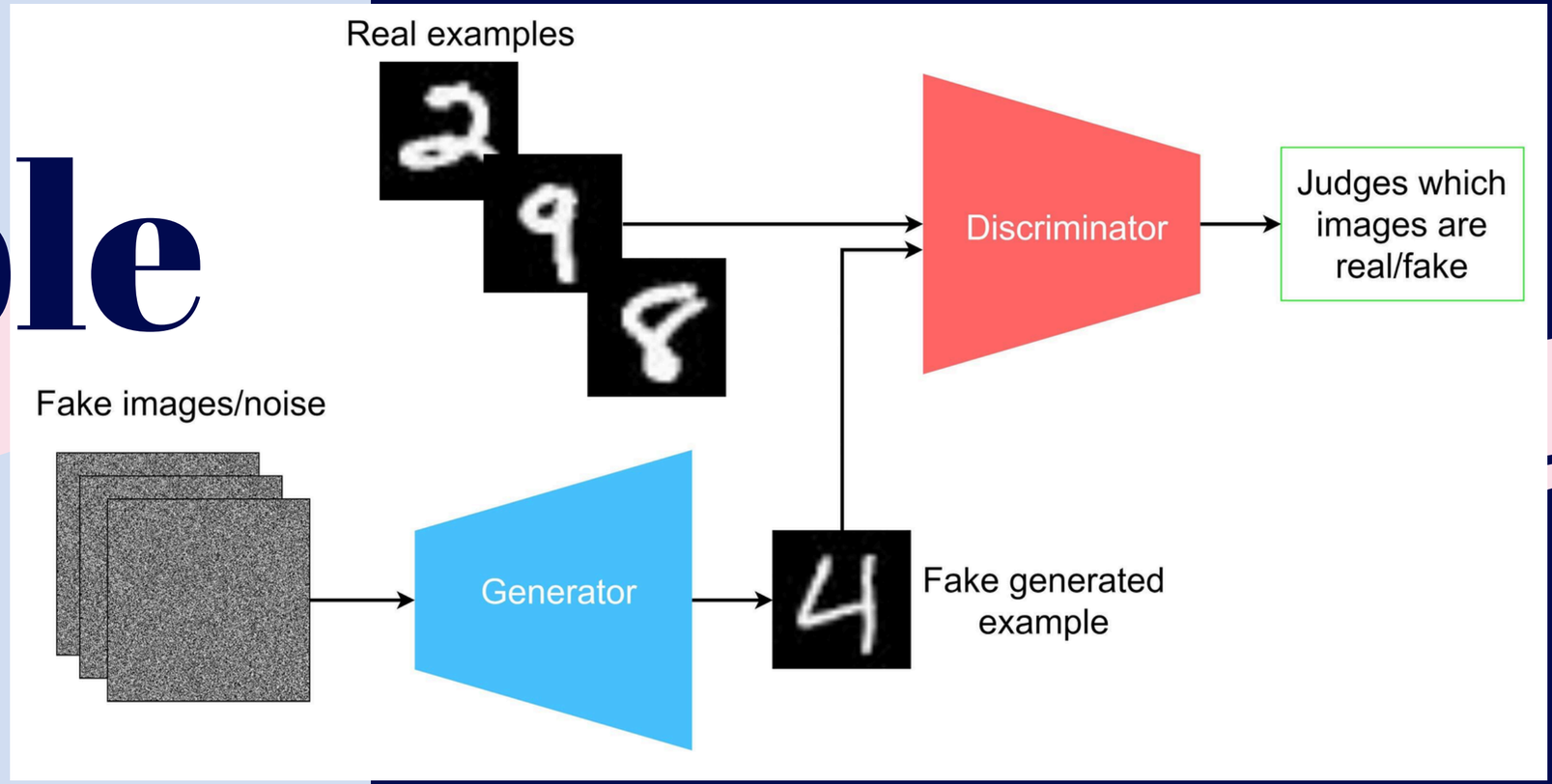
GAN models

DL 2025 LAB 10

example



generator = noise → image
discriminator = image → label

objective

GENERATOR

Minimize probability of discriminator labeling it correctly

DISCRIMINATOR

Maximize the probability that it labels the image correctly

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

D(x) is probability that x came from the data.

min

$$\log(1 - D(G(z)))$$

generator objective

THEORETICALLY

This will work well because from the generator's perspective we want the discriminator to perform well on our generations

REAL

It will start really saturated, meaning initial steps will be slow, and making learning slower

max

$$\log D(G(z))$$

generator objective

THEORETICALLY

This will work well because from the generator's perspective we want the discriminator to perform well on our generations

REAL

It will achieve the same as the last equation, but with faster initial steps

$$\max \log D(G(\boldsymbol{z}))$$

generator objective

$$\max \log D(\boldsymbol{x}) \log\left(1 - D(G(\boldsymbol{z}))\right)$$

discriminator objective