**CANU-ReID: A Conditional Adversarial Network for Unsupervised person Re-IDentification**

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**Motivation**

We address the problem of unsupervised person Re-ID in the context of the Clustering and Finetuning framework via a Camera adversarially-guided clustering, highlight and address the problem of negative transfer via a conditioned adversarial approach.

**Clustering and Finetuning for Unsupervised Person Re-ID**

Unsupervised Person Re-ID: Domain Adaptation setting for Person Re-ID.

Clustering and Finetuning: Recent works in Unsupervised Person Re-ID are based on this framework (SSG¹, MMT²):

0 - Source Pretraining: \( \phi \) is pretrained using source \( S \) in a supervised fashion. \( S \) is then discarded.

1 - Clustering step: runs a clustering algorithm on \( T \) in the embedding of \( \phi \) (frozen). Generates pseudo-ID labels on \( T : p' \).

2 - Finetuning step: \( \phi \) is finetuned for a few epochs supppervised by \( L_{\text{ID}-\text{ID}} \) and using pseudo-ID labels \( p' \) as ID-annotation.

3 - Return to 1 Clustering/Finetuning steps alternate until we reach convergence.

**Adversarial Domain Adaptation (DA)**

Adversarial DA introduced to reduce domain gap between \( S \) and \( T \) [3].

Adversarial training:

\[
\min \max_{\phi,C} \mathbb{L}_{\text{ID}}(\phi, C_{\text{ID}}) - \mu p_{\text{ID}}(D_{\text{ID}})
\]

**Training Pipeline**

1. Clustering of target's embedding vectors \( \{\epsilon_{p}\} \).
2. Conditional Adversarial Training steps.

**Comparison to State of the Art**

<table>
<thead>
<tr>
<th>Method</th>
<th>Mkt</th>
<th>Duke</th>
<th>Mkt</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1 mAP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPCGAN</td>
<td>41.1</td>
<td>22.3</td>
<td>51.2</td>
</tr>
<tr>
<td>Co-teaching</td>
<td>77.6</td>
<td>61.7</td>
<td>87.8</td>
</tr>
<tr>
<td>SSG [1]</td>
<td>73.0</td>
<td>53.4</td>
<td>80.0</td>
</tr>
<tr>
<td>CANU-SSG (ours)</td>
<td>76.1</td>
<td>57.0</td>
<td>83.3</td>
</tr>
<tr>
<td>MMT [2]</td>
<td>80.2</td>
<td>67.2</td>
<td>91.7</td>
</tr>
<tr>
<td>CANU-MMT (ours)</td>
<td>83.3</td>
<td>70.3</td>
<td>94.2</td>
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</tbody>
</table>

CANU on the Mkt ▶ Duke and Duke ▶ Mkt.

**Impact of Negative Transfer**

Conditioned CANU compared with standard camera adversarial implementation:

\[
\min \max_{\phi,C} \mathbb{L}_{\text{ID}-\text{ID}}(\phi, C_{\text{ID}}) - \mu p_{\text{ID}}(D_{\text{ID}})
\]

**Camera and pseudo-ID labels mutual information**

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<td>SGG [1]</td>
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<td>13.2</td>
<td>32.2</td>
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<tr>
<td>MMT [2]</td>
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<td>26.6</td>
<td>59.0</td>
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<tr>
<td>CANU-MMT (ours)</td>
<td>61.7</td>
<td>34.6</td>
<td>66.9</td>
</tr>
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CANU on the Mkt ▶ MSMT and Duke ▶ MSMT.

**Negative Transfer**

Adversarial framework → Negative Transfer:

Discriminator learns ID-related instead of domain-related features, and degrades \( \phi \) discriminative power.

Happens with different ID prior distributions across domains (cameras in our case).

**Camera adversarially guided clustering**

Camera adversarially-guided clustering: the discriminator is trained to retrieve camera info.

Conditioned adversarial strategy: pseudo-ID information is provided to \( D_{\text{CAM}} \) to handle negative transfer:

\[
\min \max_{\phi,C} \mathbb{L}_{\text{ID}-\text{ID}}(\phi, C_{\text{ID}}) - \mu p_{\text{ID}}(D_{\text{ID}})
\]

Can be used with any Clustering and Finetuning method: CANU-SSG, CANU-MMT.

**References**


**Contact Information**

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