Indian Institute of Technology Hyderabad
Deep Learning (AI5100): Assignment-5

Topic:AE, and VAE
Assigned on: 19th **April, 2024**
Deadline: 2nd **May, 2024**
Maximum Marks: 30

1 Instructions

- Answer all questions. We encourage best coding practices by not penalizing (i.e. you may not get full marks if you make it difficult for us to understand. Hence, use intuitive names for the variables, and comment your code liberally. You may use the text cells in the notebook for briefly explaining the objective of a code cell.)

- It is **expected** that you work on these problems individually. If you have any doubts please contact the TA or the instructor no later than 2 days prior to the deadline.

- You may use built-in implementations only for the basic functions such as `sqrt, log`, etc. from libraries such as `numpy` or `PyTorch`. Other high-level functionalities are expected to be implemented by the students. (Individual problem statements will make this clear.)

- For plots, you may use `matplotlib` and generate clear plots that are complete and easy to understand.

- You are expected to submit the Python Notebooks saved as <your-roll-number>.ipynb

- If you are asked to report your observations, use the mark down text cells in the notebook.

2 Questions

1. **Autoencoders**: In this task, consider the MNIST dataset for training autoencoder models (with a suitable regularization) with hidden (latent) dimension of 32, and 64. [10 + 5 = 15 Marks]
   (a) Report the train and test reconstruction errors for the three models (display about 10 reconstructions from the train and test data each).
   (b) Perform the reconstruction on the line joining two training data samples in the hidden space. Consider at least 5 pairs of samples.

2. **Variational Autoencoder** (VAE): Train a VAE (on MNIST dataset) for the tasks of generating MNIST-like digits. Encoder learns a distribution in $16D$ space. After successfully training the VAE, generate 64 images and display. [15 Marks]