

Generative Adversarial Network

Yu Xueqing

2022 年 7 月 27 日

1 Network as Generator

- input: x, z (z is a simple distribution, e.g. normal distribution)
- output: y (y is a distribution)
- why distribution? tasks needs "creativity"
 - drawing, chatbot
- discriminator: a neural network: e.g. 输入图片, 输出评分
- basic idea: generator vs. discriminator
- training
 - 1. fix generator, update discriminator
 - 2. fix discriminator, update generator
 - 交替训练

2 Theory behind GAN

- objective: minimize divergence between P_G and P_{data}
 $G^* = \arg \min_G Div(P_G, P_{data})$
- Discriminator: $D^* = \arg \max V(D, G)$
 $V(G, D) = E_{y \sim P_{data}} [\log D(y)] + E_{y \sim P_G} [\log(1 - D(y))]$
和 JS divergence 有关
代入 G 得到 $G^* = \arg \min \max V(G, D)$
- JS divergence 不适合: 图片数据在高维分布很稀疏, P_{data} 和 P_G 的分布几乎没有重叠
JS divergence is always $\log 2$ if two distributions don't overlap
- Wasserstein distance \rightarrow WGAN
 $\max(D \in [1 - Lipschitz], E_{y \sim P_{data}} [D(y)] - E_{y \sim P_G} [D(y)])$, 即在让 D 平滑的情况下使得 P_{data} 的输出尽可能大, P_G 尽可能小

3 evaluation

- image classifier: 每张分类结果的 distribution 是否集中
- mode collapse/mode dropping
- 评估 diversity, uniform distribution
- FID

4 conditional generator

- text-to-image:
input: text x , distribution z
output: image y
- discriminator: y is realistic or not + x and y are matched or not
data: true text-image pairs