



生成對抗網路 Generative Adversarial Network

國立東華大學電機工程學系楊哲旻

深度學習 – 生成對抗網路



生成對抗網路(Generative Adversarial Network, GAN)

生成器(Generator)

試圖創建看起來像真實的貓類影像之神經網絡
(藝術家)



鑑別器(Discriminator)

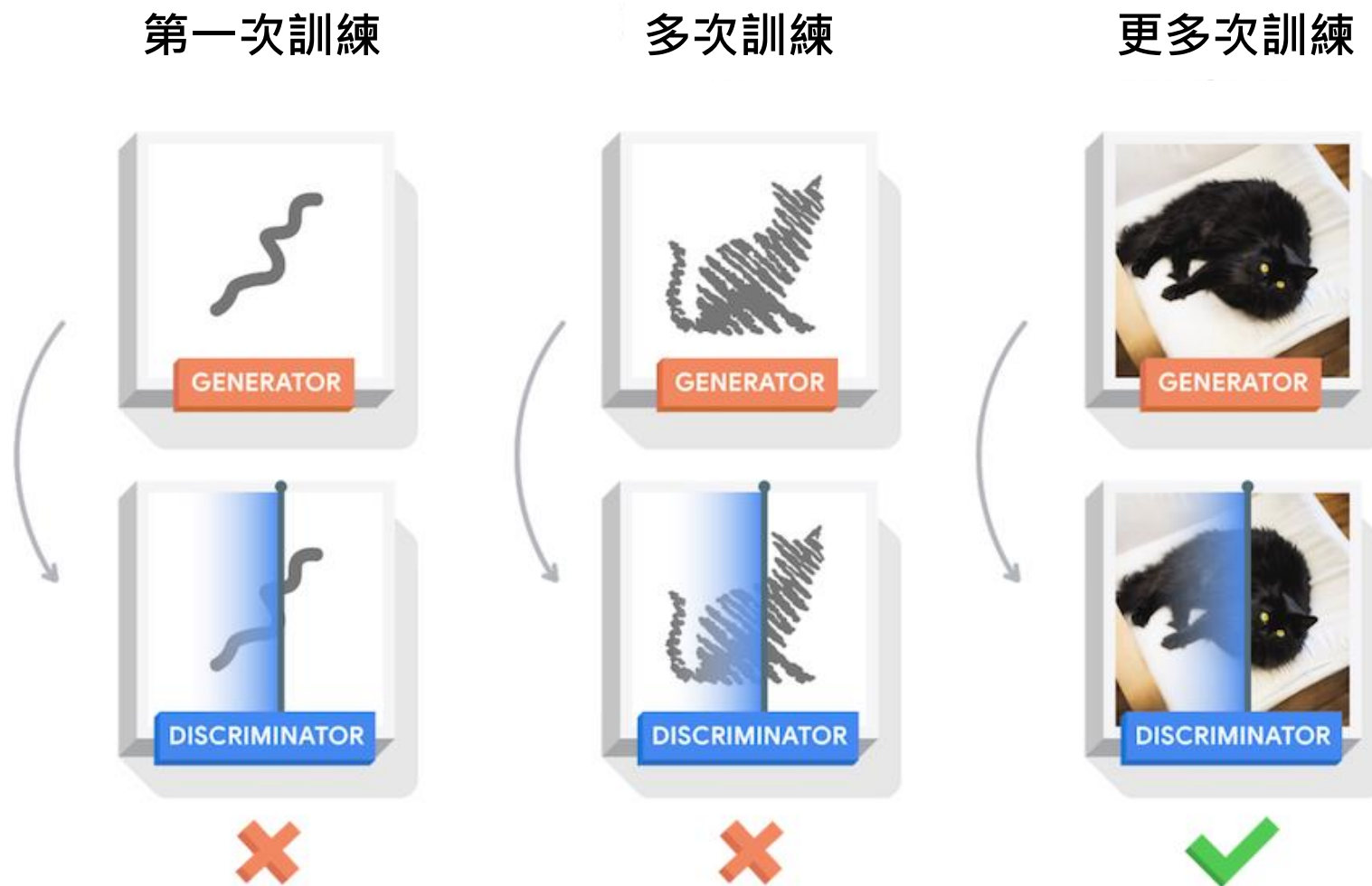
以神經網絡檢查貓類影像來確定它們是真實的或假的影像
(藝術評鑑家)



數張標記為貓類的真實影像

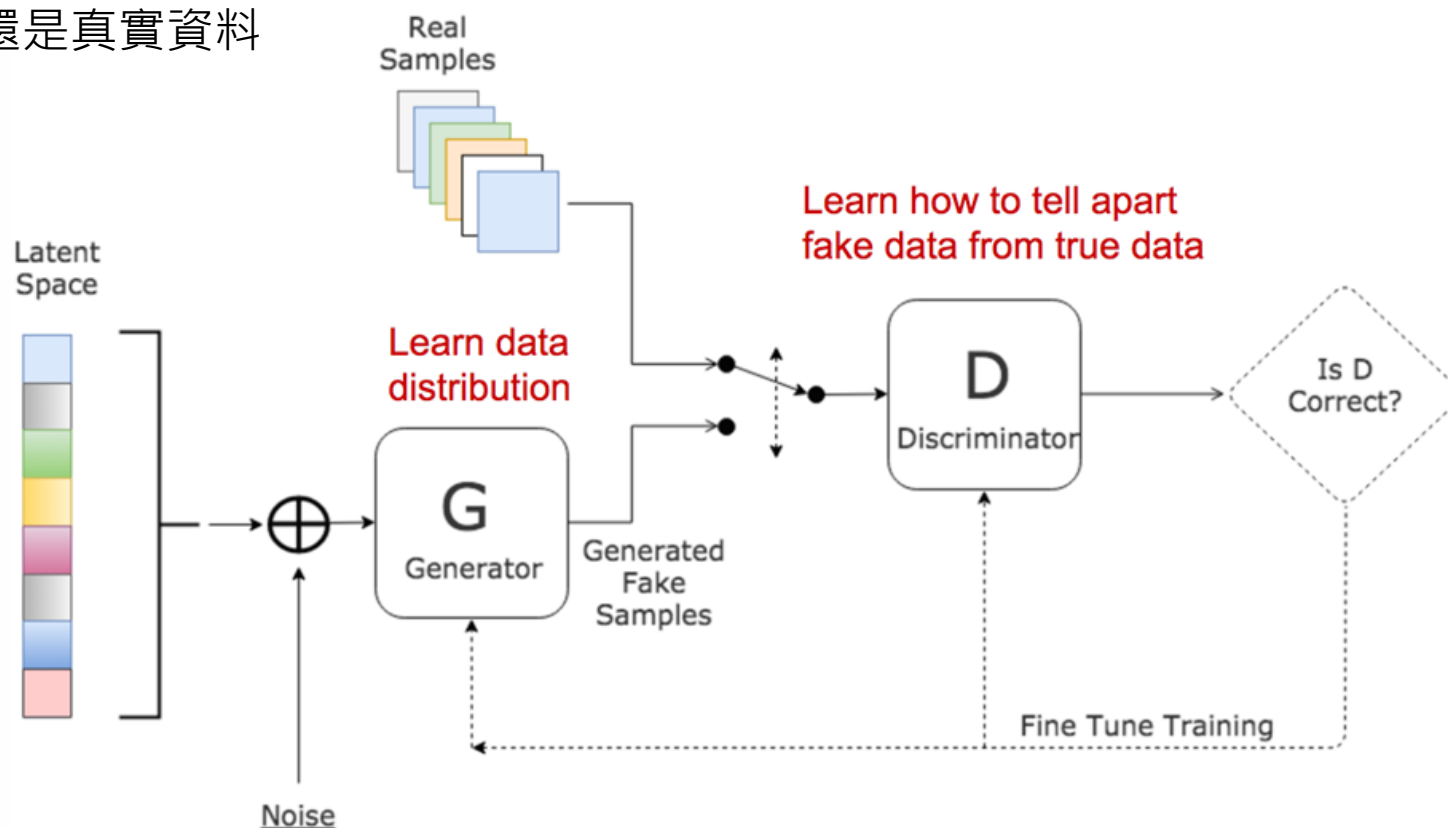


深度學習 – 目的與功能



深度學習 – 目的與功能

- GAN為生成器(Generator)與鑑別器(Discriminator)組成
- 生成器是為了生成接近真實資料分佈的虛假樣本
- 鑑別器是為了分辨樣本是來自生成器還是真實資料



深度學習 – 演算法

Initialize θ_d for D and θ_g for G

Learning Discriminator

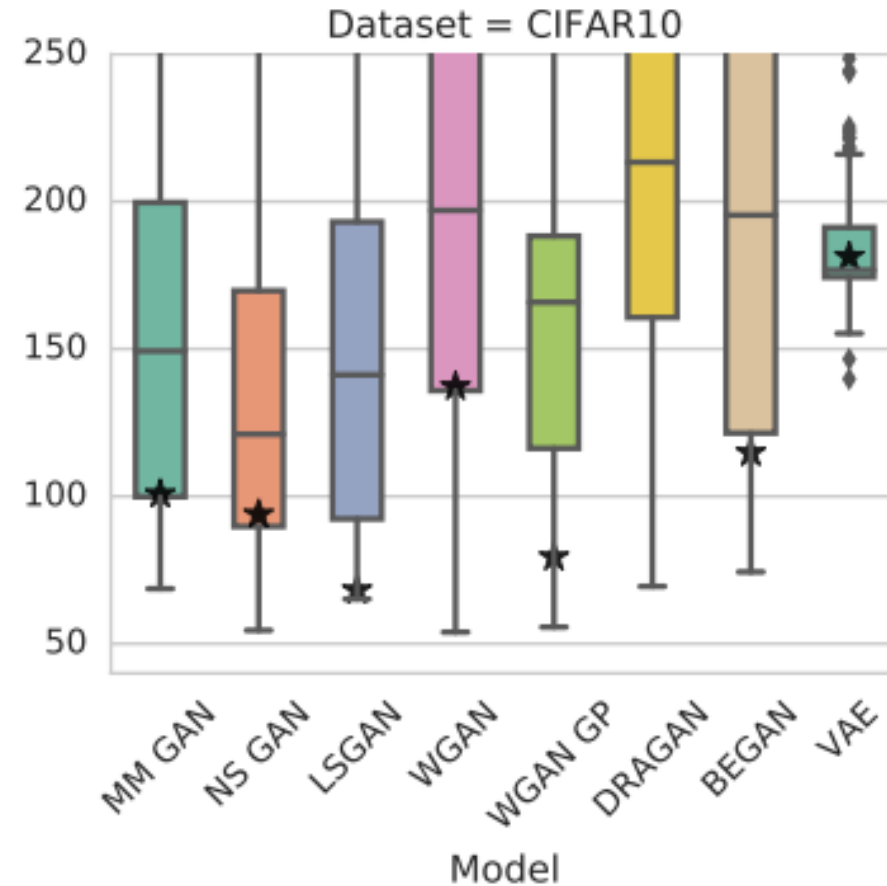
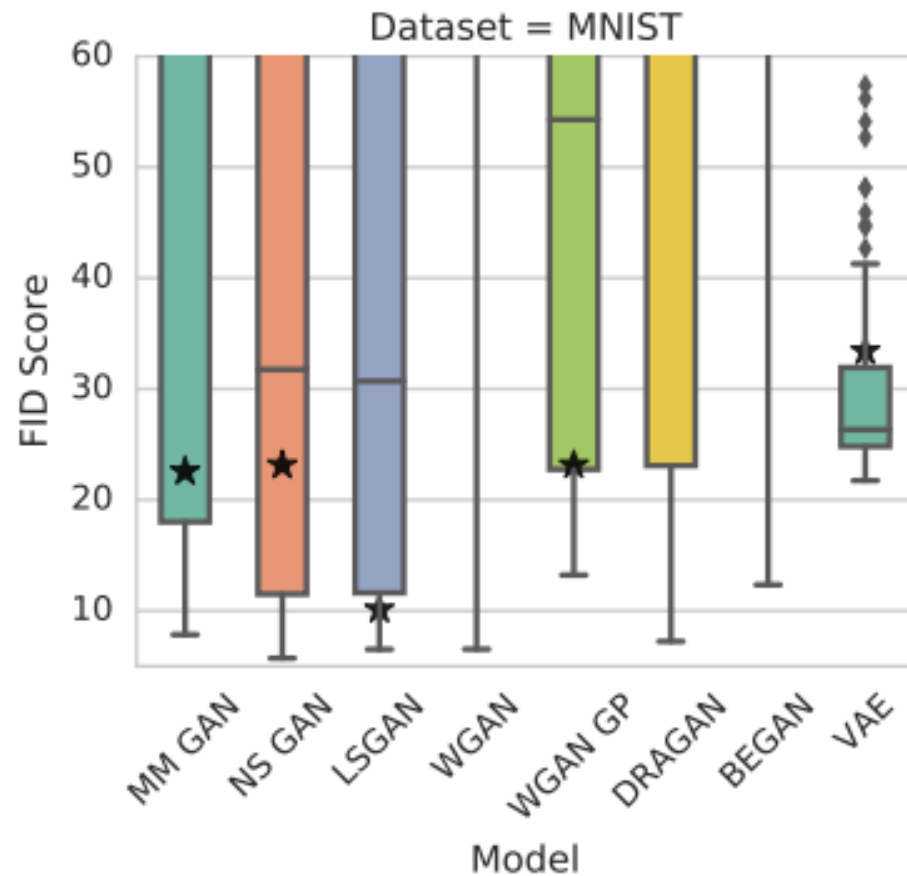
In each training iteration:

- Sample m examples $\{x^1, x^2, \dots, x^m\}$ from database
- Sample m noise samples $\{z^1, z^2, \dots, z^m\}$ from a distribution
- Obtaining generated data $\{\tilde{x}^1, \tilde{x}^2, \dots, \tilde{x}^m\}$, $\tilde{x}^i = G(z^i)$
- Update discriminator parameters θ_d to maximize
 - $\tilde{V} = \frac{1}{m} \sum_{i=1}^m \log D(x^i) + \frac{1}{m} \sum_{i=1}^m \log (1 - D(\tilde{x}^i))$
 - $\theta_d \leftarrow \theta_d + \eta \nabla \tilde{V}(\theta_d)$

Learning Generator

- Sample m noise samples $\{z^1, z^2, \dots, z^m\}$ from a distribution
- Update generator parameters θ_g to maximize
 - $\tilde{V} = \frac{1}{m} \sum_{i=1}^m \log (D(G(z^i)))$
 - $\theta_g \leftarrow \theta_g - \eta \nabla \tilde{V}(\theta_g)$

深度學習 – GAN與VAE的比較



[1] M. Lucic, K. Kurach, M. Michalski, S. Gelly, and O. Bousquet, “Are GANs Created Equal? A Large-Scale Study,” NIPS’18: *Proceedings of the 32nd International Conference on Neural Information Processing*, pp. 698–707, December 2018.