

**PHY 835: Exercise 8 (Last Assignment, Congrats!)**  
**Released April 11, 2021; Target Due Date: April 27, 2021**

### **1. Variational Autoencoder**

The aim of this exercise is to implement the variational autoencoder and to test it on the polynomial dataset from the previous exercise.

- a) Implement the loss function of the variational autoencoder in your previous architecture.
- b) Compare the performance and the latent space representations of the traditional autoencoder and your variational autoencoder.
- c) (Optional) There is a quicker way of implementing the variational autoencoder using the tensorflow probability package. Using this package implement your variational autoencoder.

### **2. GAN Optimization**

For the example  $V(x, y) = xy$  perform alternating gradient descent updates with respect to  $x$  and  $y$  as we would perform when training a GAN, i.e. one player is performing updates to optimize  $V$  and one player to optimize  $-V$ . Identify the trajectory of this update. Which 'late-time' behavior do you find?

### **3. GAN**

The aim of this exercise is to implement a GAN architecture and to test it on the polynomial dataset from the previous exercise. You can adapt the architecture from the MNIST example in the lectures.

(Optional) Update your loss function to implement a Wasserstein GAN.

Note that in case you do not have a local environment where you can calculate on a GPU, you can calculate online on collab on a GPU.