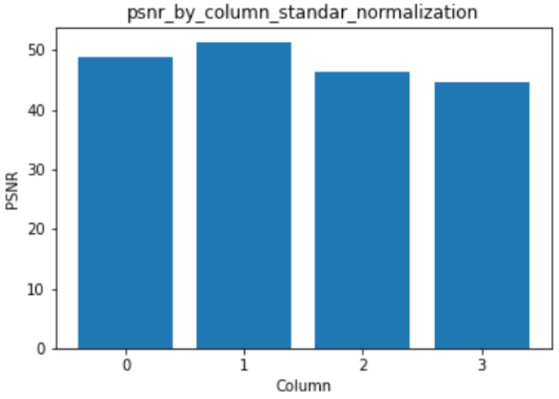
Calculated MSE and PSNR over the test set with MinMax noramalization





Calculated MSE and PSNR over the test set with standard noramalization





Summary

- An autoencoder to compress the four-momentum of a sample of simulated particles from 4 to 3 variables was successfully implemented and evaluated using PSNR and MSE.
- Two different methods to normalized data were evaluated to achieve better results.

Scan this QR code to access the repo