Intro2GenAI homework for variational autoencoders

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- Deadline: October 27 (Monday) at 11:00 PM. Please submit your homework through the course e-learning platform.

1 Programming Assignment

1. (a) Implement a β-Variational Autoencoder (β-VAE) in Pytorch using the CIFAR10 dataset for training and testing. Display both the first 10 original test images and their reconstructions to compare reconstruction quality, with a latent space dimension of 2. (50 points)

   (b) Experiment with different β values to analyze how settings of $\beta > 1$, $\beta = 1$, and $\beta < 1$ influence the model's ability to capture interpretable variations. Identify your optimal β value for disentangling, which should fall within the correct range for your analysis. Then, display a 12×12 grid of decoded images. (30 points)

   (c) Identify a poorly performing β value that results in excessive regularization and degraded reconstruction quality. Show 10 generated images for this setting. (20 points)

   Submit your work as a Python notebook (.ipynb) file named with your student ID.

Reference

1. Sample code for the Variational Autoencoder class.
2. Building a Beta-Variational AutoEncoder (β-VAE) from Scratch with PyTorch