

# Reducing Polarization by Connecting Opposing Views

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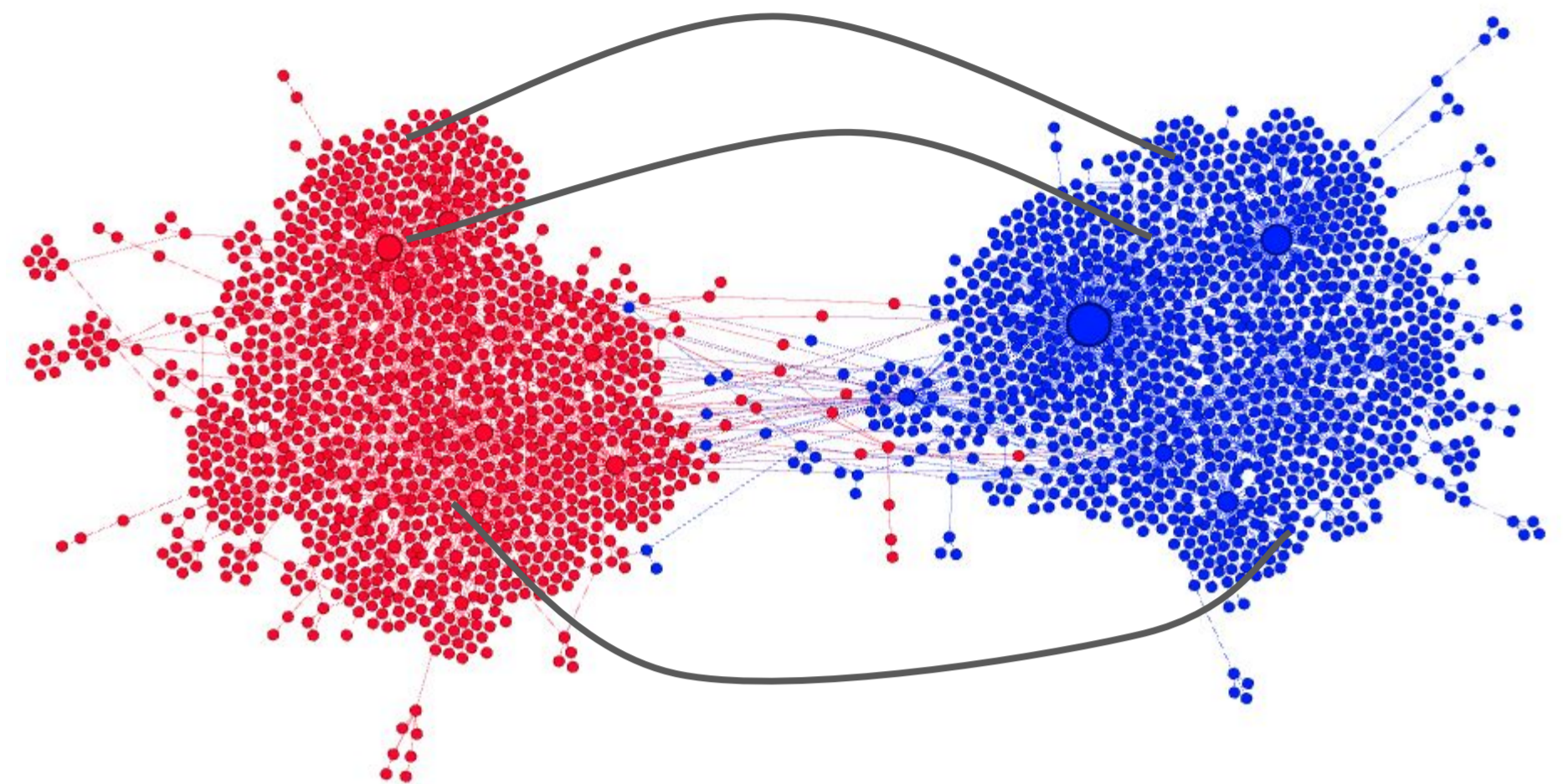
A demo of this research is available at: <https://users.ics.aalto.fi/kiran/reducingControversy>

## 1. Motivation

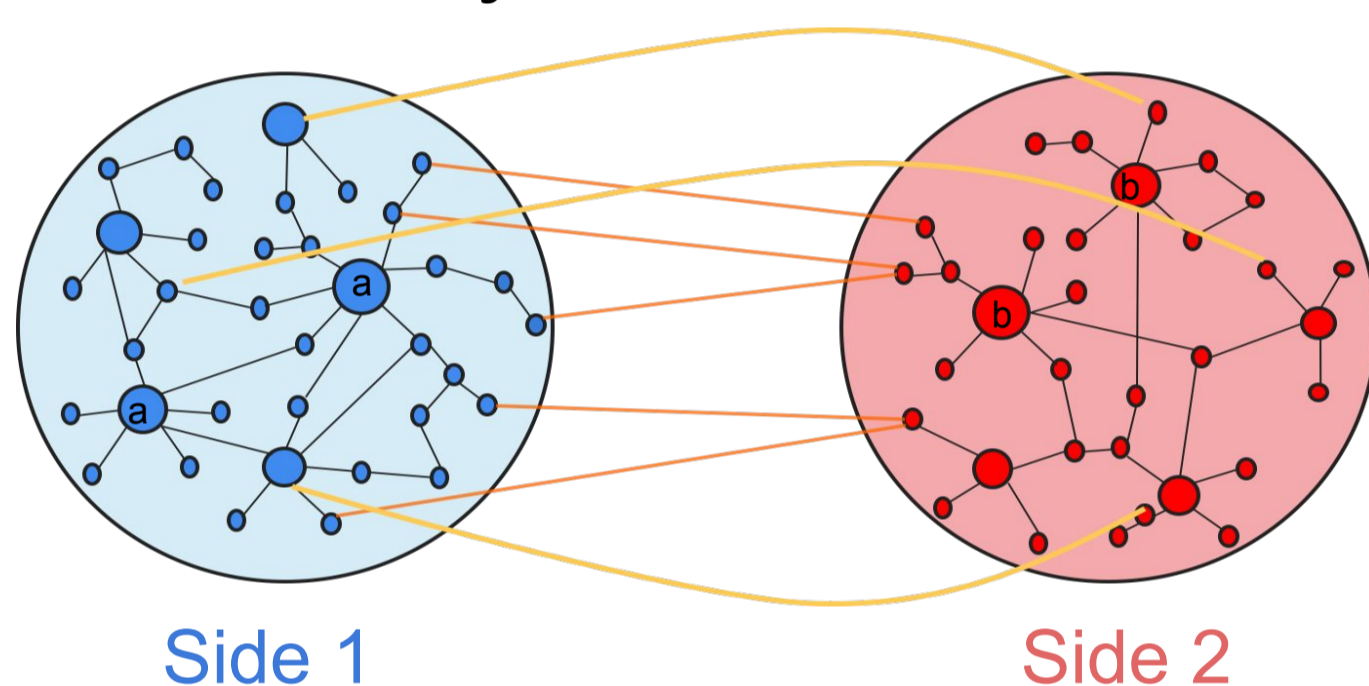
- Increasing Polarization on social media
- Echo chambers
- Filter bubbles

## 2. Setting

- Twitter
- Retweets
- Endorsement graph
- Directed, topic-specific



## 3. Objective Function



$$RWC = \sum (\text{pagerank of } a - \text{pagerank of } b, \text{ when we start from side 1}) + \sum (\text{pagerank of } b - \text{pagerank of } a, \text{ when we start from side 2})$$

Difference of the probability that a random walk starting on one side of the partition will stay on the same side and the probability that the random walk will cross to the other side.

## 4. Problem

- add  $k$  edges to minimize RWC score
- edge  $(u, v) \rightarrow$  suggest *user*  $v$  to *user*  $u$  for this topic

## 5. Algorithms

- Greedy -  $O(n^2)$
- Add edges between high degree nodes (ROV) -  $O(p^2)$ ,  $p \ll n$
- ROV + Acceptance Probability

## 6. Acceptance Probability

- an edge won't always get accepted we model probability of acceptance based on node **polarity**
  - $p(u, v) = p(\text{edge is present} \mid \text{polarity of } u, \text{ polarity of } v)$
  - Estimated using:  $N_{\text{endorsed}}(R_u, R_v) / N_{\text{exposed}}(R_u, R_v)$
- Based on retweets      Based on connections

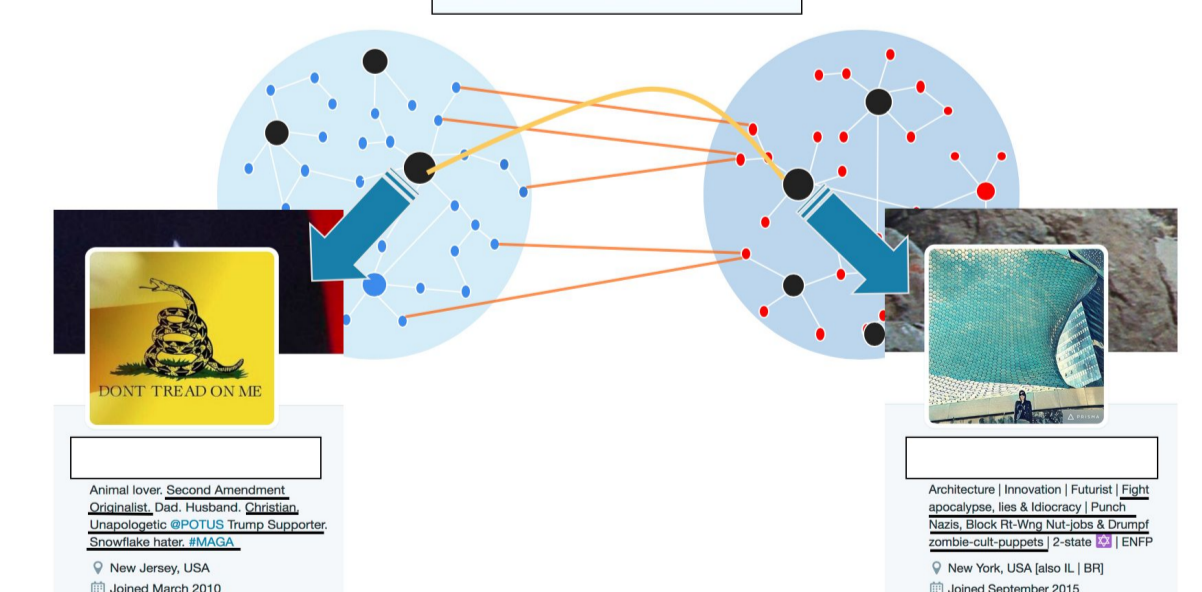
## 7. Incremental RWC Computation

- When new edge  $(u, v)$  is added, the endorsement graph changes **locally**
- Only transition probabilities from  $u$  change
- RWC can be computed incrementally by **Sherman-Morrison** formula avoiding matrix inversion

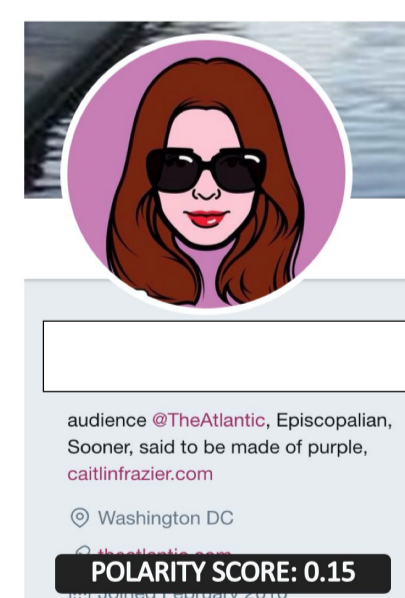
## 8. Real world examples

USERS COULD BE POLARIZED TO DIFFERENT DEGREES

Backfire effect!



Real world example



### What Conservatives Get Wrong About Trump's Immigration Order

There's reason to reserve judgment, but no cause for giving the president the benefit of the doubt.

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- Example edges added

		obamacare	
		vertex1	vertex2
ROV		mittromney	barackobama
		realdonaldtrump	truthteam2012
		barackobama	drudge_report
		barackobama	paulryanvp
		michelebachmann	barackobama
ROV-AP		kksheld	ezraklein
		lolgop	romneyresponse
		irritatedwoman	motherjones
		hcan	romneyresponse
		klsouth	dennisdmz

## 9. Acknowledgements

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