A Details of Compared Models

A.1 Multimodal Model

The multimodal model (Hori et al., 2017) is defined by the following equations:

\[
 d_{k,t} = W_{Ak}c_{k,t} + b_{Ak} 
\]

\[
 v_{k,t} = \frac{\exp(v_{k,t})}{\sum_{k=1}^{K} \exp(v_{k,t})} 
\]

\[
 c_t = \sum_{k=1}^{K} \beta_{k,t}d_{k,t} 
\]

where \( K \) is the number of modalities, \( c_{k,t} \) is the context vector, \( W_{Ak}, W_{Bk} \) are weight matrices, \( b_{Ak} \) and \( b_{Bk} \) are bias vectors, \( w_B \) is a weight vector, and \( v_{k,t} \) is a scalar.

A.2 Query-based Model

The query-based model (Nema et al., 2017) is defined by the following equations:

\[
 w_t = V[c'_t; \hat{h}_t] 
\]

\[
 a_t(s) = \frac{\exp(w_t^\top h_s)}{\sum_{s'=1}^{S} \exp(w_t^\top h_{s'})} 
\]

\[
 c_t = \sum_{s=1}^{S} a_t(s)h_s 
\]

where \( c'_t \) is the context vector of a lead and \( V \) is a weight matrix.

B Details of Crowdsourcing Results

Table 1 lists the detailed results of the crowdsourcing task of readability and usefulness for two subsets: simple and complex. The simple subset included only triples where the characters in each short title were completely matched by those in the corresponding headline. The complex subset included only non-simple triples, i.e., the complement of the simple subset.

C Full Examples of Outputs

Table 2 lists the output examples generated with the best model OpenNMT among the three baselines and our best model HybridFusion.

References


Table 2: Examples of generated titles. Headline and Lead denote headline and lead as input. Editor is reference title created by an editor. OpenNMT and HybridFusion are the default OpenNMT model and our hybrid model.

<table>
<thead>
<tr>
<th>Generated title (Japanese)</th>
<th>English translation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Headline</strong></td>
<td></td>
</tr>
<tr>
<td>逆境をチャンスに変えたダブルビジョンの進化</td>
<td>Evolution of Darvish, turning adversity into opportunity.</td>
</tr>
<tr>
<td><strong>Lead</strong></td>
<td></td>
</tr>
<tr>
<td>レンジャーズのダブルビジョン (29)</td>
<td>Yu Darvish (29) of the Rangers took the mound for the first time in 1 year and 9 months with the Pirates at home and won the return game for the first time in 1 year and 10 months. For a while the number of throws has been restricted to 90 balls so he dropped at the 5th inning when reaching 81 balls, but he gathered 3 hits and 1 run with 7 strikeouts each time, and the maximum speed of the straight marked 158 kilometers. Wilson, acting his buddy, said, “It was a wonderful pitch, the straight was 158 kilometers and the sinker was over 145 kilometers”. Baxter, the team coach, also played tribute to the “real Dar”, which he saw for the first time since taking over as director, “Pitching as I remember”.</td>
</tr>
<tr>
<td><strong>Editor</strong></td>
<td></td>
</tr>
<tr>
<td>逆境をチャンスに変えた</td>
<td>Dar sculpted his body better than before surgery.</td>
</tr>
<tr>
<td><strong>OpenNMT</strong></td>
<td></td>
</tr>
<tr>
<td>Dar turned adversity into opportunity.</td>
<td></td>
</tr>
<tr>
<td><strong>HybridFusion</strong></td>
<td></td>
</tr>
<tr>
<td>Dar turned adversity into opportunity.</td>
<td></td>
</tr>
<tr>
<td><strong>Lineage</strong></td>
<td></td>
</tr>
<tr>
<td>10年ぶりの実演でローンシーが舞台に</td>
<td>With the first profit decline in ten years, Lawson is at a crossroads. Does Lawson have any secret plan?</td>
</tr>
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<td><strong>Lead</strong></td>
<td></td>
</tr>
<tr>
<td>コンピニ大手のローンシーが舞台に</td>
<td>Lawson, a major convenience store, is at a crossroads. Lawson was second in the number of stores in 2018, but since the closure of 27 stores in Osaka-shi Abeno-ku, the last business day of the former headquarters in Abeno-ku, which was the last business day of the headquarters, seemed unchanged as usual, but occasionally there were also many people taking pictures of building signs, and a local man said, “Since childhood, SHARP was here, even though I knew about it, I still feel lonely”.</td>
</tr>
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<td></td>
</tr>
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<td>Lawson. Does Lawson have any secret plan?</td>
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<td>Lawson is at a crossroads with the first profit decline in ten years.</td>
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<td>Lawson is at a crossroads with the first profit decline in ten years.</td>
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</tr>
<tr>
<td><strong>Lineage</strong></td>
<td></td>
</tr>
<tr>
<td>2016年夏から獲得した大阪</td>
<td>SHARP headquarters moved from its home for many years in Abeno to Sakai.</td>
</tr>
<tr>
<td><strong>Lead</strong></td>
<td></td>
</tr>
<tr>
<td>2016年夏から獲得した大阪</td>
<td>Even though I knew about it, I still feel lonely. SHARP, which is in the process of restructuring, moved its headquarters from Osaka-shi Abeno-ku to Osaka Prefecture Sakai-shi Sakai-ku on the 1st. On June 30, the former headquarters in Abeno-ku, which was the last business day of the headquarters, seemed unchanged as usual, but occasionally there were also many people taking pictures of building signs, and a local man said, “Since childhood, SHARP was here, even though I knew about it, I still feel lonely”.</td>
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<td><strong>Lineage</strong></td>
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<td>アニメを超える大人とも好評</td>
<td>Surpassing “Frozen”. What is the reason for the popularity of “Zootopia”, which is also popular among adults?</td>
</tr>
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<td><strong>Lead</strong></td>
<td></td>
</tr>
<tr>
<td>アニメを超える大人とも好評</td>
<td>The latest Disney animated movie “Zootopia” has gained in popularity. As of May 22, the total number of moviegoers exceeded 3.5 million, and the box office exceeded 4.5 billion yen. We will examine the charm of “Zootopia”, which people are already saying that it might become the box-office champion of 2016.</td>
</tr>
<tr>
<td><strong>Editor</strong></td>
<td></td>
</tr>
<tr>
<td>アニメを超える大人とも好評</td>
<td>The charm of “Zootopia” is beyond our expectation.</td>
</tr>
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<td>Surpassing “Frozen”? It is popular among adults.</td>
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<td><strong>Lineage</strong></td>
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<td>ミュンヘン銃撃事件 真相を突き止める</td>
<td>Munich shooting incident. Are suspects interested in indiscriminate shootings? What is the impact of the incident on German society?</td>
</tr>
<tr>
<td><strong>Lead</strong></td>
<td></td>
</tr>
<tr>
<td>ミュンヘン銃撃事件 真相を突き止める</td>
<td>On the afternoon of the 22nd, a shooting incident occurred in a crowded shopping center in Munich part of southern Germany and 9 people were killed. The suspect was found dead at a place about 1 kilometer away from the shopping center and the authorities announced that the suspect had killed himself after suffering from depression. But investigation discovered that there is information that he was planning a shooting. What will be the impact of the incident on German society?</td>
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<td><strong>Editor</strong></td>
<td></td>
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<tr>
<td>ミュンヘン銃撃事件 真相を突き止める</td>
<td>Germany, known for having many immigrants, was shocked by a shooting rampage.</td>
</tr>
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<td></td>
</tr>
<tr>
<td>The impact on German society of a shooting incident in Munich.</td>
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