Exploring Emoji Usage and Prediction Through a Temporal Variation Lens

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Luis Marujo
Pradeep Karuturi
William Brendel
Horacio Saggion
How are emoji used over time?

Good morning!

I love mondays…

Good night 😴😴😴

I love Friday!

Santa is HERE! 🎅🏻鬯

Summer is HERE! ☀️☀️
How are emoji used over time?

<table>
<thead>
<tr>
<th>Season</th>
<th>Spring</th>
<th>Summer</th>
<th>Autumn</th>
<th>Winter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>🌼😍طلعة🌞❤️</td>
<td>🌻🌞🌞🌞🌞❤️</td>
<td>🧵❤️100❤️</td>
<td>❤️😱😭😢&gt;Description of emoji usage per season described above.</td>
</tr>
</tbody>
</table>
How are emoji used over time?

<table>
<thead>
<tr>
<th>Season</th>
<th>Spring</th>
<th>Summer</th>
<th>Autumn</th>
<th>Winter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbols</td>
<td>🌹😍👍😊🔥💕☀️👍👏100❤️🌟 glyphs</td>
<td>🌹😍👍😊🔥💕☀️👍👏100❤️🌟 glyphs</td>
<td>🌹😍👍😊🔥💕☀️👍👏100❤️🌟 glyphs</td>
<td>🌹😍👍😊🔥💕☀️👍👏100❤️🌟 glyphs</td>
</tr>
</tbody>
</table>
Outline

1. Exploring emoji embeddings (trained on different time period)
2. Using time information to improve emoji prediction
Exploring Emoji Embeddings

- We learn emoji embeddings from dataset of different period of the year: Winter, Summer, Spring, Autumn
- How does the semantic representation of emoji change over the year?
Exploring Emoji Embeddings

Comparing 10 Nearest Neighbours of the same emoji on different models (seasons)
Exploring Emoji Embeddings

Comparing 10 Nearest Neighbours of the same emoji on different models (seasons)

<table>
<thead>
<tr>
<th>Season</th>
<th>Emoji</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring</td>
<td>![Spring Emojis]</td>
</tr>
<tr>
<td>Summer</td>
<td>![Summer Emojis]</td>
</tr>
<tr>
<td>Autumn</td>
<td>![Autumn Emojis]</td>
</tr>
<tr>
<td>Winter</td>
<td>![Winter Emojis]</td>
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</table>
Exploring Emoji Embeddings

Comparing 10 Nearest Neighbours of the same emoji on different models (seasons)

<table>
<thead>
<tr>
<th></th>
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<tbody>
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</table>

[Emoji images for each season are shown]
Exploring Emoji Embeddings

Comparing 10 Nearest Neighbours of the same emoji on different models (seasons)

<table>
<thead>
<tr>
<th>Season</th>
<th>Tree</th>
<th>Plant</th>
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Comparing 10 Nearest Neighbours of the same emoji on different models (seasons)

<table>
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<td><img src="image" alt="Autumn" /></td>
<td><img src="image" alt="Winter" /></td>
<td><img src="image" alt="Spring" /></td>
<td><img src="image" alt="Summer" /></td>
<td><img src="image" alt="Autumn" /></td>
<td><img src="image" alt="Winter" /></td>
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</table>
Exploring Emoji Embeddings

Comparing 10 Nearest Neighbours of the same emoji on different models (seasons), (10 = full overlap, 0 = no overlap)

<table>
<thead>
<tr>
<th>Emoji</th>
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<th>🎵</th>
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<th>🎆</th>
<th>🏀</th>
<th>🎁</th>
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Emoji Prediction

Can we use time information to improve emoji prediction?
Emojis Prediction

“Predict the emoji included in a text message”

Can’t wait to visit #Chicago for the first time next week. What shall I do while I am in town? #LaverCup 😐
Emojis Prediction

“Predict the emoji included in a text message, given the text and time information”

Can’t wait to visit #Chicago for the first time next week. What shall I do while I am in town? #LaverCup 😐

Can’t wait to visit #Chicago for the first time next Week. What shall I do while I am in town? #LaverCup

Classifier

300 emojis
Emoji Prediction

Char Embeddings → Char B-LSTM

Word Embeddings → Word B-LSTM

Word B-LSTM → Word Attention

Word Attention → Fully Connected

Fully Connected → Softmax
Emoji Prediction - Late

- Char Embeddings
- Char B-LSTM
- Word Embeddings
- Word B-LSTM
- Word Attention
- Fully Connected
- Softmax

1-24
- Hours Embeddings

1-7
- Week Day Embeddings

1-12
- Month Embeddings
Emoji Prediction - Early

- **Char Embeddings**
- **Word Embeddings**
- **Char B-LSTM**
- **Word B-LSTM**
- **Word Attention**
- **Fully Connected**
- **Softmax**

Embeddings:
- Hours Embeddings: 1-24
- Week Day Embeddings: 1-7
- Month Embeddings: 1-12
## Emoji Prediction - Results

<table>
<thead>
<tr>
<th></th>
<th>P</th>
<th>R</th>
<th>F1</th>
<th>a@1</th>
<th>a@5</th>
<th>a@10</th>
<th>CE</th>
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</thead>
<tbody>
<tr>
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<td>21.97</td>
<td>23.22</td>
<td>21.89</td>
<td>23.13</td>
<td>38.22</td>
<td>45.70</td>
<td>44.29</td>
</tr>
<tr>
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<td>22.10</td>
<td>23.43</td>
<td>22.06</td>
<td>23.33</td>
<td>38.55</td>
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<td>Late</td>
<td>21.83</td>
<td>23.00</td>
<td>21.63</td>
<td>22.91</td>
<td>37.85</td>
<td>45.62</td>
<td>43.91</td>
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</table>
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Emoji Prediction - Results

<table>
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<th>🍬</th>
<th>🍀</th>
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<tr>
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<th>⚽️</th>
<th>🎾</th>
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</table>
Conclusions

- (Some) Emoji usage/semantics depends on the date
- We can exploit date information to improve emoji prediction
- Future:
  - Using both early and late at the same time
  - Exploring different languages / countries