

2020.03.18

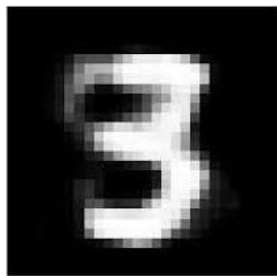
PyTorch GANs:

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Objective function

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

$$\mathbb{E}_{\mathbf{x} \sim p_{\text{data}}(\mathbf{x})} [\log D(\mathbf{x})]$$

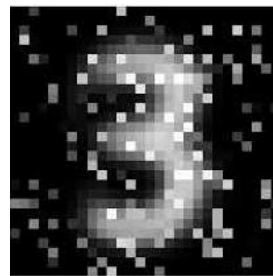


\mathbf{x}



1

$$\mathbb{E}_{\mathbf{z} \sim p_{\mathbf{z}}(\mathbf{z})} [\log(1 - D(G(\mathbf{z})))]$$



$G(\mathbf{z})$



0

Code review

```
import torch
import torch.nn as nn

D = nn.Sequential(
    nn.Linear(784, 128),
    nn.ReLU(),
    nn.Linear(128, 1),
    nn.Sigmoid())

G = nn.Sequential(
    nn.Linear(100, 128),
    nn.ReLU(),
    nn.Linear(128, 784),
    nn.Tanh()) # 생성된 값이 -1 ~ 1
```

Code review

```
criterion = nn.BCELoss() # Binary Cross Entropy Loss(h(x), y), Si

d_optimizer = torch.optim.Adam(D.parameters(), lr=0.01)
g_optimizer = torch.optim.Adam(G.parameters(), lr=0.01)
# 충돌하기에 2개의 optimizer를 설정

while True:
    # train D
    loss = criterion(D(x), 1) + criterion(D(G(z)), 0)
    loss.backward() # 모든 weight에 대해 gradient값을 계산
    d_optimizer.step()

    # train G
    loss = criterion(D(G(z)), 1)
    loss.backward()
    g_optimizer.step() # generator의 파라미터를 학습
```

Binary Cross Entropy:

$$BCE(x) = -\frac{1}{N} \sum_{i=1}^N y_i \log(h(x_i; \theta)) + (1 - y_i) \log(1 - h(x_i; \theta)).$$

$$\text{loss} = \text{criterion}(D(x), 1) + \text{criterion}(D(G(z)), 0)$$

$$\text{Binary Cross Entropy}(h(x), y) = -y \log(h(x)) - (1 - y) \log(1 - h(x))$$

$$\text{criterion}(D(x), 1) = -\log(D(x))$$

$$\text{criterion}(D(G(z)), 0) = -\log(1 - D(G(z)))$$

$$= -[\log(D(x)) + \log(1 - D(G(z)))]$$

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

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    # train D
    loss = criterion(D(x), 1) + criterion(D(G(z)), 0)
    loss.backward() # 모든 weight에 대해 gradient값을 계산
    d_optimizer.step() # gradient updated by optimizer

    # train G
    loss = criterion(D(G(z)), 1)
    loss.backward()
    g_optimizer.step() # generator의 파라미터를 학습
```

Code review

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# train G
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loss.backward()
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```

Binary Cross Entropy ($h(x)$, y) $-y\log(h(x)) - (1 - y)\log(1 - h(x))$

`criterion(D(G(z)), 1)` $-\log(D(G(z)))$

