

**CS-681**  
**Assignment #1**  
**Assigned: Monday, September 15, 2025**  
**Due: Monday, September 22nd, 2025**

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## **Comparing GAN and VAE for Data Generation**

### **Objective:**

This assignment gives you hands-on experience with two foundational families of generative models: **Generative Adversarial Networks (GANs)** and **Variational Autoencoders (VAEs)**. You will implement, train, and evaluate both models on the **same dataset** and compare their ability to generate new samples.

### **Task:**

Apply both a **GAN** and a **VAE** to the same dataset. Generate new samples with each model and compare results in terms of **quality, diversity, and limitations**.

### **Main Steps:**

1. **Select a suitable dataset.**
2. **Preprocess the data** (normalize, resize, ...etc.).
3. **Build and train a VAE** on the dataset.
  - Generate new samples from the learned latent space.
4. **Build and train a GAN** on the same dataset.
  - Generate new samples from the generator.
5. **Evaluate and compare:**
  - **Show examples of generated data** from both models.
  - Use **quantitative metric** (e.g., Precision and Recall for generative models, FID, Inception Score, .... etc.)
  - Provide comments discussing **visual quality, diversity, and reconstruction ability**.
6. **Summarize your findings:**
  - Strengths and weaknesses of each model.
  - Limitations and challenges you faced.

**Submission Requirements:**

- A **well-documented Python codebase** (.py file or Jupyter Notebook).
- Code must be complete, runnable and include clear comments

**Rubric:**

Criterion	Points	Description
<b>Correctness and Functionality</b>	3	Code runs without errors, implements GAN & VAE correctly, produces valid outputs.
<b>Clarity and Documentation</b>	3	Generated samples are meaningful; at least one quantitative metric is reported; comparisons are clear.
<b>Quality of Results</b>	2	Generated outputs demonstrate successful application of the chosen technique using correct metric computation.
<b>Effort &amp; Completeness</b>	2	Evidence of genuine effort (e.g., handling training challenges, trying different settings, thoughtful discussion of limitations).