

Variational Autoencoders and GANs

Week 14 · November 24, 2026

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Table of contents

1	Learning Objectives	1
2	Latent Variable Models	2
3	The Evidence Lower Bound	2
4	The Reparameterization Trick	2
5	Training and Sampling from a VAE	3
6	Generative Adversarial Networks	3
7	Mode Collapse and Training Instability	3
8	Comparing VAEs and GANs	3
9	Summary	3
10	Exercises	3
11	Further Reading	3

Reading Prince, *Understanding Deep Learning*, Chapters 15 and 17

⚠ These notes are still being written. The reading above is authoritative until this banner disappears.

1 Learning Objectives

By the end of this week you should be able to:

1. Explain what a latent variable model is and why the likelihood is intractable.
2. Derive the evidence lower bound and interpret its two terms.
3. Describe the reparameterization trick and why it is necessary.

4. Describe the GAN minimax objective and the roles of generator and discriminator.
5. Explain mode collapse and training instability in GANs.
6. Compare VAEs and GANs on sample quality, diversity, and training stability.

```
import numpy as np
import matplotlib.pyplot as plt
import torch

torch.manual_seed(774)
np.random.seed(774)

plt.rcParams.update({
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NDSU_GREEN = "#005643"
NDSU_GOLD = "#FFC72C"
ACCENT = "#C1121F"
```

2 Latent Variable Models

TODO

3 The Evidence Lower Bound

TODO

4 The Reparameterization Trick

TODO

5 Training and Sampling from a VAE

TODO

6 Generative Adversarial Networks

TODO

7 Mode Collapse and Training Instability

TODO

8 Comparing VAEs and GANs

TODO

9 Summary

TODO

10 Exercises

Problem numbers refer to Prince, Chapters 15 and 17.

1. TODO
2. TODO
3. Computational. TODO

11 Further Reading

- Prince, *Understanding Deep Learning*, Chapters 15 and 17.
- TODO