Neural Cellular Automata GAN(NCA-GAN)

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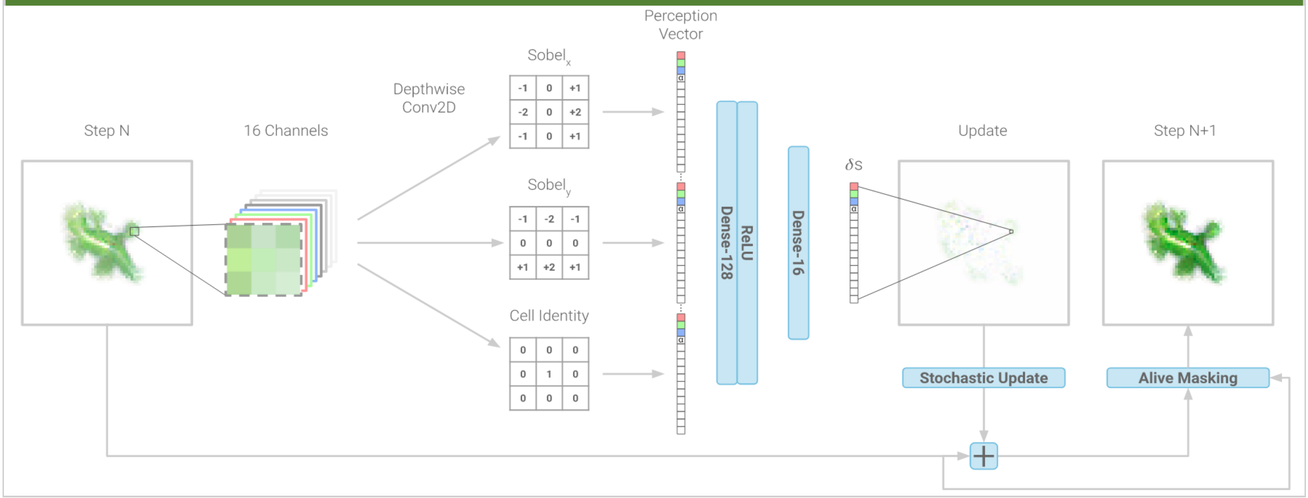
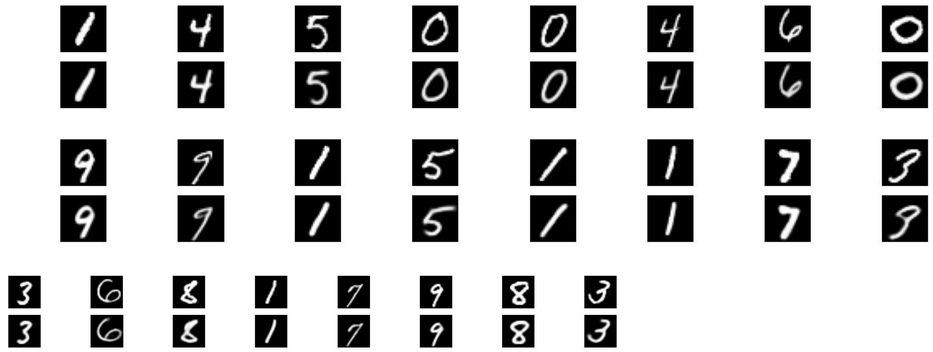
Framework of Model



Results



Link

[codes] Not Released Yet

Figure 1. Generated Results of our model.

Highlights

- We combine NCA with GAN to generate high quality images.
- Our modification to NCA to add VAE is very effiective.
- We present a further modification called NCA-GAN.
- Our generated result validate the efficacy of our method.

Neural Cellular Automata(NCA)

Definition:

Computational systems characterized by being discrete on both spatial and temporal scales and abstract.

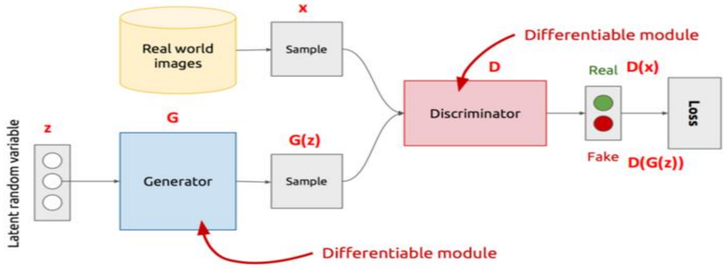
Four fundamental features:

1.discrete n-dimensional lattice of cells
2.discrete states
3.local interactions
4.discrete dynamics

Example:

Conway's game of life

Training Process



- **Z** is some random noise (Gaussian/Uniform).
- **Z** can be thought as the latent representation of the image.

Challenges/Motivations

1.NCA
- Need enhancement or other auxiliary components such as VAE

2.Discriminator
- Match the generative capability of NCA

3.Loss function
- Find a good loss function

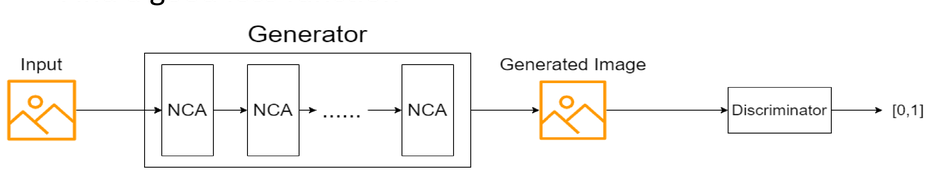


Figure 1. Enhancement to NCA and GAN

Generator vs. Discriminator

Figure 1. Function of generator and discriminator

The idea behind the GANs is very straightforward. Two networks -- a Generator and a Discriminator play a game against each other. The objective of the Generator is to produce an object, say, a picture of a person, that would look like a real one. The goal of the Discriminator is to be able to tell the difference between generated and real images.Through continuous training, the generator and discriminator are enhanced.

References

1. Otte M, Delfosse Q, Czech J, Kersting K. Generative Adversarial Neural Cellular Automata. arXiv preprint arXiv:2108.04328. 2021 Jul 19.
2. Mordvintsev A, Randazzo E, Niklasson E, Levin M. Growing neural cellular automata. Distill. 2020 Feb 11;5(2):e23.