ASAP

GEONETCast Course WS 09/10
GUI

selection parameters

Manager

List<List<Proxy>>

Fileloader

<creates>

Geotiff Proxy

Spatial Checker

Similarity Selector
- common design pattern
- contains all relevant information
  – bounding box
  – file path
  – sample of pixels
- is the central element to process
Fileloader

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• separates the input by its spatial extract
• only images of the same space can be compared
• 1st important concept:
• Mahalanobis distance between images x and y

\[
d = \sqrt{(\tilde{x} - \tilde{y})' \cdot S^{-1} \cdot (\tilde{x} - \tilde{y})}
\]

\[
\tilde{x} = (x_1, x_2, ..., x_n)'
\]

• n is the number of pixels (sample size)

• Problem: How to estimate S?
Problem: How to estimate \( S \)?
Number of pixels \( n \) (e.g. \( n=1000 \))
Number of images \( k \) (e.g. \( k=20 \))
\( n \gg k \)
\( \Rightarrow S \) is singular, therefore not invertible!
• Problem: How to estimate \( S \)?
• Idea: Autocovariance function

\[
\text{cov}(x_i, x_j) = \text{acv}(h_{i,j})
\]
\[
\text{acv}(h_{i,j}) = e^{-h_{i,j}/a}
\]

\[
S = \begin{pmatrix}
\text{acv}(0) & \cdots & \text{acv}(h_{1,n}) \\
\vdots & \ddots & \vdots \\
\text{acv}(h_{n,1}) & \cdots & \text{acv}(0)
\end{pmatrix}
\]
• S can now be inverted!
• Next: Distance Matrix $M \ (k \times k)$ of all combinations of the $k$ images

$$M = \begin{pmatrix}
0 & d(x, y) & \cdots & d(x, z) \\
d(x, y) & 0 & \cdots & \vdots \\
\vdots & \vdots & \ddots & \vdots \\
d(x, z) & \cdots & \cdots & 0
\end{pmatrix}$$

$$d(x, y) = \sqrt{(\hat{x} - \hat{y})' \ast S^{-1} \ast (\hat{x} - \hat{y})}$$
• What to do with M?

• 2nd important concept:
• Multi Dimensional Scaling (MDS)
• Multi Dimensional Scaling (MDS)
• Example: Here 2 dimensions

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
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<td>15</td>
<td>30</td>
<td>45</td>
<td>60</td>
</tr>
<tr>
<td>B</td>
<td>...</td>
<td>0</td>
<td>...</td>
<td>...</td>
<td>...</td>
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<tr>
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<td>...</td>
<td>...</td>
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<tr>
<td>D</td>
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<td>...</td>
<td>...</td>
<td>...</td>
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</tbody>
</table>

• How can we get the relative positions?
• Multi Dimensional Scaling (MDS)
- Multi Dimensional Scaling (MDS)
- We need One-Dimensional-Scaling
- Each image gets an MDS value

<table>
<thead>
<tr>
<th>Im10</th>
<th>im1</th>
<th>im7</th>
<th>im2</th>
<th>im6</th>
<th>im8</th>
<th>im4</th>
<th>im3</th>
<th>im9</th>
<th>im5</th>
</tr>
</thead>
<tbody>
<tr>
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<td>-312</td>
<td>-201</td>
<td>-23</td>
<td>65</td>
<td>134</td>
<td>333</td>
<td>506</td>
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</tbody>
</table>
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• Thanks for your attention!