Graduate Certificate in Artificial Intelligence with Machine Learning
AIGC 5504 – Emerging Technologies in Artificial Intelligence

# Lab 2 and 3: Hands-On with Variational Autoencoders

## Submission guidelines:

- For this lab, you will need to submit 1 PDF file.
- Convert your codes to PDF.
- Name the PDF as follows: firstname_lastname_LAB2,3.pdf
- Go to the course Blackboard → Labs folder → Lab Exercises 2,3 and submit the pdf.

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## Lab goals:

- Understand the fundamental components of Variational Autoencoders (VAEs).
- Implement and train a VAE to reconstruct a circular dataset.
- Explore and visualize the latent space of the trained VAE.

## Part 1: Implementing a VAE (Follow the Live in-lab Demo)

1. Train a VAE on a circular dataset.
2. Visualize the original and reconstructed data.
3. Analyze the VAE's performance by observing reconstruction quality.

## Part 2: Exploration and Visualization of Latent Space

1. Modify the code to plot the latent space of the trained VAE by extracting the mu (mean) values for each input point.
2. Visualize the latent space and observe how the circular dataset is represented in 2D.

## Part 3: Your Challenge

1. Generate new synthetic data that is different from our circular data.
2. Train and test the reconstructed data.

Enjoy!

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