A Base-Derivative Framework for Cross-Modality RGB-Infrared Person Re-Identification

Hong Liu, Ziling Miao, Bing Yang and Runwei Ding

Key Laboratory of Machine Perception, Peking University, Shenzhen Graduate School, Shenzhen, China

Introduction

A new base-derivative framework is proposed, where base refers to the original visible and infrared modalities, and derivative refers to the two auxiliary modalities that are derived from base.

In the proposed framework, the double-modality cross-modal learning problem is reformulated as a four-modality one. After that, the images of all the base and derivative modalities are fed into the feature learning network. With the doubled input images, the learned person features become more discriminative.

Furthermore, the proposed framework is optimized by the enhanced intra- and cross-modality constraints with the assistance of two derivative modalities.

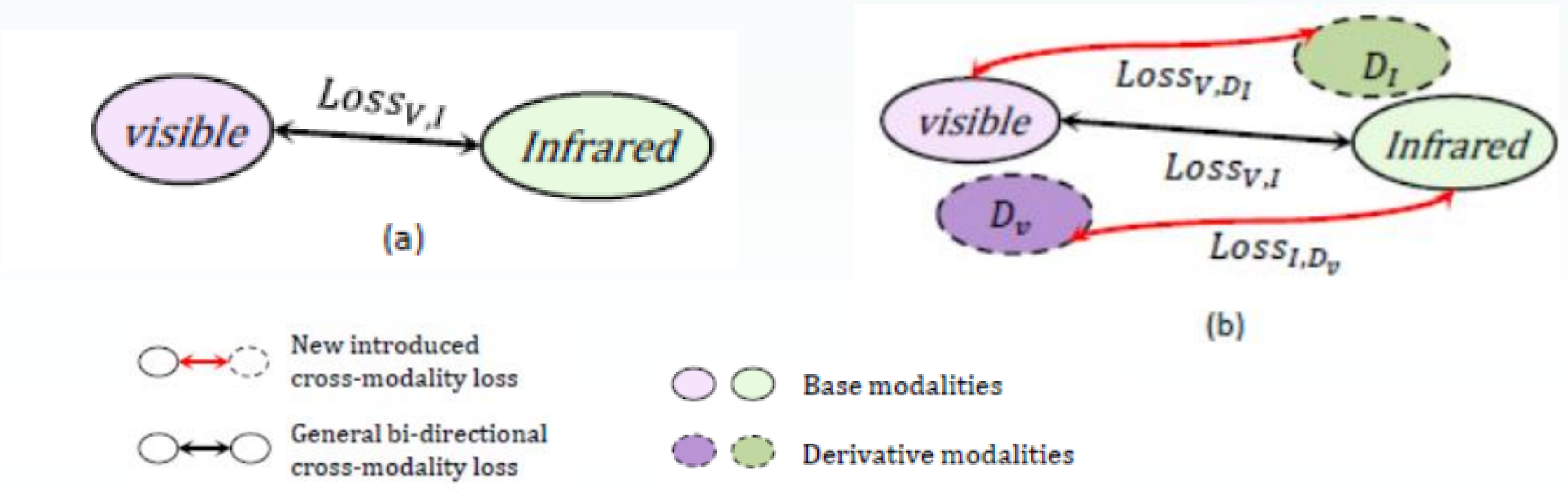
Objectives

Three loss functions are used to guide the learning.

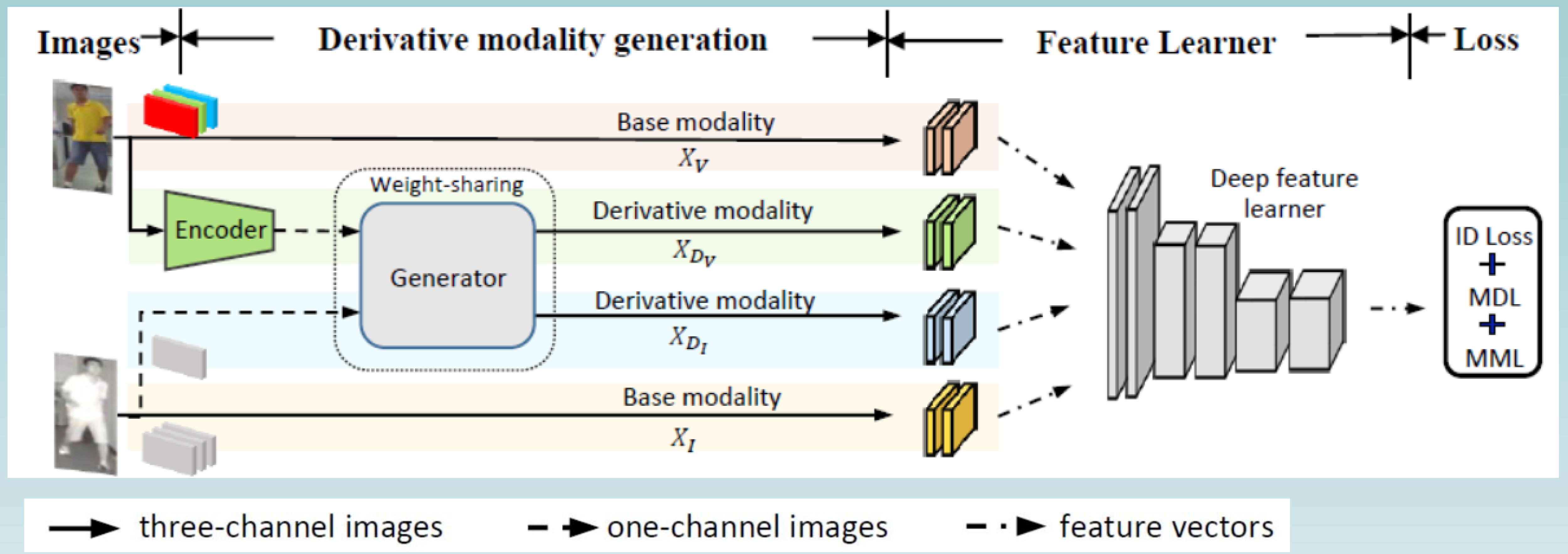
- **ID loss**
- **Multi-mode intra-modality loss (MML)**

MML enlarges the general two-mode intra-modality triplet loss into multimode (two base modalities and two derivative modalities).

- **Multi-directional cross-modality loss (MDL)**



Methods



The four modalities take different streams (shown in different colors). The feature learner is divided into two parts: four modality-independent feature learners and a modality-sharing deep feature learner.

Results

TABLE I
COMPARISON RESULTS(%) AT RANK r WITH THE STATE-OF-THE-ART CROSS-MODALITY RE-ID METHODS ON THE SYSU-MM01 DATASET.

Methods	All-search				Indoor-search			
	R1	R10	R20	mAP	R1	R10	R20	mAP
Zero-Padding [20] $_{ICCV17}$	14.8	54.12	71.33	15.95	20.58	68.38	85.79	26.92
HCML [7] $_{AAAI18}$	14.32	53.16	69.17	16.16	24.52	-	-	30.08
D-HSME [10] $_{AAAI19}$	20.68	62.74	77.95	23.12	-	-	-	-
eBDTR [6] $_{TIFS17}$	27.82	67.34	81.34	28.42	32.46	77.42	89.62	42.46
cmGAN [24] $_{IJCAI18}$	26.97	67.51	80.56	27.8	31.63	77.23	89.18	42.19
D^2RL [12] $_{CVPR19}$	28.9	70.60	82.40	29.20	-	-	-	-
MAC [8] $_{MM19}$	33.26	79.04	90.09	36.22	33.37	82.49	93.69	44.95
MSR [9] $_{TIP19}$	37.35	83.40	93.34	38.11	39.64	89.29	97.66	50.88
AlignGAN [13] $_{ICCV19}$	42.4	85.00	93.70	40.7	45.9	87.6	94.4	54.3
Hi-CMD [23] $_{CVPR20}$	34.94	77.58	-	35.94	-	-	-	-
JSIA [25] $_{AAAI20}$	38.10	80.7	89.9	36.9	43.8	86.2	94.2	52.9
Ours	**51.05**	**87.75**	**94.43**	**49.63**	**55.93**	**91.55**	**96.95**	**63.38**

TABLE II
COMPARISON RESULTS(%) WITH THE STATE-OF-THE-ART CROSS-MODALITY RE-ID METHODS ON THE REGDB DATASET.

Methods	visible2thermal			
	R1	R10	R20	mAP
Zero-Padding [20] $_{ICCV17}$	17.75	34.21	44.35	18.90
HCML [7] $_{AAAI18}$	24.44	47.53	56.78	20.08
eBDTR [6] $_{TIFS19}$	34.62	58.96	68.72	33.46
MAC [8] $_{MM19}$	36.43	62.36	71.63	37.03
D^2RL [12] $_{CVPR19}$	43.4	66.10	76.30	44.1
MSR [9] $_{TIP19}$	48.43	70.32	79.95	48.67
D-HSME [10] $_{AAAI19}$	50.85	73.36	81.66	47.00
AlignGAN [13] $_{ICCV19}$	57.9	-	-	53.6
XIV [16] $_{AAAI20}$	62.21	83.13	91.72	60.18
Hi-CMD [23] $_{CVPR20}$	70.93	86.39	-	66.04
Ours	**80.67**	**87.72**	**90.45**	**78.83**

Conclusion

- **A base-derivative framework for cross-modality person Re-ID is proposed.**
- **Multi-mode intra-modality loss and multi-directional cross-modality loss are designed to promote the reduction of intra- and cross-modality discrepancy.**