# Variational Auto-Encoders

## Introduction

In this homework, I use 2 VAEs to model a generative process on MNIST dataset.

## VAE_basic

The  basic model uses Bernoulli likelihood function.
Each training epoch takes an average of ~60s.

*Figure1: Output of VAE_basic after epoch10*

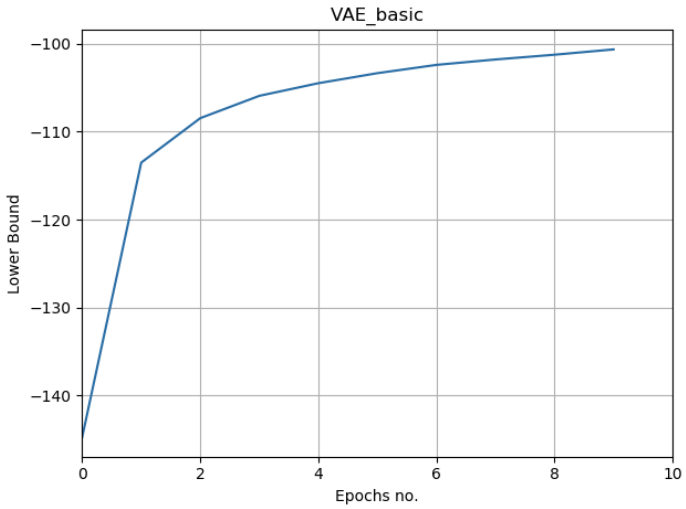


*Figure2: Lower bound of VAE_basic after epoch10*

## VAE_gaussian

This model uses Gaussian likelihood function.
Each training epoch takes an average of ~75s.

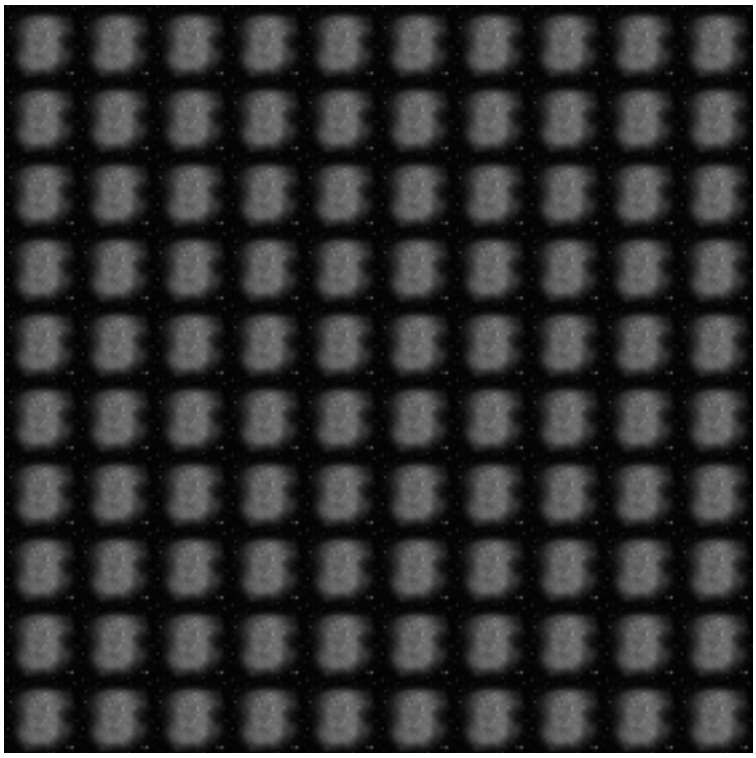

*Figure3: Output of VAE_gaussian after epoch10*

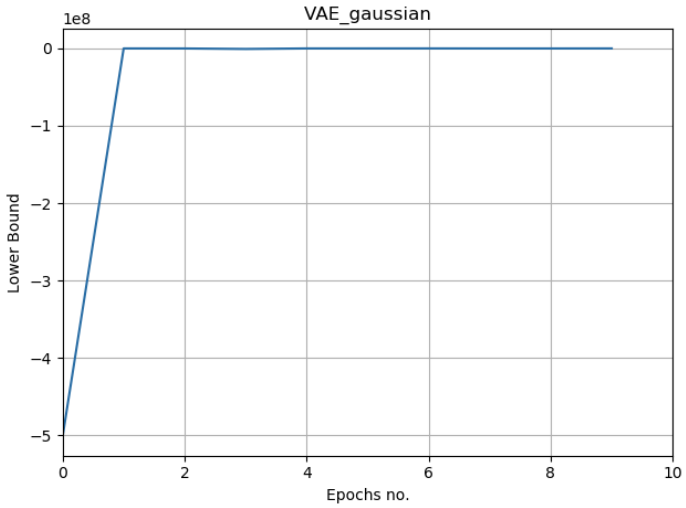


*Figure4: Lower bound of VAE_ gaussian after epoch10*

## Comments and Discussion

For *VAE_gaussian*, the lower bound is in the order of $-10^5$ after 10 epochs. This is much larger than that of *VAE_basic*, which was in the order of $-10^2$. This means that *VAE_gaussian* is learning the correct distribution.

A possible reason is that *VAE_gaussian* takes longer to learn and we have not run enough epochs. Another possible reason is implementation error.