Learning to Rank Definitions to Generate Quizzes for Interactive Information Presentation

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Overview

• We propose ranking biographical facts (definitions) to automatically generate “Who is this?” quizzes.
• Such ranking would realize an information presentation dialogue (Fig.1) in which users can be highly motivated to receive information, which could lead to better understanding by users.
• Supervised learning approach achieves better ranking than those using co-occurrence statistics. (Tab.1)
• Content of a definition (e.g., birth, occupation) must be taken into account for better ranking. (Tab.2)
• Quiz-style information presentation is actually effective for learning. (to be presented at Interspeech 2007)

Figure 1

A procedure for realizing a quiz-style information presentation dialogue

Entry of Natsume Soseki in an encyclopedia


Quiz-style ordering of biographical facts

1. Graduated from the University of Tokyo.
2. Born in Ushigome, Edo.
3. Novelist and scholar of British literature.
4. Published masterpieces in Asahi Shimbun.
5. Real name: Kinnosuke.
6. Master of early-modern literature along with Mori Ogai.
7. After the success of “I Am a Cat”, quit all teaching jobs and joined Asahi Shimbun.
8. Works include “Botchan”, “Sanshiro”, etc.

Quiz-style information presentation dialogue

S1 Who is this? First hint: Graduated from the University of Tokyo.
U1 Yoshida Shigeru?
S2 No, not even close! Second hint: Born in Ushigome, Edo.
U2 I don’t know.
S3 OK. Third hint: Novelist and scholar of British literature.
U3 Murakami Haruki?
S4 Close! Fourth hint: Familiar with Haiku, Chinese poetry, and calligraphy.
U4 Mori Ogai?
S5 Very close! Fifth hint: Published masterpieces in Asahi Shimbun.
U5 Natsume Soseki?
S6 That’s right!

(S stands for system utterance and U for user utterance in the dialogue.)

Approach: Training a ranking model by supervised learning

Reference Ranking Data
• 11 annotators ranked definitions of 150 people
• Mean Kendall’s coefficients of concordance: 0.76

Features (4,991 features in total)
• IR-related features (co-occurrence statistics of content words)
• Positional features (positions of content words in Wikipedia)
• Bag-of-Words features
• Semantic category features

Learning Algorithm
• Ranking SVM (Joachims, 2002)

Table 1. Performance of the proposed ranking model and 5 best performing baselines (cf. Ranking Error: rate of incorrectly ordered pairs)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Description</th>
<th>Ranking Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Proposed ranking model</td>
<td>0.185</td>
</tr>
<tr>
<td>2</td>
<td>Wikipedia-Sentence-PMI-max</td>
<td>0.299</td>
</tr>
<tr>
<td>3</td>
<td>Wikipedia-Section-PMI-max</td>
<td>0.309</td>
</tr>
<tr>
<td>4</td>
<td>Wikipedia-Document-PMI-max</td>
<td>0.312</td>
</tr>
<tr>
<td>5</td>
<td>Mainichi-Sentence-PMI-max</td>
<td>0.318</td>
</tr>
<tr>
<td>6</td>
<td>Mainichi-Document-PMI-max</td>
<td>0.325</td>
</tr>
</tbody>
</table>

Table 2. 10 most salient features in the trained ranking model

<table>
<thead>
<tr>
<th>Rank</th>
<th>Feature Name</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wikipedia-Sentence-PMI-max</td>
<td>0.723</td>
</tr>
<tr>
<td>2</td>
<td>SemCat:33 (others/someone)</td>
<td>-0.559</td>
</tr>
<tr>
<td>3</td>
<td>SemCat:186 (creator)</td>
<td>0.485</td>
</tr>
<tr>
<td>4</td>
<td>Bag-of-Words:bakufu (feudal government)</td>
<td>0.451</td>
</tr>
<tr>
<td>5</td>
<td>SemCat:163 (sovereign/ruler/monarch)</td>
<td>0.422</td>
</tr>
<tr>
<td>6</td>
<td>Wikipedia-Document-PMI-max</td>
<td>0.409</td>
</tr>
<tr>
<td>7</td>
<td>SemCat:2391 (birth)</td>
<td>-0.404</td>
</tr>
<tr>
<td>8</td>
<td>Wikipedia-Section-PMI-max</td>
<td>0.402</td>
</tr>
<tr>
<td>9</td>
<td>SemCat:2595 (unit; e.g., numeral classifier)</td>
<td>0.374</td>
</tr>
<tr>
<td>10</td>
<td>SemCat:2606 (plural; e.g., plural form)</td>
<td>-0.368</td>
</tr>
</tbody>
</table>