Linear Ranking Scales of Naturalness and Openness of Scenes

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Introduction
There is clear evidence that people use global scene properties faster than basic-level information in scene categorization¹. However, there is uncertainty about the degree to which scenes are characteristics of various global properties. Thus, reference scales that can describe the subjective continues changes in characteristics of global properties would be essential for perceptual researches.

Method
Subject
1055 subjects in total participated on Amazon Mechanic Turk for $1.75.

Stimuli
7035 images of scene were selected from Scene Understanding (SUN) database².

Task
Subjects were asked to decide which of a random pair of scenes was more natural, man-made, open or closed. Each task consists of 450 trials which takes about 15~25 minutes.

Analysis
- Elo/Stephen:
  - Uncertainty in standard deviations
  - Restricted with chess player ranking
- SVM
  - Demanding in computational memory
- Bradley Terry Model

Bradley Terry Model³

\[ \Pi_{ab} = \frac{\exp(\beta_a)}{\exp(\beta_a) + \exp(\beta_b)} \]

\( \Pi_{ab} \): the probability that a > b
\( \beta_i \): ability parameter
\( \Pi_{ab} > \frac{1}{2} \) when \( \beta_a > \beta_b \)

Spearman’s rank correlation coefficient

<table>
<thead>
<tr>
<th>Natural and Man-made:</th>
<th>Natural and Open:</th>
<th>Open and Closed:</th>
<th>Man-made and Closed:</th>
</tr>
</thead>
<tbody>
<tr>
<td>( r = -0.86, p &lt; 0.01 )</td>
<td>( r = 0.83, p &lt; 0.01 )</td>
<td>( r = -0.93, p &lt; 0.01 )</td>
<td>( r = 0.77, p &lt; 0.01 )</td>
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Conclusion
Our standard ranking scales take wide range of subjective opinions about how people perceive the scene images, hence can benefit research areas such as neuroscience and computational vision in further.

In the future work, we hope to use these scales as the basis for studies on the interrelations between the perceptual processing of these attributes.

Reference