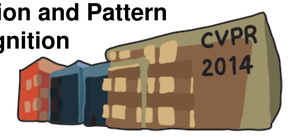
Learning Mid-level Filters for Person Re-identification

Rui Zhao Wanli Ouyang Xiaogang Wang

香港中文大學
The Chinese University of Hong Kong

IEEE 2014 Conference on Computer Vision and Pattern Recognition

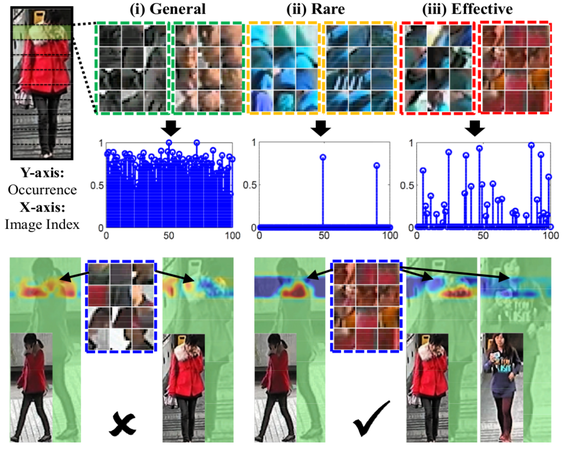


Scan to visit project page. Code is available!

Overview:

- Propose to learn mid-level *filters* from automatically discovered clusters of patches for person re-identification.

  A ***filter*** captures a visual pattern related to a particular body part.
- Motivated by:
  - What are good filters for person re-identification?
  - What are good patch clusters to train these filters?
  - How to quantify observations for guiding the learning process?



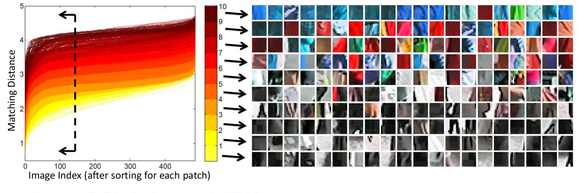
Contibutions:

- *Partial Area Under Curve (pAUC)* score is proposed to measure the discriminative power of local patches
- *Hierarchical clustering trees* are built to exploit visual patterns from local patches
- A simple but effective *cross-view training* strategy is proposed to learn view-invariant and discriminative SVM filters
- Matching scores of filter responses are integrated with patch matching in RankSVM training

Partial AUC Quantization:

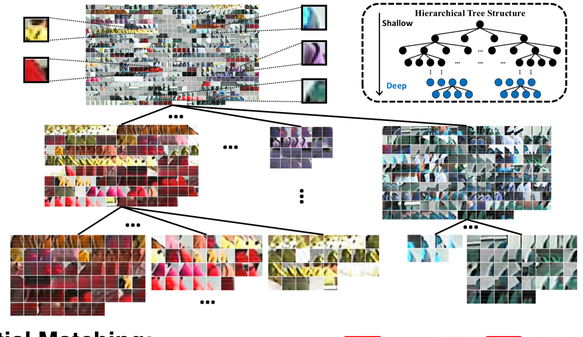
- **Partial AUC Score**
  - Low-pAUC-score patch: monochromatic and frequently seen
  - High-pAUC-score patch: varicolored and less frequently appeared

$$s^{pAUC}(x_{m,n}^{A,u}) = \sum_{k=1}^{N_p} d_k(X_{NN}(x_{m,n}^{A,u})),$$

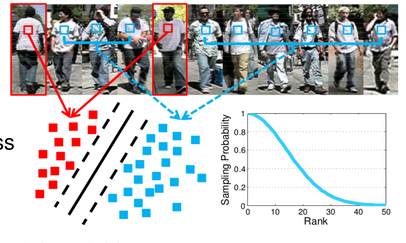


Learning Mid-level Filters:

- **Hierarchical clustering for each pAUC level.**



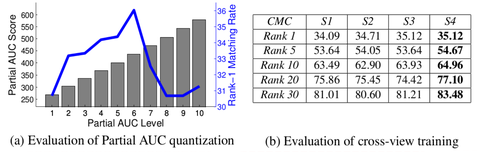
- **Initial Matching:**
  - Overal patch matching scores
- **Cross-view Training:**
  - Mining positive for robustness
  - Mining negative for discriminativeness



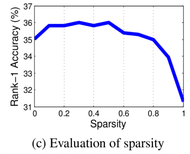
Integrated Matching:

- Normalize and sparsify filter response
- Integrate filter response matching with patch matching
- Learn unified weighting in RankSVM

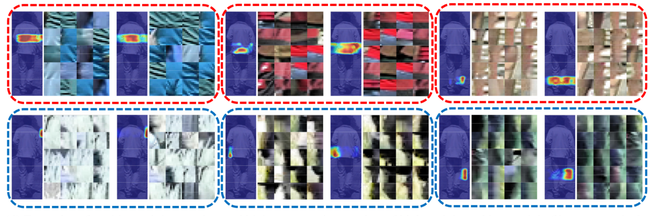
Experimental Results:



CMC	S1	S2	S3	S4
Rank 1	34.09	34.71	35.12	**35.12**
Rank 5	53.64	54.05	53.64	**54.67**
Rank 10	63.49	62.90	63.93	**64.96**
Rank 20	75.86	75.45	74.42	**77.10**
Rank 30	81.01	80.60	81.21	**83.48**

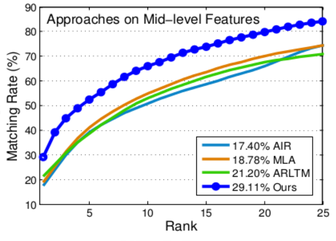


(a) Evaluation of Partial AUC quantization (b) Evaluation of cross-view training (c) Evaluation of sparsity

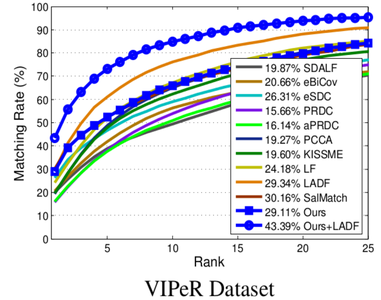


(d) Examples of positive training patches and high-score testing patches of high-weight and low-weight filters respectively

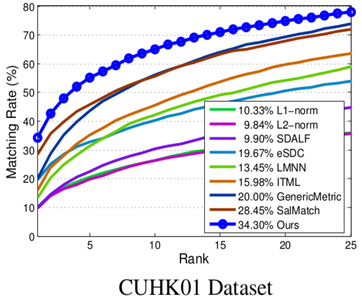
- Evaluation and analysis:
  - Partial AUC Quantization
  - Cross-view Training
  - Sparse Filtering
- Comparison with other mid-level features
  - AIR [Layne et al. BMVC 2012]
  - MLA [Layne et al. ECCV workshop 2012]
  - ARLTM [Song et al. PR 2012]
- Comparison with popular ReId methods:
  - VIPeR Dataset
  - CUHK01 Dataset



VIPeR Dataset



VIPeR Dataset



CUHK01 Dataset