

VAE on MNIST

MNIST achieved the best overall performance among all experiments.

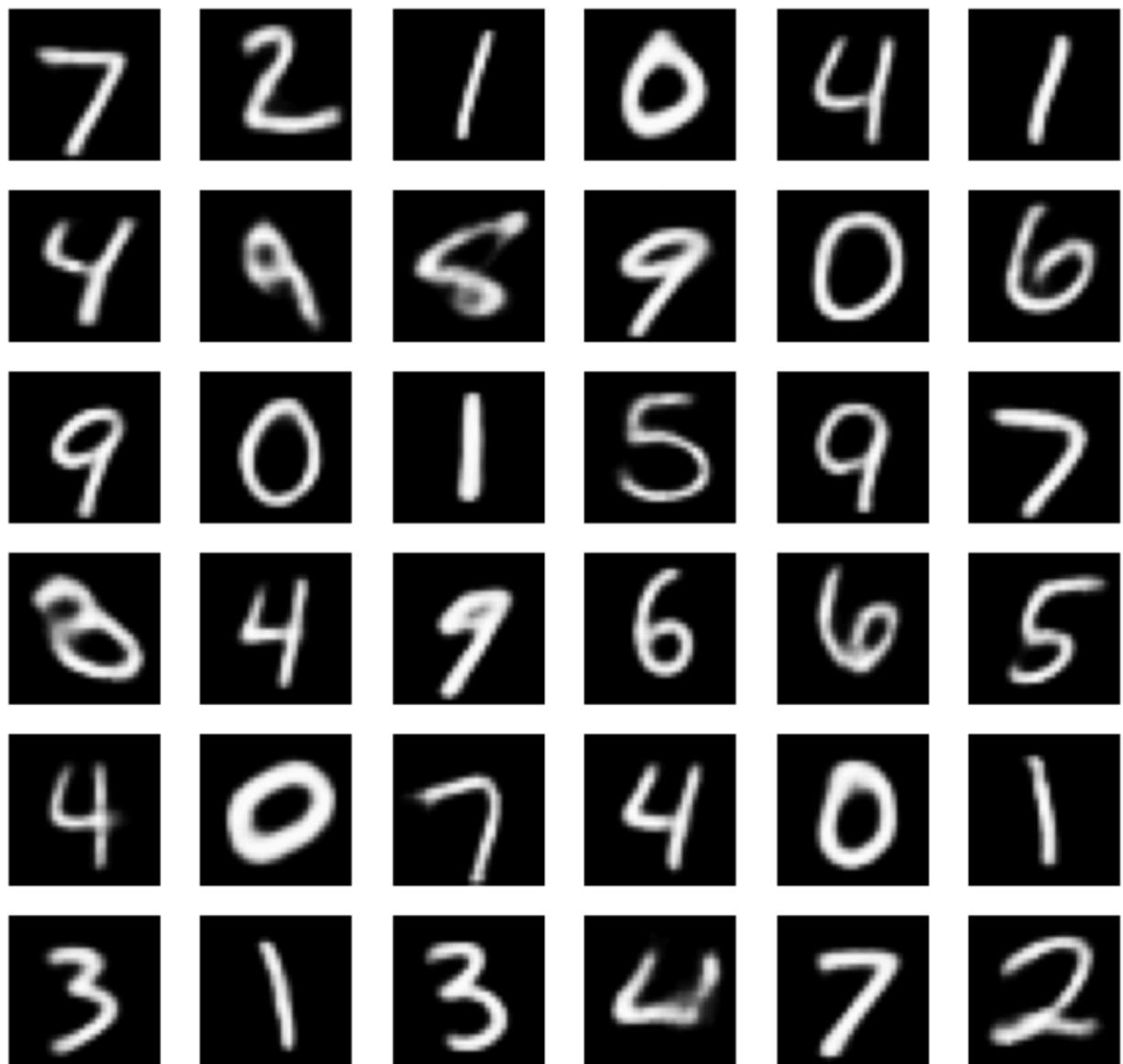
Final test BPD ≈ 0.18

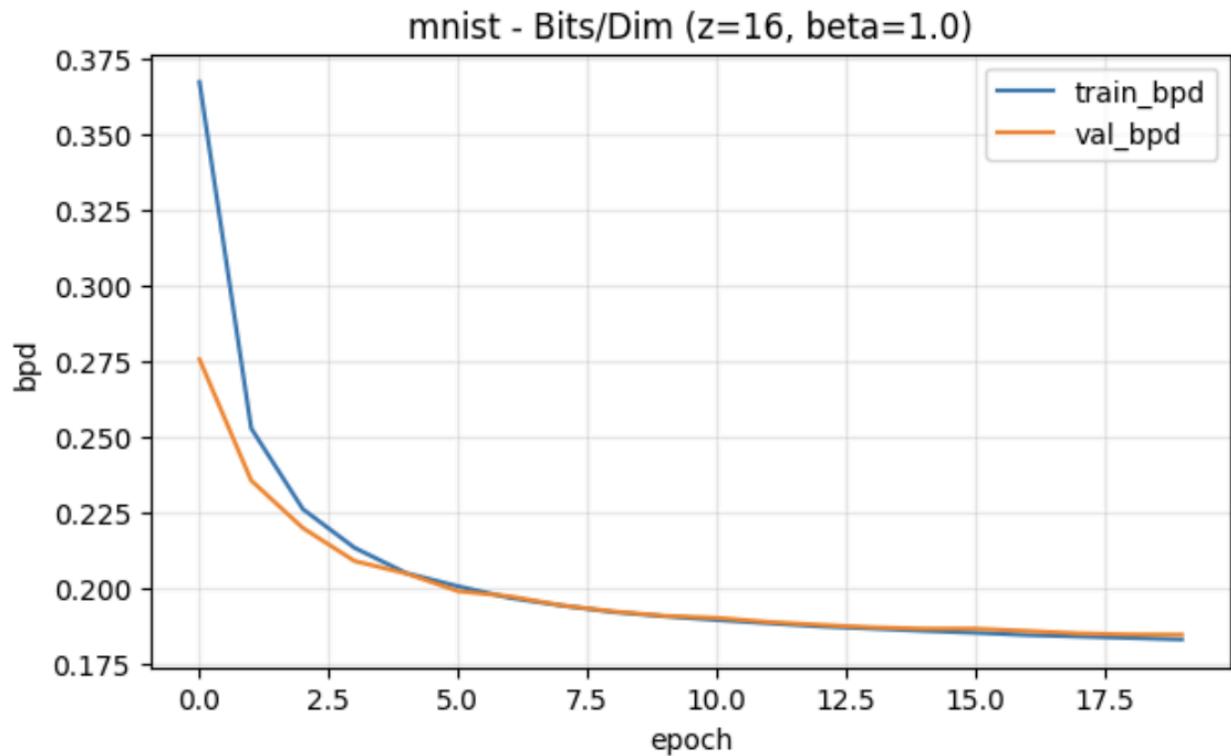
Stable training and validation curves

Generated samples are clearly recognizable digits

VAE performs very well on simple, highly structured datasets with clear shapes.

mnist VAE reconstructions





The final test BPD reached approximately 0.18, indicating good likelihood estimation. Training and validation curves were stable, with no signs of overfitting.

The generated samples are clearly recognizable digits, preserving the overall shape and structure. This confirms that the VAE effectively captures the underlying data distribution. It is definitely better than Realvnp

VAE on Fashion-MNIST

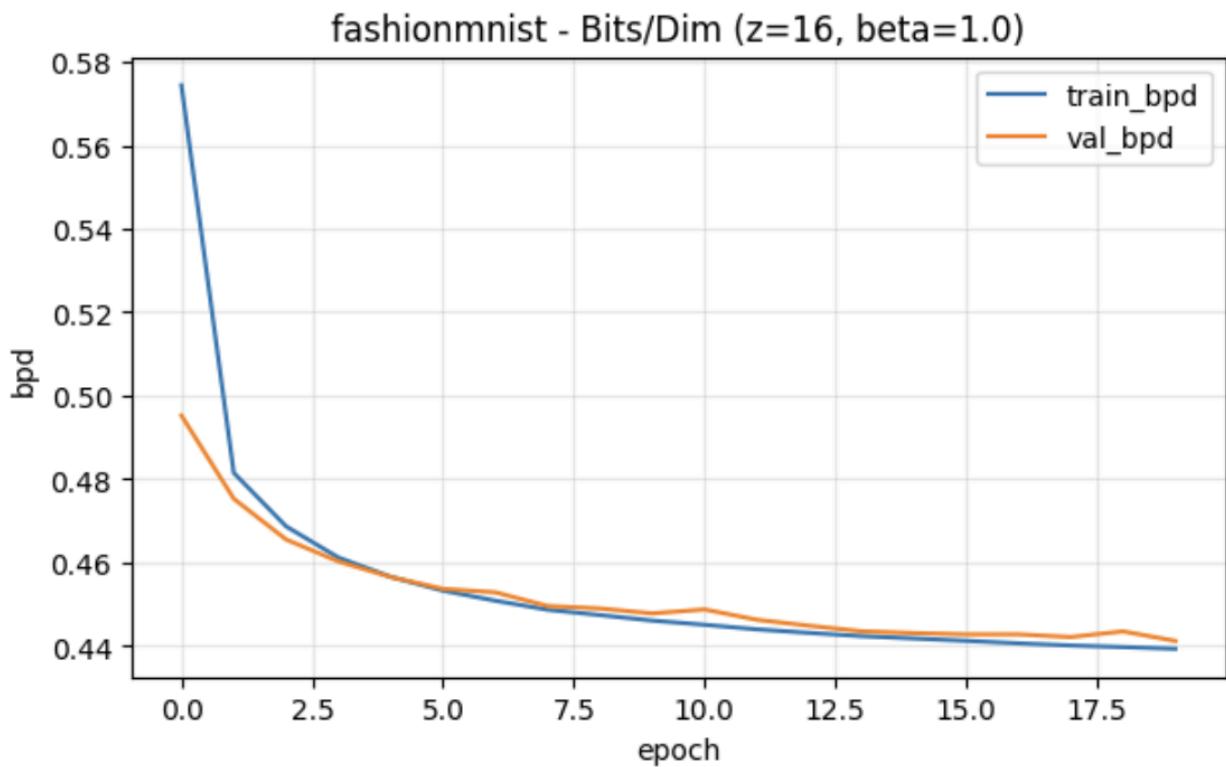
Results are noticeably worse compared to MNIST, which is expected because data are more complicated.

Final test BPD ≈ 0.44

Generated images are blurrier, but shapes are still captured and classes can be recognized. Fashion-MNIST is a more challenging dataset. The VAE captures coarse structure but struggles with fine details.

fashionmnist samples (ep 20)





The final test BPD is approximately 0.44, indicating a weaker likelihood estimation. Visually results are not worse than MNIST data, even that Fashion-MNIST is a more challenging dataset

β -VAE ($\beta = 4.0$)

Effect of higher β :

Reconstruction quality decreases

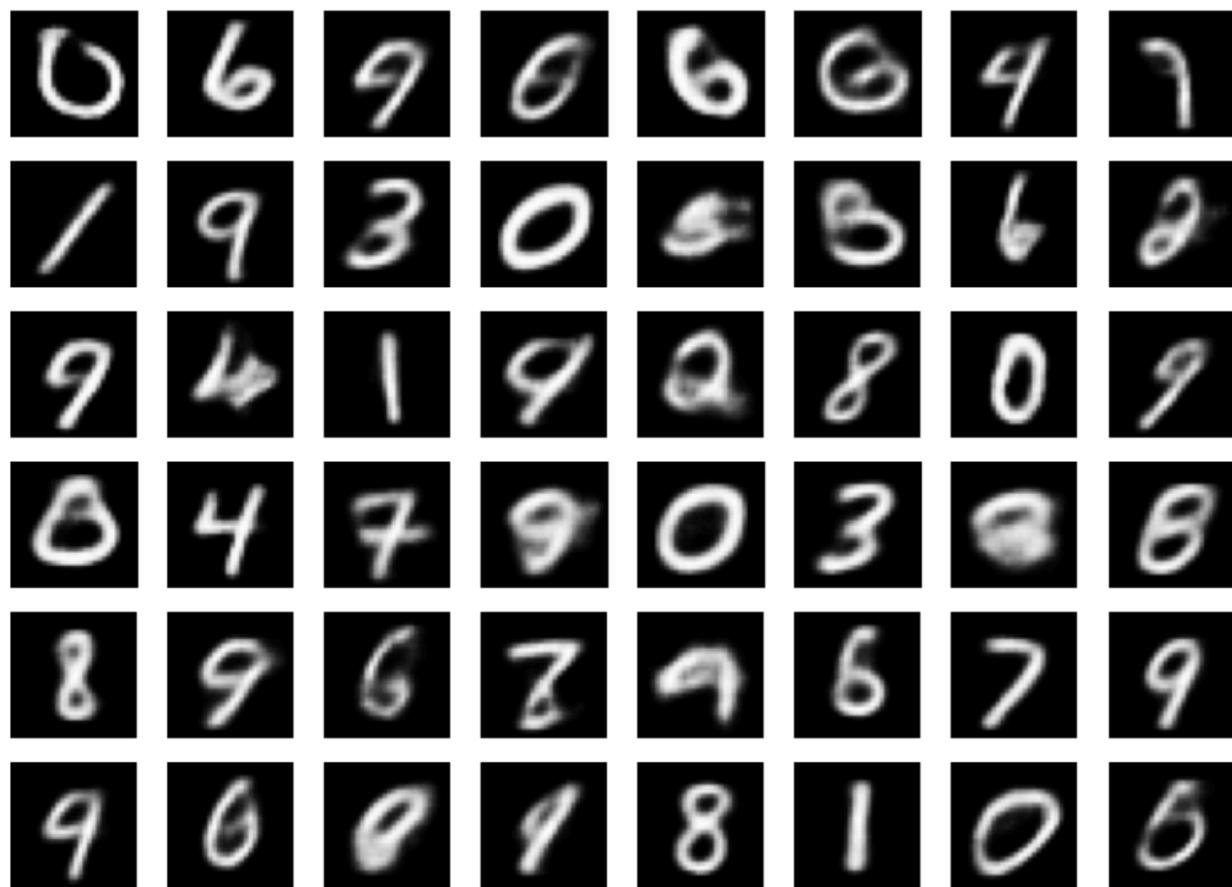
Latent space becomes more regular

Sample diversity is reduced

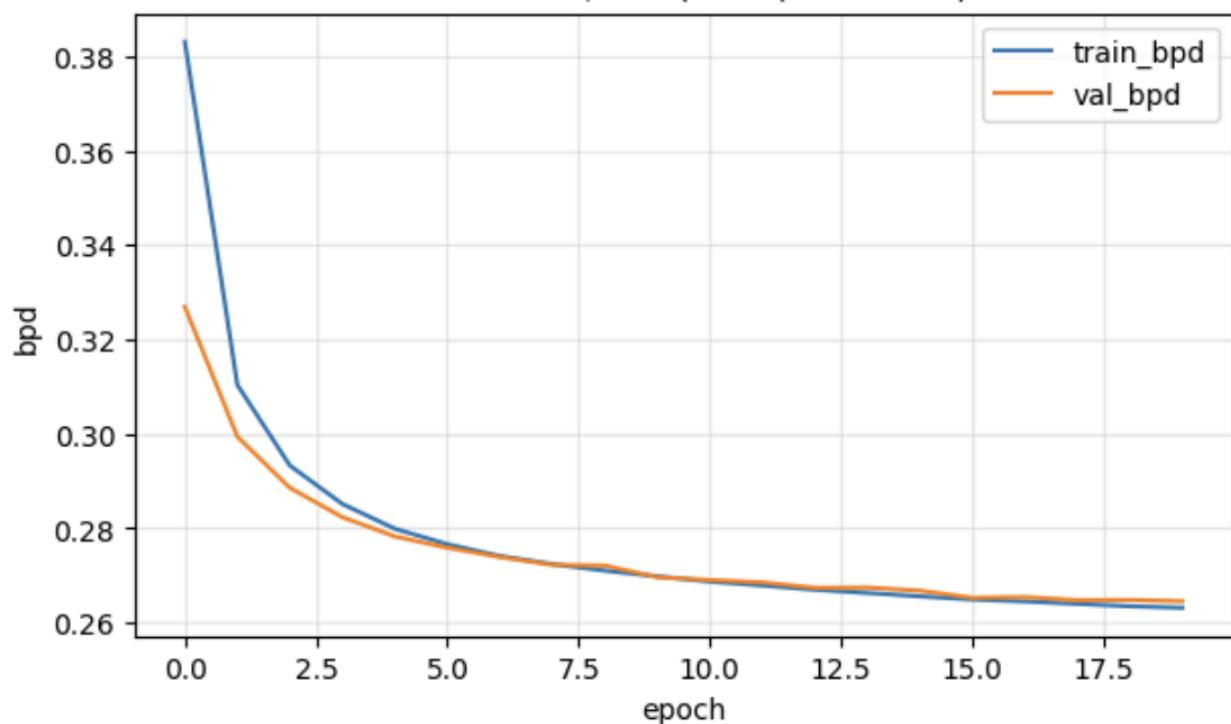
β -VAE improves latent disentanglement at the cost of reconstruction quality.

Additionally, after nlp home assignment, I ran out of compute units and I needed to buy additional computation resources in Colab in order to run the code. With this option it was really fast.

mnist samples (ep 20)



mnist - Bits/Dim (z=16, beta=4.0)



The training and validation BPD curves are consistently higher than the baseline VAE ($\beta = 1.0$), indicating worse likelihood.

Generated samples are still recognizable digits as in the baseline.

Reconstruction quality decreases as β increases.