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Learning Camera-invariant Representation for Person Re-identification

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Architecture

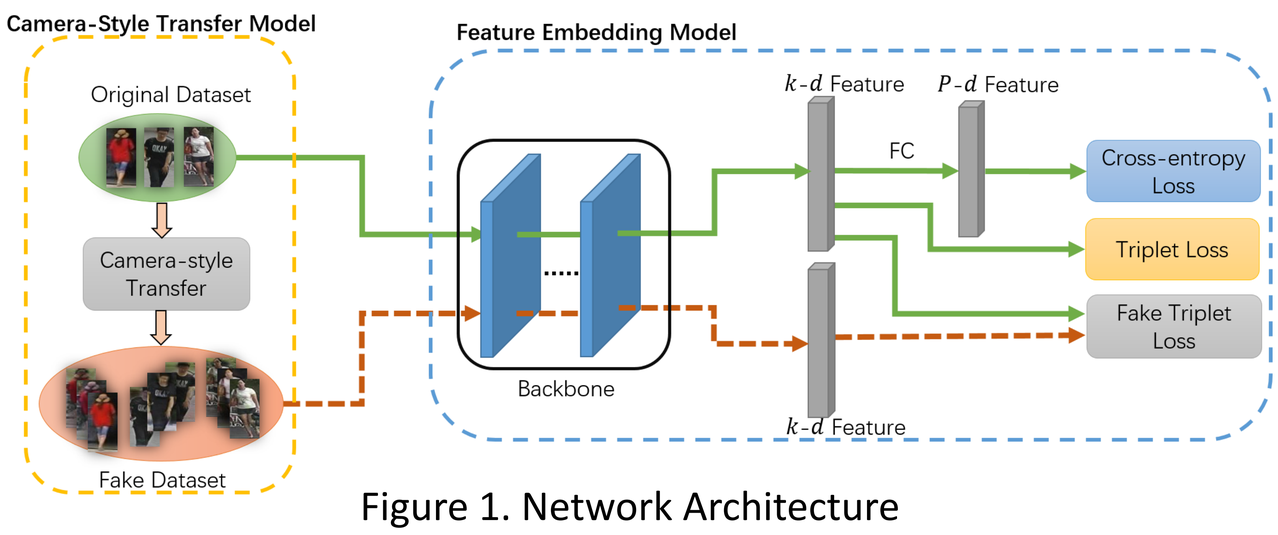

Figure 1. Network Architecture

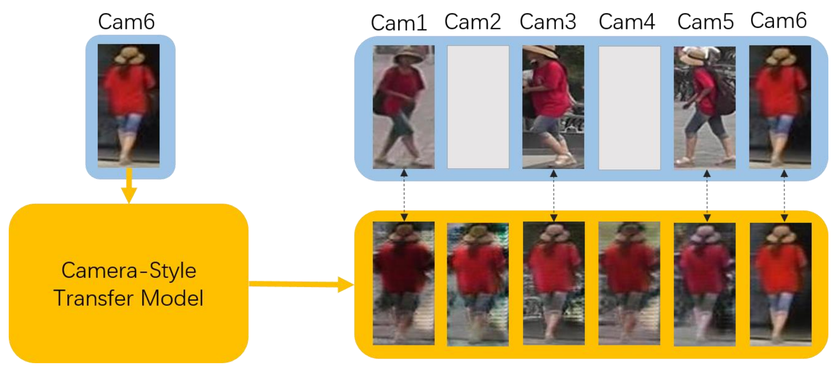

Figure 2. Camera-Style Transfer Model

Motivation

- Transfer Person Images from one camera-style to another.
- Train re-ID model with generated person images.

Contribution

- Generate style-transferred person images with StarGAN.
- Propose **Fake Triplet Loss** to overcome the influence of image distortion.

Component

- Camera-Style Transfer Model: StarGAN, camera-IDs of images are considered as domains in StarGAN model.
- Feature Embedding Model: ID-Embedding(IDE) or Mid-level.

Loss Functions

- **Smoothing Cross-entropy Loss**

$$L_{cls} = -\frac{1}{N}\sum_{i=1}^{N}\log p(x_i)q'(x_i), q'(x_i) = (1-\epsilon)q(x_i) + \frac{\epsilon}{K}$$

where $p(x_i)$ is prediction and $q(x_i)$ is label.

- **Triplet Loss**

$$L_{tri} = \sum_{i=1}^{P}\sum_{a=1}^{K}[m_\alpha - \min_{\substack{j=1..P \\ n=1..K \\ j\neq i}} D(x_a^i, x_n^j) + \max_{p=1..K} D(x_a^i, x_p^i)]_+$$

where x_a^i is an anchor image, x_a^j is a negative image and x_p^i is a positive image.

- **Fake Triplet Loss**

$$L_{fake} = \sum_{i=1}^{P}\sum_{a=1}^{K}[m_{fake} - \min_{\substack{j=1..P \\ n=1..K \\ j\neq i}} D(x_a^{r,i}, x_n^j) + \max_{p=1..K} D(x_a^{r,i}, x_p^{f,i})]_+$$

where $x_a^{r,i}$ is a real image and $x_p^{f,i}$ is a fake image.

Methods

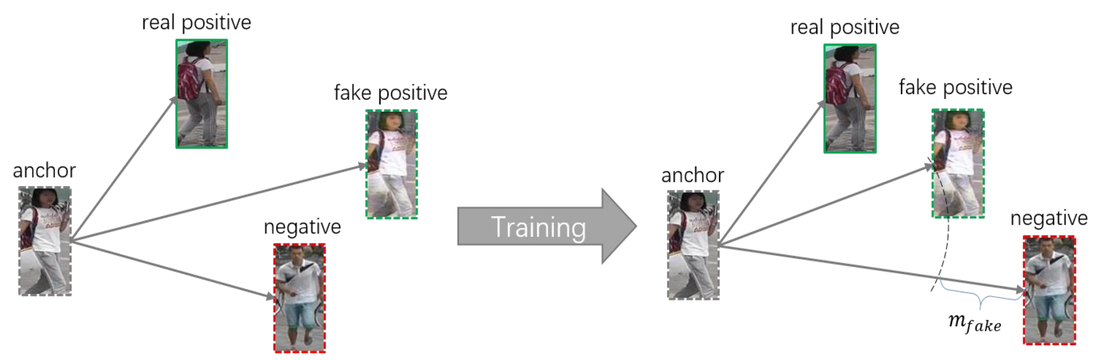

Figure 3. Fake Triplet Loss

Experiments

Table 1. Ablation study of losses

Model	L_{cls}	L_{tri}	L_{fake}	Rank-1	mAP
IDE	√			86.73	69.87
IDE		√		88.36	74.19
IDE	√	√		89.49	74.95
IDE		√	√	89.10	74.44
IDE	√	√	√	**90.70**	**76.48**
Mid-level	√	√		90.53	76.79
Mid-level	√	√	√	**92.73**	**79.41**

Table 2. Augment dataset with incremental schema

Dataset	Rank-1	mAP
Real	89.49	74.95
Real+Fake(1,2,3)	90.35	74.85
Real+Fake(4,5,6)	90.08	75.27
Real+Fake(1,2,3)+Fake(4,5,6)	90.71	76.75
Real+Fake(1,2,3,4,5,6)	90.70	76.48

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