DGM Assignment 2

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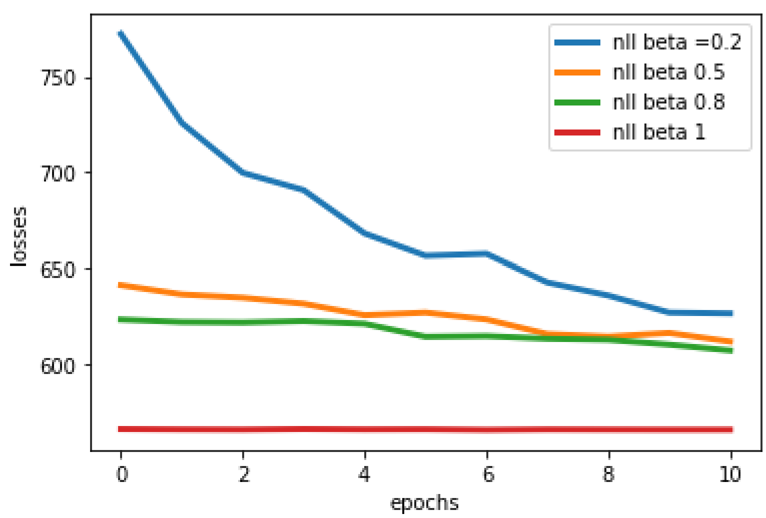
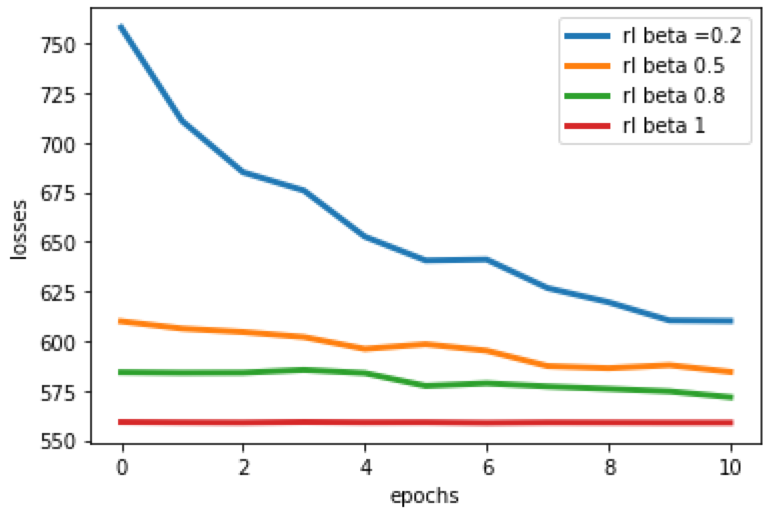
bVAE Implementation:

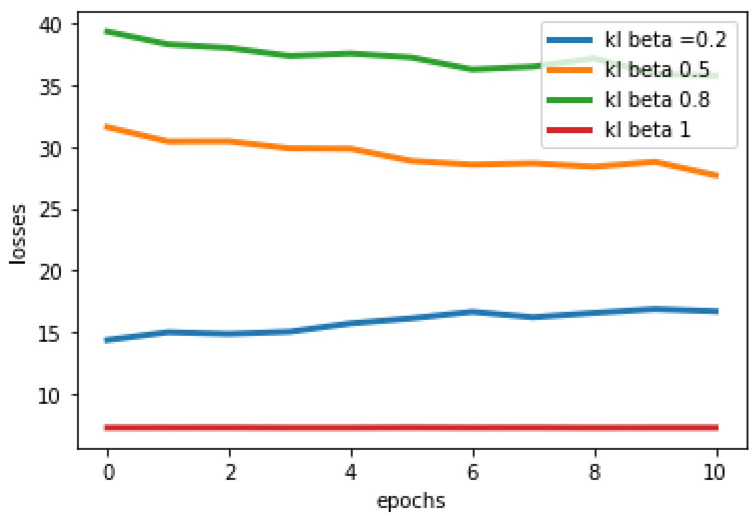
In betaVAE, there is a variational encoder and decoder. The encoder networks is a deep neural network that encodes the input into a latent space which is easier to sample from. For this experiment we try to replicate a gaussian distribution. The decoder decodes from the latent distribution and the loss is calculated using ELBO method. In ELBO, there are two terms the reconstruction loss which is evaluated between the decoder output and the input image. The other term KL is calculated between the two distributions in the latent space.
Also, since we have 10 states for input image we calculate the reconstruction loss and call it log categorical by one-hot encoding the states.

Observation and Results:

We test the betaVAE model for different beta values (0.2,0.5,0.8,1). The model with beta = 1 is a normal VAE model. The observations are that for higher beta the loss is lower and the samples are more sharper. Also, the KL value is higher for the models with higher beta than the models with lower beta values
Loss plot with various beta values. It is observed that the model with beta =1 has the lowest Loss. The images show the nll, reconstruction loss and kl term. For the model with latent dimensions (50).







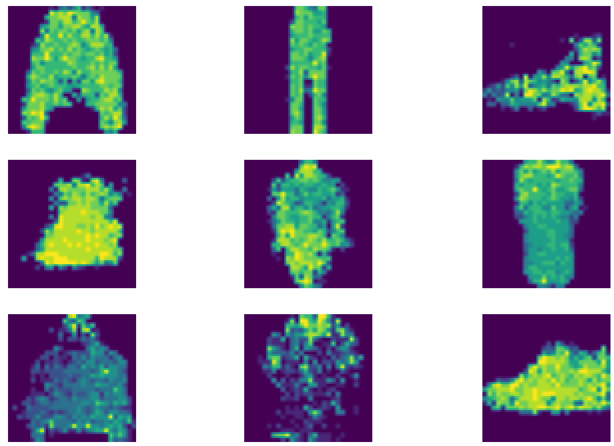
Samples Generated:

Noise Contrastive Estimation:

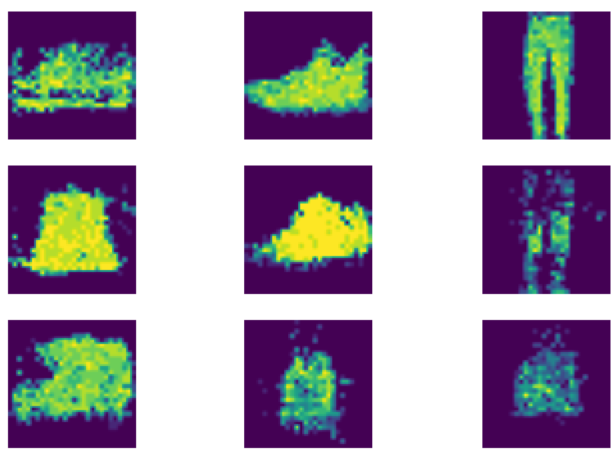
In this part, we use the encoder output (q(z))from the VAE and p(z) the normal distribution and create a binary classifier to distinguish between the samples from both distributions in the latent space. We use this classifier and multiply with p(z) to build an Energy function. Now, we can use langevin dynamics to sample from the Energy function and pass it to the decoder. This shows an improvement in the result samples.

Observations:
The samples generated using Langevin are slightly sharper than the samples obtained from betaVae. The background and foreground are clearly distinguished.

Sample generated From Langevin Dynamics:



Sample generated using betaVAE:



The rest of the samples for latent size (50,100) are presented in the ipynb file.