A Comparison between Gray Weighted Distance Transforms and Weighted Transforms On Curved Spaces

Magnus Gedda
magnus.gedda@cb.uu.se

Centre for Image Analysis
Uppsala University

Computer Assisted Image Analysis
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Background

- Clustering of local maxima in blobs closely situated.

- Euclidean distance failed.
- Tried fuzzy distance. [Gedda, 2006]
- Teamed up with Celine Fouard to make a thorough comparison of fuzzy distances. [Fouard, 2006]
Automatic Clustering of Local Maxima

Synthetic image

Euclidean clustering

Fuzzy clustering

Gedda (Uppsala University)
Definitions

Rutovitz (GWD)

\[ D_{GWD} = \int_{0}^{1} |\pi(t)| dt \]

\[ w_{GWD_i} = \frac{1}{2} (\mathcal{I}(t_i) + \mathcal{I}(t_{i+1})) \times ||t_i - t_{i+1}|| \]

Toivanen (WDOCS)

\[ D_{WDOCS} = \int_{0}^{1} \left| \frac{d\pi}{dt}(t) \right| dt \]

\[ w_{WDOCS_i} = \sqrt{(\mathcal{I}(t_{i+1}) - \mathcal{I}(t_i))^2 + ||t_i - t_{i+1}||^2} \]
Interpretation

Continuous

Discrete

Crisp case

\[ \mathcal{I}(x) \]

\[ \pi \]

\[ \mathcal{I}(x) \]

\[ \pi \]

\[ \mathcal{I}(x) \]

\[ \pi \]

\[ \mathcal{I}(x) \]

\[ \pi \]

\[ \mathcal{I}(x) \]

\[ \pi \]
Comparison on Density Maps 1

\[ d_{\text{within}} \quad d_{\text{trans}} \]

<table>
<thead>
<tr>
<th>Measure</th>
<th>(d_{\text{within}})</th>
<th>(d_{\text{trans}})</th>
<th>(r = d_{\text{trans}} / d_{\text{within}})</th>
</tr>
</thead>
<tbody>
<tr>
<td>GWDT</td>
<td>187.72</td>
<td>225.38</td>
<td>1.20</td>
</tr>
<tr>
<td>WDTOCS</td>
<td>37.54</td>
<td>68.27</td>
<td>1.82</td>
</tr>
<tr>
<td>Euclidean DT</td>
<td>19</td>
<td>12</td>
<td>0.63</td>
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</tbody>
</table>
**Comparison on Density Maps 2**

\[
d_{\text{within}} \quad d_{\text{trans}}
\]

<table>
<thead>
<tr>
<th>Measure</th>
<th>(d_{\text{within}})</th>
<th>(d_{\text{trans}})</th>
<th>(r = d_{\text{trans}} / d_{\text{within}})</th>
</tr>
</thead>
<tbody>
<tr>
<td>GWDT</td>
<td>125.13</td>
<td>303.40</td>
<td>2.42</td>
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<tr>
<td>WDTOCS</td>
<td>6.45</td>
<td>17.38</td>
<td>2.69</td>
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<tr>
<td>Euclidean DT</td>
<td>6.08</td>
<td>13.45</td>
<td>2.21</td>
</tr>
</tbody>
</table>
References

C. Fouard and M. Gedda.
An Objective Comparison between Gray Weighted Distance Transforms and Distance Transforms On Curve Spaces.

M. Gedda and S. Svensson.
Fuzzy Distance Based Hierarchical Clustering Calculated Using the A* Algorithm.