Cooperation and Conflict in Wikipedia

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Introduction

• In this talk: model of opinion formation and participation structure in open authoring systems (e.g. wikis, opensource projects)

• The method is agent-based simulations

• The model is not 100% stable, new ideas thrown in, old features dropped
Outline of the talk

• Motivation of this research
• Modeling open authoring environments
• Studying the model with agent-based simulations
• Discussion and future directions
Motivation

• Opinion dynamics
  • Negotiation
  • Fact Finding
  • Prediction

• Open authoring process is a mix of some or all of the three

• In online communities, contribution is usually on a voluntary basis
Research questions

• Is there any interplay between opinion formation and the level of participation of users in the authoring process?

• Is it possible to model the users’ level of participation by taking into account simple motivational factors?

• Interactions between users are indirect (mediated by objects being authored). How does this influence the collective dynamics?
Model ingredients

- A group of $N$ agents working on $P$ artifacts
- The state space is a continuous opinion space, e.g. $S = [0,1]$ in the simulations
  \[ x_i(t) \text{ } i\text{-th agent}, \quad y_j(t) \text{ } j\text{-th artifact} \]
- Agents modify “features” of the artifact
- Some artifacts are more controversial than others
• Each artifact has its own intrinsic degree of controversiality/tolerance $\varepsilon_j$

• Hence a bounded confidence rule (à la Deffuant) models the act of editing

$$\text{if } \|x_i(t) - y_j(t)\|_2 \leq \varepsilon_j$$

$$x_i(t) \leftarrow x_i(t) + \mu(y_j(t) - x_i(t))$$

$$y_j(t) \leftarrow y_j(t) + \mu(x_i(t) - y_j(t))$$

$$\text{if } \exists t^* = \max\{t' < t : \|x_i(t) - y_j(t')\|_2 \leq \varepsilon_j\}$$

$$y_j(t) \leftarrow y_j(t^*)$$

else:

$$y_j(t) \leftarrow x_i(t)$$
• Activity selection model
  \[ \Pr\{\text{user } i \text{ edits artifact } j\} = p_i(t), \quad i = 1, \ldots, P \]
  \[ \Pr\{\text{user } i \text{ does nothing}\} = p_0(t) \]

• Introduces memory of past actions of agents

• Probability \( p_j(t) \) to select artifact \( j \) is proportional to the number of successes

  gratification rule:
  “success” if: \( \| x_i(t) - y_j(t) \| \leq \varepsilon_j \)
  “failure” otherwise
Features

- Indirect interactions between agents
- Artifacts act as centers of attraction for agents by means of repeated averaging
- But to foster local consensus of agents into clusters, the artifact must stay within the bound of confidence of the cluster
- Hence clusters compete for artifacts
Simulations with adaptive selection

- Agents interact and update their memory of actions

- Initial conditions
  - opinion profile uniformly distributed in \([0,1]\)
  - all artifacts equally probable of being selected, probability of no action is 0

- Limit selection distribution depends on the opinion dynamics:
  - consensus, polarization, fragmentation and slow convergence
Global consensus

$N = 200$ agents, $\varepsilon_1, 2 = 0.1, 0.3$

$T = 5 \times 10^4$, memory = 50 edits
Global consensus

\[ N = 200 \text{ agents}, \ \varepsilon_{1,2} = 0.1, 0.3 \]
\[ T = 5 \times 10^4, \ \text{memory} = 50 \text{ edits} \]
Polarization

Artif. histogram

opinion vs probability of edit scatter

Artifact state

Agent state

\[ N = 200 \text{ agents}, \ \varepsilon_{1,2} = 0.18, 0.28 \]

\[ T = 5 \times 10^4, \ \text{memory} = 50 \text{ edits} \]
Polarization

$N = 200$ agents, $\varepsilon_{1,2} = 0.18, 0.28$

$T = 5 \times 10^4$, memory = 50 edits
Fragmentation and slow convergence

$N = 200$ agents, $\varepsilon_{1,2} = 0.18$

$T = 5 \times 10^4$, memory = 50 edits
Summary of qualitative effects

- Expulsion of outliers / small clusters (Consensus, Polarization, Fragmentation)
- Heterogeneous levels of activity between clusters (Polarization, Fragmentation)
- Slow convergence within clusters (Polarization, Fragmentation)
Extensions of the model

- The state of an artifact is not determined only from the most recent interaction
  - A memory of past states
- Small edits affects less a large document compared to a small one (increasing inertia)
- Consider effects due to social selection between agents
• Simple extensions of bounded confidence models yield interesting phenomena on collective behavior

• Idealized model of gratification may explain different levels of participation to a community
  • assumption is an open authoring policy
  • but psychological studies of uses and gratifications in media audience are fairly more detailed!
Challenges

- the weight of an Ox
- continuous opinion

Impartiality between POVs
- wording issues