Modeling Online Discourse with Coupled Distributed Topics

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We propose a deep, globally normalized topic model that captures discursive interactions along observed reply links, typical of online data, in addition to traditional topic information. Our model incorporates latent distributed representations arranged in a deep architecture, which enables efficient GPU-based variational inference. We apply our model to a new dataset of 13M comments mined from Reddit.

### Distributed Topics

Discrete (LDA) vs distributed (RS) topic modeling approaches for explaining some particular word

Discrete (LDA) vs distributed (RS) topic modeling approaches for explaining some particular word

### Analysis

**t-SNE plot of thread-level representations colored by subreddit of origin**

**t-SNE plot of comment-level representations colored by comment length**

Strongest word emissions for particular thread-level topic bits (single bit active)

Bit 1
maduro venezuelan ballot puerto catalonia rican quak skateboard venezuela quebec

Bit 2
comey pedron pgl3 maja globalist ucf committe cuck distributor

Bit 3
btc gameplay tutori cyclist dev currency kitti bitcoin rpi crypto

Strongest word emissions for particular comment-level topic bits (single bit active)

Bit 1
irl rianswymart legend config rick aboard favr madman skillset tunnel

Bit 2
faq tilda pmz 165 till keyword questions feedback chat pm

Bit 3
funniest mah tfw teleport fav hoo piz bah whyd dumbest

Strongest word emissions based on inferred latent comment-level topic representations (multiple bits active)

Embedding 1
reev keanus christoph morphy walken vincent chris till wick roger

Embedding 2
reddit skill question background user subreddit answer relev discord guild

Embedding 3
moron douchebag stupid dipshit snitch jackass dickhead idioct hypocrit riddano

Qualitative analysis of strongest word emissions for selected topic bits

### Results

Perplexity (nats) ↓

<table>
<thead>
<tr>
<th></th>
<th>RS (thr)</th>
<th>RS (cont)</th>
<th>DTTM (cont)</th>
<th>DDTM (ct)</th>
</tr>
</thead>
</table>
| Performance of our model (DDTM), with and without (-cpl) coupling potentials, vs baselines at both thread (thr) and comment (cont) resolutions

Upvote Regression (MSE) ↓

<table>
<thead>
<tr>
<th></th>
<th>LDA (thr)</th>
<th>LDA (cont)</th>
<th>RS (thr)</th>
<th>RS (cont)</th>
<th>DTTM (thr)</th>
<th>DTTM (cont)</th>
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Deletion Prediction (% acc) ↓

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<tr>
<th></th>
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<th>RS (cont)</th>
<th>DTTM (thr)</th>
<th>DTTM (cont)</th>
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</table>

### Online Discourse

Here it is at 3000x2000 url_imgur

<table>
<thead>
<tr>
<th></th>
<th>X1</th>
<th>X2</th>
<th>X3</th>
<th>X4</th>
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<tbody>
<tr>
<td>Thanks for this better res.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>oh thank god</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>same</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Visualization of a branching Reddit thread with observed reply links