Vanishing Gradient Details

Problem Cascade

1. Discriminator becomes too successful

↓

2. D correctly classifies fake samples with high confidence

$$D(G(z)) \rightarrow 0$$

↓

3. Original loss function saturates

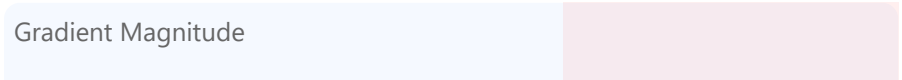
$$\log(1 - D(G(z))) \rightarrow \log(1) = 0$$

↓

4. Gradients vanish - Generator receives no learning signal

$$\nabla_G \rightarrow 0$$

Gradient Magnitude Over Training



When It Occurs

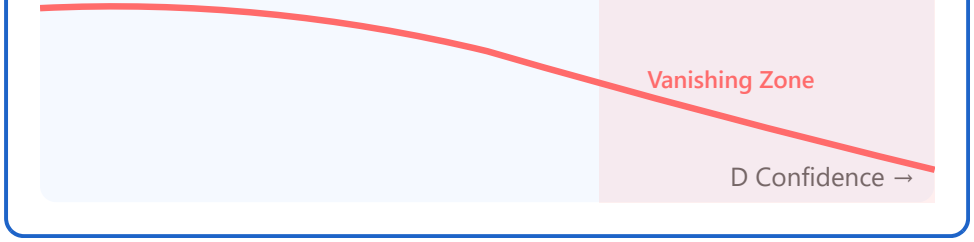
- ⚠ D is too successful
- ⚠ D(G(z)) approaches 0
- ⚠ No learning signal for G

⚖ Key Insight

Careful capacity balance between G and D is crucial to prevent one from dominating

✓ Solutions

- Non-saturating loss
- WGAN (Wasserstein GAN)
- Gradient penalty methods
- Balance G and D capacity


Vanishing Zone
D Confidence →