Mapping the Invocation Structure of Online Political Interaction

Manish Raghavan, Ashton Anderson, and Jon Kleinberg
Interactions on Twitter

@realDonaldTrump has attacked American companies regularly and indiscriminately.

But these outbursts do not mask the fact that the President pushed through a massive, unnecessary tax cut for the wealthy – help that could have gone to the middle class.

@skoot62 - Apr 5
Replying to @GovMurphy @realDonaldTrump
Here's a list of companies that gave their employees raises and bonuses!! List of companies that paid bonuses or boosted pay since tax bill passed
usat.ly/2miWX7q via @usatoday

List of companies that paid bonuses or boosted pay since tax bill pa...
Walmart is the latest U.S. company to share their tax cut windfall with employees.
usatoday.com

Friggeri, Adamic, Eckles, Cheng ‘14: invoked network structure using Snopes replies
Invocation Graph on Domains

Could try graph on articles, but in practice too sparse
Invocation Graph Details

Key point: linkage reflects use by readers, not hyperlinks by authors
Fundamentally different type of network
Invocation Graph Details

- Blacklist: youtube.com, facebook.com, ...
- Politically relevant: high co-occurrence with Clinton/Trump retweets
- BFS from known political domain following only edges with large weight
- No self-loops
Basic Questions

• How are edges arranged in a political sense?
• Is linkage symmetric about the political middle?
• How does the structure of the graph evolve over time?
• $P(x \mid C) =$ probability of tweeting URL from $x$ given retweet of Clinton on the same day

• $(P(x \mid T)$ analogous for Trump)

• $s(x) = \frac{P(x \mid T)}{P(x \mid C) + P(x \mid T)}$ [Benkler, Faris, Roberts, Zuckerman ‘17]
Embedding then Invocation Graph on the Political Spectrum
Concrete Questions

• Does linking pattern from $x$ correlate with $x$’s position on the spectrum?
• Does this change over time?
• What symmetries and asymmetries exist in the graph?
• Where do edges fall on the spectrum?
Linking Pattern

- $\delta_{out}(x) = \mu_{out}(x) - \mu_{out}(G\backslash x)$
- Measures how far $x$'s out-links are from average (positive = right, negative = left)
- Correlation with $s(x)$
  - Positive (homophily)? Negative (adversarial)?
  - Change over time?
Correlation between Linking Pattern and Political Spectrum

(a) January 2016

(b) October 2016
Change in Correlation over 2016

Working against homophily
• Baseline comparison: randomly rewired $\hat{G}$

$E \left[ f_\rightarrow(y, \hat{G}) \right]$ and $E \left[ f_\leftarrow(y, \hat{G}) \right]$
Edges Crossing over the Spectrum

(a) January 2016

(b) October 2016
Analogs in other Domains

- Political spectrum

- Higher rate of cross-ideological interaction leading up to election
Adapting to Reddit

- Too sparse – not enough URL → URL replies
- Alternative: user characteristics
  - r/hillaryclinton, r/The_Donald
  - Sets of active users have small overlap
- Look at interactions in r/politics
- Domain frequencies in each subreddit
Comparing Spectra
Comparing Spectra

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Spearman’s rank correlation = 0.871
(max of 10,000 random permutations = 0.757)
Cross-Ideological Interactions on Reddit
Comparing Trends
Conclusion and Further Directions

• Developed techniques to analyze invocation graphs
• Built graph based on usage, not hyperlinks
• Uncovered trends leading up to 2016 US election
• Further directions
  • Relationship between invocation graph and polarization
  • Do trends generalize beyond 2016 US election?
  • Curated news feeds