Dual Reverse Attention Networks for Person Re-identification

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Person Re-identification

Aims at retrieve images
belonging to the same person identity to query

Given a person of interest,
Re-id spots his appearance at:

other time

other location

other cameras

Person Re-identification

training

testing

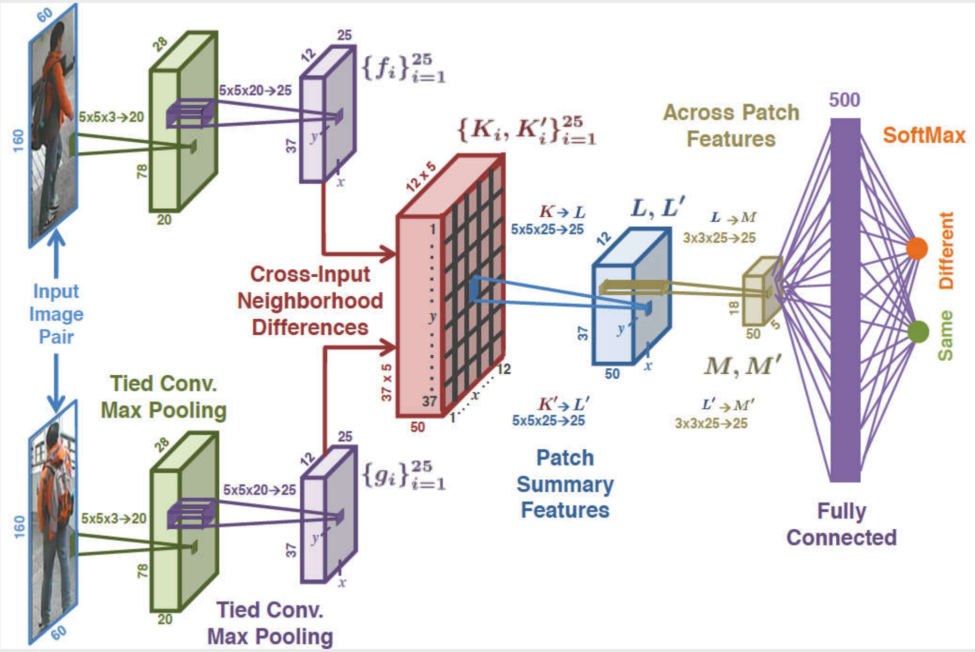
Challenge

Due to pedestrian images being taken at different times and cameras, the environmental settings like background clutter, illumination as well as human attributes like posture and clothing are quite various.

This requires the Re-ID model to be invariant to visual cues, especially hard examples with complex deformation, occlusion and low resolution

Existing Method : hard examples mining

Offline mining



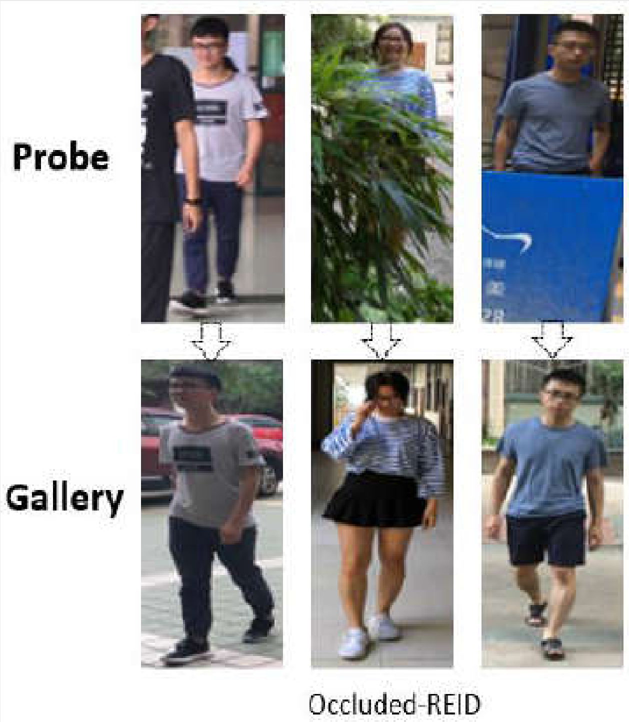
Online mining

$$\mathcal{L}_{\mathrm{BH}}(\theta;X) = \overbrace{\sum_{i=1}^{P}\sum_{a=1}^{K}}^{\text{all anchors}} \Big[m + \overbrace{\max_{p=1\dots K} D\big(f_\theta(x_a^i), f_\theta(x_p^i)\big)}^{\text{hardest positive}} \underbrace{- \min_{\substack{j=1\dots P\\ n=1\dots K\\ j\neq a}} D\big(f_\theta(x_a^i), f_\theta(x_n^j)\big)}_{\text{hardest negative}} \Big]_+ , \tag{5}$$

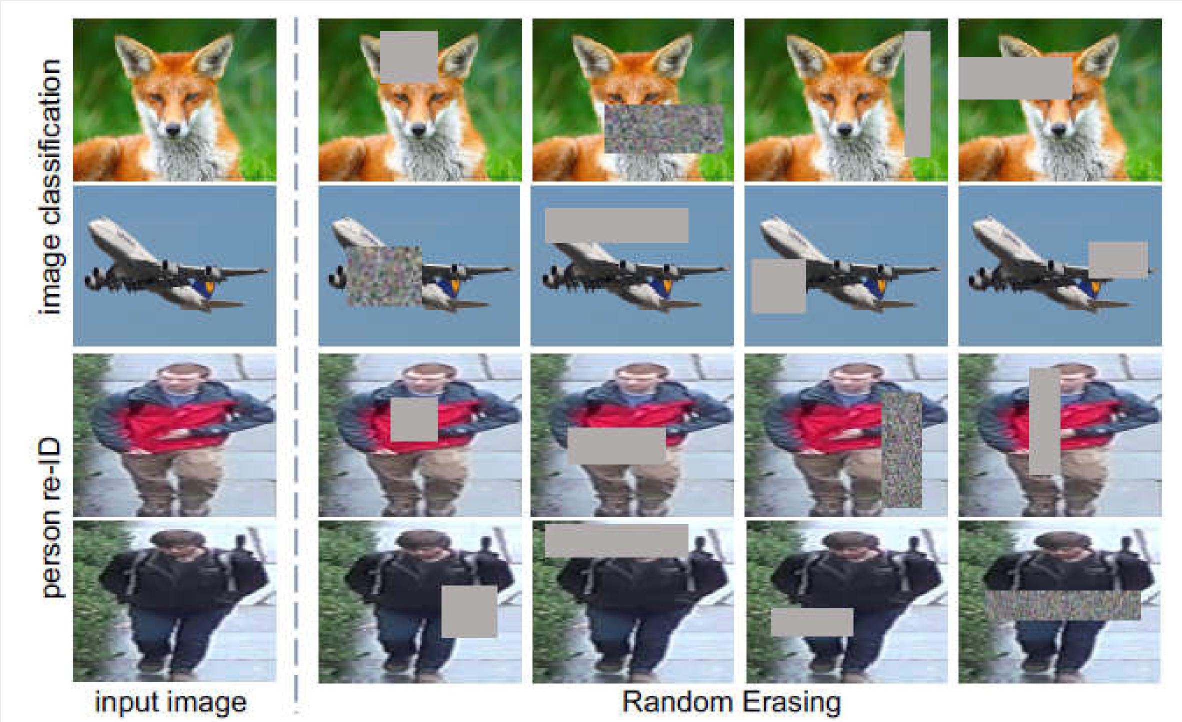
Ahmed E et. al, An improved deep learning architecture for person re-identification, in CVPR 2015
Hermans A et. al, In defense of the triplet loss for person re-identification, in arXiv 2017.

Existing Method : hard examples generating

Offline generating



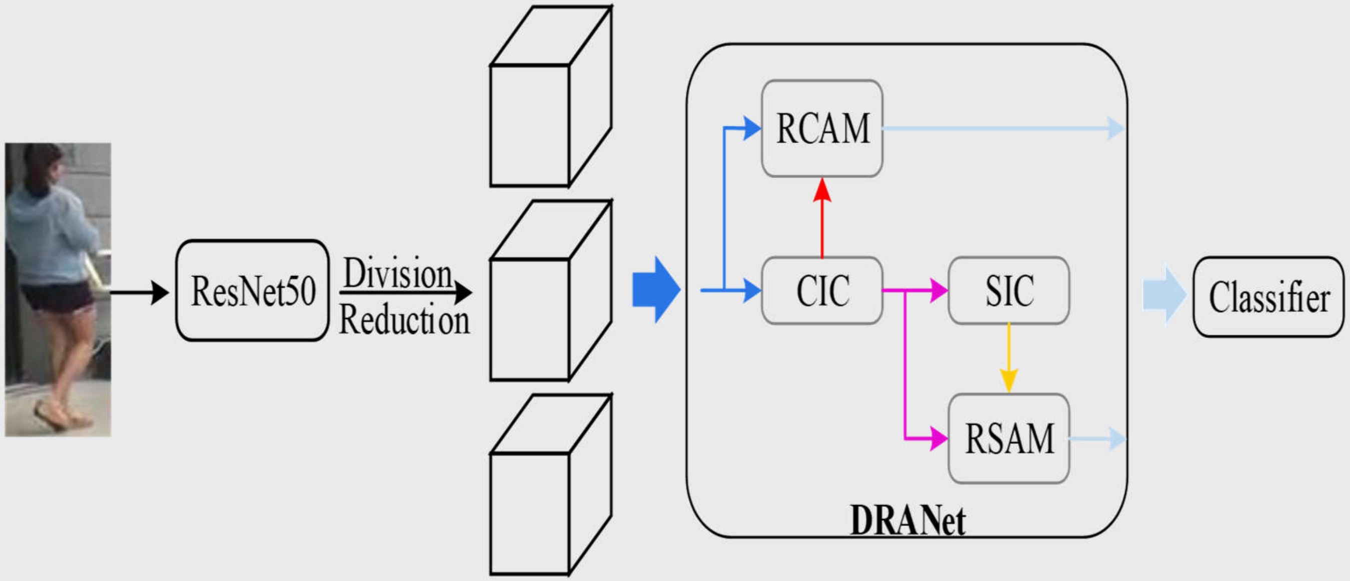
Online generating



Zhuo Jiaxuan et. al, "Occluded person re-identification." in ICME 2018.
Zhong Z et al., Random erasing data augmentation in arXiv 2017

Proposed Framework

- Hard examples generating in the convolutional space
- Powered by reverse attention modules



CIC : channel information captor

SIC : spatial information captor

RCAM: reverse channel attention module

RSAM: reverse spatial attention module

Fig. 1. Illustration of Dual Reverse Attention Networks(DRANet).

Proposed Framework

$$m = f_{eq}(g) = \sigma(W_1\delta(W_0 g))$$

$$\boldsymbol{B} = \boldsymbol{A} \cdot m$$

$$\bar{m} = (1-m)^{\alpha_c}$$

$$\boldsymbol{C} = \boldsymbol{A} \cdot \bar{m} = \boldsymbol{A} \cdot (1-m)^{\alpha_c}$$

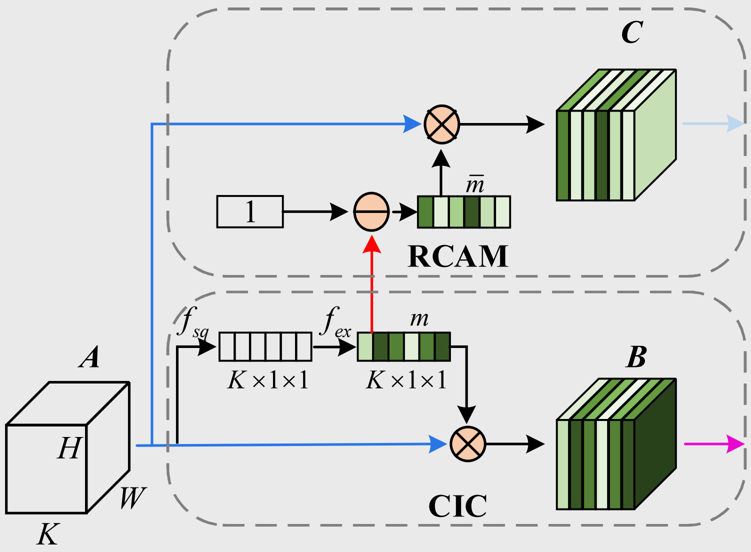


Fig. 2. Illustration of generating channel hard examples.

$$H_n = f_{1\times1}(f_{3\times3}(\boldsymbol{B}))[n,:,:]$$

$$\bar{H}_n = (1-H_n)^{\alpha_s}$$

$$\boldsymbol{D} = \boldsymbol{B} \cdot \bar{H}_n = \boldsymbol{B} \cdot (1-H_n)^{\alpha_s}$$

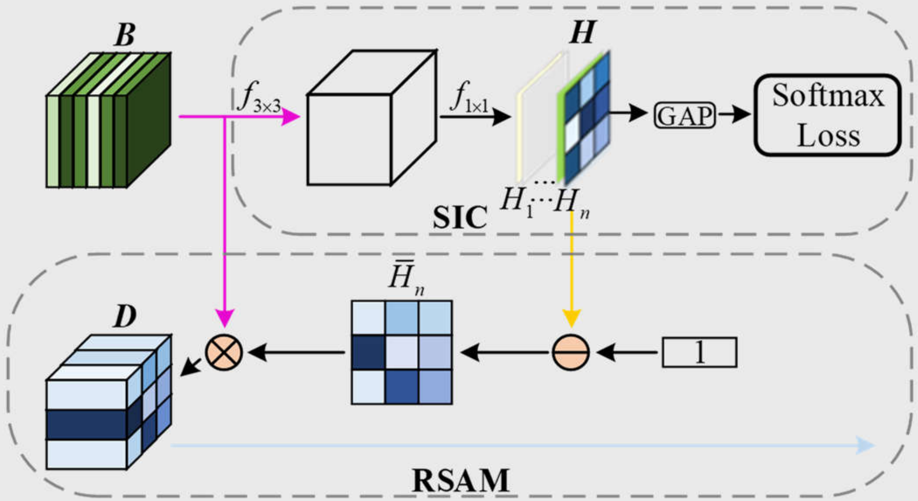


Fig. 3. Illustration of generating spatial hard examples.

Experiment results

Comparison with the State-of-the-art

Table 1. Evaluation on Market-1501.

Method	rank1	rank5	rank10	mAP
DLPAR [10]	81.0	92.0	94.7	63.4
SVDNet [23]	82.3	92.3	95.2	62.1
Triplet Loss [4]	84.9	94.2	-	69.1
IDE+RE [9]	85.2	-	-	68.3
AOS [21]	86.5	-	-	70.4
HA-CNN[11]	91.2	-	-	75.7
PCB [22]	92.3	97.2	98.2	77.4
Ours (DRANet)	**92.9**	**97.2**	**98.3**	**79.7**

Table 2. Evaluation on DukeMTMC-reID.

Method	rank1	mAP
IDE+RE [9]	74.2	56.2
SVDNet [23]	76.7	56.8
AOS [21]	79.2	62.1
HA-CNN [11]	80.5	63.8
PCB [22]	81.7	66.1
Ours (DRANet)	**84.3**	**69.5**

Table 3. Evaluation on CUHK03

Method	Rank1	mAP
IDE+RE [9]	41.5	36.8
SVDNet [23]	41.5	37.3
HA-CNN [11]	41.7	38.6
AOS [21]	47.1	43.3
PCB [22]	59.7	53.2
Ours (DRANet)	**61.7**	**58.6**

Experiment results

Comparison with the baseline

Table 4. Comparison of different revere attention modules

Dataset	Method	rank1	rank5	mAP
Market-1501	Baseline	91.5	96.6	77.5
	Baseline+RCAM	92.7	96.9	79.5
	Baseline+RSAM	92.1	96.6	79.4
	Baseline+RCAM+RSAM	**92.9**	**97.2**	**79.7**
DukeMTMC-reID	Baseline	81.3	89.0	65.5
	Baseline+RCAM	82.8	91.4	68.2
	Baseline+RSAM	84.0	**91.8**	**70.2**
	Baseline+RCAM+RSAM	**84.3**	90.7	69.5
CUHK03	Baseline	55.1	73.2	52.1
	Baseline+RCAM	58.6	77.6	56.3
	Baseline+RSAM	59.9	**78.5**	58.1
	Baseline+RCAM+RSAM	**61.7**	78.1	**58.6**

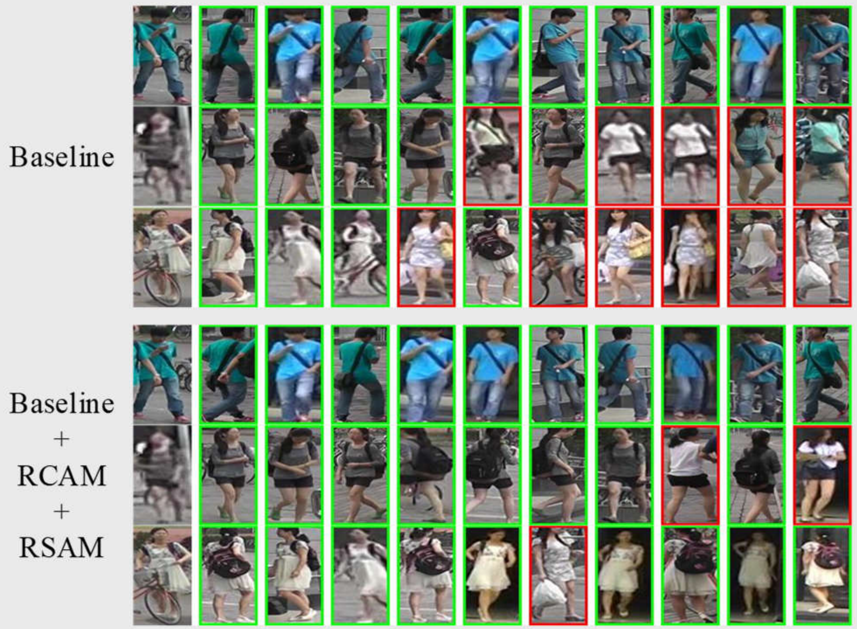


Fig. 4. Ranking list of whether using RCAM and RSAM.

Main Contribution

- Hard examples generating in the convolutional feature space

- A novel dual reverse attention networks (DRANet)

Thank You