

Generative Adversarial Networks (Part 3)

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Challenges in Training GANs

Training Generative Adversarial Networks (GANs) can be challenging due to several issues:

- ❖ **Vanishing Gradient**
- ❖ **Mode Collapse**

These challenges are active areas of research, with ongoing efforts to develop effective solutions.

Vanishing Gradient

When the discriminator is optimal, the loss function minimizes a measure of distance based on KL divergence.

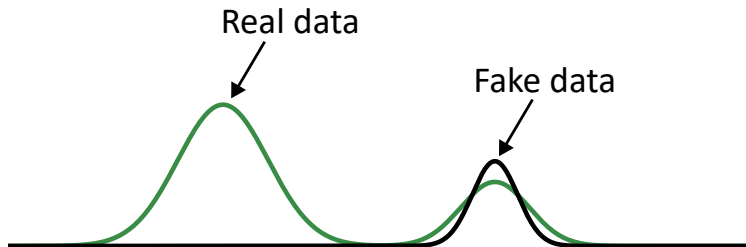
- ❖ If the probability distributions are completely disjoint, KL divergence becomes infinite.
- ❖ In such cases, any small change to the generator will not decrease the loss.

$$D_{KL} [p \parallel q] = \int p(x) \log \left(\frac{p(x)}{q(x)} \right) dx$$

- ❖ $D_{KL} [p \parallel q]$ can be infinite when there are points such that $q(x) = 0$ and $p(x) > 0$.

Mode Collapse

Mode collapse is a common failure mode where the generator produces plausible samples, but these only represent a subset of the data. For example, it might never generate faces with beards.



- ❖ Some or most modes of the true distribution can be ignored.
- ❖ Each generated sample is pushed towards the nearest data example.
- ❖ This ensures that each generated sample has a nearby data example, but it does not ensure that each data example has a nearby generated sample.