

Generative AI Models

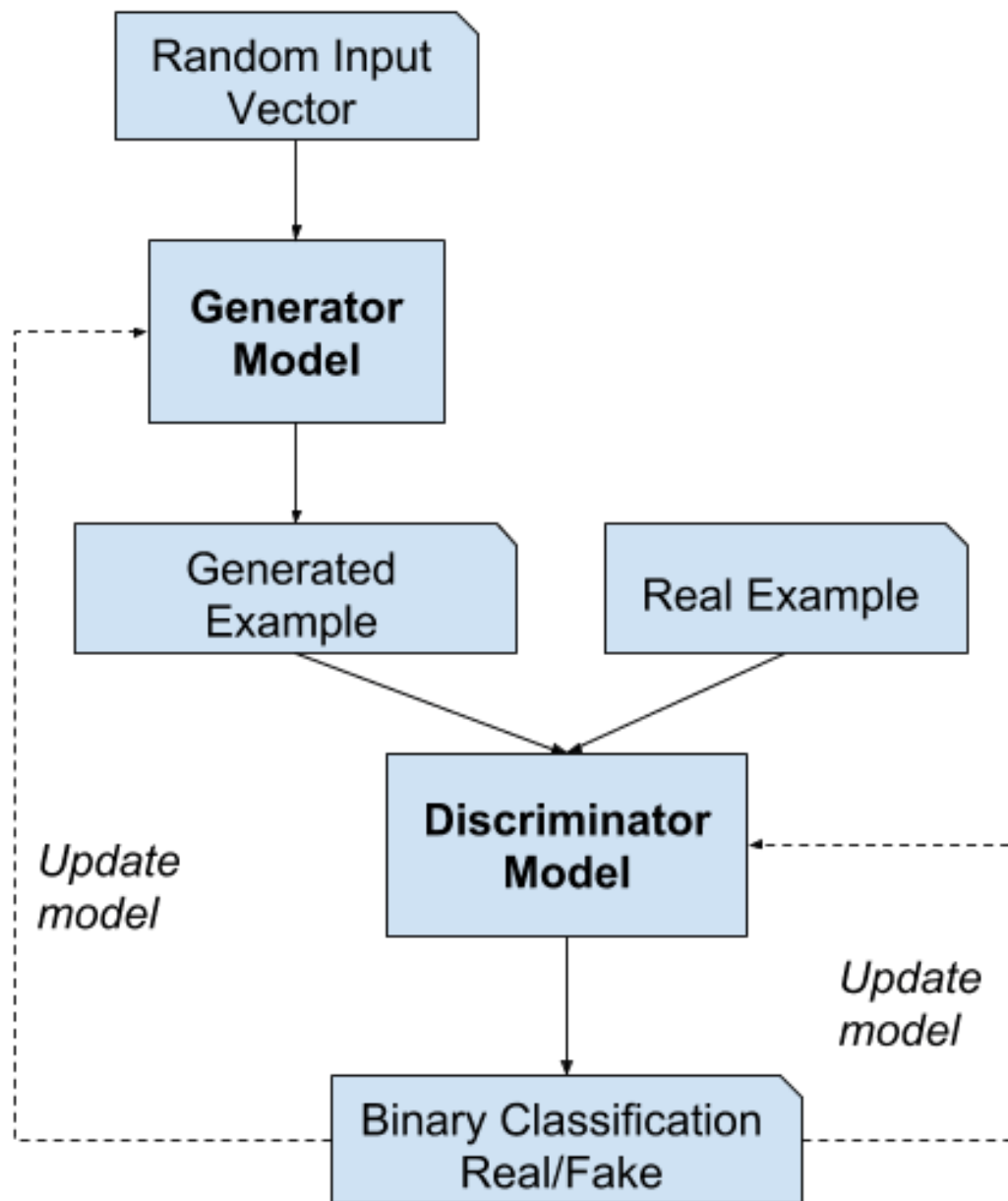
ECE 598 LV – Lecture 8

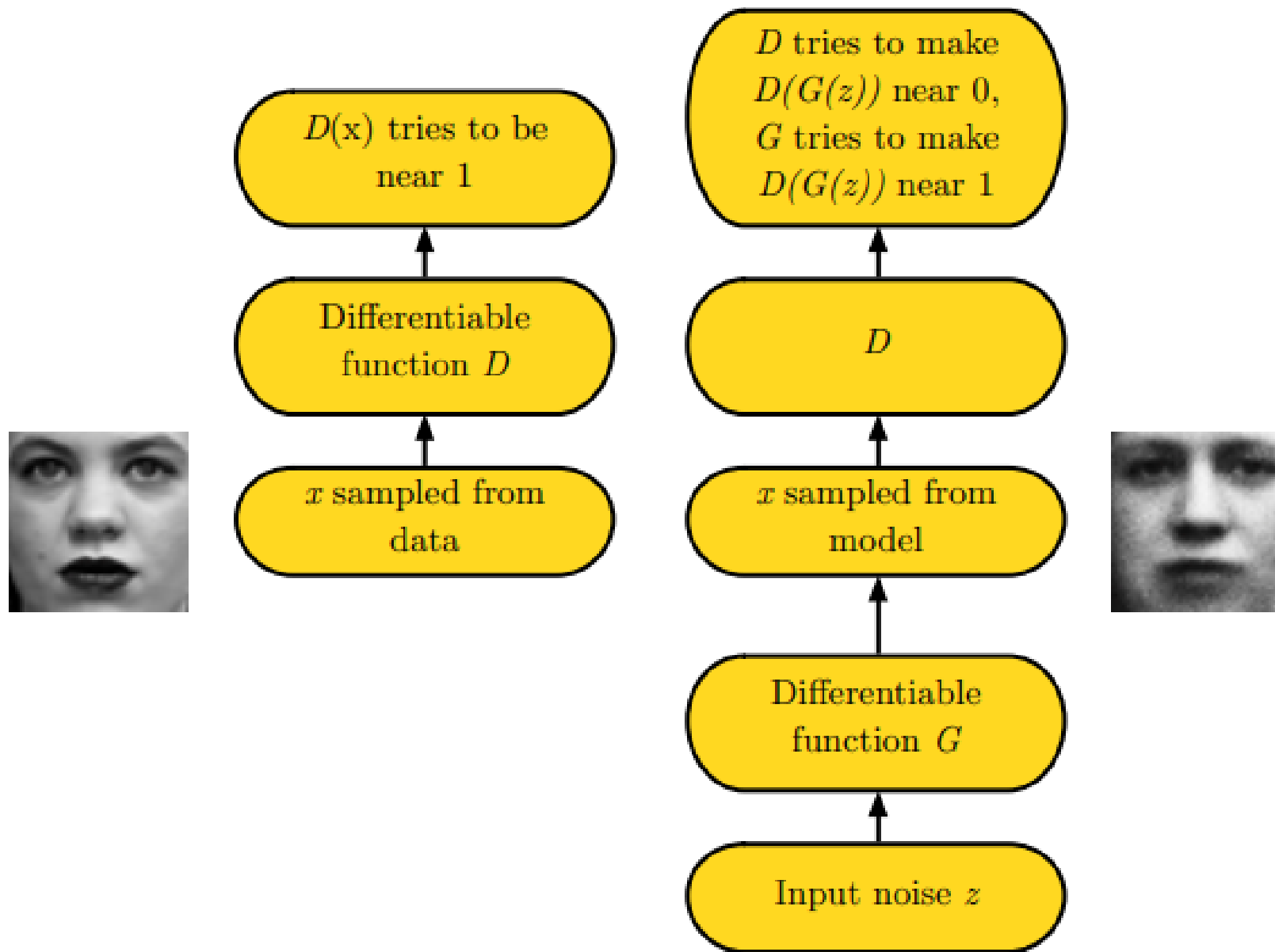
Lav R. Varshney

15 February 2022



<https://thispersondoesnotexist.com/>





The GAN framework pits two adversaries against each other in a game.

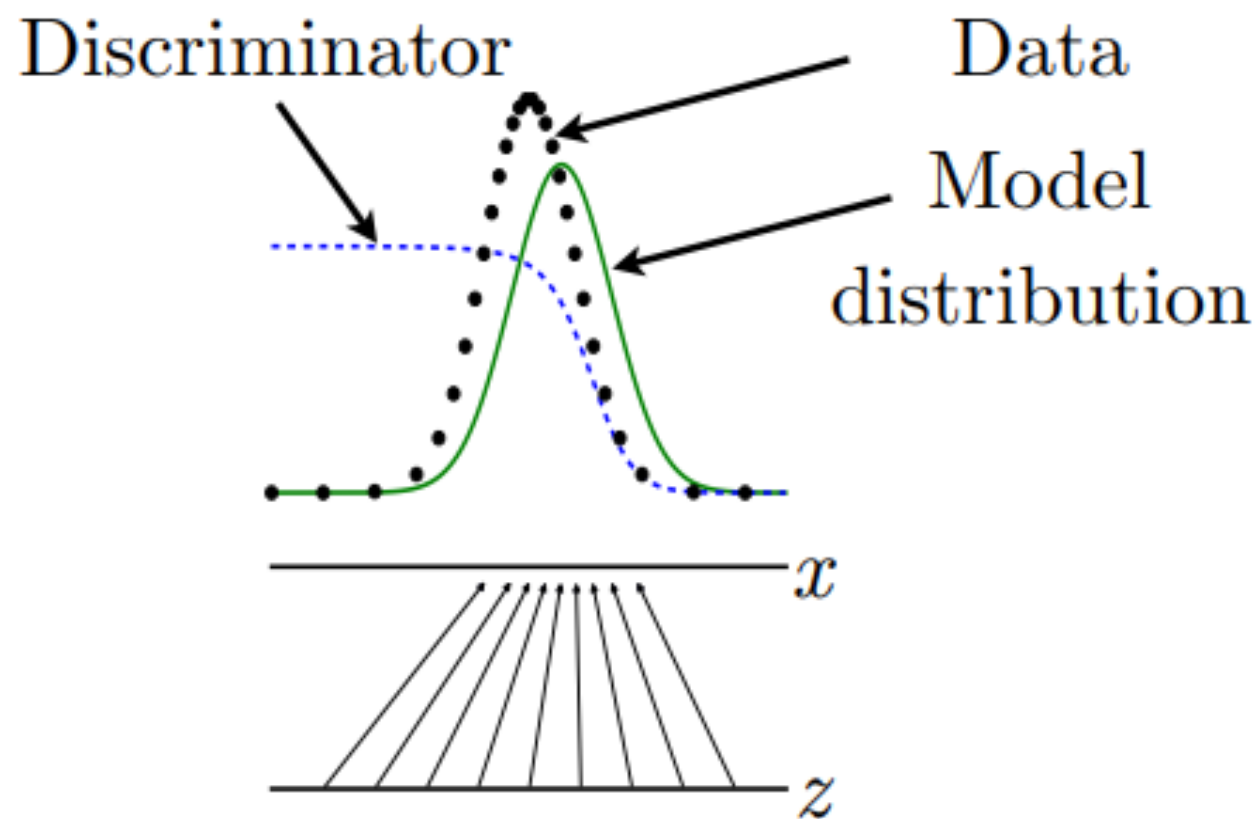


Figure 35: An illustration of how the discriminator estimates a ratio of densities. In this example, we assume that both z and x are one dimensional for simplicity. The mapping from z to x (shown by the black arrows) is non-uniform so that $p_{\text{model}}(x)$ (shown by the green curve) is greater in places where z values are brought together more densely. The discriminator (dashed blue line) estimates the ratio between the data density (black dots) and the sum of the data and model densities. Wherever the output of the discriminator is large, the model density is too low, and wherever the output of the discriminator is small, the model density is too high. The generator can learn to produce a better model density by following the discriminator uphill; each $G(z)$ value should move slightly in the direction that increases $D(G(z))$. Figure reproduced from Goodfellow *et al.* (2014b).

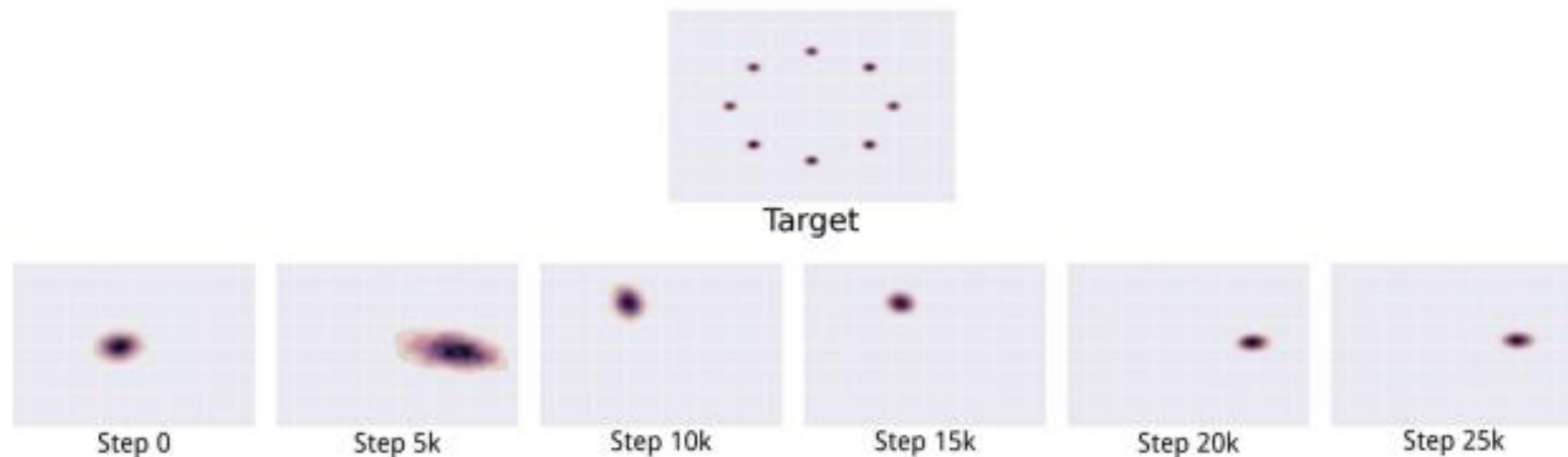


Figure 22: An illustration of the mode collapse problem on a two-dimensional toy dataset. In the top row, we see the target distribution p_{data} that the model should learn. It is a mixture of Gaussians in a two-dimensional space. In the lower row, we see a series of different distributions learned over time as the GAN is trained. Rather than converging to a distribution containing all of the modes in the training set, the generator only ever produces a single mode at a time, cycling between different modes as the discriminator learns to reject each one. Images from Metz *et al.* (2016).

this small bird has a pink breast and crown, and black primaries and secondaries.



this magnificent fellow is almost all black with a red crest, and white cheek patch.



the flower has petals that are bright pinkish purple with white stigma



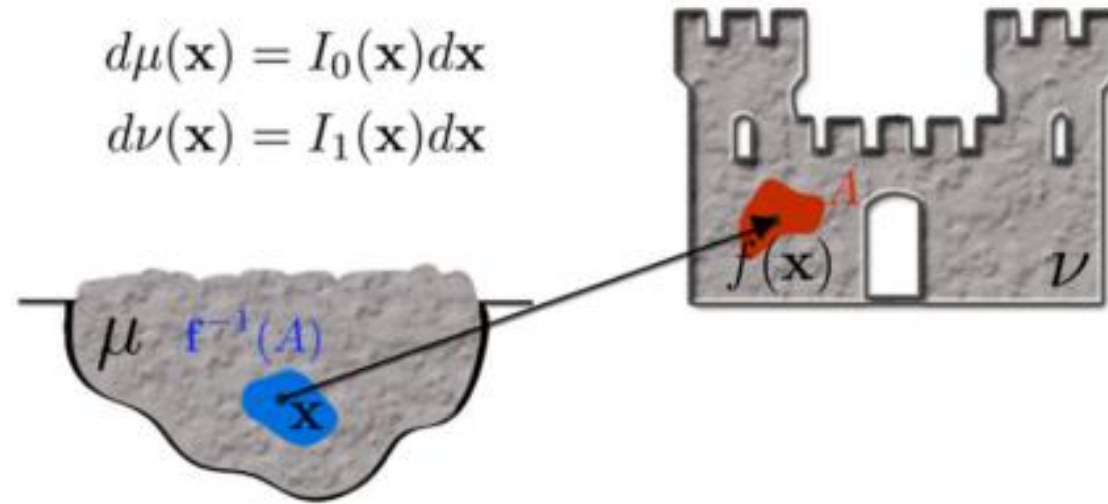
this white and yellow flower have thin white petals and a round yellow stamen



Figure 23: Text-to-image synthesis with GANs. Image reproduced from Reed *et al.* (2016b).



Gaspard Monge
1746-1818



Le mémoire sur les déblais et les remblais
(The note on land excavation and infill)