RUCIR at NTCIR-14 STC-3
CECG Subtask

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### Conversation Generation Task

- **Input:** post \((X = x_1 x_2 \cdots x_n)\)
- **Output:** response (*with fluency and coherence*)

<table>
<thead>
<tr>
<th>Post (Given)</th>
<th>Response (to be Generated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>爱狗还会做饭的男人，最帅了！The man who cooks and loves dogs is very handsome!</td>
<td>会做饭的男人是很帅的啊。The man who cooks is handsome.</td>
</tr>
</tbody>
</table>
STC-3 CECG @ NTCIR-14

Conversation Generation Task

- **Input**: post \((X = x_1x_2 \cdots x_n)\)
- **Output**: response *(with fluency and coherence)*

---

<table>
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<tbody>
<tr>
<td>爱狗还会做饭的男人，最帅了！The man who cooks and loves dogs is very handsome!</td>
<td>会做饭的男人是很帅气的啊。The man who cooks is handsome.</td>
</tr>
</tbody>
</table>

Not Consider **Emotion** *(Important in Conversation)*
Emotional Conversation Generation

- **Input:** post & emotion category (of response)
  
  {Like, Happiness, Anger, Disgust, Sadness, Other}

- **Output:** response *(with fluency and coherence & emotional consistency)*

<table>
<thead>
<tr>
<th>Post (Given)</th>
<th>Emotion (Given)</th>
<th>Response (to be Generated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>爱狗还会做饭的男人，最帅了！</td>
<td>喜欢</td>
<td>会做饭的男人是很帅的啊。</td>
</tr>
<tr>
<td>The man who cooks and loves dogs is very handsome!</td>
<td>Like</td>
<td>The man who cooks is handsome.</td>
</tr>
</tbody>
</table>
Emotional Conversation Generation

- **Input**: post & emotion category (of response)
  - \{Like, Happiness, Anger, Disgust, Sadness, Other\}
- **Output**: response (with fluency and coherence & emotional consistency)

<table>
<thead>
<tr>
<th>Post (Given)</th>
<th>Emotion (Given)</th>
<th>Response (to be Generated)</th>
</tr>
</thead>
</table>
| 爱狗还会做饭的男人，最帅了！
The man who cooks and loves dogs is very handsome! | 喜欢 Like | 会做饭的男人是很帅的啊。
The man who cooks is handsome. |

**Goal**: Generate the Response with Special Emotion
<table>
<thead>
<tr>
<th>Post (Given)</th>
<th>Emotion (Given)</th>
<th>Response (to be Generated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>爱狗还会做饭的男人，最帅了！The man who cooks and loves dogs is very handsome!</td>
<td>喜欢 Like</td>
<td>会做饭的男人是很帅的啊。The man who cooks is handsome.</td>
</tr>
<tr>
<td>爱狗还会做饭的男人，最帅了！The man who cooks and loves dogs is very handsome!</td>
<td>厌恶 Disgust</td>
<td>但是我真的讨厌这样的男人！But I really hate such a man!</td>
</tr>
<tr>
<td>爱狗还会做饭的男人，最帅了！The man who cooks and loves dogs is very handsome!</td>
<td>悲伤 Sadness</td>
<td>好伤心，我没遇到过这样的男人。So sad, I have never met such a man.</td>
</tr>
</tbody>
</table>
Model Architecture

Generate and Select

1. Rule-Based
   - Keywords Extraction
   - Encoder
   - Attention Mechanism

2. Multi-Seq2Seq with Fine Tune
   - Attention Mechanism
   - Encoder
   - Decoder

3. Emotional Seq2Seq
   - Attention Mechanism
   - Copy Mechanism
   - Emotion Factor
   - Encoder
   - Decoder

4. Reranker
   - Emotional Response
   - Reranker
   - Post & Emotion

Generate and Select

1. Rule-Based
   - Keywords Extraction
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   - Emotional Response
   - Reranker
   - Post & Emotion
Rule-Based Method

Generate and Select

1. Rule-Based

2. Multi-Seq2Seq with Fine Tune

3. Emotional Seq2Seq

4. Reranker

Rule-Based Method

Keywords Extraction

Post & Emotion

Encoder

Decoder

Attention Mechanism

Copy Mechanism

Emotion Factor

Emotional Response

×k
Rule-Based Method

- Extract the **Keyword** in the Post (based on NER)
- Fill it into the Proper Constructed **Template**

<table>
<thead>
<tr>
<th><strong>Post</strong></th>
<th><strong>Keyword</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>海南游是破灭了[怒][怒][怒]</td>
<td>Hainan tour is ruined [angry] [angry] [angry]</td>
</tr>
<tr>
<td>喜欢 Like</td>
<td>最喜欢 海南 了</td>
</tr>
<tr>
<td>高兴 Happiness</td>
<td>想到 海南 就很开心</td>
</tr>
<tr>
<td>生气 Anger</td>
<td>不想听到 海南，别跟我提！</td>
</tr>
<tr>
<td>厌恶 Disgust</td>
<td>超级不喜欢 海南！</td>
</tr>
<tr>
<td>悲伤 Sadness</td>
<td>海南 伤透了我的心</td>
</tr>
</tbody>
</table>
Multi-Seq2Seq

**Generate and Select**

1. Rule-Based
   - Keywords Extraction
   - Rule-Based

2. Multi-Seq2Seq with Fine Tune
   - Decoder
   - Attention Mechanism
   - Encoder
   - Encoder
   - $\times k$

3. Emotional Seq2Seq
   - Decoder
   - Attention Mechanism
   - Copy Mechanism
   - Emotion Factor

4. Reranker
   - Emotional Response
   - Reranker

Generate and Select

- Emotional Response
- Reranker
- Emotional Seq2Seq
- Post & Emotion
Seq2Seq with Attention

Alignment Model

Encoder

Decoder

That is really cool.

Yeah, totally true.

Is the guy really cool?

Yes,的确 true.

That /

小子 guy

真 is really

酷 cool

是的 Yeah

的确 totally

如此 true

<EOS>
Multi-Seq2Seq with Fine Tune

- Train Different Seq2Seq Models for Different Emotions

All Data: Post ➔ Encoder ➔ Attention ➔ Decoder ➔ Response
Multi-Seq2Seq with Fine Tune

- Multi-Seq2Seq: One Model for One Emotion Category

---

All Data: Post

<table>
<thead>
<tr>
<th>Encoder</th>
<th>Attention</th>
<th>Decoder</th>
<th>Response</th>
</tr>
</thead>
</table>

Like Data: Post

<table>
<thead>
<tr>
<th>Encoder</th>
<th>Attention</th>
<th>Decoder</th>
<th>Response (Like)</th>
</tr>
</thead>
</table>

Happy Data: Post

<table>
<thead>
<tr>
<th>Encoder</th>
<th>Attention</th>
<th>Decoder</th>
<th>Response (Happy)</th>
</tr>
</thead>
</table>

Anger Data: Post

<table>
<thead>
<tr>
<th>Encoder</th>
<th>Attention</th>
<th>Decoder</th>
<th>Response (Anger)</th>
</tr>
</thead>
</table>

Disgust Data: Post

<table>
<thead>
<tr>
<th>Encoder</th>
<th>Attention</th>
<th>Decoder</th>
<th>Response (Disgust)</th>
</tr>
</thead>
</table>

Sad Data: Post

<table>
<thead>
<tr>
<th>Encoder</th>
<th>Attention</th>
<th>Decoder</th>
<th>Response (Sad)</th>
</tr>
</thead>
</table>
Emotional Seq2Seq

Generate and Select

1. Rule-Based
2. Multi-Seq2Seq with Fine Tune
3. Emotional Seq2Seq
4. Reranker

Rule-Based

Decoder

Encoder

×k

Emotion Factor

Attention Mechanism

Copy Mechanism

Encoder

Decoder

Attention Mechanism

Copy Mechanism

Encoder

Decoder

Keywords Extraction

Post & Emotion

Emotional Response
Emotional Seq2Seq

- Idea: Increase the Probability of Emotional Words
- Emotional Seq2Seq: One Model for Many Emotion Categories

Emotional Seq2Seq

- Implicit Method: Emotion Factor by **Emotion Embedding** \( (e_i) \)

\[
s_t = \text{GRU}_{\text{decoder}}(s_{t-1}; [y_{t-1}, c_t, e_i])
\]

Emotional Seq2Seq

- Explicit Method: Adding **Copy Probability** of Emotional Word in **Emotional Dictionary** ($E$) Built by Clustering

$$P(y_t|s_t) = P_{ori}(y_t|s_t) + P_{emo}(y_t|s_t, E)$$

$$P_{emo}(y_t|s_t, E) = \begin{cases} 0, & \text{non–emotional word} \\ \text{softmax}(EW_es_t), & \text{emotional word} \end{cases}$$

Re-Ranker

Generate and Select

1. Rule-Based
2. Multi-Seq2Seq with Fine Tune
3. Emotional Seq2Seq
4. Reranker

Encoder
Decoder
Attention Mechanism
Encoder
Decoder
Attention Mechanism
Encoder
Decoder
Attention Mechanism
Copy Mechanism
Emotion Factor

Keywords Extraction

Emotional Response

Post & Emotion

×k
Re-Ranker

➢ Given the Response Set: How to select the Best Response?

- Rule-Based Method Generated Response
- Multi-Seq2Seq Generated Responses
- Emotional Seq2Seq Generated Responses

Beam Width

Beam Width
Re-Ranker

➢ Given the Response Set: How to select the Best Response?
➢ Metrics: Emotional Consistency & Coherence & Fluency
➢ Rank by Metrics: Emotion Score + Coherence Score

Rule-Base Method Generated Response

Multi-Seq2Seq Generated Responses

Emotional Seq2Seq Generated Responses
Re-Ranker

- **Emotion Score based on Emotional Dictionary**
  - **Explicit Emotional Word**: High Score
  - **Implicit Emotional Word**: Low Score
  - **Degree Word** (e.g., very, a little, not): 
  - **Strengthen or Weaken or Reverse Emotion Score**

<table>
<thead>
<tr>
<th>Post</th>
<th>你看看上去不太好。  You don't look very good.</th>
</tr>
</thead>
<tbody>
<tr>
<td>悲伤</td>
<td>你昨晚失眠了。  I lost sleep last night.</td>
</tr>
<tr>
<td>Sadness</td>
<td></td>
</tr>
<tr>
<td>悲伤</td>
<td>我昨晚失眠了，我好难过。</td>
</tr>
<tr>
<td>Sadness</td>
<td>I was so sad about insomnia last night.</td>
</tr>
</tbody>
</table>

Re-Ranker

- **Coherence Score**
- The **Term Similarity** between Response and Post
- Count the Number of Same Term (to be improved)

<table>
<thead>
<tr>
<th>Post</th>
<th>我获奖了。 I won the prize.</th>
</tr>
</thead>
<tbody>
<tr>
<td>高兴 Happiness</td>
<td>我为你感到很开心。 I am so happy for you.</td>
</tr>
<tr>
<td>高兴 Happiness</td>
<td>我为你获奖而感到开心。 I am very happy that you won the prize.</td>
</tr>
</tbody>
</table>
Data Description

The dataset (from weibo) looks like:

\[
\text{[[[post,post\_label],[response,response\_label]],}
\text{[[post,post\_label],[response,response\_label]], ...].}
\]

Emotion Label

0: Other; 1: Like; 2: Sadness;
3: Disgust; 4: Anger; 5: Happiness

Training Set: 1.5M+
Dev Set & Test Set: 5000
Final Submit Set: 200

Data Source: Hosted by Prof. Minlie Huang, AI lab. of Computer Science, Tsinghua University, Beijing 100084, China.
Data Preprocessing

● **Token-level Data Pre-processing**
  - Emoji (e.g., “[angry]” (“怒”)): remove
  - Kaomoji (e.g., “ヽ( ^∀^)/”): remove
  - Mention and repost characters (i.e., “@” or “//@”): remove
  - Meaningless beginning of sentence (e.g., “Yes” (“嗯嗯”)): remove
  - Dialect (e.g., Cantonese): translate to Mandarin
  - Online buzzwords (e.g., “肿么了”, “神马”): translate to Mandarin
  - Repeated expressions (e.g., “Hahahahahahah”: simplify (e.g., “Haha”)

● **Sentence-level Data Pre-processing**
  - High-frequency response (e.g., “What’s up” (“怎么了”)): delete
  - Post-response pairs that are not Chinese or too short: delete
### Evaluation Metric

**Post:** 爱狗还会做饭的男人，最帅了！
The man who cooks and loves dogs is very handsome!

<table>
<thead>
<tr>
<th>Emotion</th>
<th>Response</th>
<th>Coherence and Fluency</th>
<th>Emotion Consistency</th>
<th>Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>喜欢 Like</td>
<td>会做饭的男人是很帅的啊。 The man who cooks is handsome.</td>
<td>Yes</td>
<td>Yes</td>
<td>2</td>
</tr>
<tr>
<td>喜欢 Like</td>
<td>是的，我也觉得。 Yes, I feel the same way.</td>
<td>Yes</td>
<td>No</td>
<td>1</td>
</tr>
<tr>
<td>喜欢 Like</td>
<td>这是同主义同的道！ This is the same way of the same doctrine!</td>
<td>No</td>
<td>No</td>
<td>0</td>
</tr>
</tbody>
</table>
## Experiment Result

<table>
<thead>
<tr>
<th>Team Name</th>
<th>Label 0</th>
<th>Label 1</th>
<th>Label 2</th>
<th>Total</th>
<th>Overall Score</th>
<th>Average Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1191_1</td>
<td>581</td>
<td>320</td>
<td>99</td>
<td>1,000</td>
<td>518</td>
<td>0.518</td>
</tr>
<tr>
<td>1191_2</td>
<td>831</td>
<td>109</td>
<td>60</td>
<td>1,000</td>
<td>229</td>
<td>0.229</td>
</tr>
<tr>
<td>AINTPU_1</td>
<td>716</td>
<td>200</td>
<td>84</td>
<td>1,000</td>
<td>367</td>
<td>0.336</td>
</tr>
<tr>
<td>CKIP_1</td>
<td>845</td>
<td>29</td>
<td>126</td>
<td>1,000</td>
<td>281</td>
<td>0.281</td>
</tr>
<tr>
<td>CKIP_2</td>
<td>840</td>
<td>28</td>
<td>132</td>
<td>1,000</td>
<td>292</td>
<td>0.292</td>
</tr>
<tr>
<td>IMTKU_1</td>
<td>580</td>
<td>248</td>
<td>172</td>
<td>1,000</td>
<td>592</td>
<td>0.592</td>
</tr>
<tr>
<td>IMTKU_2</td>
<td>954</td>
<td>32</td>
<td>14</td>
<td>1,000</td>
<td>60</td>
<td>0.060</td>
</tr>
<tr>
<td>TMUNLP_1</td>
<td>777</td>
<td>126</td>
<td>97</td>
<td>1,000</td>
<td>320</td>
<td>0.320</td>
</tr>
<tr>
<td>TUA1_1</td>
<td>443</td>
<td>293</td>
<td>264</td>
<td>1,000</td>
<td>821</td>
<td>0.821</td>
</tr>
<tr>
<td>TUA1_2</td>
<td>454</td>
<td>278</td>
<td>268</td>
<td>1,000</td>
<td>814</td>
<td>0.814</td>
</tr>
<tr>
<td>WUST_1</td>
<td>601</td>
<td>211</td>
<td>188</td>
<td>1,000</td>
<td>587</td>
<td>0.587</td>
</tr>
<tr>
<td>WUST_2</td>
<td>999</td>
<td>0</td>
<td>1</td>
<td>1,000</td>
<td>2</td>
<td>0.002</td>
</tr>
<tr>
<td>TKUIM_2</td>
<td>507</td>
<td>260</td>
<td>233</td>
<td>1,000</td>
<td>726</td>
<td>0.726</td>
</tr>
<tr>
<td>RUCIR_1</td>
<td>392</td>
<td>263</td>
<td>345</td>
<td>1,000</td>
<td>953</td>
<td>0.953</td>
</tr>
<tr>
<td>RUCIR_2</td>
<td>460</td>
<td>342</td>
<td>198</td>
<td>1,000</td>
<td>738</td>
<td>0.738</td>
</tr>
</tbody>
</table>
# Experiment Result

<table>
<thead>
<tr>
<th>Emotion Category</th>
<th>Team Name</th>
<th>Label 0</th>
<th>Label 1</th>
<th>Label 2</th>
<th>Overall Score</th>
<th>Average Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Like</td>
<td>RUCIR_1</td>
<td>88</td>
<td>36</td>
<td>76</td>
<td>188</td>
<td>0.940</td>
</tr>
<tr>
<td></td>
<td>RUCIR_2</td>
<td>96</td>
<td>44</td>
<td>60</td>
<td>164</td>
<td>0.820</td>
</tr>
<tr>
<td></td>
<td>TKUIM_2</td>
<td>90</td>
<td>56</td>
<td>54</td>
<td>164</td>
<td>0.820</td>
</tr>
<tr>
<td></td>
<td>RUCIR_1</td>
<td>72</td>
<td>48</td>
<td>80</td>
<td>208</td>
<td>1.040</td>
</tr>
<tr>
<td>Sad</td>
<td>TUA1_1</td>
<td>84</td>
<td>31</td>
<td>85</td>
<td>201</td>
<td>1.005</td>
</tr>
<tr>
<td></td>
<td>RUCIR_1</td>
<td>83</td>
<td>57</td>
<td>60</td>
<td>177</td>
<td>0.885</td>
</tr>
<tr>
<td>Disgust</td>
<td>RUCIR_1</td>
<td>71</td>
<td>76</td>
<td>53</td>
<td>182</td>
<td>0.910</td>
</tr>
<tr>
<td></td>
<td>TUA1_2</td>
<td>92</td>
<td>82</td>
<td>26</td>
<td>134</td>
<td>0.670</td>
</tr>
<tr>
<td></td>
<td>TUA1_1</td>
<td>82</td>
<td>105</td>
<td>13</td>
<td>131</td>
<td>0.655</td>
</tr>
<tr>
<td>Anger</td>
<td>RUCIR_1</td>
<td>88</td>
<td>63</td>
<td>49</td>
<td>161</td>
<td>0.805</td>
</tr>
<tr>
<td></td>
<td>TKUIM_2</td>
<td>112</td>
<td>45</td>
<td>43</td>
<td>131</td>
<td>0.655</td>
</tr>
<tr>
<td></td>
<td>TUA1_2</td>
<td>85</td>
<td>107</td>
<td>8</td>
<td>123</td>
<td>0.615</td>
</tr>
<tr>
<td>Happy</td>
<td>TUA1_2</td>
<td>76</td>
<td>25</td>
<td>99</td>
<td>223</td>
<td>1.115</td>
</tr>
<tr>
<td></td>
<td>TUA1_1</td>
<td>71</td>
<td>36</td>
<td>93</td>
<td>222</td>
<td>1.110</td>
</tr>
<tr>
<td></td>
<td>RUCIR_1</td>
<td>73</td>
<td>40</td>
<td>87</td>
<td>214</td>
<td>1.070</td>
</tr>
</tbody>
</table>
Thanks

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Author: Xiaohe Li and Zhicheng Dou
Email: {lixiaohe, dou}@ruc.edu.cn