Generative Adversarial Network

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May 11, 2018

In the last article, it was introduced that researchers made GAN-based AI create new levels for Doom and Super Mario games. Today, I read something about GAN.

Generative adversarial networks are a class of artificial intelligence algorithms used in unsupervised machine learning [2]. This technique can generate photographs that look at least superficially authentic to human observers, having many realistic characteristics.

This concept was introduced by IJ Godfellow *et al.* in 2014 [1]. GANs have been used to produced samples of photorealistic[1] images for the purposes of visualizing new interior/industrial design or items for computer games' scenes.

In Godfellow's paper, an equation (Equ. 1) is given to be described in mathematical linguistics. This equation is difficult to understand.

$$\min_G \max_D V(D,G) = \mathbb{E}_{\boldsymbol{x}\sim p_{data}(\boldsymbol{x})}[\log D(\boldsymbol{x})] + \mathbb{E}_{\boldsymbol{z}\sim p_{\boldsymbol{z}}(\boldsymbol{z})}[\log(1 - D(G(\boldsymbol{z})))] \tag{1}$$

As shown in Fig. 1, the figure is easy to understand. The left part displays when a sample x from data is input to the function D which is called Discriminator, and tries to Discriminator make $D(x)$ be near 1 as x is from real data. The right part shows that function G which is called Generator generates a fake data $G(z)$ by accepting a noise z, then this fake data is input to function D, Discriminator tires to make $D(G(z))$ near 0 as $G(z)$ is not a real data, while Generator tires to make $D(G(z))$ near 1 for its inherent function.

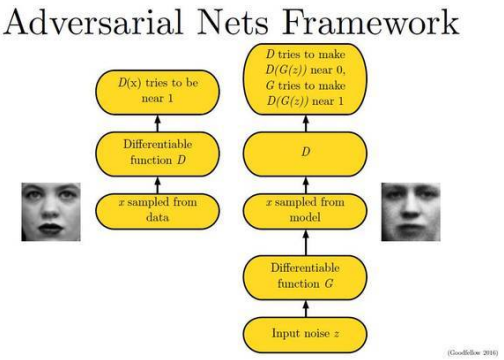

Figure 1: Adversarial Nets Framework

That is to say, Discriminator tries its best to distinguish the real data from the fake data , and Generator also does its best to generate a 'real' data to cheat Discriminator.

[1] a genre of art that encompasses painting, drawing and other graphic media.

References

[1] IJ Goodfellow *et al.* Generative adversarial networks. *Advances in Neural Information Processing Systems*, 3:2672–2680, 2014.

[2] Wikipedia. Generative adversarial network. https://en.wikipedia.org/wiki/Generative_adversarial_network.