# Using unsupervised learning in search of new physics

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Sakarias Garcia de Presno Frette

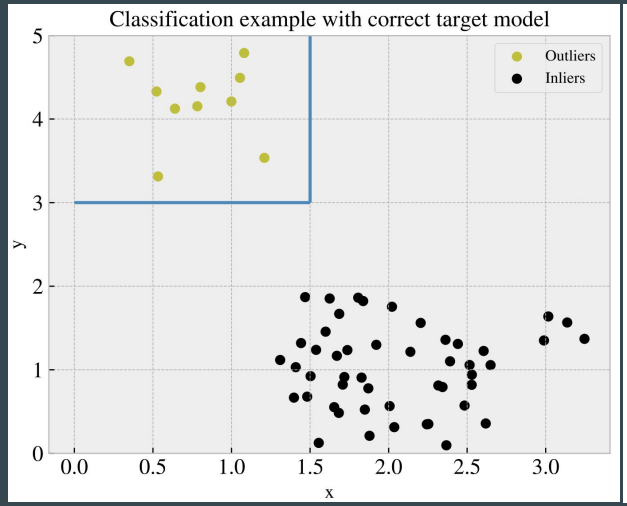
# Master thesis

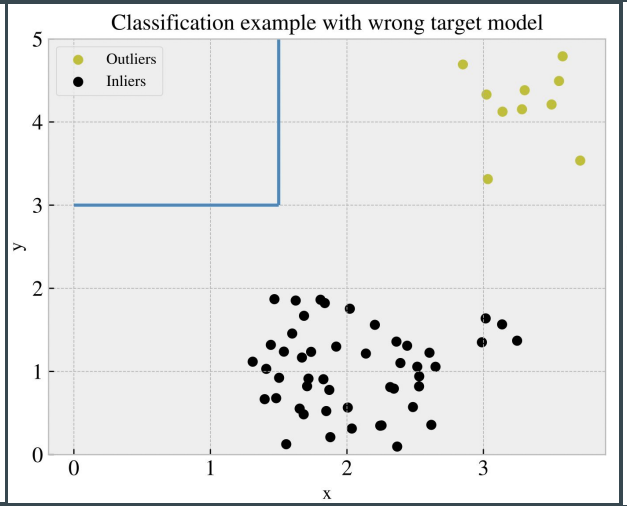
- Attempt to see if the auto encoder can learn, without copying, to reconstruct sm processes and filter out new physics
- If anomalies are found they will be compared to two new models, heavy neutrinos and heavy right handed W bosons
- Compare with supervised results

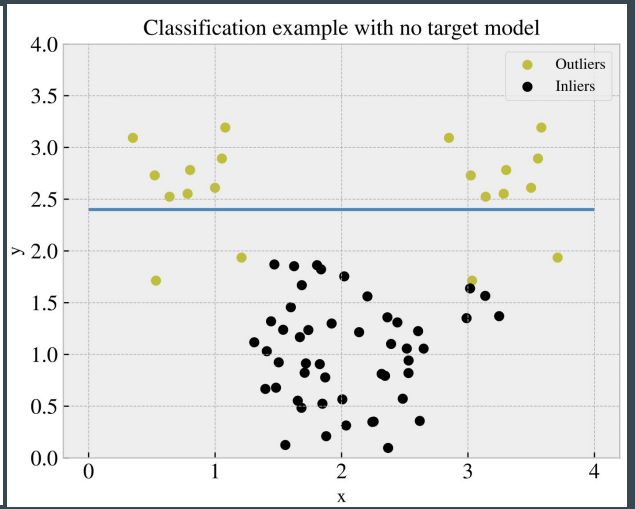
# Using auto encoder for anomaly detection with ATLAS open data

- Attempt to see if the auto encoder can learn, without copying, to reconstruct sm processes and filter out new physics
- Test against new physics models

# Anomaly detection

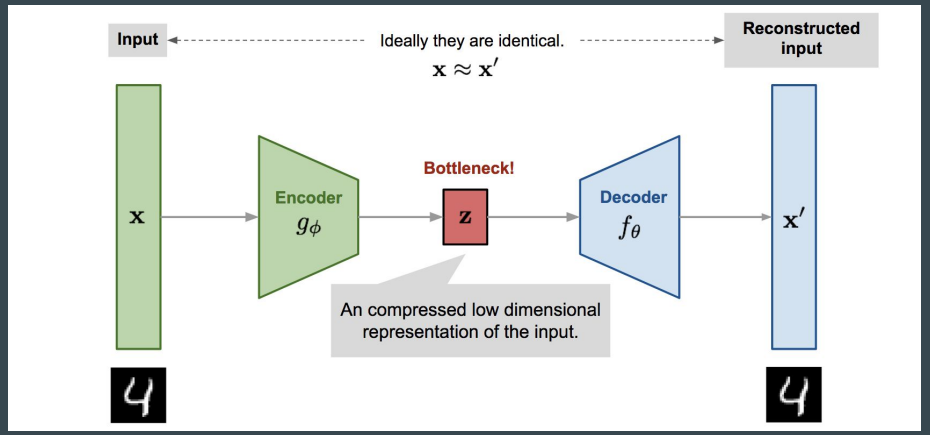


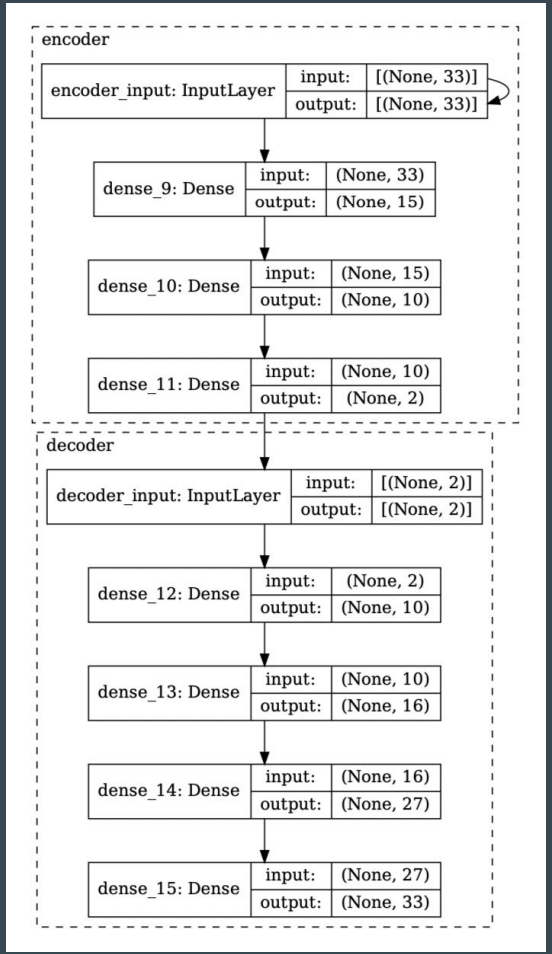



# Auto Encoders

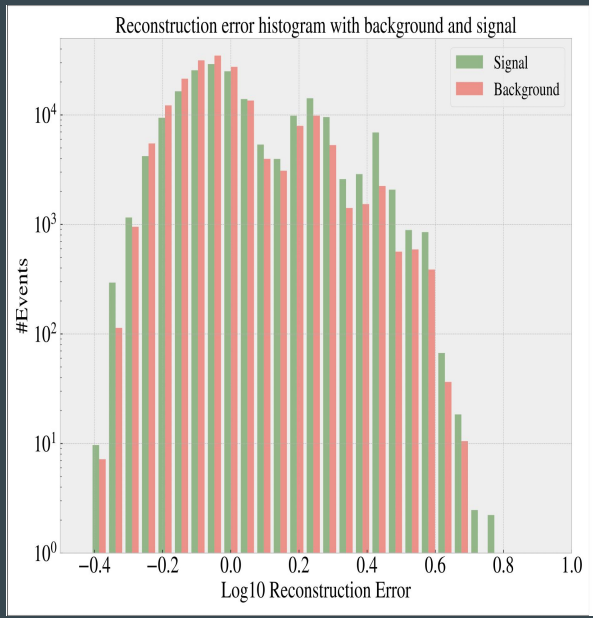
- Reconstruction
- Hyper parameters

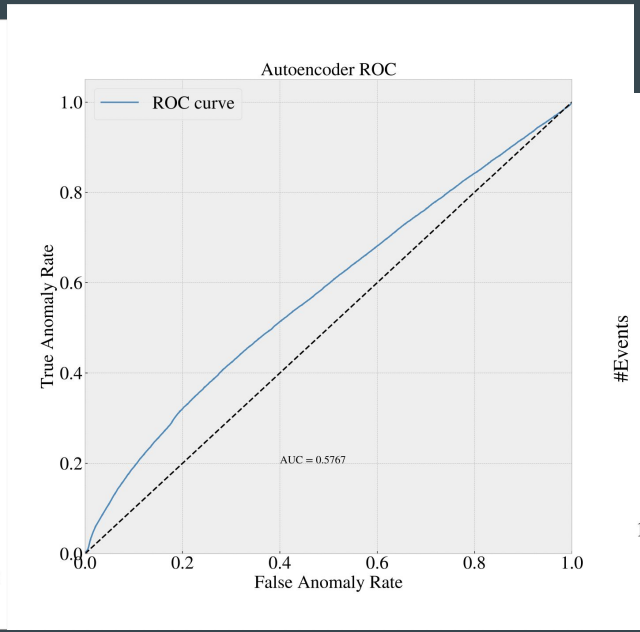


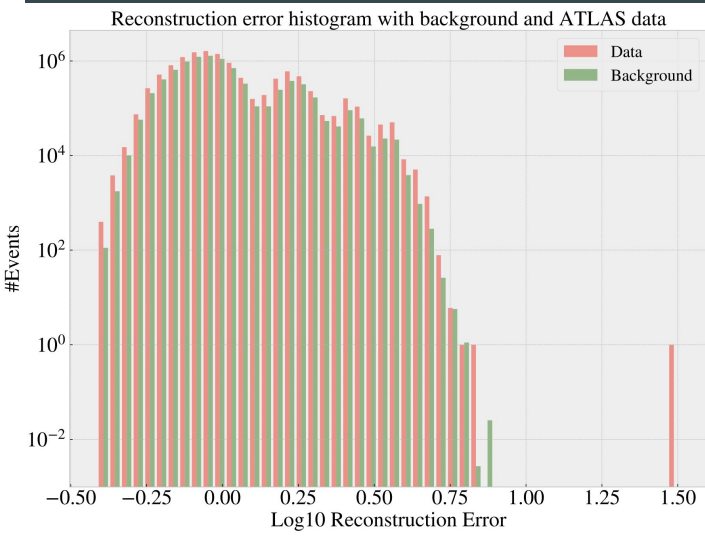

Source: https://lilianweng.github.io/posts/2018-08-12-vae/



# Results


Reconstruction error histogram with background and signal
Signal
Background
#Events
Log10 Reconstruction Error


Autoencoder ROC
ROC curve
True Anomaly Rate
False Anomaly Rate
AUC = 0.5767


Reconstruction error histogram with background and ATLAS data
Data
Background
#Events
Log10 Reconstruction Error

# More results