Unsupervised Domain Adaptation Through Synthesis For Person Re-Identification

Suncheng Xiang, Yuzhuo Fu, Guanjie You, Ting Liu

School of Electronic Information and Electrical Engineering
Shanghai Jiao Tong University

ICME 2020
IEEE International Conference on Multimedia and Expo
6-10 July 2020 || London, United Kingdom || Virtual

Introduction: Domain Adaptation for Person Re-ID

- Performing training and testing in different domains

Training

Source（DukeMTMC-reID）

Different Domain

Testing

Target（Market-1501）

Challenges:

- Small-scale datasets
- Lack of diversity in viewpoint, weather, illumination and pose, etc
- Overfitting due to rare labeled data

dataset		#identity	#box	#cam	view
Real	Market-1501 [4]	1,501	32,668	6	N
	CUHK03 [1]	1,467	14,096	2	N
	DukeMTMC-reID [3]	1,404	36,411	8	N
Synthetic	SOMAset [2]	50	100,000	250	N
	SyRI [5]	100	1,680,000	–	N
	PersonX [6]	1,266	273,456	6	Y
	GPR	**754**	**443,352**	**12**	**Y**

Our work（GPR dataset）

A backgrounds

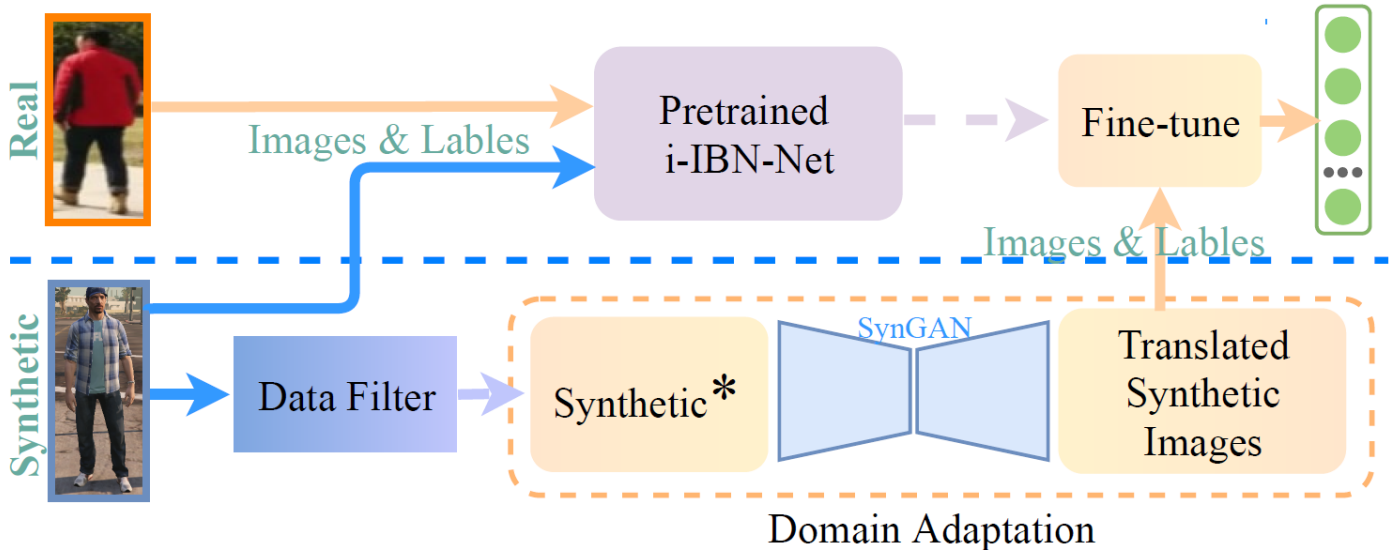
B identities

viewpoint

weather

time distribution

Our work



- Domain Adaptation Framework which consists of i-IBN-Net and SynGAN

i-IBN-Net

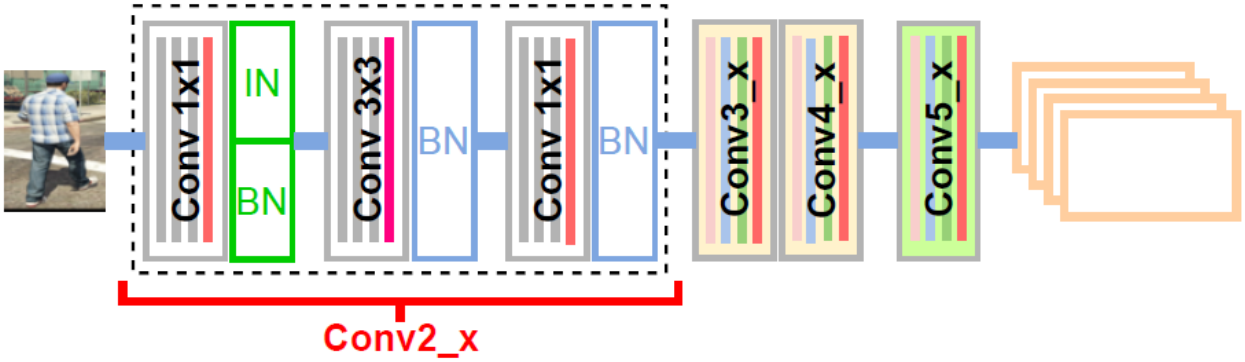
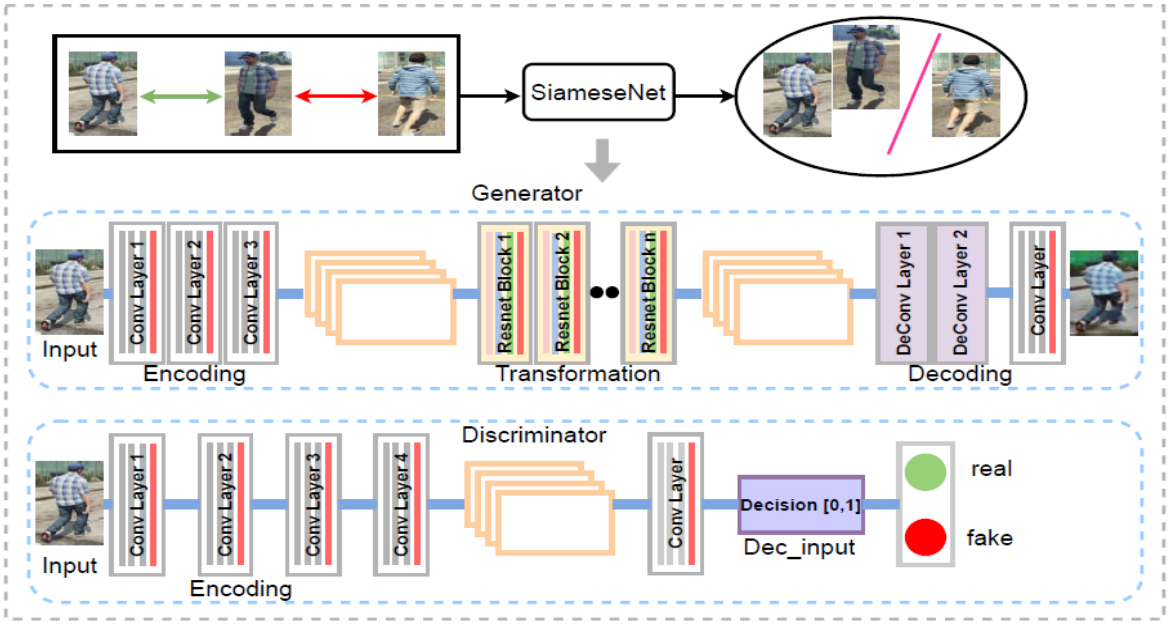


Table 1. The network architectures of i-IBN-Net

conv2_x	conv3_x	conv4_x	conv5_x
$\begin{bmatrix} 1\times1, 64 \\ IN, 32\ BN, 32 \\ 3\times3, 64 \\ BN, 64 \\ 1\times1, 256 \\ BN, 256 \end{bmatrix} \times 3$	$\begin{bmatrix} 1\times1, 128 \\ IN, 64\ BN, 64 \\ 3\times3, 128 \\ BN, 128 \\ 1\times1, 512 \\ BN, 512 \end{bmatrix} \times 4$	$\begin{bmatrix} 1\times1, 256 \\ IN, 128\ BN, 128 \\ 3\times3, 256 \\ BN, 256 \\ 1\times1, 1024 \\ BN, 1024 \end{bmatrix} \times 6$	$\begin{bmatrix} 1\times1, 512 \\ BN, 512 \\ 3\times3, 512 \\ BN, 512 \\ 1\times1, 2048 \\ BN, 2048 \end{bmatrix} \times 3$

- Modified based on ResNet-50.
- integrates IN and BN as building blocks to the first three groups of ResNet-50, and leave the fourth group as before without any change.

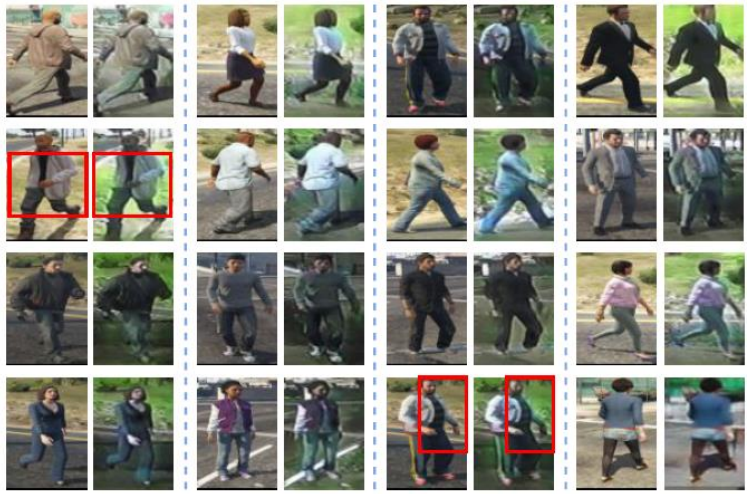
SynGAN



- Slightly modification based on the CycleGAN (image-image translation)
- Integrate a SiameseNet with CycleGAN (Similarity preserving learning)
- CycleGAN learning mapping function between two domain
- SiameseNet learning a latent space to constrain the mapping function

Visualization

GPR to Market-1501



GPR to DukeMTMC-reID

Results

Ablation study

Methods	Market-1501				DukeMTMC-reID			
	rank-1	rank-5	rank-10	mAP	rank-1	rank-5	rank-10	mAP
state-of-the-art (MAR [12])	67.7	81.9	87.3	40.0	67.1	79.8	84.2	48.0
Real	61.8	75.6	80.9	31.2	60.1	74.3	78.2	35.7
Real+GPR	73.8	86.9	91.1	47.1	68.7	80.3	84.1	49.3
Real+GPR (**Fine-tune w/ Target**)	76.2	89.2	93.6	50.8	71.2	82.7	86.8	51.9
CycleGAN†	73.6	86.5	90.7	46.6	69.1	80.8	84.6	50.5
CycleGAN+$\mathcal{L}_{id}$†	75.3	88.1	92.3	48.2	70.1	81.7	85.8	50.7
CycleGAN+$\mathcal{L}_{con}$†	75.6	88.4	92.5	48.4	70.3	81.9	86.0	50.8
CycleGAN+$\mathcal{L}_{id}$+$\mathcal{L}_{con}$† (**SynGAN**)	**76.1**	**89.0**	**93.2**	**49.7**	**70.9**	**82.4**	**86.2**	**51.1**

+2.5%

+1.8%

Comparison with existing methods

Methods	Market-1501			DukeMTMC-reID		
	rank-1	rank-5	mAP	rank-1	rank-5	mAP
LOMO [8]	27.2	41.6	8.0	12.3	21.3	4.8
BOW [4]	35.8	52.4	14.8	17.1	28.8	8.3
PTGAN [10]	38.6	57.3	15.7	27.4	43.6	13.5
SPGAN [9]	51.5	70.1	22.8	41.1	56.6	22.3
HHL [15]	62.2	78.8	31.4	46.9	61.0	27.2
ECN [11]	**75.1**	**87.6**	**43.0**	63.3	75.8	40.4
MAR [12]	67.7	81.9	40.0	**67.1**	**79.8**	**48.0**
Ours	**76.1**	**89.0**	**49.7**	**70.9**	**82.4**	**51.1**

We can achieve the SOTA results

Conclusion

Contribution:

- Create a large-scale，synthetic and diverse person Re-ID dataset GPR.
- Propose a novel domain adaptation framework to boost the performance for unsupervised Re-ID task.（a phenomenal job）

Future work:

- Focus on Re-ID task via domain adaptation.
- Explore how to extract more effective domain invariant features between synthetic and real-world data.

Thank you!