A Global-Local Architecture Constrained by Multiple Attributes for Person Re-identification

Chao Liu, Hongyan Quan

East China Normal University, Shanghai, China

Introduction

Person re-identification (person re-ID) is often considered as a sub-problem of image retrieval, which aims to match pedestrians under non-overlapping cameras. In this work, we present a novel global and local network structure integrating pedestrian identities with multiple attributes to improve the performance of person re-ID. The proposed framework consists of three modules: shared one, global one and local one. The shared module based on pre-trained residual network extracts low-level and mid-level features. And the global module guided by identification loss learns high-level semantic feature representations. To achieve accurate localization of local attribute features, we propose a multi-attributes partitioning learning method and consider pedestrian attributes as supervised information of the local module. Meanwhile, we employ whole-to-part spatial transformer networks (STNs) to achieve coarse-to-fine meaningful feature locations. By applying a multi-task learning strategy, we design various objective functions including identification and multiple attributes classification losses for training our model. The experimental results on several challenging datasets show our method significantly improves person re-ID performance. Specifically, our model achieves 87.49% of the attribute recognition accuracy on Market1501 dataset.

Method

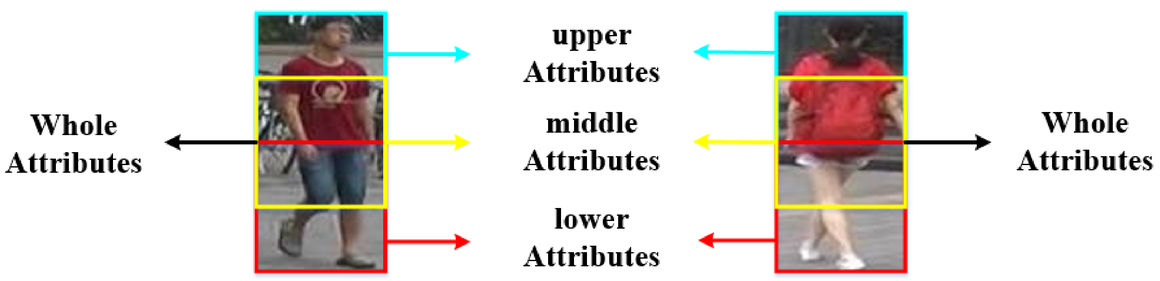

Figure 1: Sample images contain some visual attributes

- **Multi-attributes partition learning:**

Different pedestrian body areas have corresponding pedestrian attributes, such as whole attributes, gender, can be reflected in the whole pedestrian.

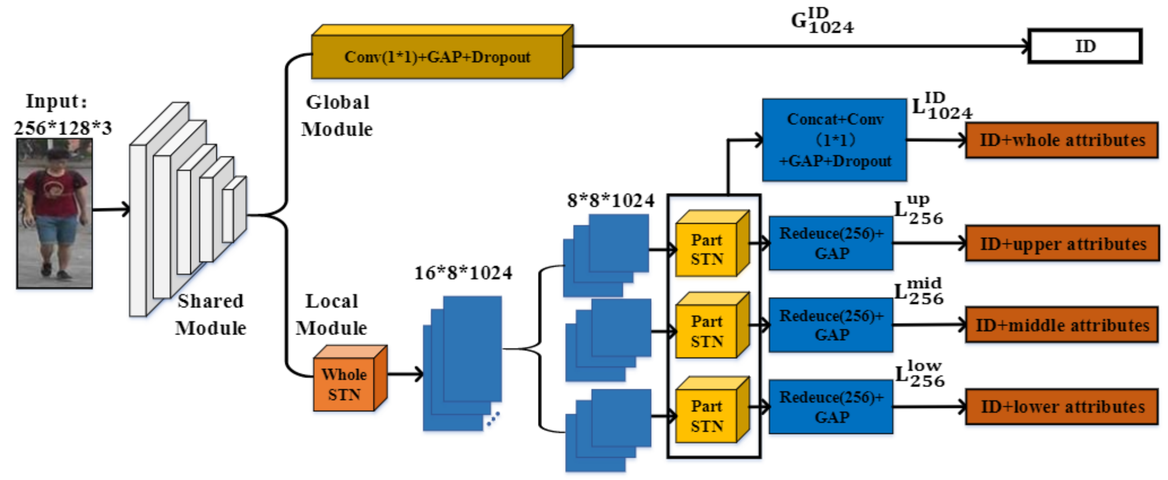

Figure 2:An overview of the proposed network architecture.

- **Global and local fine-grained framework:**

The proposed model mainly contains three modules. Firstly, the shared module is based on modified ResNet-101 (remove max-pooling and fully connected layers). And we feed ResNet101-4 and ResNet101-5 feature maps into our local and global modules, respectively. Secondly, the global module is trained with identification (ID) loss. Finally, the local module is responsible for learning multi-attributes features and predict multiple pedestrian attributes. Meanwhile, attributes are classified accurately into four categories including whole, upper, middle and lower parts. GAP denotes global average pooling.

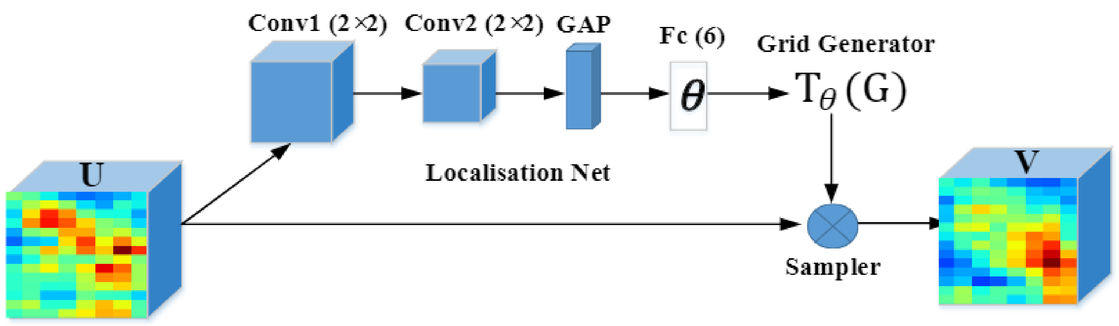

Figure 3: The structure of improved STN module.

- **Improve STN:**

We applied improved STN to achieve coarse-to-fine meaningful feature locations, The improved STN can be complementary to multi-attributes partition learning.

Results

Table1:Experimental Results on Market1501 and DukeMTMC-reID.

Mark1501	Rank-1	mAP	DukeMTMC-reID	Rank-1	mAP
LOMO+XQDA	43.79	22.22	LOMO+XQDA	30.75	17.04
APR	84.29	64.67	APR	70.69	51.88
JLML	85.1	65.5	JLML	-	-
Aligment(GAN)	86.67	69.33	Aligment(GAN)	71.59	51.5
Sun et al.	87.05	70.12	Sun et al.	80.57	66.68
PCB+RPP	93.8	86.9	PCB+RPP	83.3	69.2
MGN	**95.7**	86.9	MGN	88.7	78.4
Ours	94.8	85.5	Ours	86.5	76.1
Ours+Triplet	95.2	**87.1**	Ours+Triplet	**88.9**	**78.9**

Table2:Recognition accuracy of seven visual attributes on Market1501.

Method	Hair	Hat	Backpack	Bag	Clothes	Handbag	Gender	Mean
APR	83.65	97.13	82.79	75.07	91.46	88.98	86.45	86.50
Sun et al	78.26	97.06	**85.46**	67.28	84.79	88.40	**88.94**	84.31
Ours	**86.62**	**97.75**	81.89	**75.59**	**92.86**	**89.85**	87.92	**87.49**

- Proposed model can evaluate the performance of person re-ID. It can be seen that our model significantly improve person re-ID performance and achieve 87.49% of the attribute recognition accuracy.

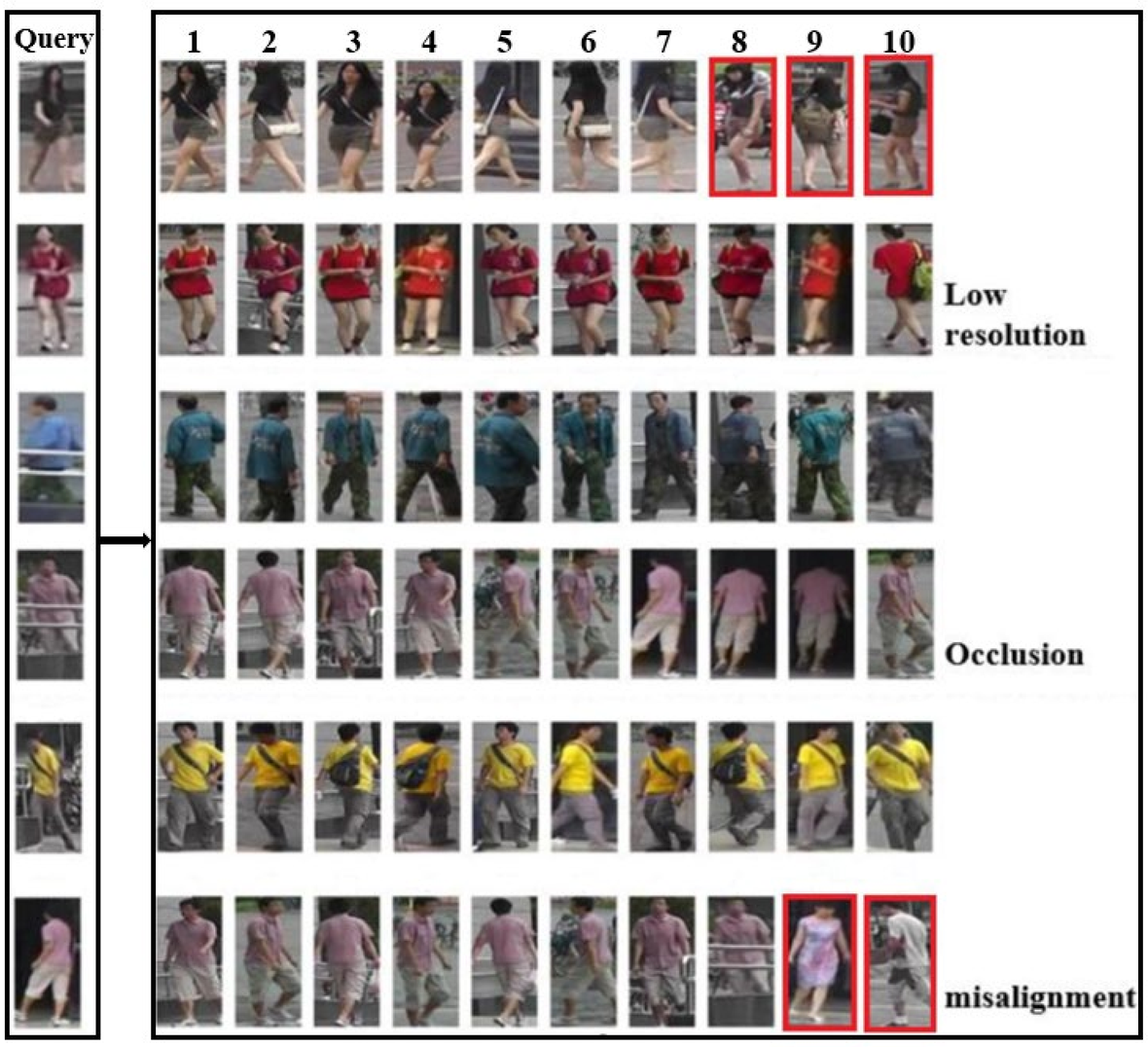

Figure 4: The visualization results in person retrieval.

- The visualization results demonstrate the effectiveness of our method, against the low-resolution images, occlusion, and misalignment with a person bounding box.

Our Contacts

- The corresponding author is Hongyan Quan.
- Email: 51174500106@stu.ecnu.edu.cn
- WeChat:1535471036