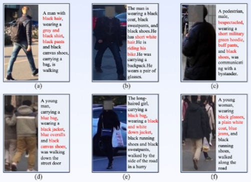
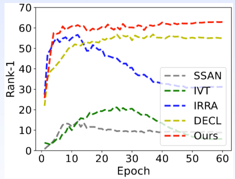
Noisy-Correspondence Learning for Text-to-Image Person Re-identification

Yang Qin, Yingke Chen, Dezhong Peng, Xi Peng, Joey Tianyi Zhou, Peng Hu*
College of Computer Science, Sichuan University
Github: https://github.com/QinYang79/RDE (CVPR 2024)

Observation & Motivation

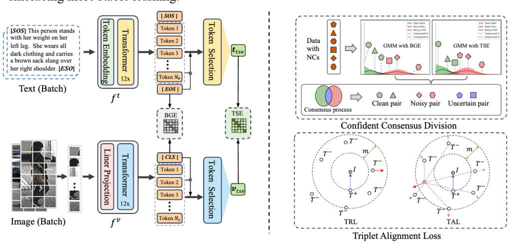




"Noisy correspondences would cause model degradation."

Overall Framework

The overview of our RDE. (a) is the illustration of the cross-modal embedding model used in RDE, which consists of basical global embedding (BGE) and token selection embedding (TSE) modules with different granularity. By integrating them, RDE can capture coarse-grained cross-modal interactions while selecting informative local token features to encode more fine-grained representations for a more accurate similarity. (b) shows the core of RDE to achieve robust similarity learning, which consists of Confident Consensus Division (CCD) and Triplet Alignment Loss (TAL). CCD performs consensus division to obtain confident clean training data, thus avoiding misleading from noisy pairs. Unlike traditional Triplet Ranking Loss (TRL), TAL exploits an upper bound to consider all negative pairs, thus embracing more stable learning.

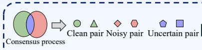


(a) Cross-modal Embedding Model (b) Robust Similarity Learning

Confident Consensus Division

BGE: per-sample loss & TSE: per-sample loss

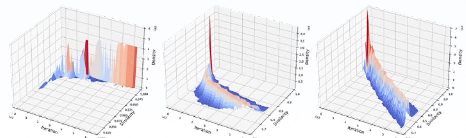
$$\ell(\mathcal{M},\mathcal{P})=\{\ell_i\}_{i=1}^{N}=\{\mathcal{L}(I_i,T_i)\}_{i=1}^{N} \Rightarrow GMM \Rightarrow p(k=0|l_i)$$



$$\hat{l}_{ii}=\begin{cases}1, & \text{if } (I_i,T_i)\in\hat{\mathcal{P}}^c\\ 0, & \text{if } (I_i,T_i)\in\hat{\mathcal{P}}^n\\ Rand(\{0,1\}), & \text{if } (I_i,T_i)\in\hat{\mathcal{P}}^u\end{cases}$$

Division and Recalibration

Triplet Alignment Loss



(a) TRL (3.64%) (b) TRL-S (44.93%) (c) TAL (63.35%)

$$\mathcal{L}_{tal}(I_i,T_i)=\Big[m-S_{i2t}^{+}(I_i)+\tau\log\Big(\sum_{j=1}^{K}q_{ij}\exp(S(I_i,T_j)/\tau)\Big)\Big]_+ + \Big[m-S_{t2i}^{+}(T_i)+\tau\log\Big(\sum_{j=1}^{K}q_{ji}\exp(S(I_j,T_i)/\tau)\Big)\Big]_+$$

Lemma 1 *TAL is the upper bound of TRL, i.e.,*

$$\mathcal{L}_{trl}(I_i,T_i)=\big[m-S_{i2t}^{+}(I_i)+S(I_i,\hat{T}_i)\big]_+ + \big[m-S_{t2i}^{+}(T_i)+S(\hat{I}_i,T_i)\big]_+\le\mathcal{L}_{tal}(I_i,T_i),$$

where $\hat{T}_i\in\{T_j|l_{ij}=0,\forall j\in\{1,\cdots,K\}\}$ is the hardest negative text for I_i and $\hat{I}_i\in\{I_j|l_{ji}=0,\forall j\in\{1,\cdots,K\}\}$ is the hardest negative image for I_i, respectively.

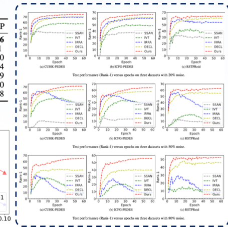
- *More stable*
- *More Robust*
- *No collapse*

Experiments

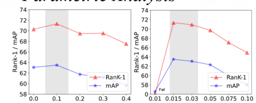
Noise	Methods		CUHK-PEDES R-1	R-5	R-10	mAP	mINP	ICFG-PEDES R-1	R-5	R-10	mAP	mINP	RSTPReid R-1	R-5	R-10	mAP	mINP
0%	SSAN	Best	61.37	80.15	86.73	-	-	54.23	72.63	79.53	-	-	43.50	67.80	77.15	-	-
	IVT	Best	65.59	83.11	89.21	-	-	56.04	73.60	80.22	-	-	46.70	70.00	78.80	-	-
	CFine	Best	69.57	85.93	91.15	-	-	60.83	76.55	82.42	-	-	50.55	72.50	81.60	-	-
	IRRA	Best	73.38	89.93	93.71	66.13	50.24	63.46	80.25	85.82	38.06	**7.93**	60.20	81.30	88.20	47.17	25.28
	RDE	Best	**75.94**	**90.14**	**94.12**	**67.56**	**51.44**	**67.68**	**82.47**	**87.36**	**40.06**	7.87	**65.35**	**83.95**	**89.90**	**50.88**	**28.08**
20%	SSAN	Best	46.52	68.36	77.42	42.49	28.13	40.57	62.58	71.53	20.93	2.22	35.10	60.00	71.45	28.90	12.08
		Last	45.76	67.98	76.28	40.05	24.12	40.28	62.68	71.53	20.98	2.25	33.45	58.15	69.60	26.46	10.08
	IVT	Best	58.59	78.51	85.61	57.19	45.78	50.21	69.14	76.18	34.72	8.77	43.65	66.50	75.70	37.22	20.47
		Last	57.67	78.04	85.02	56.17	44.42	48.70	67.42	75.06	34.44	**9.25**	37.95	63.35	73.75	34.24	19.67
	IRRA	Best	69.74	87.09	92.20	62.28	45.84	60.76	78.26	84.01	35.87	6.80	58.75	81.90	88.25	46.38	24.78
		Last	69.44	87.09	92.04	62.16	45.70	60.58	78.14	84.20	35.92	6.91	54.00	77.15	85.55	43.20	22.53
	CLIP-C	Best	66.41	85.15	90.89	59.36	43.02	55.25	74.76	81.32	31.09	4.94	54.45	77.80	86.70	42.58	21.38
		Last	66.10	86.01	91.02	59.77	43.57	55.17	74.58	81.46	31.12	4.97	53.20	76.25	85.40	41.95	21.95
	DECL	Best	70.29	87.04	91.93	62.84	46.54	61.95	78.36	83.88	36.08	6.25	61.75	80.70	86.90	47.70	26.07
		Last	70.08	87.20	92.14	62.86	46.63	61.95	78.36	83.88	36.08	6.25	60.85	80.45	86.65	47.34	25.86
	RDE	Best	74.46	**89.42**	**93.63**	**66.13**	**49.66**	66.54	**81.70**	86.70	39.08	7.55	**64.45**	83.50	**90.00**	49.78	27.43
		Last	**74.53**	89.23	93.55	**66.13**	49.63	66.51	**81.70**	**86.71**	**39.09**	7.56	63.85	**83.85**	89.45	**50.27**	**27.75**
50%	SSAN	Best	13.43	31.74	41.89	14.12	6.91	18.83	37.70	47.43	9.83	1.01	19.40	39.25	50.95	15.95	6.13
		Last	11.31	28.07	37.90	10.57	3.46	17.06	37.18	47.85	6.58	0.39	14.10	33.95	46.55	11.88	4.04
	IVT	Best	50.49	71.82	79.81	48.85	36.60	43.03	61.48	69.56	28.86	6.11	39.70	63.80	73.95	34.35	18.56
		Last	42.02	65.04	73.72	40.49	27.89	36.57	54.83	62.91	24.30	5.08	28.55	52.05	62.70	26.82	13.97
	IRRA	Best	62.41	82.23	88.40	55.52	38.48	52.53	71.99	79.41	29.05	4.43	56.65	78.40	86.55	42.41	21.05
		Last	42.79	64.31	72.58	36.76	21.11	39.22	60.52	69.26	19.44	1.98	31.15	55.40	65.45	23.96	9.67
	CLIP-C	Best	64.02	83.66	89.38	57.33	40.90	51.60	71.89	79.31	28.76	4.33	53.45	76.80	85.50	41.43	21.17
		Last	63.97	83.74	89.54	57.35	40.88	51.49	71.99	79.32	28.77	4.37	52.35	76.35	85.25	40.64	20.45
	DECL	Best	65.22	83.72	89.28	57.94	41.39	57.50	75.09	81.24	32.64	5.27	56.75	80.55	87.65	44.53	23.61
		Last	65.09	83.58	89.26	57.89	41.35	57.49	75.10	81.23	32.63	5.26	55.00	80.50	86.50	43.81	23.31
	RDE	Best	**71.33**	**87.41**	**91.81**	63.50	47.36	**63.76**	**79.53**	**84.91**	**37.38**	**6.80**	**62.85**	**83.20**	**89.15**	**47.67**	**23.97**
		Last	71.25	87.39	91.76	**63.59**	**47.50**	**63.76**	**79.53**	**84.91**	**37.38**	**6.80**	**62.85**	**83.20**	**89.15**	**47.67**	23.96

Ablation Study

No.	S^b	S^t	CCD	Loss	R-1	R-5	R-10	mAP	mINP
#1	✓	✓	✓	TAL	**71.33**	**87.41**	**91.81**	**63.50**	**47.36**
#2	✓	✓	✓	TRL	6.40	16.08	22.14	6.53	2.51
#3	✓	✓	✓	TRL-S	67.38	85.35	90.64	60.04	43.60
#4	✓	✓	✓	SDM	69.33	86.99	91.68	61.99	45.34
#5		✓	✓	TAL	70.70	86.60	91.16	62.67	46.19
#6	✓		✓	TAL	69.07	86.09	91.13	61.69	45.40
#7	✓	✓		TAL	63.11	81.04	87.22	55.42	38.68



Parametric Analysis



My Wechat Github/RDE

Any questions please contact us!