Multi-Scale Analysis of Linear Data in a Two-Dimensional Space

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The Triangular Model (TM)

The linear representation of time intervals

Mapping a time interval to a 2D point

The TM representation of time intervals
Interval visualization
Rough Interval Visualization

\[ (a) \]
\[ \bar{I}_1 = [5.9], \quad \hat{I}_1 = \{7\} \]
\[ \bar{I}_2 = [3.5], \quad \hat{I}_2 = \emptyset \]
\[ \bar{I}_3 = [0.7], \quad \hat{I}_3 = [1.5] \]
\[ \bar{I}_4 = [0.10], \quad \hat{I}_4 = [2.8] \]

\[ (b) \]
\[ R(I_1) \]
\[ R(I_2) \]
\[ R(I_3) \]
\[ R(I_4) \]

\[ (c) \]
Supporting GIS
Continuous Triangular Model (CTM) : visualizing linear data

Traffic jam length: kilometre

(a)

Interval duration

1 year
0.5 year
3 months
1 month
1 week
1 day

(b)

Time axis
Continuous Triangular Model (CTM) : visualizing linear data
Map Algebra on the CTM

Air Quality in 2008

Air Quality in 2007

Length of duration
1 month
3 months
0.5 year
1 year
Time Axis

Negative
Positive

Cartographic Modelling using the CTM: multi-criteria decision making

### Criteria and constraints

<table>
<thead>
<tr>
<th>Available datasets</th>
<th>Requirements of the surfer</th>
<th>Preference of the surfer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ridable wave</strong></td>
<td>Percentage of days that have ridable waves, of every month.</td>
<td>At least 60 days having ridable wave.</td>
</tr>
<tr>
<td><strong>Ground wave</strong></td>
<td>Percentage of days that have ground waves, of every month.</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Sea temperature</strong></td>
<td>Average sea temperature, of every month.</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Avoidance</strong></td>
<td>N/A</td>
<td>Avoiding the international tournament in August.</td>
</tr>
</tbody>
</table>
Modelling weather conditions in the CTM diagrams

- Percentage of days having ridable waves
- Percentage of days having ground waves
- Sea temperature
- Days having ridable waves

**CTM 1:** Rates of weather conditions in CTM

**CTM 2:** Days having ridable waves

**CTM 3:** Binary map of ridable waves

**CTM 4:** Suitability map of a surfing site

**Map Algebra:**
- Multiply
- Reclassify ($\geq 60$: 1, $< 60$: 0)

**CTM of average:**

**CTM of sum:**

**Overall rates of weather conditions:**
Comparing the suitability of the candidate sites

Select the site with highest value

Nominal map: Best surfing site in all intervals

Eliminate periods that conflict with the tournament

Mask for excluding zones that overlap August

Erased zones
Suitable zones

Overlapped by
Meet
Before
Started by
Finishes by
During
Finished by
Started by
After

Final output: excluded periods ‘touch’ August

RaTM3 of South Africa
RaTM3 of Hawaii
RaTM3 of Fiji
RaTM3 of Australia
Linking the CTM with the STC

- Space-time trajectories are linear data.
  - e.g. speed, elevation and direction.
  - other linear attributes, e.g. heart beats of a cyclist.

- The STC is difficult for long and volatile trajectories
  - The CTM gives an overview at all levels of details

- The STC suffers from 3D problems
  - The CTM can probably help to overcome visual biases.

- Interactive link between the STC and CTM
  - Selecting trajectories in the STC, compare them in the CTM
  - Click on a point in the CTM, zoom into the interval in the STC
Thanks for your attention!

Comments or questions are welcome