PA3: Comparative Analysis of DCGAN and CycleGAN Performance

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1 DCGAN Experiments

The DCGAN model was trained for 100 epochs on the emoji dataset, with evaluation metrics recorded throughout the training process.

1.1 Training Dynamics

Figure 1 presents the training loss trajectories for both generator and discriminator components. Several key observations emerge:

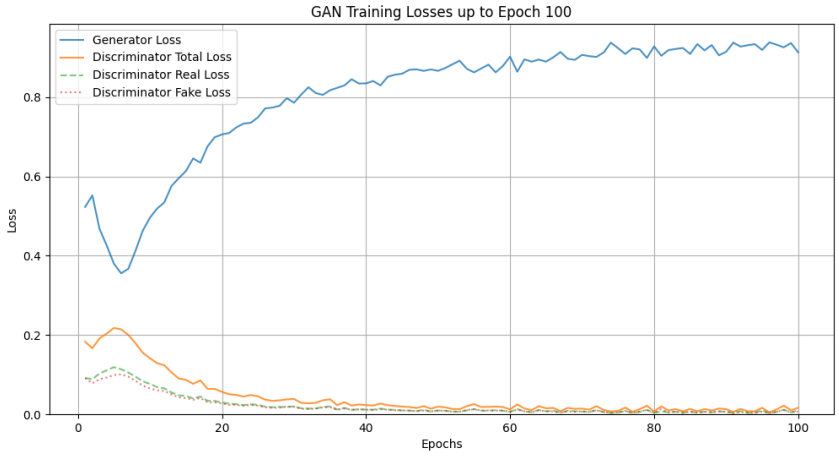
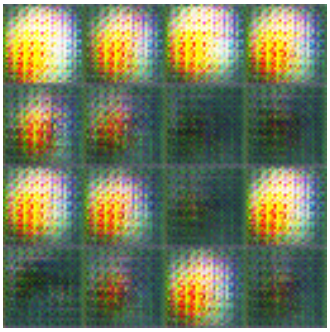


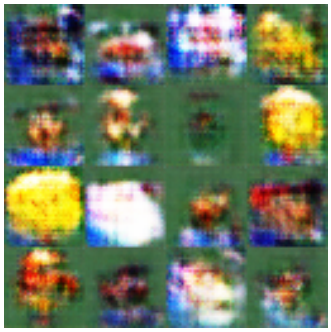
Figure 1: Training loss in 100 epochs

1.2 Generated Samples

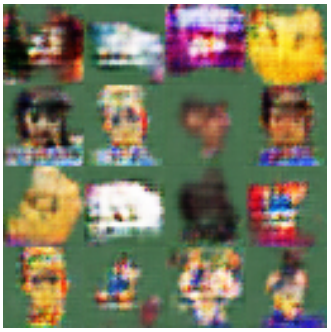
Five representative samples generated by the DCGAN model:



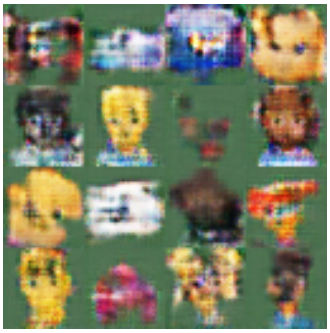
(a) dcgan sample 200 iterations



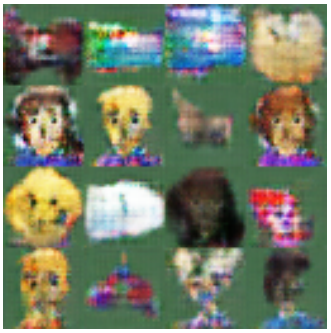
(b) dcgan sample 1000 iterations



(c) dcgan sample 4000 iterations



(d) dcgan sample 8000 iterations



(e) dcgan sample 12600 iterations

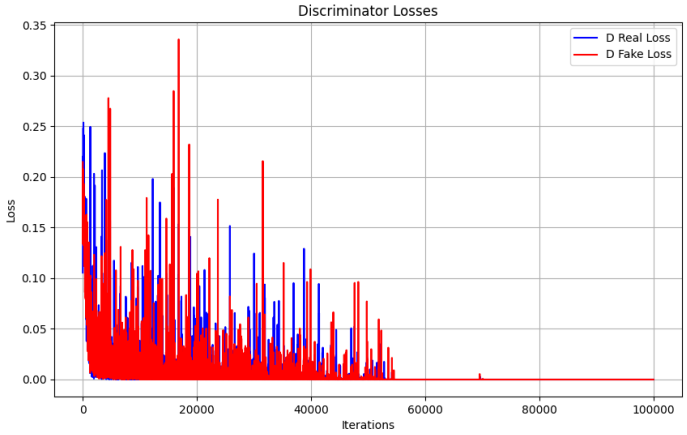
Figure 2: Five representative samples generated by DCGAN demonstrating the model's output characteristics

2 CycleGAN Experiments

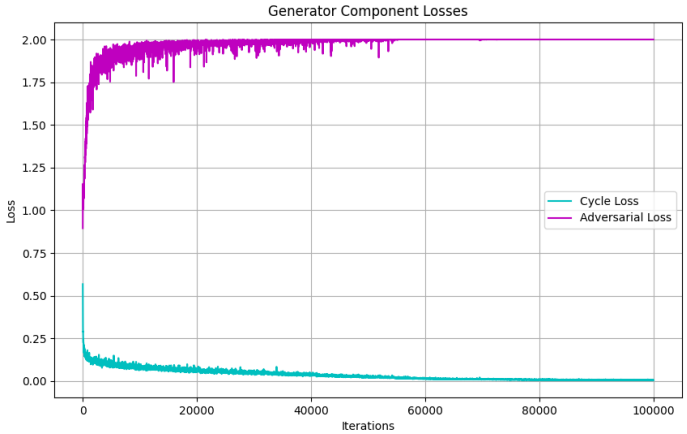
The CycleGAN model was trained for 100,000 iterations on the Apple-Windows dataset for unpaired image-to-image translation.

2.1 Loss Component Analysis

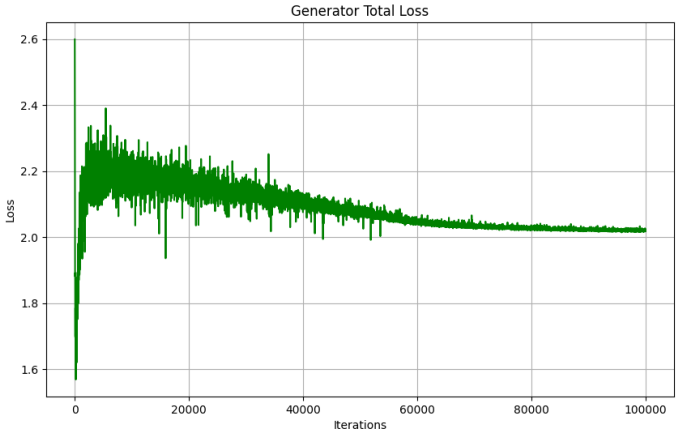
Figure 3 presents the comprehensive loss trajectories:



(a) Discriminator losses (D_A and D_B)



(b) Generator loss components



(c) Total generator loss

Figure 3: CycleGAN loss trajectories showing (a) discriminator losses, (b) generator component losses, and (c) total generator loss. The stabilization of metrics after 10,000 iterations indicates convergence.

2.2 Initial Training Phase Analysis

To better illustrate the training process in GAN, we also present the loss figure for the first 10,400 iterations here.

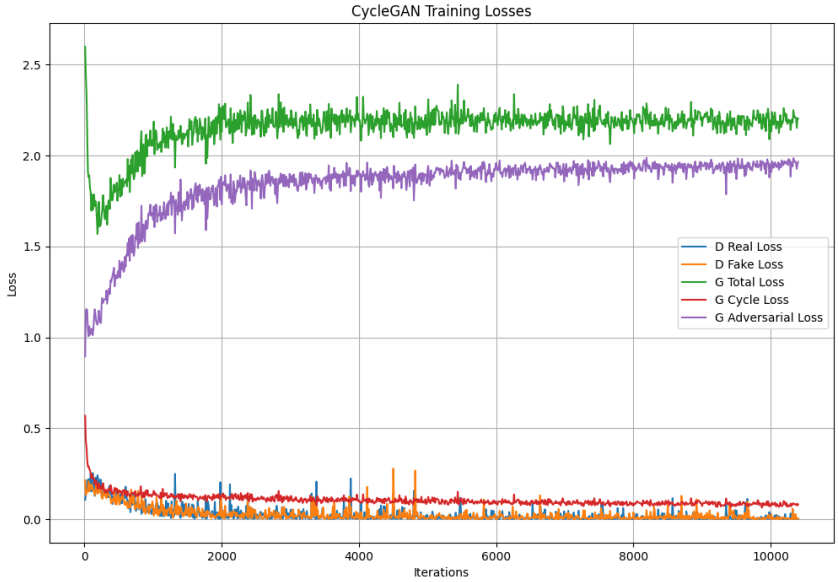
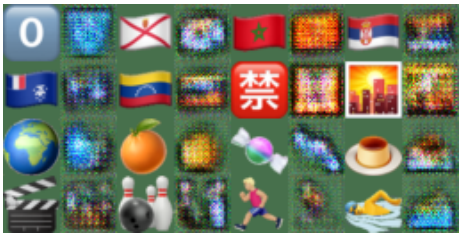


Figure 4: Training loss during the first 10,400 iterations

2.3 Translation Sample Pairs

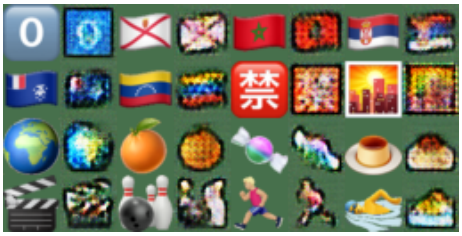
Five representative translation pairs demonstrating the model's bidirectional transformation capability:



(a) Pair 1:iteration 100 X→Y

(b) Pair 1:iterations 100 Y→X

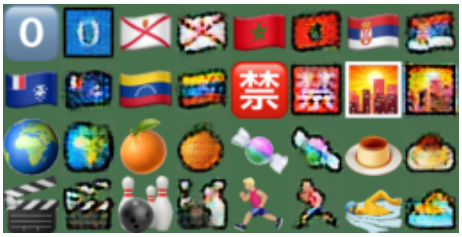
Figure 5: CycleGAN translation pair 1 showing bidirectional transformation between domains



(a) Pair 2:iteration 1000 X→Y

(b) Pair 2:iteration 1000 Y→X

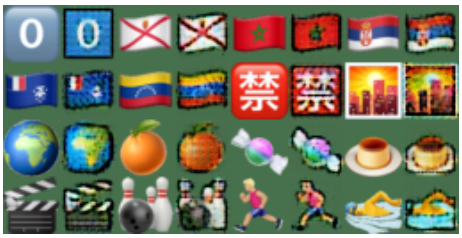
Figure 6: CycleGAN translation pair 2 showing bidirectional transformation between domains



(a) Pair 3:iteration 5000 X→Y

(b) Pair 3:iteration 5000 Y→X

Figure 7: CycleGAN translation pair 3 showing bidirectional transformation between domains



(a) Pair 4:iteration 10000 X→Y

(b) Pair 4:iteration 10000 Y→X

Figure 8: CycleGAN translation pair 4 showing bidirectional transformation between domains

3 Notes

For enhanced training effectiveness, the Cycle Consistency loss and Generative Adversarial loss were combined using a weighted summation approach, with the weighting coefficient treated as a tunable hyperparameter. Additionally, subtle model adjustments were implemented (e.g., replacing ReLU with LeakyReLU, experimenting with soft labels for the discriminator), but these modifications did not yield significant improvements in performance.