Using Text Similarity to Detect Social Interactions not Captured by Formal Reply Mechanisms

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Users’ reactions
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• Common prediction task: is this particular user going to reply to this message?
  • A dual problem: this user created a message. Is it a reaction to some received message?

• Users might generate content as reaction to received messages
  • Reply mechanisms help to capture part of these reactions
    • Twitter Replies and Retweets and Facebook Likes and Shares
  • What are we missing?

• Research questions
  • Do explicit responses in fact tend to have high text similarity?
  • What is the potential of text similarity to find non-explicit responses?
  • What is the nature of the reactions captured by text similarity?
  • Are many users “invisible” because they do not use formal replies mechanisms but still react to the content they see?
The Proposed Approach

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1. Reconstruct the ego-user’s timeline at the moment he generated each of his messages
   • Ego-networks are suitable since they encompass all messages a user send and receive
   • Easy to be done in reverse-chronological ordered timelines
2. Look in the ego-user’s timeline for similar messages to the one that was generated
   • A normalized version of Tf-Idf scoring

• Our data
  • 449 Twitter users’ ego-networks, including the messages generate by each user
  • The dataset was crawled in the first three weeks of December, 2012, users are Obama’s followers originally crawled for a diffusion study on the presidential campaign
  • Filtered users that:
    • did not choose English as their profile language
    • did not posted in the last month previous to the crawling
    • the followee crawling did not provide at least 80% of overlapping activity
Timeline reconstruction
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- One window for each message
- For messages that are Replies, 80%+ of the messages they reply to are in the last 100 tweets (Comarela et al.)

<table>
<thead>
<tr>
<th>Replies</th>
<th>4192</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replies in windows</td>
<td>3455</td>
</tr>
</tbody>
</table>
Similarity Evaluation

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- Tf-idf transformation on the union of all the windows of one user
- Each message is used as a query to search in the associated rows in the final matrix
- The result is normalized by the largest possible score for a given window, i.e., the largest row sum for each window

\[ \text{Set } D \text{ of all windows' tweets without repetition.} \]

\[ \text{Generate tf-idf matrix.} \]

\[ \text{Evaluate the score in the window } w_i. \text{ Normalize by the largest row sum in } w_i. \]

\[ \text{We use the user's tweet as a query to search in the window's tweets for the most relevant document.} \]

\[ t_i \]
Looking for missed reactions
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Do explicit responses in fact tend to have high text similarity?

Considering a conservative cutoff

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Median</th>
<th>Std.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Tagged</td>
<td>0.135</td>
<td>0.102</td>
<td>0.136</td>
</tr>
<tr>
<td>Replies</td>
<td>0.212</td>
<td>0.200</td>
<td>0.092</td>
</tr>
<tr>
<td>Retweets</td>
<td>0.384</td>
<td>0.287</td>
<td>0.282</td>
</tr>
</tbody>
</table>

What is the potential of text similarity to find non-explicit responses?

<table>
<thead>
<tr>
<th></th>
<th>Non-Tagged</th>
<th>Replies</th>
<th>Retweets</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Scored (score ≥ 0.384)</td>
<td>998</td>
<td>177</td>
<td>2408</td>
</tr>
<tr>
<td>Total</td>
<td>16650</td>
<td>4192</td>
<td>5209</td>
</tr>
</tbody>
</table>

11%
What is the nature of these reactions?

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**Retweets**
- High scored presents the same content
- Score drops with the size, even with the same content
- Low scored have the RT marker but weren’t found in windows

**Replies**
- High scored look like retweets or multiple mentions in a conversation
- @-mentions seem to be the main evidence for similarity

**Non-Tagged**
- High scored look like retweets
- Users may be independently retweeting the same content
- Usually have small comments
- As the score goes down, looks less like a retweet, but often topically related, e.g., same hashtags

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Serrae: @MollytheGhost @PhantomRat @hollye83 @hockeybychoice @onlymystory @sjopierce @phouse1964 Hate them.

hollye83: @hockeybychoice @onlymystory @PhantomRat @sjopierce @phouse1964 @MollytheGhost @Serrae Hateful. Just hateful.

Zac_Hartlage14: @BadJerry20 OKC traded James Harden

24_Jag: Why WOULD OKC TRADE JAMES HARDEN????

DavidAmejia: RT @Snoopy: It’s Monday, Snoopy! http://t.co/asOF9yPA

AshKetchum151: Mondays are like Zubats. Nobody likes Zubats.
The users we are missing
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- 149 out of 449 (29%) users generated high scoring non-tagged messages
- There are users who consistently generate high scored messages belonging to all ranges of level of activity
More on how we are missing users
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- 6% of the users generated more high scored messages than formal replies
- 24% of the users did not use formal reply mechanisms nor generated high scored messages
- 8% of the users had a high score attributed to at least 10% of their messages
- 71% of the users only used formal reply mechanisms with no high scored messages

High Scored Non-Tagged %
Tagged %

Users' high Non-Tagged Pct CDF
High Scored Non-Tagged %

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Wrapping it up
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• Considering a conservative cutoff
  • Possibly missing up to 11% of reactions
  • Seriously underrepresenting up to 6% of the users

• What are we missing?
  • Users that for some reason don’t use the formal mechanisms
  • Users are sharing an external context outside of the social network
  • Interactions not fully characterized by the existing mechanisms, e.g., group conversations

• But the method is not perfect
  • Underevaluate replies
  • Sensitive to retweet size
  • Reactions due to content outside the timeline are not captured
Next Steps
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• Improve the scoring function
  • Normalizing by the maximum score for the document
  • Mixture between maximum scoring term and tf-idf score

• Improve the model considering other features, e.g., network characteristics, social media metadata
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