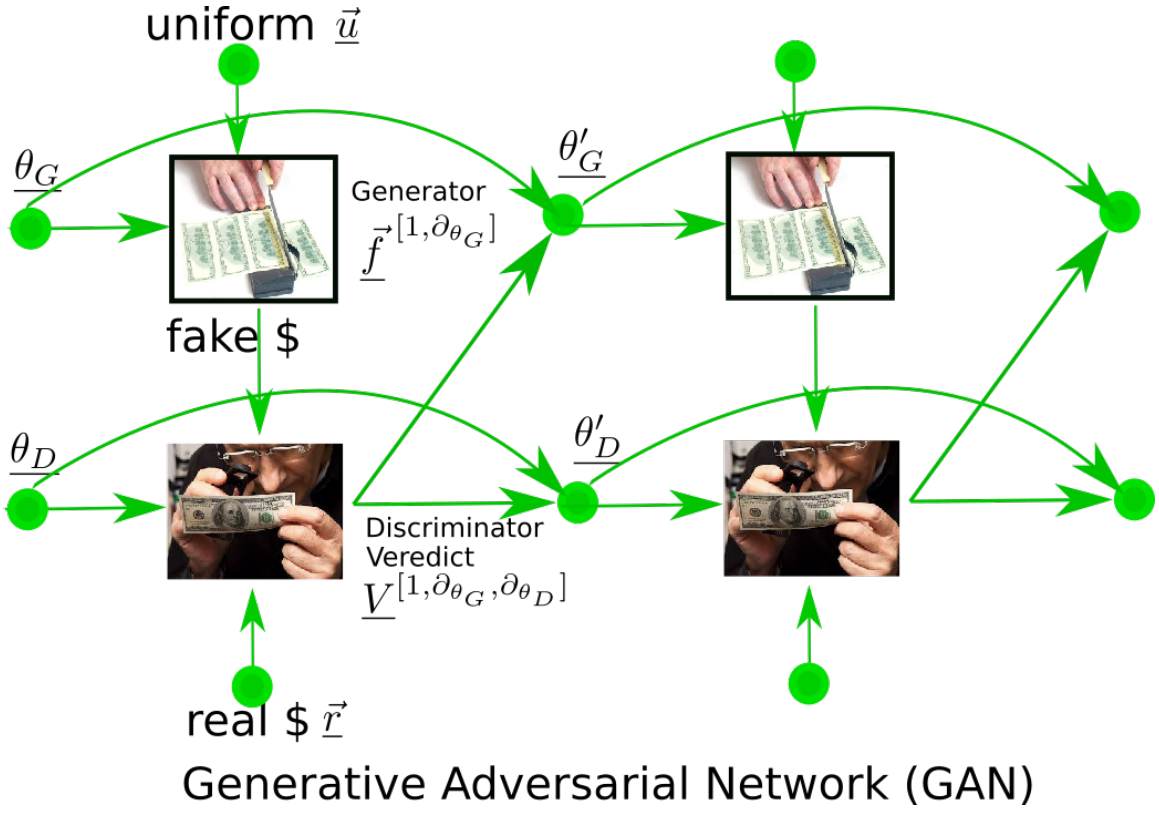
1 Generative Adversarial Network (GAN)



f = fake, r = real, u= uniform, V=Veredict

$$f^{[1,\partial_x,\partial_y]}(x,y) = [f, \partial_x f, \partial_y f] \tag{1}$$

$f^{[1,\partial_x,\partial_y]} = f^+$

$$\begin{aligned} V(\theta_G,\theta_D) &= \sum_{r,u} P(u)P(r)\log\{D(r;\theta_D)(1-D[G(u;\theta_G);\theta_D])\} &(2)\\ &\approx \sum_{a,b} \log\{D(r[b];\theta_D)(1-D[G(u[a];\theta_G);\theta_D])\} &(3)\end{aligned}$$

$$\delta V(\theta_G,\theta_D) = 0 \tag{4}$$

$$\partial_{\theta_G} V(\theta_G,\theta_D) = \partial_{\theta_D} V(\theta_G,\theta_D) = 0 \tag{5}$$

$$V_{opt} = \min_{\theta_G}\max_{\theta_D} V(\theta_G,\theta_D) \tag{6}$$

$$P(\theta_G) = \delta(\theta_G, \theta_G^{init}) \tag{7}$$

$$P(\theta_D) = \delta(\theta_D, \theta_D^{init}) \tag{8}$$

$$P(\vec{u}) = \prod_a P(u[a]) \tag{9}$$

$$P(\vec{r}) = \prod_a P(r[a]) \tag{10}$$

$$P(\vec{f}^{[1,\partial_{\theta_G}]}|\vec{u}, \theta_G) = \delta[\vec{f}^{[1,\partial_{\theta_G}]}, G^{[1,\partial_{\theta_G}]}(\vec{u}; \theta_G)] \tag{11}$$

$$P(V^{[1,\partial_{\theta_G},\partial_{\theta_D}]}|\vec{f}^{[1,\partial_{\theta_G}]}, \vec{r}, \theta_D) = \delta[V^{[1,\partial_{\theta_G},\partial_{\theta_D}]}, V^{[1,\partial_{\theta_G},\partial_{\theta_D}]}(\theta_G, \theta_D)] \tag{12}$$

$\eta_G, \eta_D \geq 0$, maximize wrt θ_D, minimize wrt θ_G

$$P(\theta'_G|V^{[1,\partial_{\theta_G},\partial_{\theta_D}]}, \theta_G) = \delta[\theta'_G, \theta_G - \eta_G \partial_{\theta_G} V(\theta_G, \theta_D)] \tag{13}$$

$$P(\theta'_D|V^{[1,\partial_{\theta_G},\partial_{\theta_D}]}, \theta_D) = \delta[\theta'_D, \theta_D + \eta_D \partial_{\theta_D} V(\theta_G, \theta_D)] \tag{14}$$

$$P(\theta'_G, \theta'_D|\theta_G, \theta_D) = \sum_{V^{[1,\partial_{\theta_G},\partial_{\theta_D}]}, \vec{f}^{[1,\partial_{\theta_G}]}, \vec{u}, \vec{r}} P(\theta'_G|V^+, \theta_G) P(\theta'_D|V^+, \theta_D) P(V^+|\vec{f}^+, \vec{r}^+, \theta_D) P(\vec{f}^+|\vec{u}, \theta_G) P(\vec{u}) P(\vec{r}) \tag{15}$$