Multi-attribute Learning for Pedestrian Attribute Recognition in Surveillance Scenarios

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Introduction

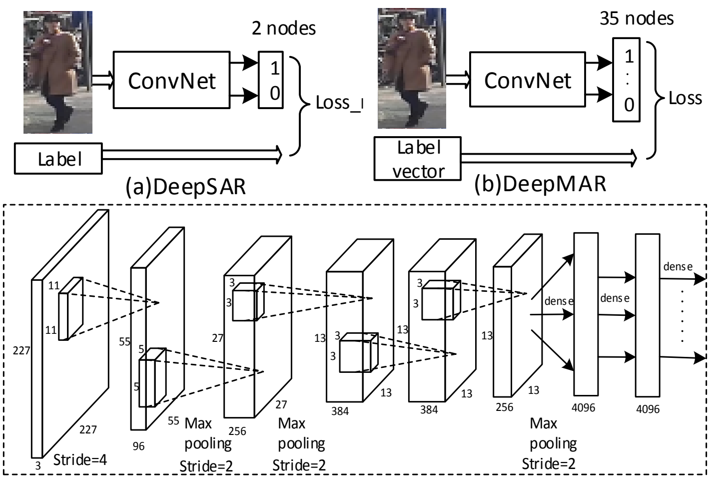
Recognizing pedestrian attributes, such as gender, cloth type, action, is very important in practical applications scenarios. The traditional pedestrian attribute recognition methods usually adopt hand-craft features and ignore the relationship among attributes. In this paper, we introduce two deep learning based models to solve these two drawbacks incrementally, which obtain impressive results.

Contribution

Considering the drawbacks of current attribute recognition methods that focus on surveillance scenarios, this paper have two contributions below:

- The automatically learned features are introduced into pedestrian recognition tasks to handle the complicated surveillance scenarios.
- To exploit the relationship among attributes, the unified multi-attribute jointly learning model is proposed. In addition, the weighted sigmoid cross entropy loss is proposed to handle the unbalance distributed attributes.

Proposed Method



(a)DeepSAR

(b)DeepMAR

(c)ConvNet

Proposed method

Deep learning based Sing Attribute Recognition(DeepSAR)

Treat each attribute as independent component, for each attribute the DeepSAR model using loss (1) is trained.

$$Loss_l = -\frac{1}{N}\sum_{i=1}^{N} log(\hat{p}_{i,y_{il}}) \tag{1}$$

$$l \in \{1,\ldots,L\}, y_{il} \in \{0,1\}$$

$$\hat{p}_{i,y_{il}} = exp(x_{i,y_{il}}) \Big/ \sum_{y_{il}=0}^{1} exp(x_{i,y_{il}}) \tag{2}$$

Deep learning based Multi-attribute Recognition(DeepMAR)

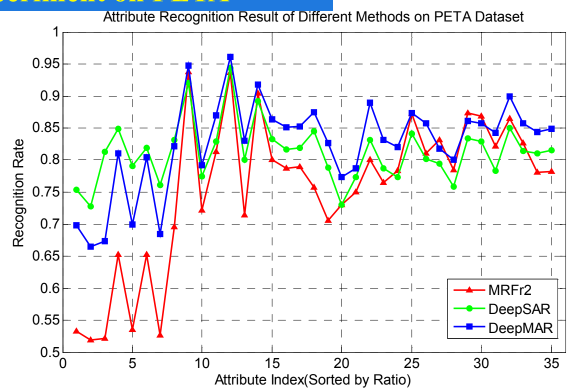
To exploit the relationship among attributes, the DeepMAR model using proposed weight sigmoid cross entropy loss (3) is trained for all the attributes jointly.

$$Loss = -\frac{1}{N}\sum_{i=1}^{N}\sum_{l=1}^{L} w_l(y_{il}log(\hat{p}_{i,y_{il}}) + (1-y_{il})log(1-\hat{p}_{i,y_{il}})) \tag{3}$$

$$w_l = \begin{cases} exp\left((1\text{-}p_l)/\sigma^2\right) & y=1 \\ exp\left(p_l/\sigma^2\right) & y=0 \end{cases} \tag{4}$$

Experimental Results

Experiment on PETA



Experiment on APiS

Attribute	Long Pants	Shirt	Skirt	T-Shirt	Long Hair	Back Bag	...	Mean(AUC)
AdaBoost	0.925	0.839	0.900	0.854	0.852	0.836	...	0.8670
DeepMAR	0.970	0.880	0.910	0.906	0.862	0.866	...	0.8996

Conclusions

The proposed two models have obtained impressive improvements than current state-of-the-art methods, which shows the importance of the learned features and relationship among attributes. In the future, we will explore new loss functions into multi-attribute learning and apply attributes to assist pedestrian re-identification problem.

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