Emotion and Interaction Processes in a Collaborative Online Network

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Introduction

- Self-Organized Collaboration:
  - social forces increasingly important
  - technological/social innovation, political problem-solving, creation of economic value occur:
    - in informal, fast organizations.
    - in emerging distributed economy and digital democracy.
    - enabled through cheap and ubiquitous ICT (§ 5, 11).

- THEMIS.COG (themis-cog.ca):
  - Study the open, collaborative development of software.
  - GitHub (github.com): online social coding communities.
  - Explore collaboration dynamics in communities like GitHub.
  - Understand the social and psychological mechanisms of modern human collaboration.

Social Identity Dynamics

- People care about social relationships, and about individual (e.g. economic) gains.
- Identity dynamics explains interactions.
- A mathematical model to predict and test collaborative dynamics.
- based on interaction process (IP) model [4],
- implemented and simulated using the BayesACT sentiment and identity model of human dyadic and group interactions [15].
- General underlying assumption: humans strive for their social experiences to be coherent and consistent with cultural sense of self and values.

Software Collaborations

- Emotions and interaction processes play an important role in software collaborations:
  - positive (happiness): developers more creative
  - negative (fear): developers refrain from changing/refactoring their code
  - affect task quality, productivity, creativity, group rapport and job satisfaction.

- Software discussions data: openly available.
- the discussions can be of a technical nature (e.g. code).
- to use made predictions of other’s behaviours,
- and to guide action choices for an agent.

Affect Control Theory (ACT) [9]

- ACT basics:
  - sociological model of human interaction.
  - Humans have shared cultural sentiments about identities, behaviours, and interaction dynamics.
  - Cultural consistency, a keystone of intelligence.
  - Used to make predictions of other’s behaviours,
  - and to guide action choices for an agent.

- ACT proposes affective prescriptions for action:
  - results in affective ecosystem of roles and behaviours,
  - an equilibrium that yields a social order

- Bayesian Affect Control Theory (BayesAct) [15]:
  - sentiments are probability distributions,
  - propositional (non-affective) states,
  - explicit utility function.

ACT+IP=Group Simulator [10]

- Interaction Process Analysis (IP) [4]:
  - Interaction Process Analysis (IP): a method for the analysis of groups
  - uses 12 behaviour categories based on observations of human groups [3].
  - ten emotions related to IP categories by [10],
  - used in group process simulations [10].

Examples

<table>
<thead>
<tr>
<th>IP group</th>
<th>IP Category</th>
<th>Example pull request comment</th>
<th>Emotions</th>
</tr>
</thead>
<tbody>
<tr>
<td>positive reactions</td>
<td>Shows solidarity</td>
<td>I’m sure you’ll recover somehow</td>
<td>Calm</td>
</tr>
<tr>
<td>Shows tension release</td>
<td>This is really what I need</td>
<td>Saintly, Careless</td>
<td></td>
</tr>
<tr>
<td>attempted answers</td>
<td>Gives suggestion</td>
<td>Needs a metric tonne of docs</td>
<td>Careful, Calm</td>
</tr>
<tr>
<td>Gives opinion</td>
<td>love it</td>
<td>Nigel, Careful</td>
<td></td>
</tr>
<tr>
<td>negative reactions</td>
<td>shows tension</td>
<td>Ain’t I just said Linux which is not very useful at all</td>
<td>Aggressive, Careful</td>
</tr>
<tr>
<td>Needed orientation</td>
<td>I’m hungry now</td>
<td>Aggressive, Careful</td>
<td></td>
</tr>
<tr>
<td>Disagrees</td>
<td>for me just says Linux which is not very useful at all</td>
<td>Careful, Calm</td>
<td></td>
</tr>
<tr>
<td>Shows antagonism</td>
<td>with an axe and their bare hands</td>
<td>Intensive, Agressive</td>
<td></td>
</tr>
</tbody>
</table>

3000 pull request comments from GHTorrent’s GitHub dump (Feb. 2017),
from pull requests 41 open, 343 closed without being merged, 450 merged.
Comments filtered to remove sections of code,
4 different MTurk annotations of 12 IP + 10 emotions,
majority threshold ratings,
averaged TF-IDF weighted Google word vectors for each comment.
linear SVM (Logistic regression, metric learning, deep learning gave similar results [14]),
F1-scores for a one-vs-all classification task,
parameters were set by maximizing F1-score in a grid search
5-fold cross validation,
aggregated IP and emotion categories.

References


Data and Methods

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Conclusions

- Subjective emotional and social interactions play a significant role in online software development.
- Automated detection: a significant challenge,
- requires more detailed emotional analysis [1].

Current work:
- fine-grained sentiment analysis,
- further group process analysis,
- develop artificial agents that catalyze more effective group processes online.

Thank you

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