Advantages of Dynamic Time Warping window function in automated correlation of stratigraphic time series

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Study Area

- IODP Sites (e.g. U1463)
- ODP Sites (e.g. 765)
- Industrial Sites (e.g. Picard-1, Bounty-1, Minilya-1)

Table 1: U1463 datums and their approximate position at three industrial sites

<table>
<thead>
<tr>
<th>DATUM</th>
<th>STRATIGRAPHIC DEPTH POSITION (METERS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top G. fistulosus</td>
<td>370 Picard-1 375 Bounty-1 320 Minilya-1</td>
</tr>
<tr>
<td>Base G. crassiformis</td>
<td>430 Picard-1 460 Bounty-1 365 Minilya-1</td>
</tr>
<tr>
<td>Manual Datum</td>
<td>545 Picard-1 630 Bounty-1 480 Minilya-1</td>
</tr>
<tr>
<td>Manual Datum</td>
<td>1010 Picard-1 1275 Bounty-1 810 Minilya-1</td>
</tr>
<tr>
<td>Manual Datum</td>
<td>1190 Picard-1  - 940 Minilya-1</td>
</tr>
</tbody>
</table>

What is Dynamic Time Warping (DTW)?

- Aligns two sequences by stretching or compressing locally
- Method to calculate optimal matching
- Powerful for finding patterns in sequential data
- Applications: speech recognition, financial markets, bioinformatics, stratigraphy

Step Pattern

a) asymmetricP1
b) custom

Window Function

Custom windows reflecting datums

Result

No custom window

- Alignment over-compression

Custom window

- 25-30% reduction in computation time
- Evaluates all possible stratigraphic correlations
- Improvement in correlation quality
- Stratigraphically plausible correlation

Key Findings

- No Custom Window
  - More computation time (~10-15 s)
    - Poor correlation quality

- Custom Window
  - 25-30% reduction in computation time
  - Evaluates all possible stratigraphic correlations
  - Improvement in correlation quality
  - Stratigraphically plausible correlation

https://github.com/rosamant/EGU-DTW_Calculations