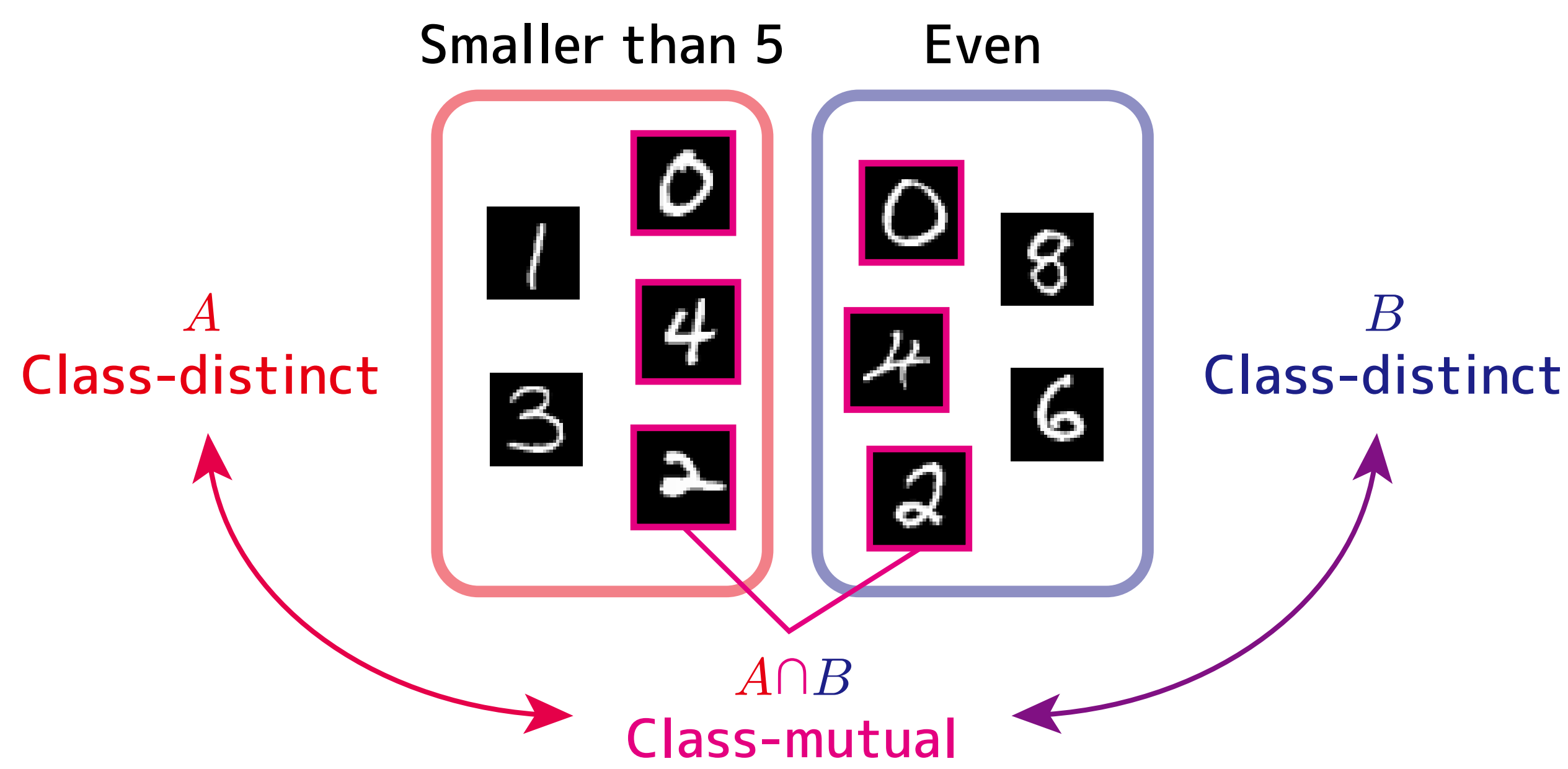




Introduction

Class-distinct and class-mutual image generation

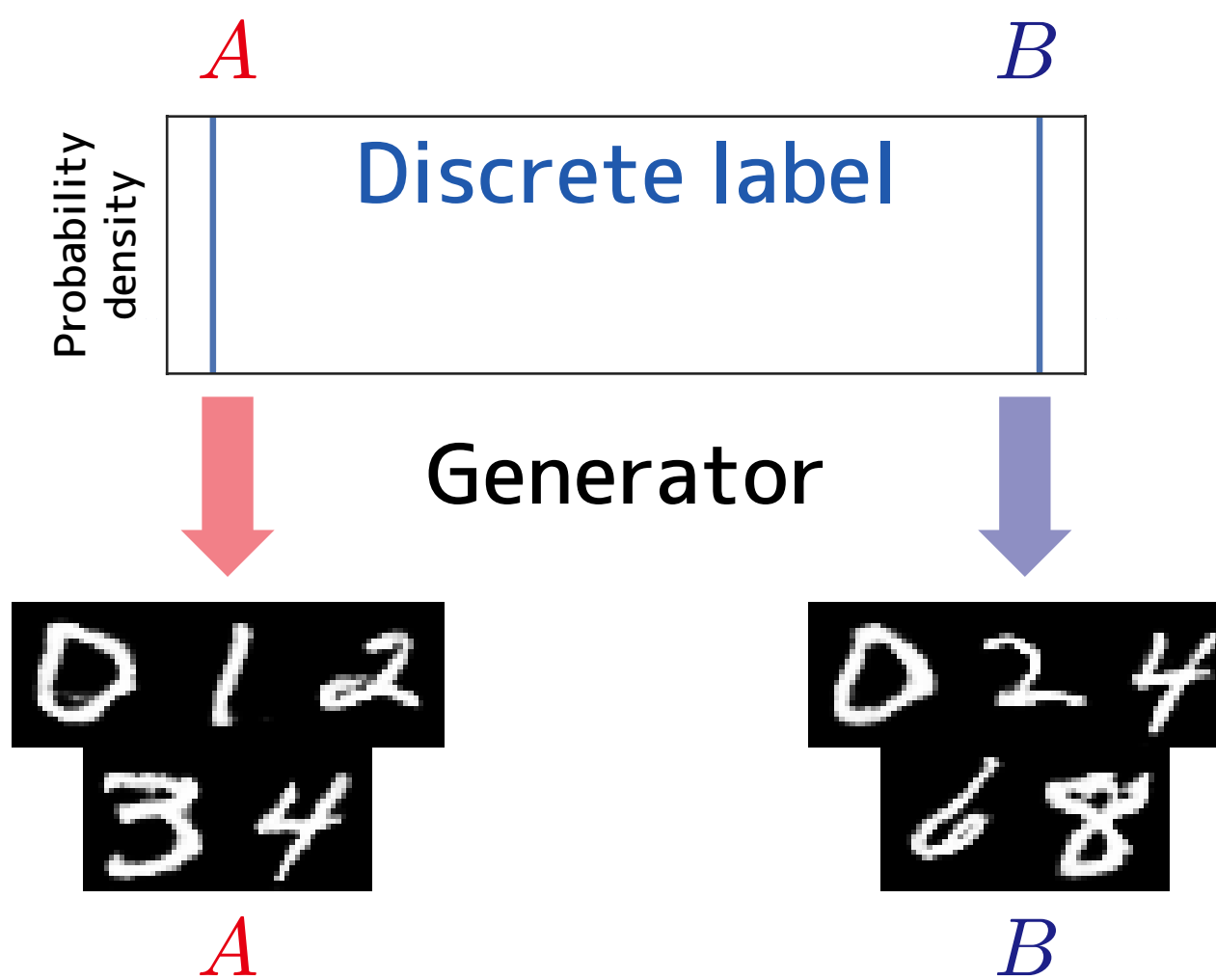
- **Given:** Class-overlapping data
- **Goal:** To construct a generator that can generate class-distinct and class-mutual images selectively



Challenges

AC-GAN (Previous) [Odena+2017]

Optimized conditioned on discrete labels

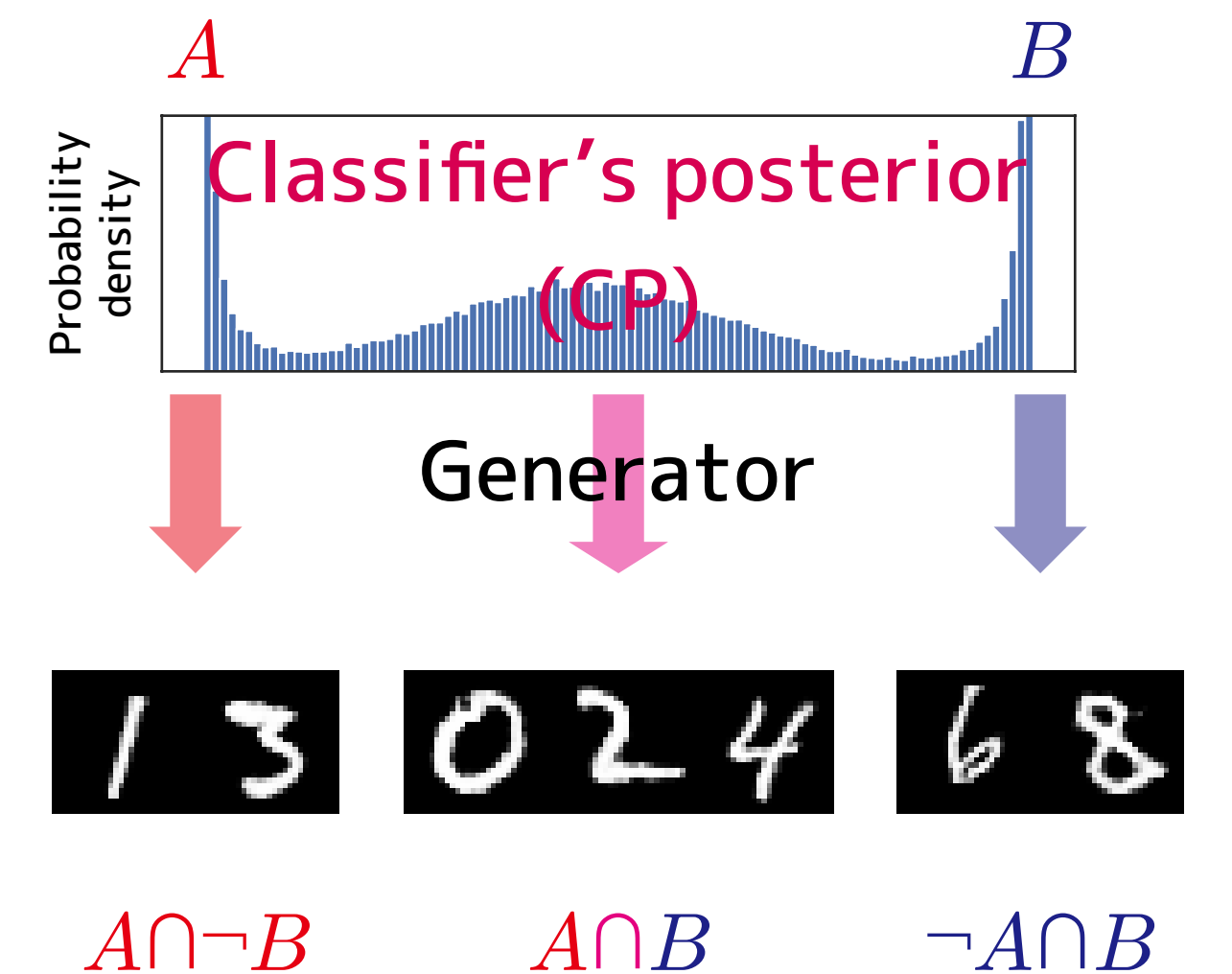


Limited to generate data of each class separately

Contributions

CP-GAN (Proposed)

Represents between-class relationships using CP

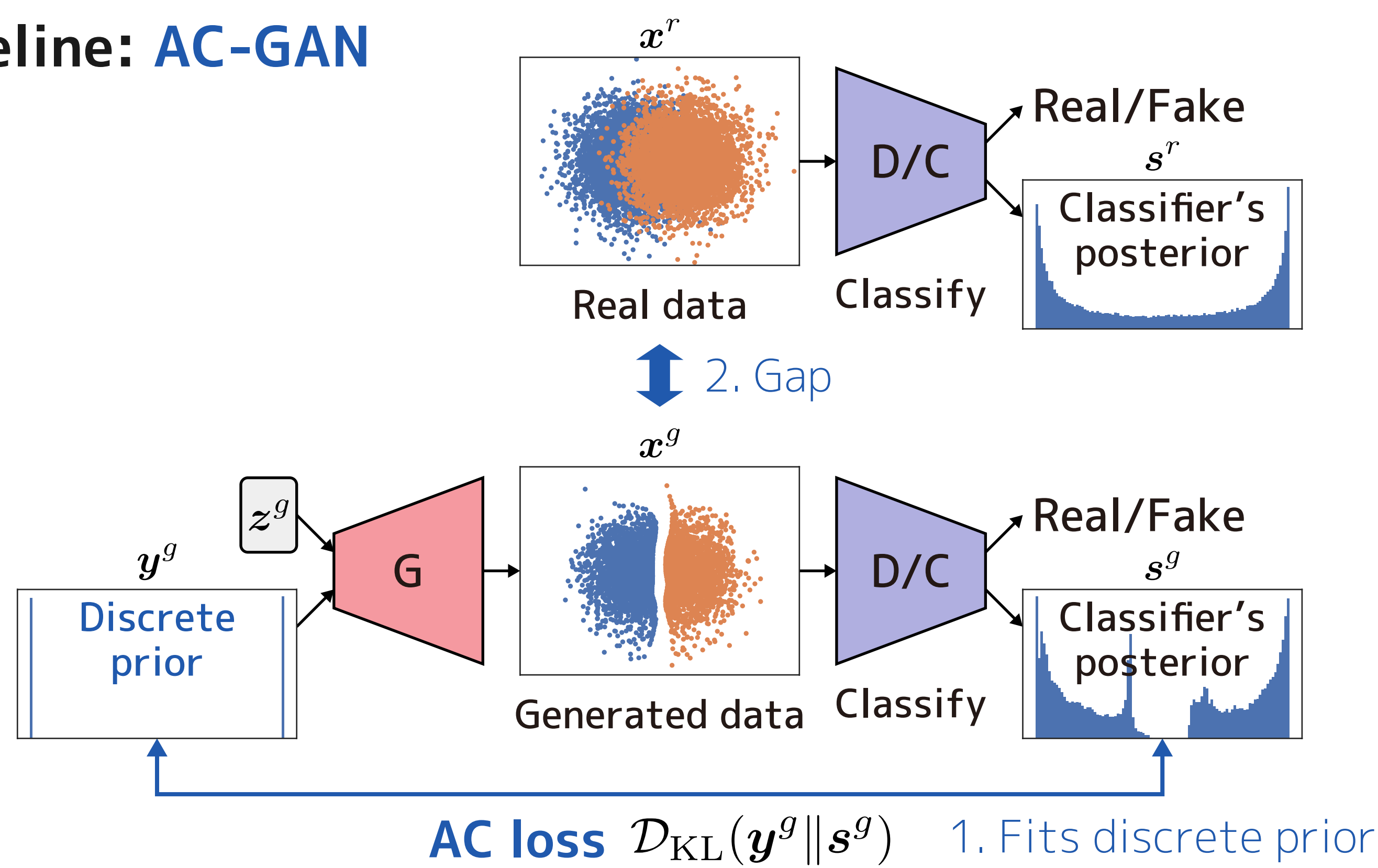


Able to generate data on the basis of class specificity

Proposed Method: Classifier's Posterior Generative Adversarial Networks (CP-GAN)

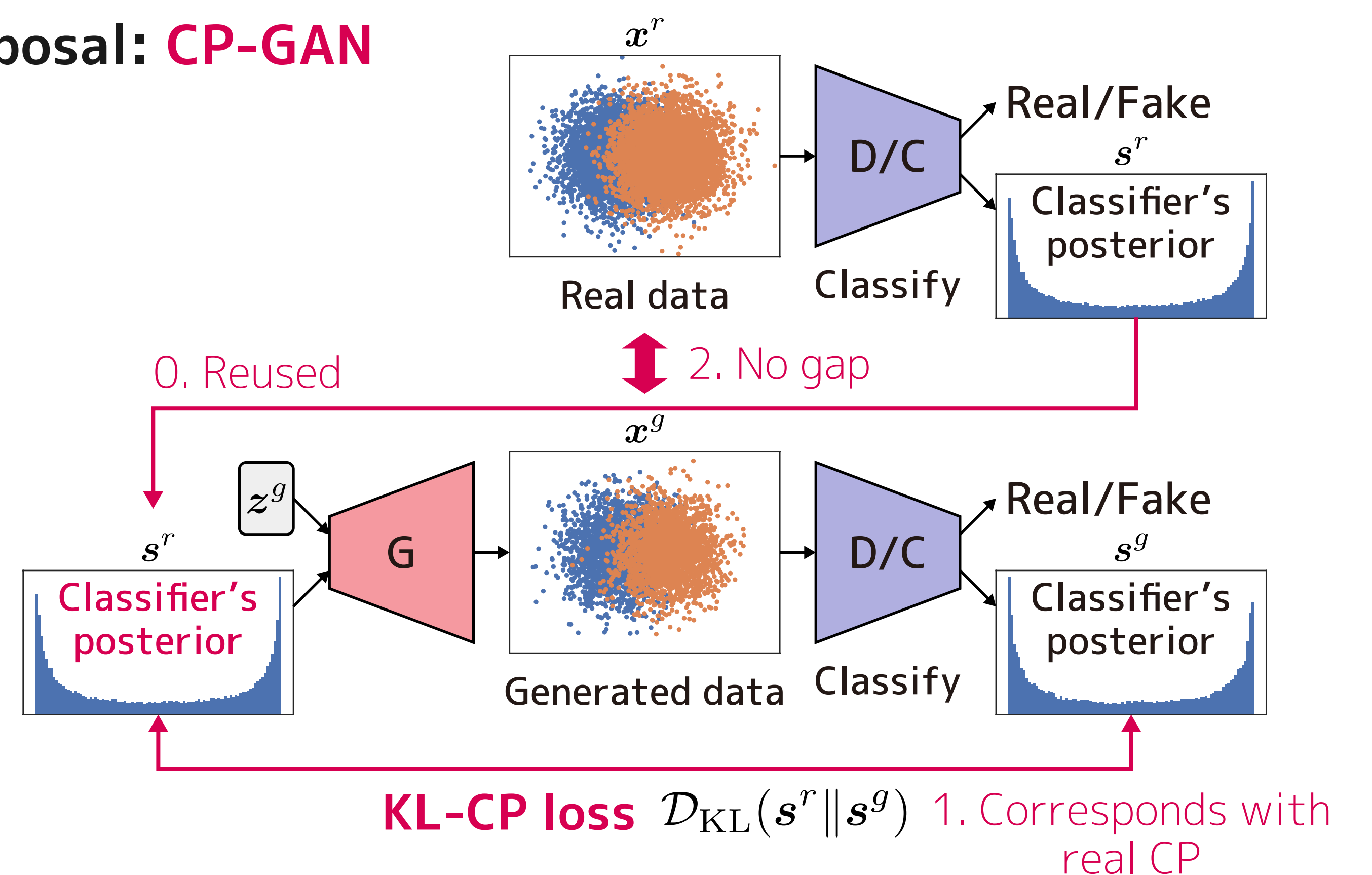
- **Key idea:** We redesign the generator input and the objective function of AC-GAN. (G: Generator, D: Discriminator, C: Classifier)

Baseline: AC-GAN



Class-separate distribution is learned.

Proposal: CP-GAN



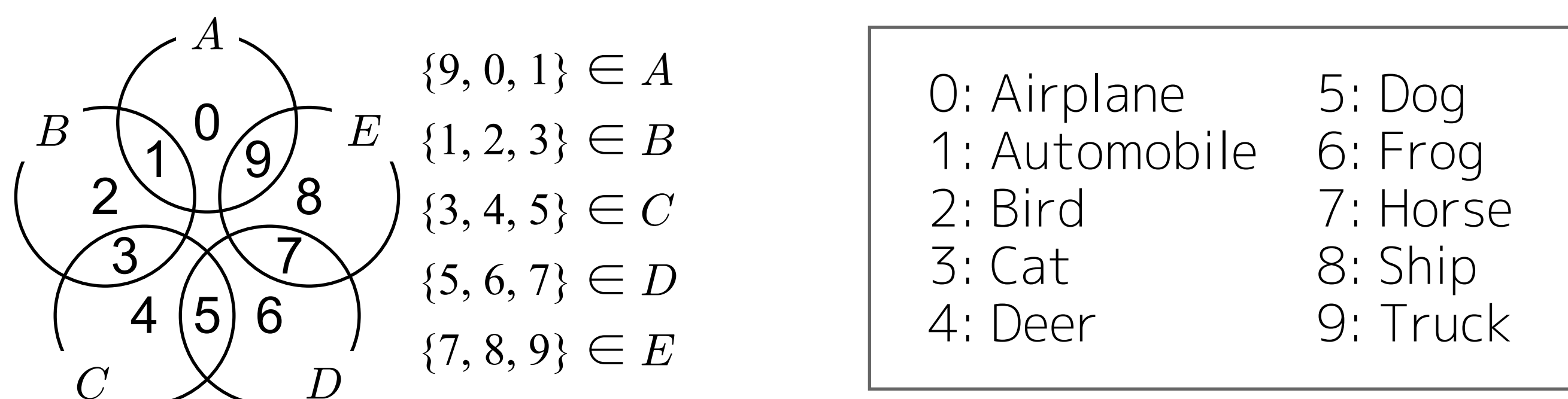
Class-overlapping distribution is learned.

Experiments

Experiment I: Controlled class-overlapping data

CIFAR-10to5: Class overlaps are made synthetically

We divide the original **ten** classes (0, ..., 9) [Krizhevsky2009] into **five** classes (A, ..., E).



Expected states	A	A ∩ B	B	B ∩ C	C	C ∩ D	D	D ∩ E	E	E ∩ A	FID↓	DMA↑
AC-GAN [Odena+2017]											13.7	36.6
cGAN [Miyato+2018]											16.9	32.3
CFGAN [Kaneko+2017]											15.8	50.9
CP-GAN											12.5	95.0

FID (Fréchet Inception distance), DMA (Class-distinct and class-mutual accuracy)

- ✓ Achieves the best FID
- ✓ Generates class-distinct and class-mutual images selectively

Experiment II: Real-world class-overlapping data

Clothing1M [Xiao+2015]: Includes real-world class-overlapping data

The data are collected from shopping web sites (the annotation accuracy: 61.54%).



Expected states	T-Shirt	Chiffon	Windbreaker	Suit	Vest															
	Shirt	Sweater	Hoodie	Down Coat	Shawl															
	Knitwear				Dress															
AC-GAN [Odena+2017]						FID: 9.3	49.5	49.2	23.7	52.4	5.9	27.0	23.8	70.4	81.3	60.5	35.0	60.7	54.3	54.7
cGAN [Miyato+2018]						FID: 11.4	44.8	48.0	25.7	37.6	34.0	35.8	52.5	64.8	73.1	44.9	74.9	52.6	41.8	62.4
CP-GAN						FID: 6.8	51.4	60.2	42.2	55.7	33.6	48.6	86.3	67.9	92.7	67.6	91.9	74.2	70.6	68.1

FID (Fréchet Inception distance), DA (Class-distinct accuracy; numbers below images)

- ✓ Achieves the best FID
- ✓ Generates class-distinct images selectively