Report for Preliminary Study

DQM-DC
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21 June 2019

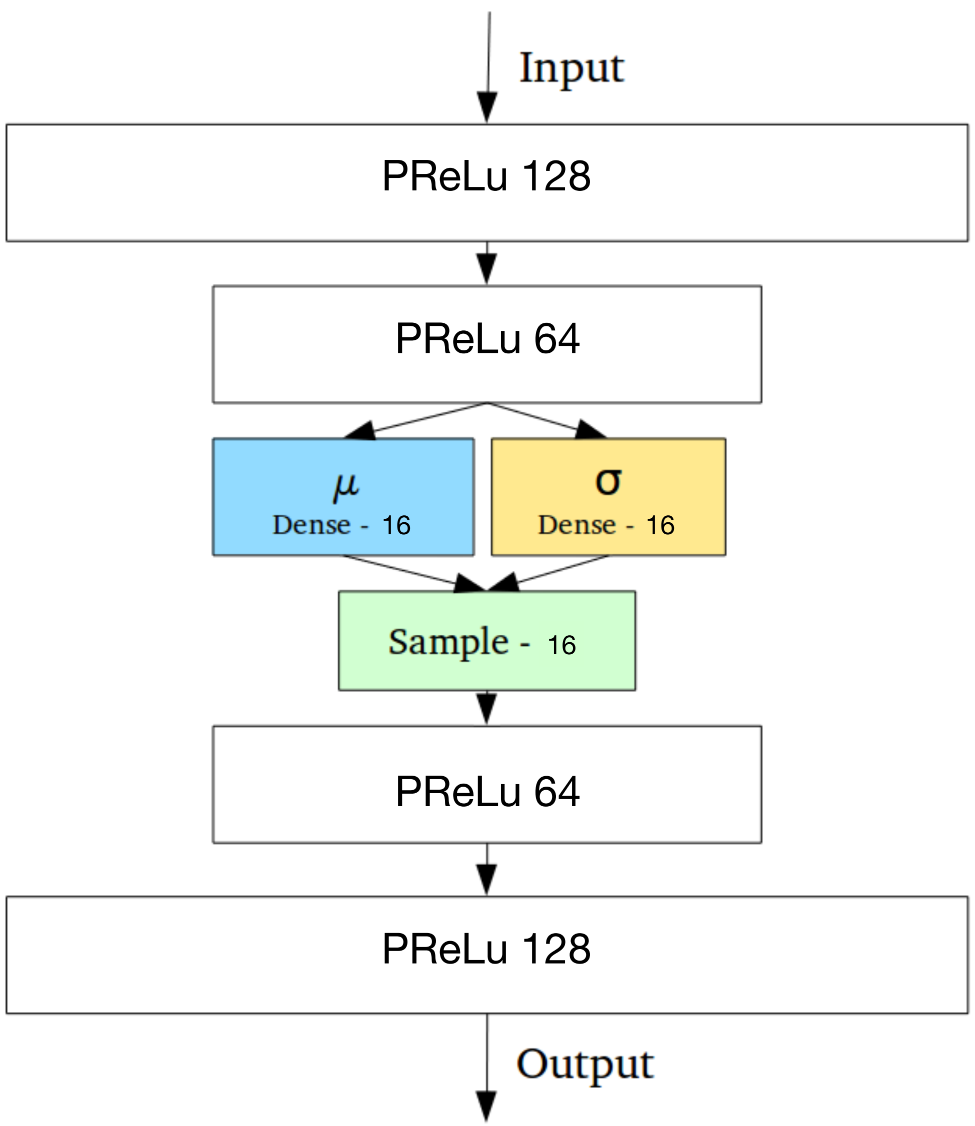
Outline

- Variational Autoencoder
  - Model
  - Training (Also include vanilla)

- To sum up

Variational Model

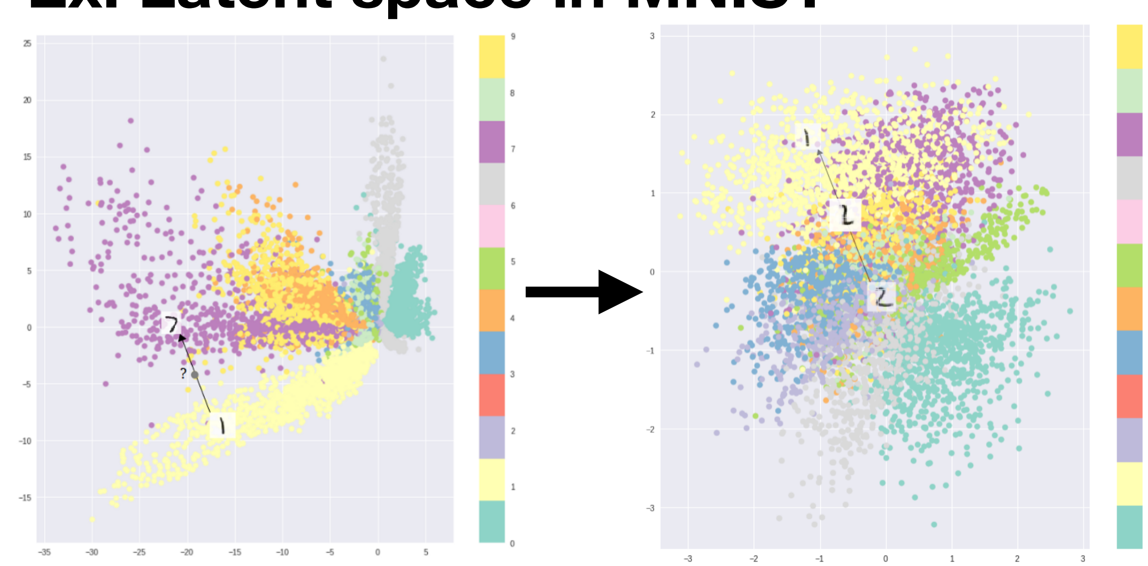
- Tweak by **Random Sampling in Encoding vector (Remove discontinuity in Latent Space)**



$$\mathcal{Z}_i \equiv \mathcal{N}(\mu_i, \sigma_i)$$

"Random new sampling by gaussian"

Ex: Latent space in MNIST



[1] https://towardsdatascience.com/intuitively-understanding-variational-autoencoders-1bfe67eb5daf

Variational Model

- Kullback–Leibler divergence

$$\mathcal{D}_{\mathrm{KL}}(p|q) \equiv < \log p - \log q >$$

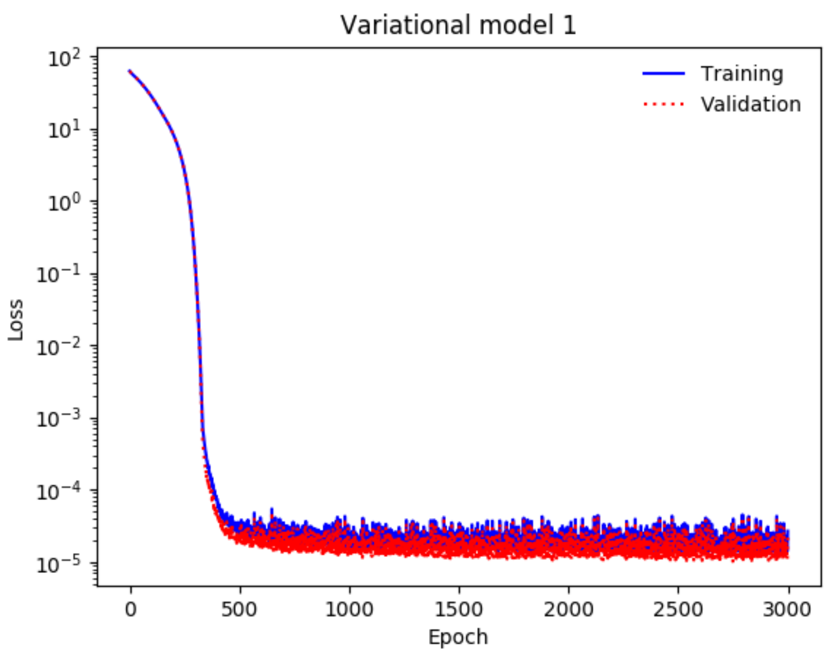
- where p is observed value, and q is approx. fn.

- Since our q is gaussian, then

$$\mathcal{L}_{\mathrm{tot}} \equiv \mathcal{L}_{MSE} + \frac{1}{2}\sum_i(\mu_i^2 + \sigma_i^2 - \log(\sigma_i^2) - 1)$$

Variational Training

Fraction of data feeding 20%



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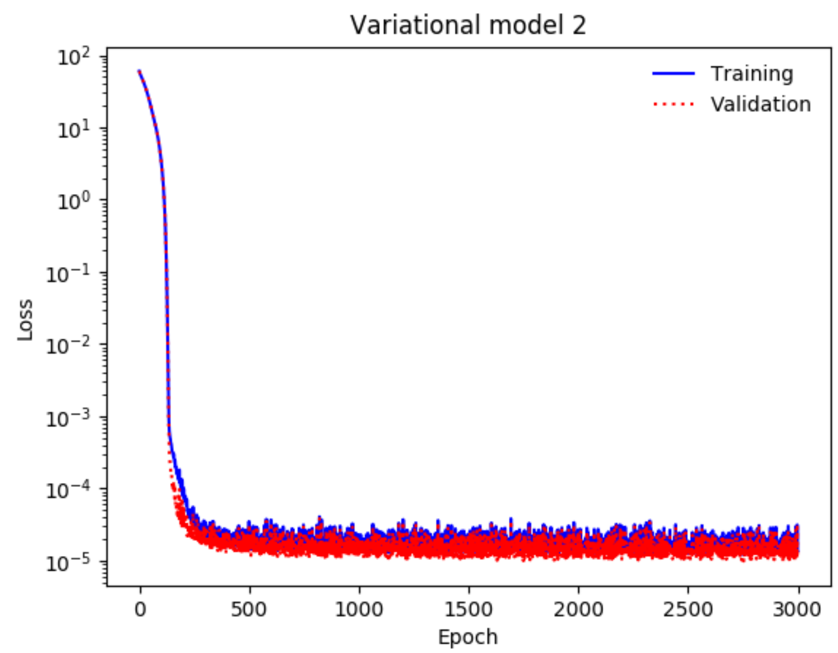

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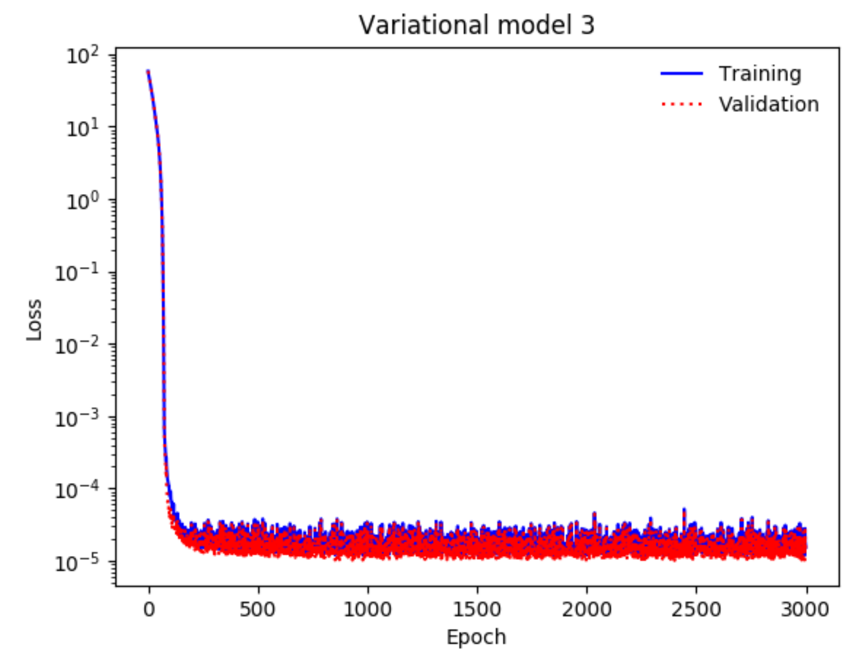

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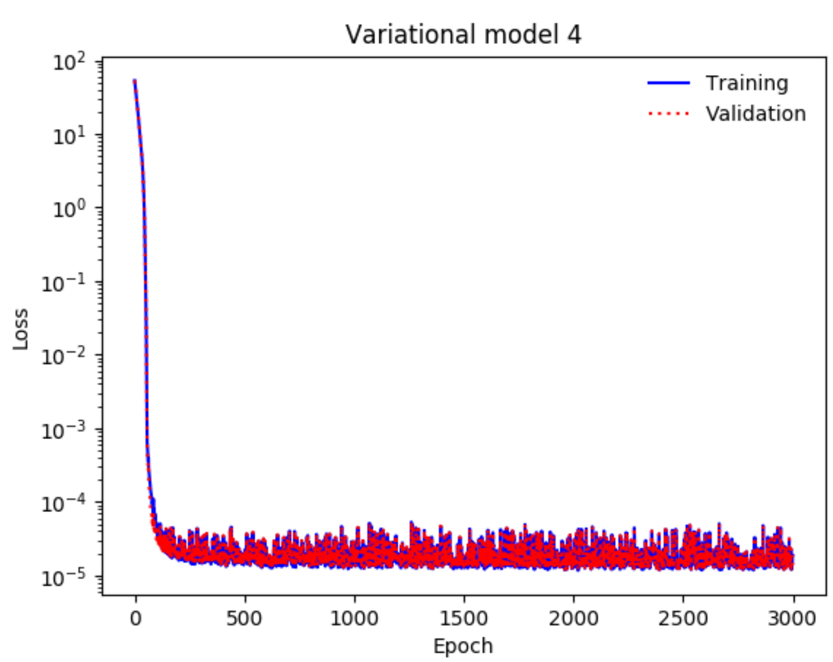
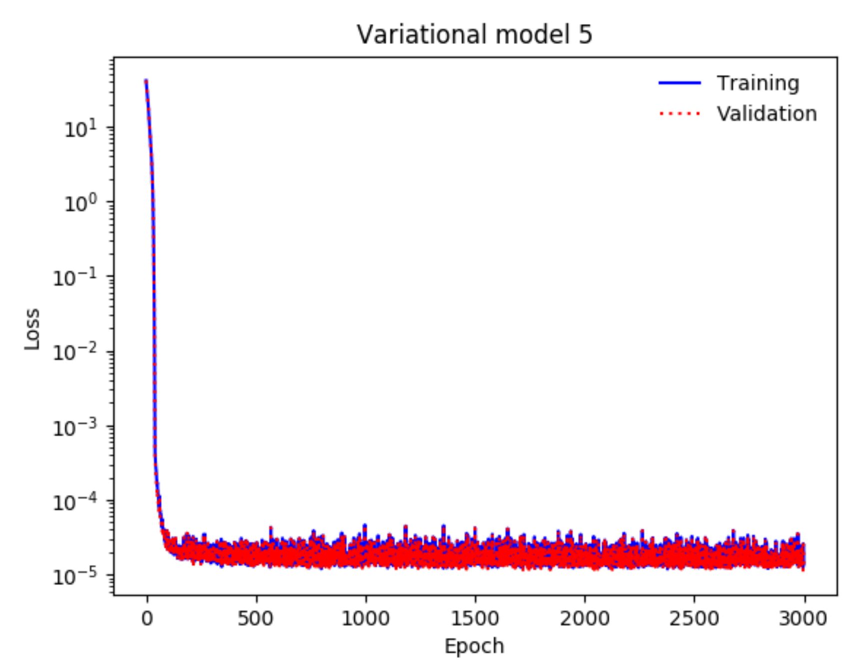
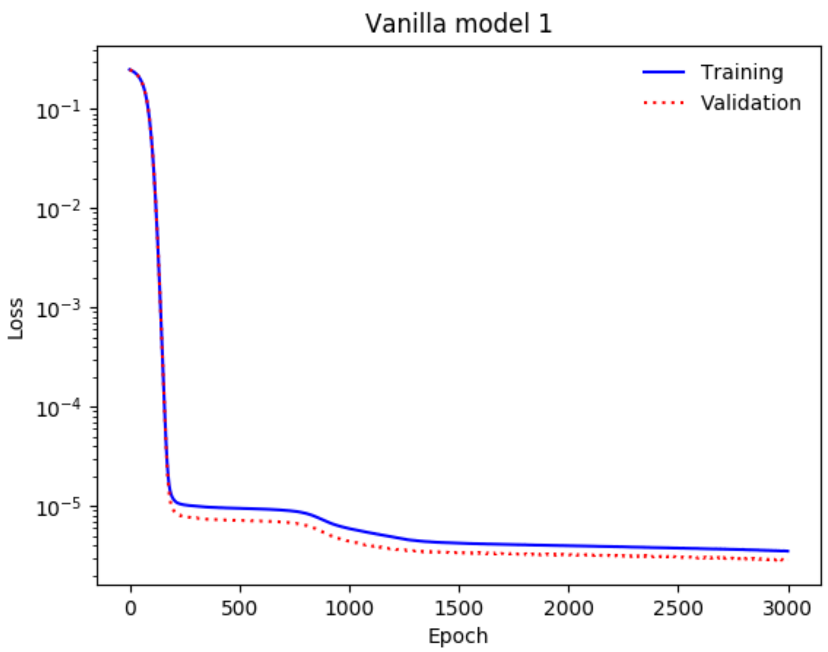


100%



Don’t forget Vanilla!

Fraction of data feeding 20%



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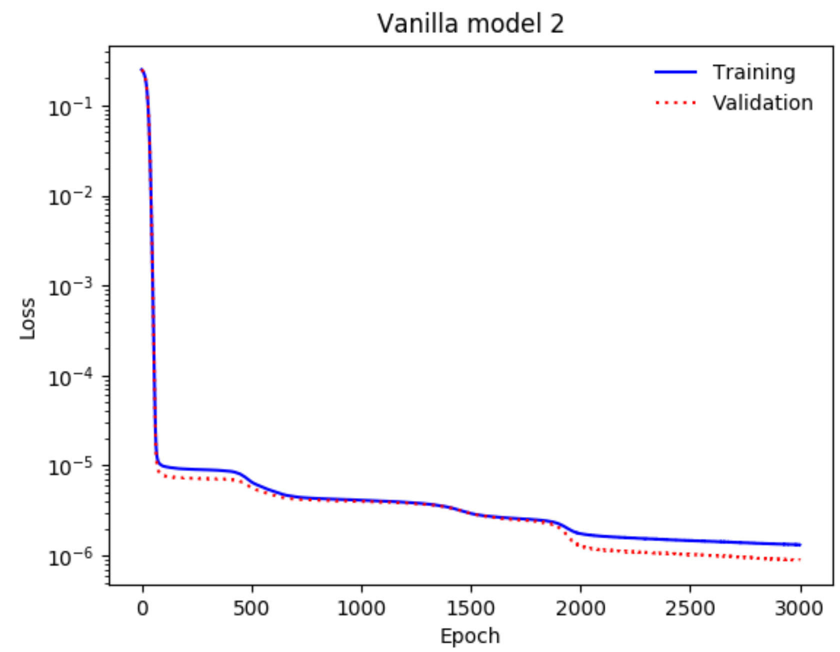

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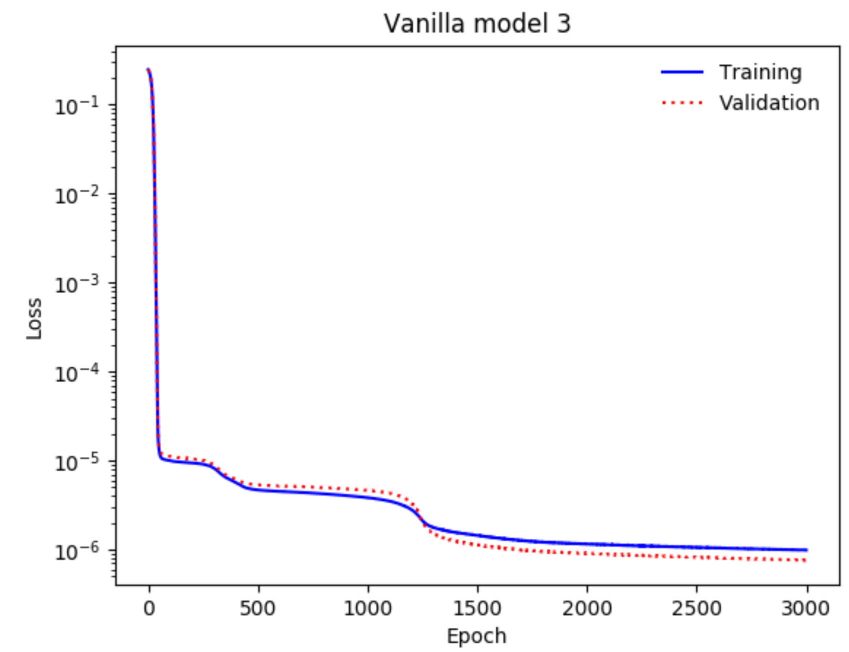

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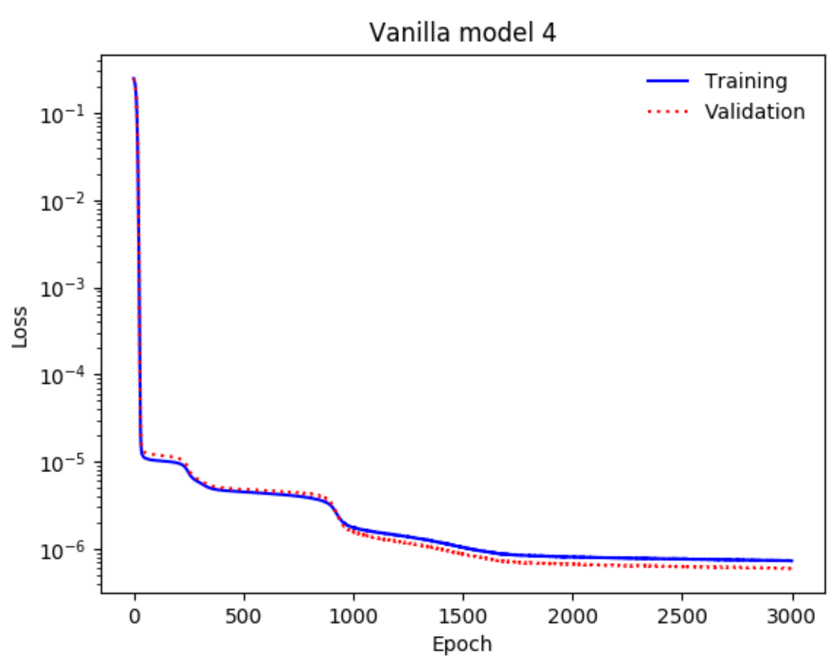

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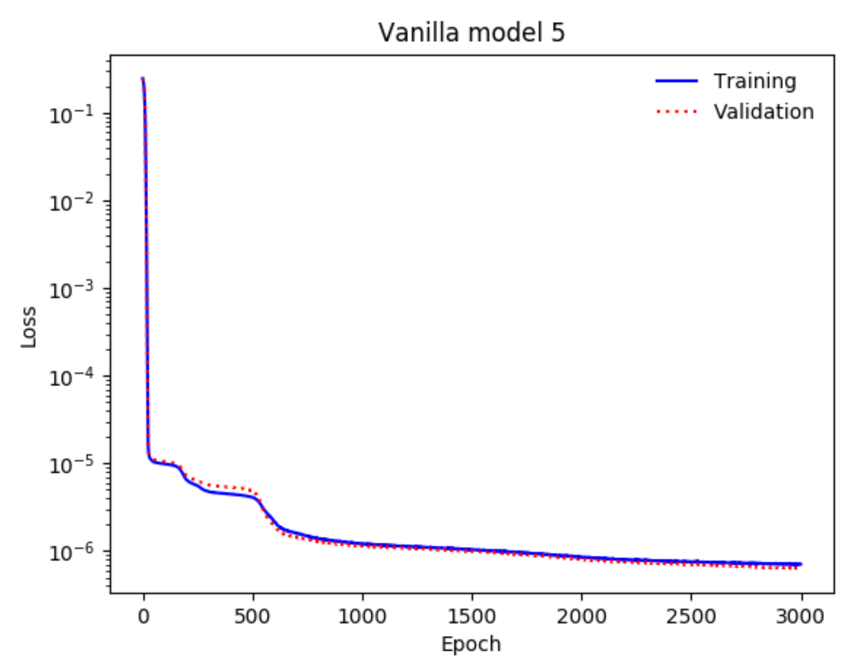
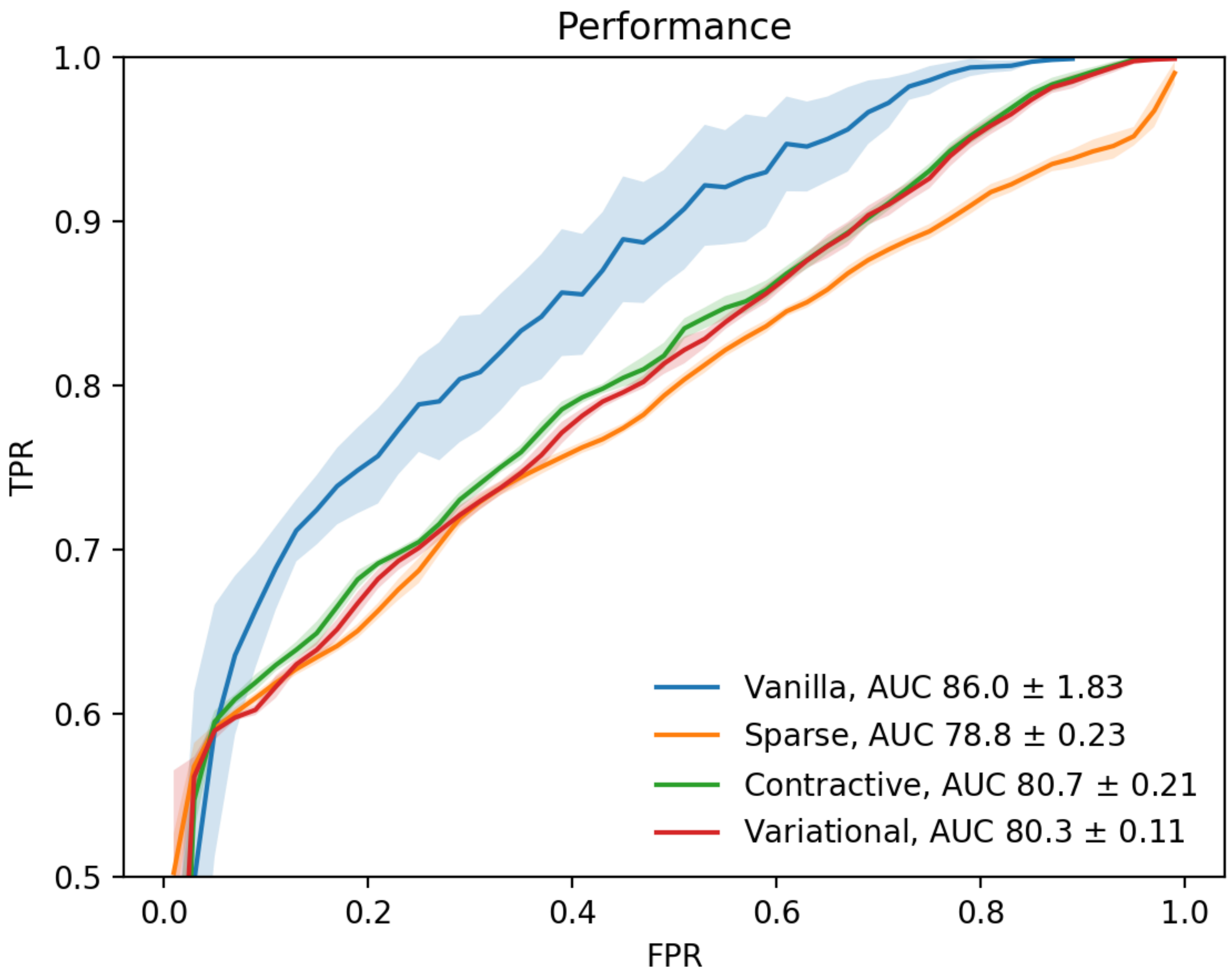


Finalize

- **Reproducing new training for 4 flavours** of ice-cream (Autoencoder) with
  - Reduced **Features from 2806 => 259** (Take care only cumulative Jet)
  - Batch_size 256
  - EPOCHS 1200
  - SPLITTING DATASETS
    - 60% **Training (Only good condition)**
    - 20% Validation (Only good condition)
    - 20% **Testing (Mix with bad)**

Results

- Repeat 10 times of process to measure robustness



Interesting Spots

AUC\Model	Vanilla	Sparse	Contractive	Variational
MEAN (%)	86.0	78.8	80.7	80.3
STD (±)	1.83	0.23	0.21	0.11

- Simplest one work best (doesn’t mean that Vanilla would be best candidate for all 4 channels of Yandex’s prototype)
- Variational is obvious to be most robust as loss value in training

Future work

- Anymore evaluation technique ?
- Explore new thing (maybe construct new model if need)
- Get more familiar with big picture of DQM-DC and figure out how I could implement..

- BTW, could checkout on https://github.com/calzonelover/CMS_DC_ANOMALY/