Recover and Identify: A Generative Dual Model for Cross-Resolution Person Re-Identification

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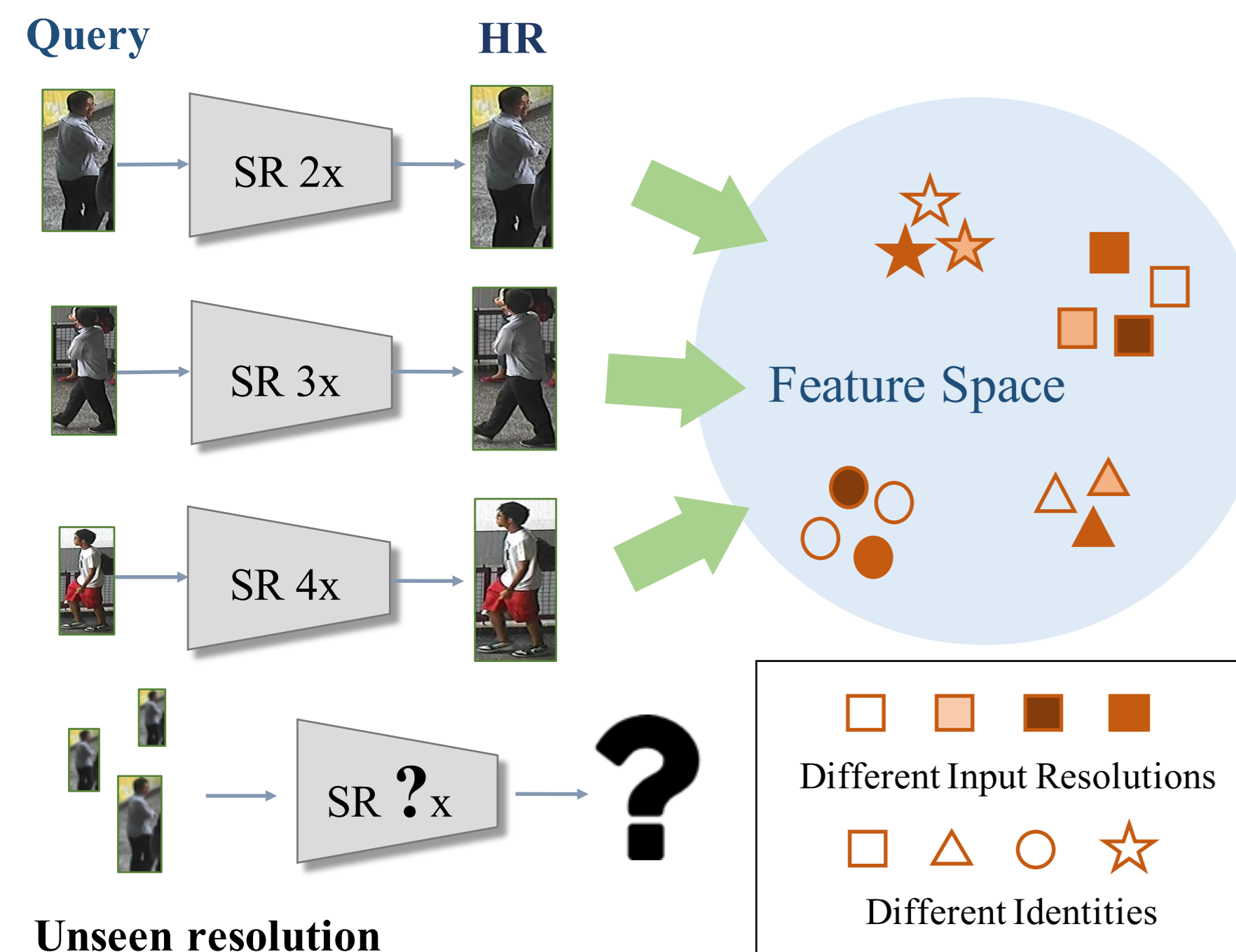ICCV 2019 Seoul, Korea

Cross-Resolution Person Re-ID

Goal: Identify images of the same person across cameras with different resolutions

Challenges:

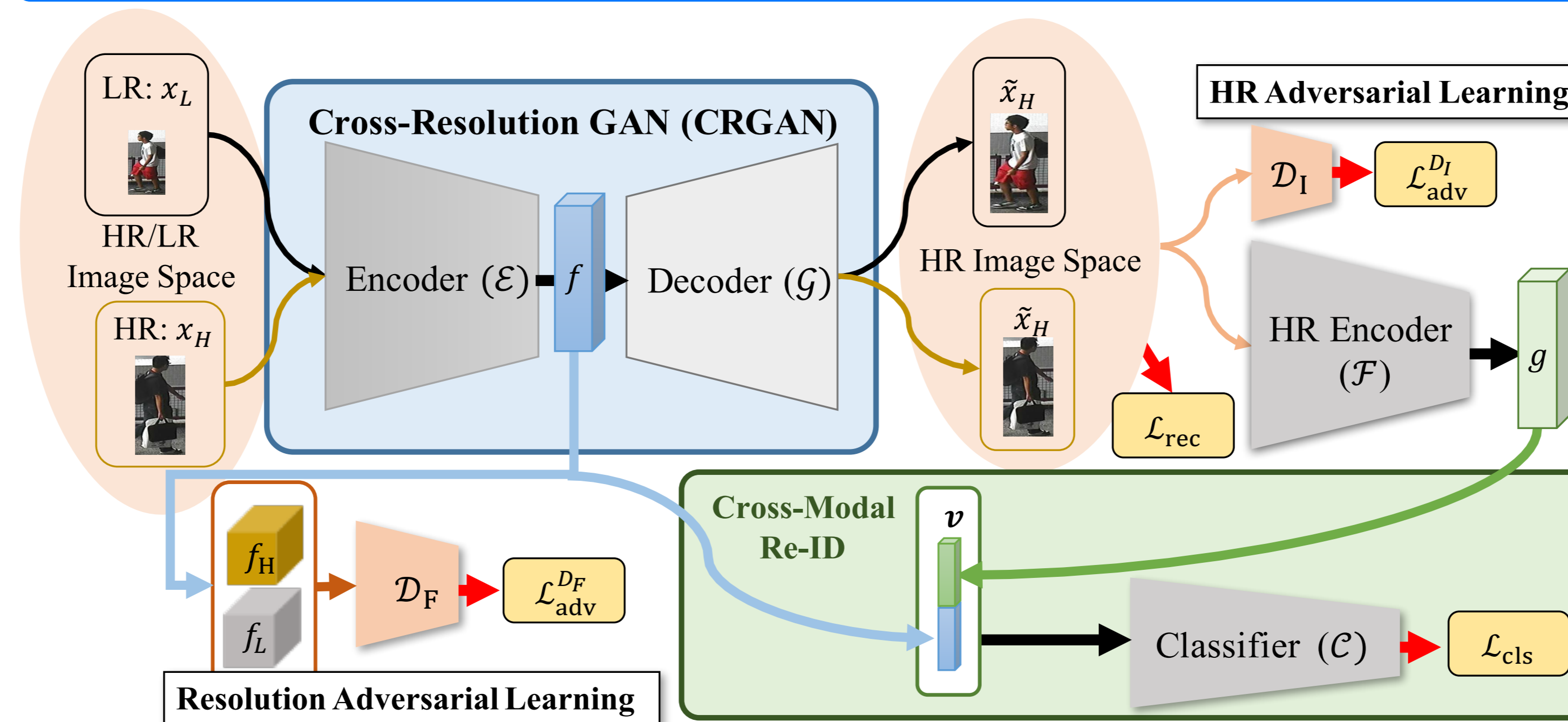- Viewpoint & resolution variations

Long distance → Low resolution   Short Distance → High resolution
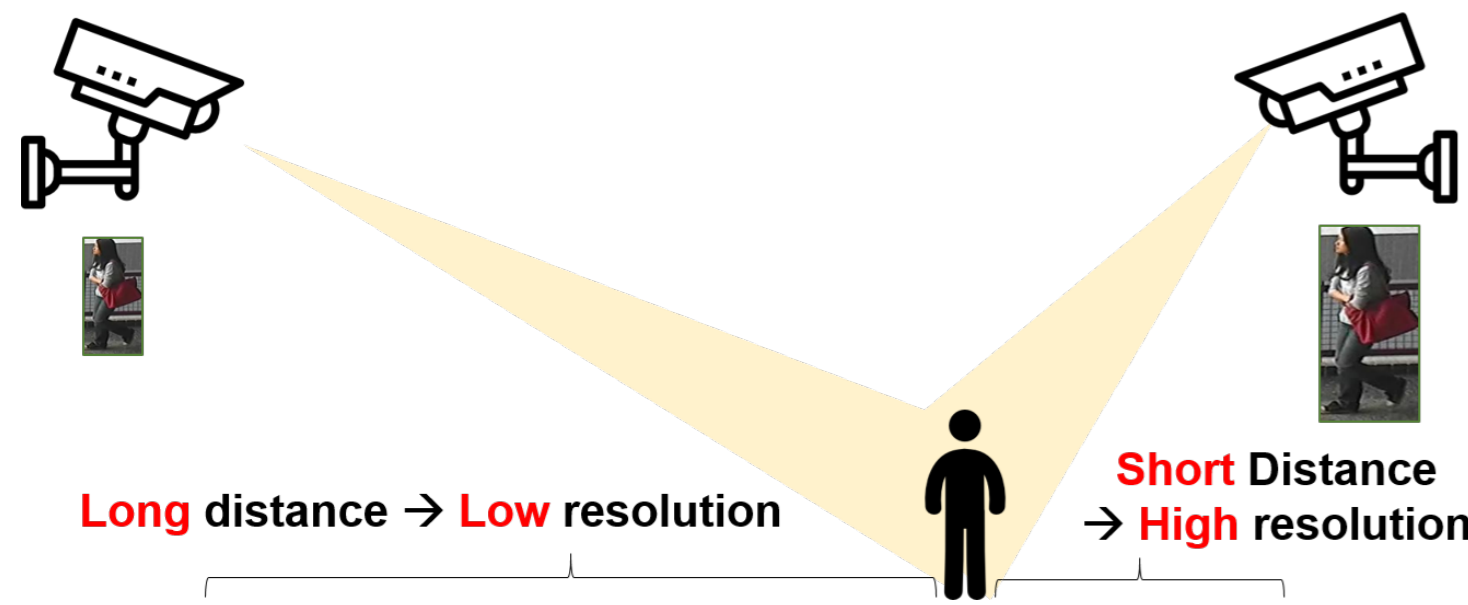
- Need to deal with images with **unseen resolutions**

Query   HR   SR 2x   SR 3x   SR 4x   Feature Space   SR ?x

Unseen resolution

□ Different Input Resolutions   □ △ ○ ☆ Different Identities

Cross-Resolution Adversarial Dual Network

Cross-Resolution GAN (CRGAN)

LR: x_L HR/LR Image Space   HR: x_H Encoder ($\mathcal{E}$) f Decoder ($\mathcal{G}$)   HR Image Space $\tilde{x}_H$ $\tilde{x}_H$ $\mathcal{L}_{rec}$

HR Adversarial Learning $\mathcal{D}_I$ $\mathcal{L}_{adv}^{D_I}$

HR Encoder ($\mathcal{F}$) g

f_H f_L $\mathcal{D}_F$ $\mathcal{L}_{adv}^{D_F}$ **Resolution Adversarial Learning**

Cross-Modal Re-ID v Classifier ($\mathcal{C}$) $\mathcal{L}_{cls}$

Results of Cross-Resolution Person Re-ID

Method	MLR-CUHK03		MLR-VIPeR		CAVIAR		MLR-Market-1501		MLR-DukeMTMC-reID	
	Rank 1	Rank 5	Rank 1	Rank 5	Rank 1	Rank 5	Rank 1	Rank 5	Rank 1	Rank 5
JUDEA [Li ICCV'15]	26.2	58.0	26.0	55.1	22.0	60.1	-	-	-	-
SLD²L [Jing CVPR'15]	-	-	20.3	44.0	18.4	44.8	-	-	-	-
SDF [Wang IJCAI'16]	22.2	48.0	9.3	38.1	14.3	37.5	-	-	-	-
SING [Jiao AAAI'18]	67.7	90.7	33.5	57.0	33.5	72.7	74.4	87.8	65.2	80.1
CSR-GAN [Wang IJCAI'18]	71.3	92.1	37.2	62.3	34.7	72.5	76.4	88.5	67.6	81.4
CamStyle [Zhong CVPR'18]	69.1	89.6	34.4	56.8	32.1	72.3	74.5	88.6	64.0	78.1
FD-GAN [Ge NeurIPS'18]	73.4	93.8	39.1	62.1	33.5	71.4	79.6	91.6	67.5	82.0
Ours (f only)	77.6	96.2	41.2	66.3	41.5	75.3	80.1	90.6	73.4	84.4
Ours (g only)	79.7	97.4	41.7	66.4	38.9	73.1	82.2	91.3	74.1	85.1
Ours	82.1	97.4	43.1	68.2	42.8	76.2	83.7	92.7	75.6	86.7

HR Image Recovery

Method	Down-sampling rate $r \in \{2, 3, 4\}$ (seen)				Down-sampling rate $r = 8$ (unseen)			
	SSIM ↑	PSNR ↑	LPIPS ↓	Rank 1 ↑	SSIM ↑	PSNR ↑	LPIPS ↓	Rank 1 ↑
CycleGAN [Zhu ICCV'17]	0.55	14.1	0.31	62.1	0.42	12.7	0.37	40.5
SING [Jiao AAAI'18]	0.65	18.1	0.18	67.7	0.52	14.5	0.34	54.2
CSR-GAN [Wang IJCAI'18]	0.76	21.5	0.13	71.3	0.67	17.2	0.25	62.1
Ours	0.73	20.2	0.07	82.1	0.71	19.8	0.11	78.6

r 1   2   4   8

Input   CycleGAN   SING   CSR-GAN   CRGAN (Ours)
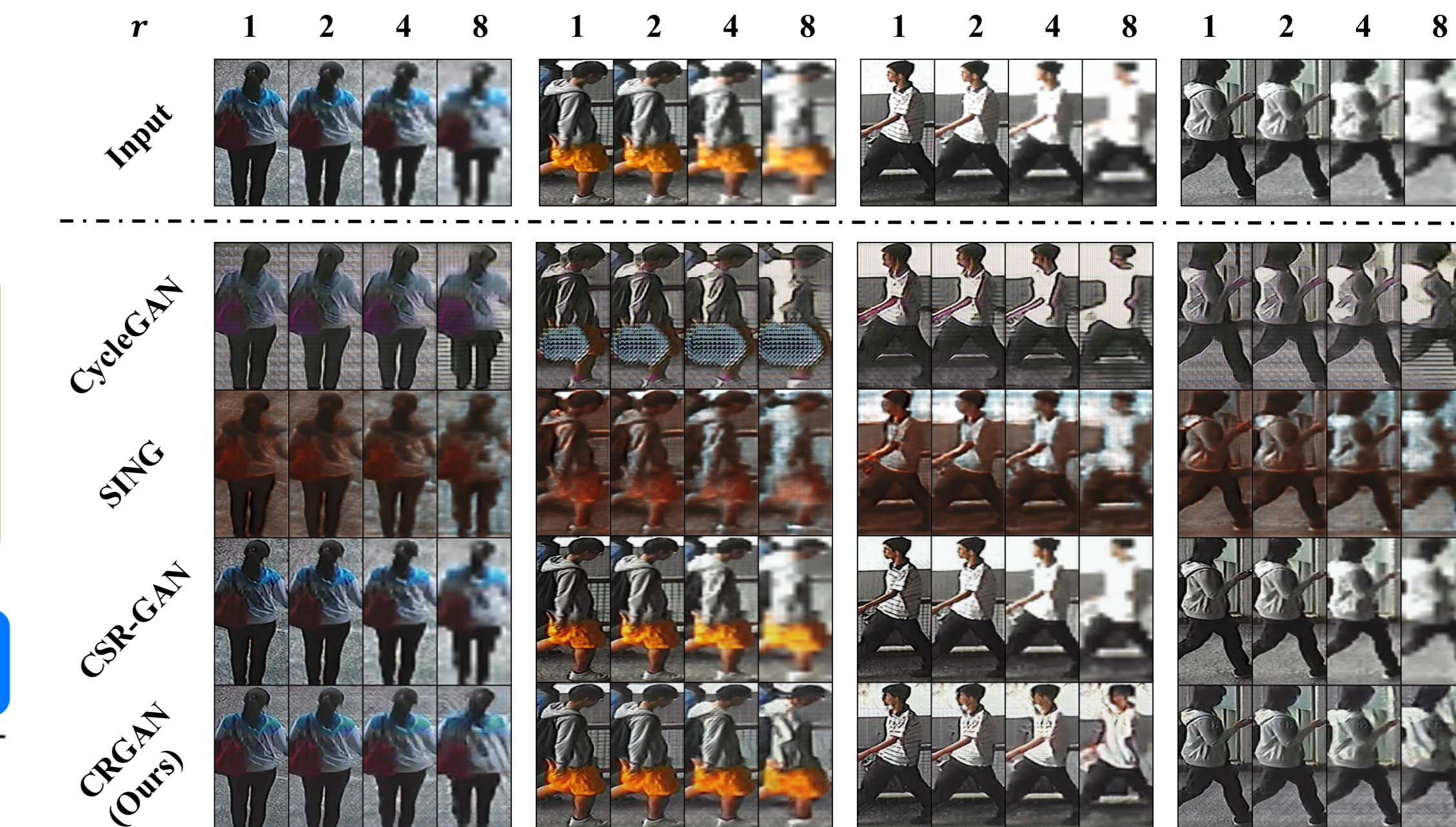
Resolution-Invariant Representation

(a) Ours w/o $\mathcal{L}_{adv}^{D_F}$: colorized w.r.t **identity**.   (b) Ours: colorized w.r.t **identity**.   (c) Ours: colorized w.r.t **resolution**.