Keyword-Constrained Natural Language Generation

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Introduction

Prior works on language modeling consider:
- Left to Right generation (Write an essay starting with)
- Masked generation (Fill in the correct preposition)
- Make sentences with these words

Methodology

\[ p_\theta (w_i | w_{<i}, K) \]
\[
\max_\theta \quad E_{p_\theta} [f(x, K)]
\]

Generate sentences from left to right. Challenging when the value of \( i \) is small.

\( f(x, K) \) is a keyword inclusion metric. Ensure sentence sampled from \( p_\theta \) have high score on it.

- Action (|V|) and state space (|V|^{n} * |K|) is pretty large.
- Supervised learning to pre-train encoder-decoder architecture.
- End rewards are too sparse.
- Reward shaping. Reward phrases.
- Verbose generation.
- Interpolation with Language Model.

Experimental Results

MSCOCO Captions
Lin et. al. 2014

Better models →
(at training time)

<table>
<thead>
<tr>
<th>Seq2Seq</th>
<th>Seq2Seq</th>
<th>Seq2Seq</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ Attn</td>
<td>+ Attn</td>
<td>+ REINFORCE</td>
</tr>
<tr>
<td>S: 84.5 %</td>
<td>+1.5 %</td>
<td>+1.1 %</td>
</tr>
<tr>
<td>H: 72.3 %</td>
<td>+1.6 %</td>
<td>+2 %</td>
</tr>
<tr>
<td>P: 89.186</td>
<td>-20.33</td>
<td>-1.54</td>
</tr>
<tr>
<td>+ CD</td>
<td>+ CD</td>
<td>+ CD</td>
</tr>
<tr>
<td>S: +3.2 %</td>
<td>+6 %</td>
<td>+6.4 %</td>
</tr>
<tr>
<td>H: +4.2 %</td>
<td>+10.4 %</td>
<td>+10.8 %</td>
</tr>
<tr>
<td>P: -4.4</td>
<td>-10.9</td>
<td>-22.75</td>
</tr>
</tbody>
</table>

NLG Dataset for Dialog Systems
Duˇsek and Jurˇc iˇcek 2016

Translation Sentences
Trang et. al. 2009

Better models
(at test time)

Randomly sampled sentences:
- [man, racquet] <B> a man holding a tennis racquet standing on a tennis court <E>
- [trash] <B> a toilet seat next to a trash can in a bathroom <E>
- [bed, laying] <B> a woman laying on a bed with a cat laying on the floor <E>
- [modern, shower, curtain] <B> a modern bathroom with a toilet sink and shower curtain <E>

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