Writer Identification Using VLAD
Encoded Contour-Zernike Moments

Pattern Recognition Lab (CS 5)
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Motivation

Encoding

Vectors of locally aggregated descriptors (VLAD) [2]
Local Descriptors: \( X = \{ x_1, \ldots, x_T \} \); learned Dictionary: \( D = \{ \mu_1, \ldots, \mu_K \} \)

\[
V_k = \sum_{x_i \in N_k(k)} (x_i - \mu_k), \quad \text{NN: nearest neighbor of } x_i \text{ in } D
\]

Postprocessing

- Intra-normalization
- Joint dimensionality reduction and whitening

Datasets

CVL
- 310 writers (training: 27, test: 283)
- 5 forms (1 German, 4 English)

ICDAR13
- 350 writers (training: 100, test: 250)
- 4 forms (2 English / 2 Greek)

Evaluation

Hard criterion and mAP evaluated on ICDAR13 (test set)

<table>
<thead>
<tr>
<th></th>
<th>TOP-1</th>
<th>TOP-2</th>
<th>TOP-3</th>
<th>mAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>SV [3]</td>
<td>97.1</td>
<td>42.8</td>
<td>23.8</td>
<td>67.1</td>
</tr>
<tr>
<td>RootSIFT + VLAD + W.-full</td>
<td>96.1</td>
<td>51.7</td>
<td>29.1</td>
<td>70.7</td>
</tr>
<tr>
<td>SURF + VLAD + W.-full</td>
<td>95.6</td>
<td>50.6</td>
<td>28.2</td>
<td>70.5</td>
</tr>
<tr>
<td>Proposed</td>
<td>97.5</td>
<td>70.7</td>
<td>48.1</td>
<td>80.8</td>
</tr>
<tr>
<td>Proposed + W.-256</td>
<td>99.3</td>
<td>79.8</td>
<td>59.6</td>
<td>87.3</td>
</tr>
<tr>
<td>Proposed + W.-full</td>
<td>99.4</td>
<td>81.0</td>
<td>61.8</td>
<td>88.0</td>
</tr>
</tbody>
</table>

Hard criterion and mAP evaluated on CVL (test set)

<table>
<thead>
<tr>
<th></th>
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<th>TOP-2</th>
<th>TOP-3</th>
<th>mAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comb. [4]</td>
<td>99.4</td>
<td>98.3</td>
<td>94.8</td>
<td>82.9</td>
</tr>
<tr>
<td>SV [3]</td>
<td>99.2</td>
<td>98.1</td>
<td>95.8</td>
<td>88.7</td>
</tr>
<tr>
<td>Proposed</td>
<td>98.8</td>
<td>97.6</td>
<td>95.3</td>
<td>86.2</td>
</tr>
<tr>
<td>Proposed + W.-256</td>
<td>99.2</td>
<td>98.7</td>
<td>97.5</td>
<td>92.5</td>
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<tr>
<td>Proposed + W.-full</td>
<td>99.4</td>
<td>98.9</td>
<td>97.4</td>
<td>92.7</td>
</tr>
</tbody>
</table>

Conclusion

- Outperforms s. o. t. a. on ICDAR13 and CVL
- Winning algorithm of the “ICDAR2015 Competition on Multi-script Writer Identification using QUWI Database”
- Using only a few components (256) is sufficient for comparable results
  \( \rightarrow \) enables large scale writer identification

Parameter Evaluation

References