#DebateNight: The Role and Influence of **Socialbots** in the Democratic Process

Sydney,
February 15th, 2018

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Case study: the 2016 U.S. Presidential elections

Some key features:

- A non-traditional republican candidate;
- Massive use of online social media;
- World-wide impact – shift in US external politics.

Case study: the 2016 U.S. Presidential elections

Common traits:

- Opinion leaders;
- Highly influential, highly followed and retweeted;
- Pro-republican;
- ...

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Russian-controlled bots operated by the Internet Research Agency in St. Petersburg

The political influence of socialbots

SocialBots:

"Software processes that are programmed to appear to be human-generated within the context of social networking sites such as Facebook and Twitter"

(Gehl and Bakardjieva 2016, p.2)

Open questions about automated bots:

were they influential during the democratic process?

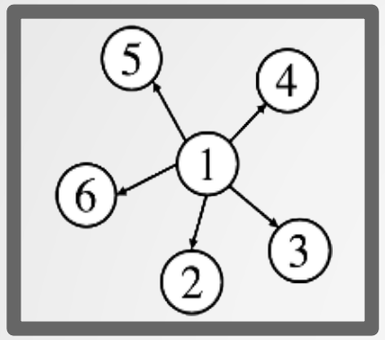
did they have political partisanship?

did they infiltrate the political discourse?

did they manipulate public opinion at scale?

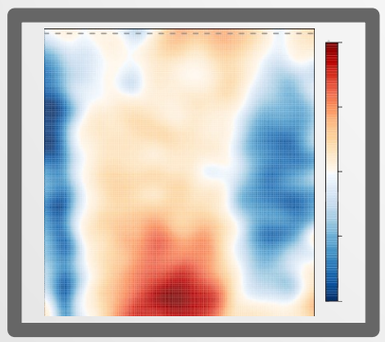
were they instrumental for the results of the elections?

Presentation outline



Estimating user influence from retweet diffusions

Botness and political partisanship



Analyzing political behavior of bots

Dataset of retweet diffusions

Characteristics:

- Crawled during the first U.S. Presidential Debate (26 sept 2016)
- Set of hashtags chosen by Social Scientists
- Complete – crawled using Twitter Firehose.

Dimensionality:

- length: **90 minutes**
- #tweets: **6.5M**
- #users: **1.45M**
- #retweet diffusions: **0.2M**

Hashtags:

#DebateNight
#Debates2016
#election2016
#HillaryClinton
#Debates,
#Hillary2016
#DonaldTrump
#Trump2016

What is user influence?

User influence:

"Average number of users in the social network who get in contact with the content emitted by *u*"

(Du et al, NIPS 2013)

Hard problem in our context:

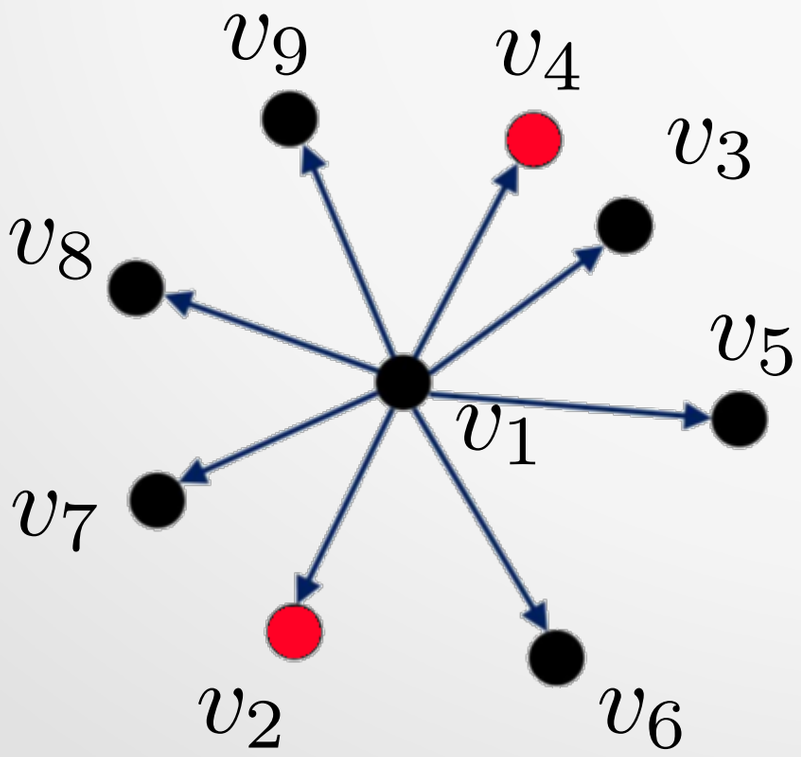
- Unknown underlying social network;
- Large number of diffusion in very short time;
- Large number of users.

Unobserved diffusion structure

Observed tweet timestamps and their users in cascade C

$$C = \{v_i = (u_i, t_i)\}_{i=1}^{n}$$

Unobserved diffusion structure



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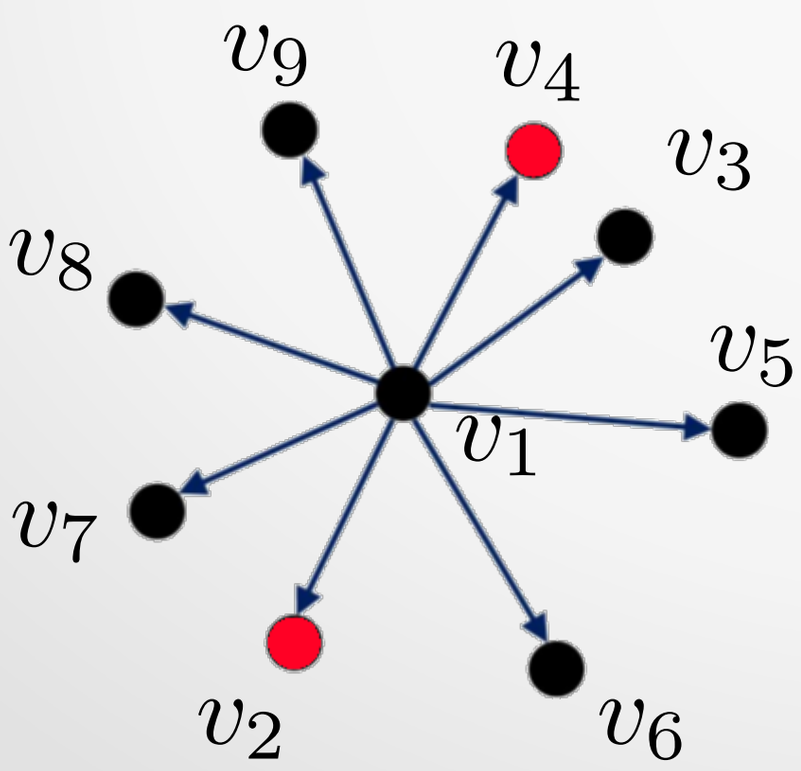
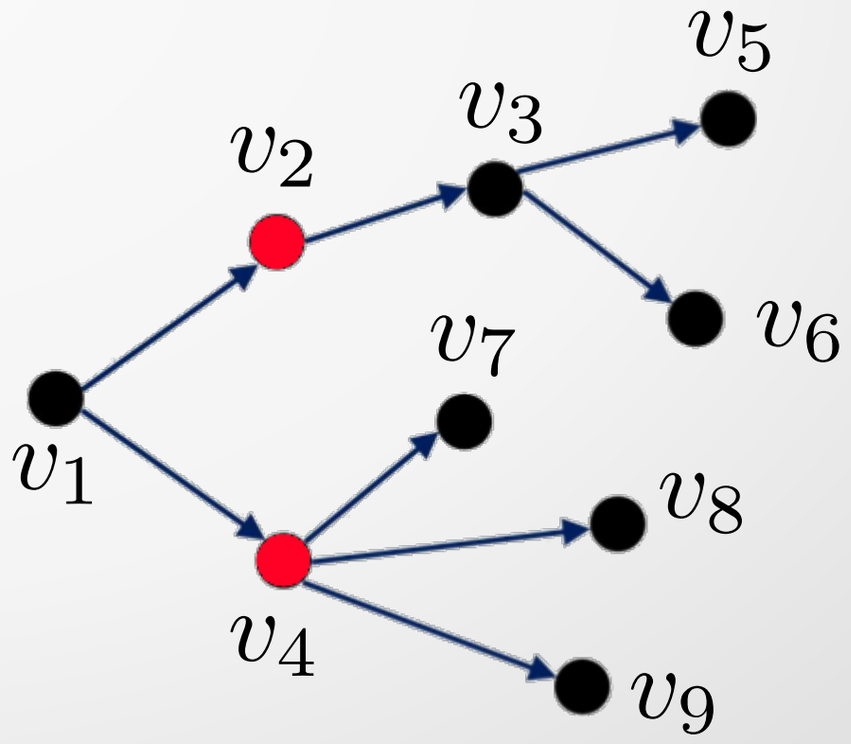
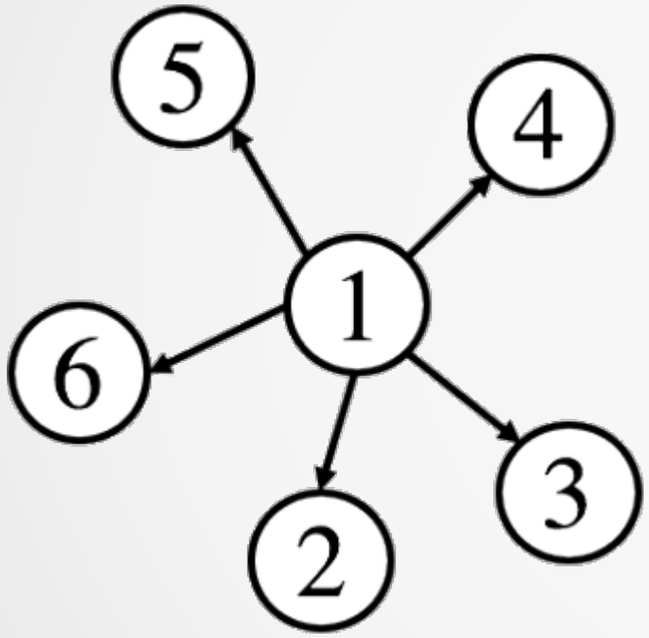
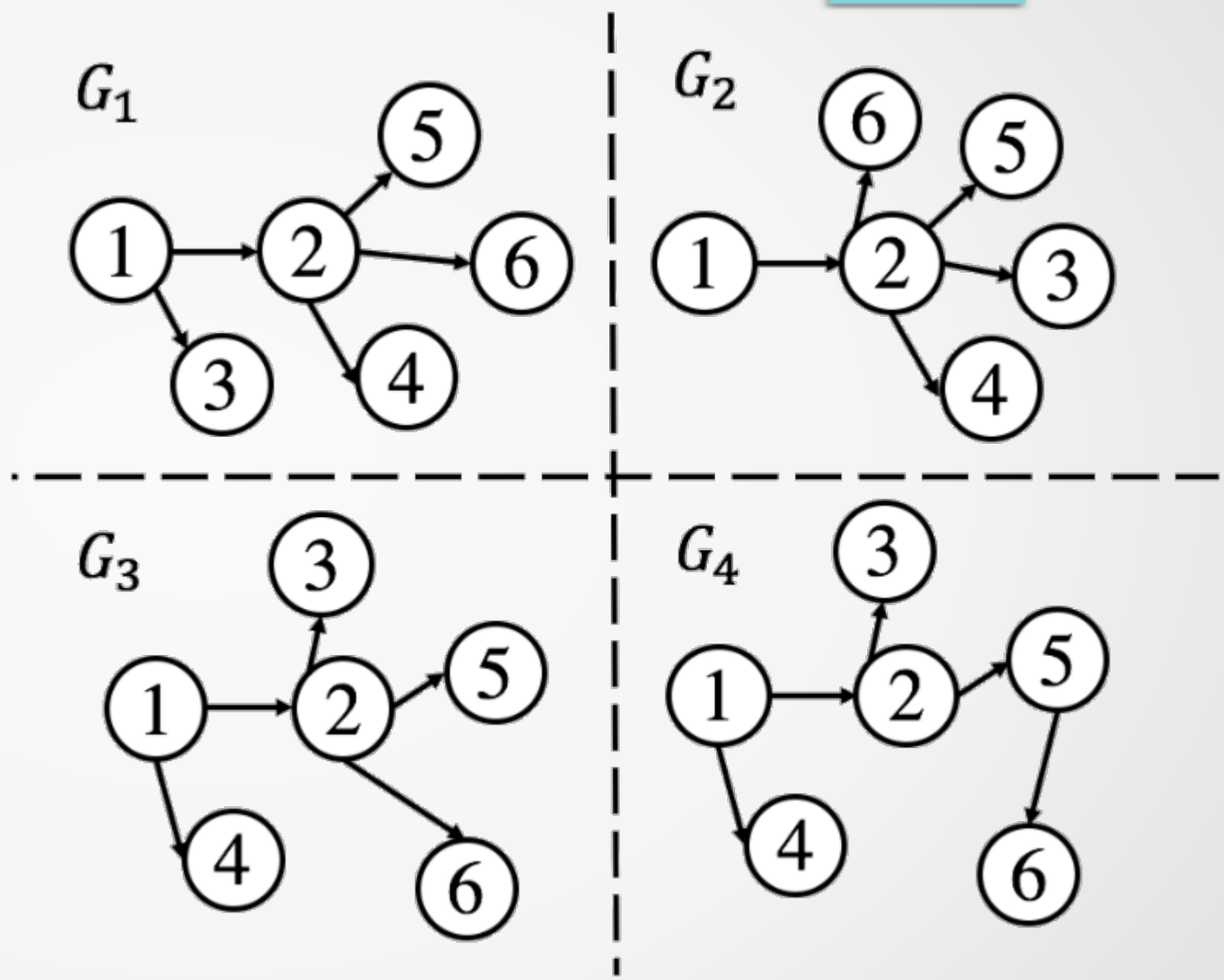




Latent diffusions: scenarios

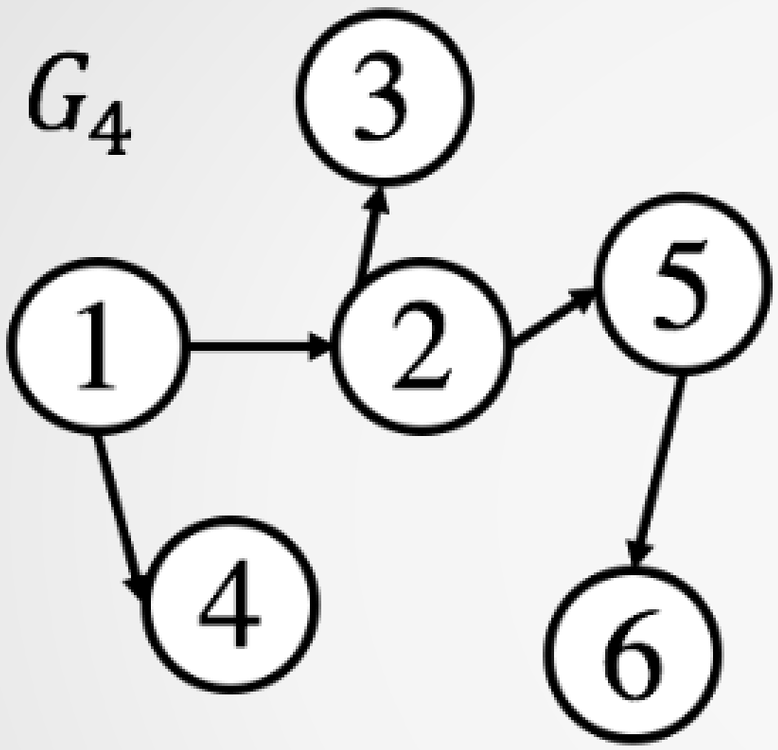




Temporal precedence

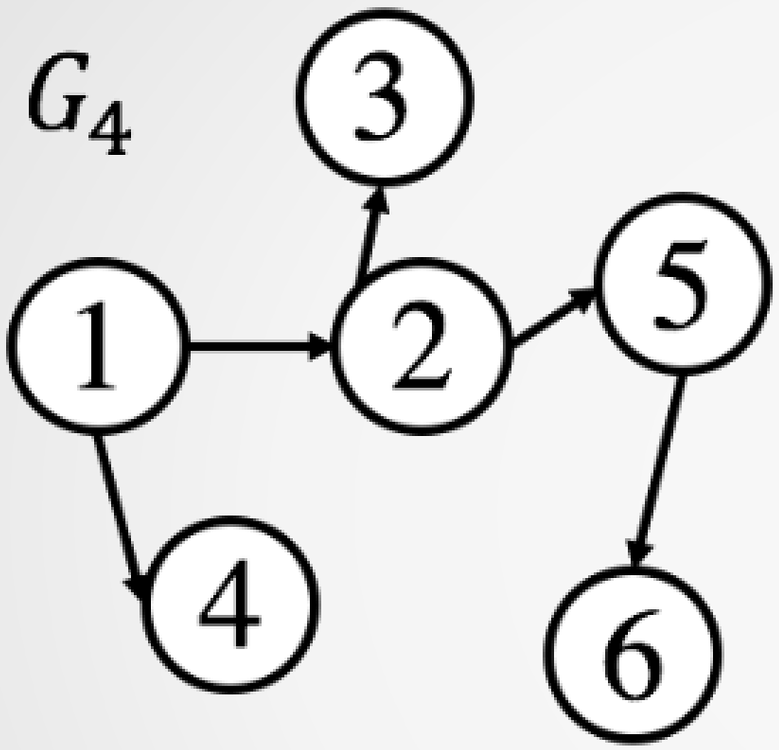
$$t_1 < t_2 < \ldots < t_n$$

Latent diffusions: edge probability



$$P\big((v_i, v_j)\big) = \frac{m_i e^{-r(t_j - t_i)}}{\sum_{k=1}^{j-1} m_k e^{-r(t_j - t_k)}}, t_i < t_j$$

Latent diffusions: edge probability



Two social factors:

- users retweet *fresh content*

[Wu and Huberman 2007]

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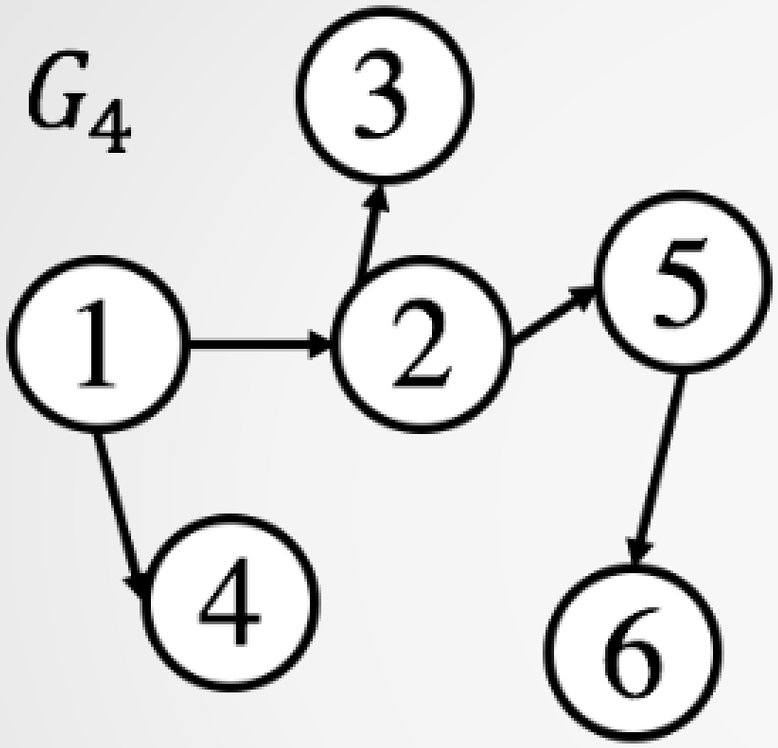

Two social factors:

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[Wu and Huberman 2007]

- preferential attachment

[Barabási 2005]

number of followers of u_i

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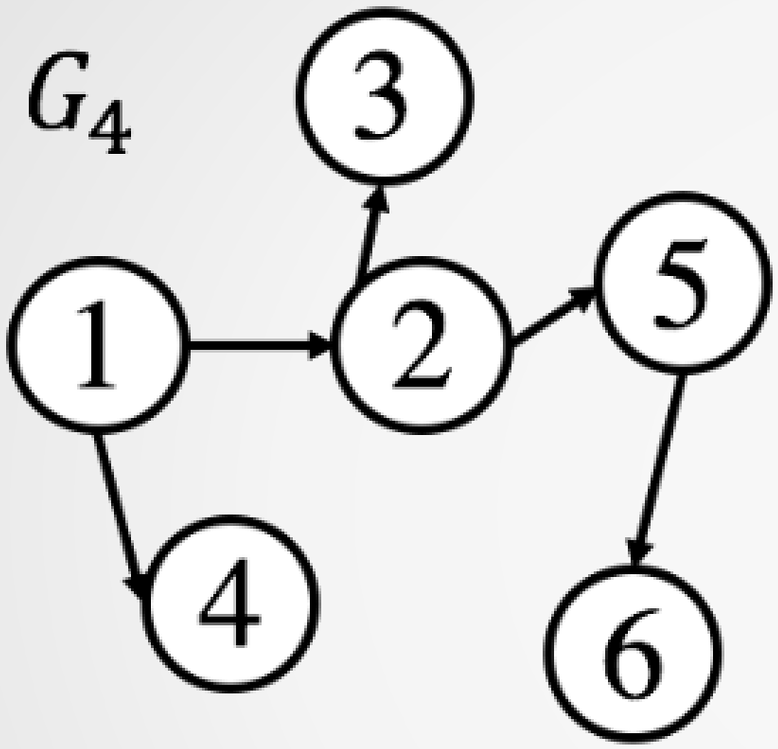
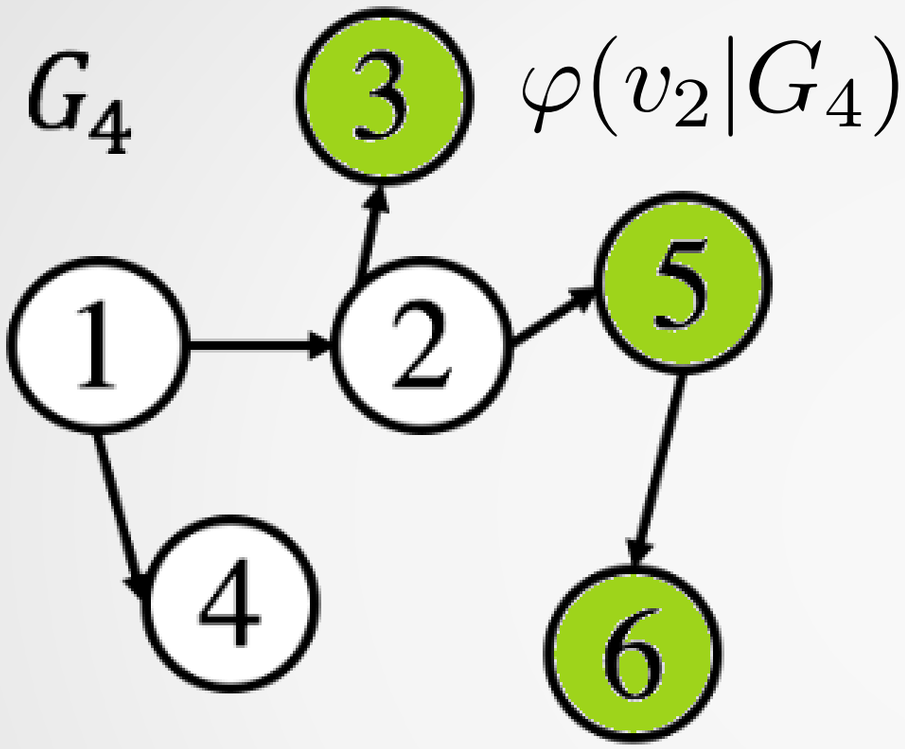
Latent diffusions: tweet influence



Tweet influence: the expected number of users reached from node using a model of independent binomials

$$\varphi(v_i|G) = \sum_{v_k \in V(G)} \prod_{(v_a,v_b)\in z(v_i,v_k)} P\big((v_a,v_b)\big)$$

Latent diffusions: tweet influence



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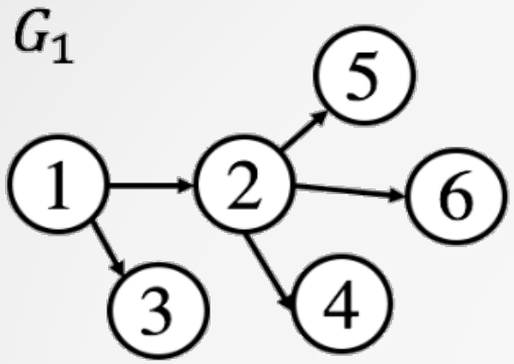
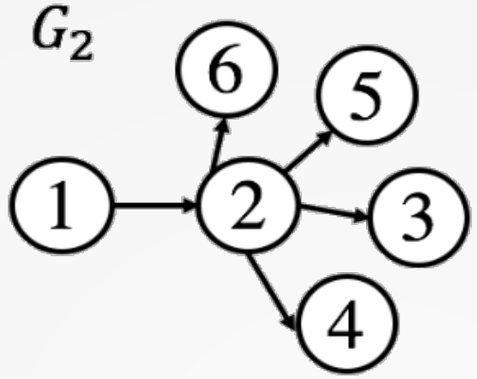
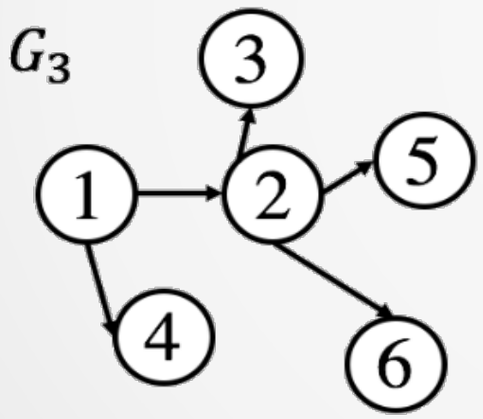
Influence over a diffusion

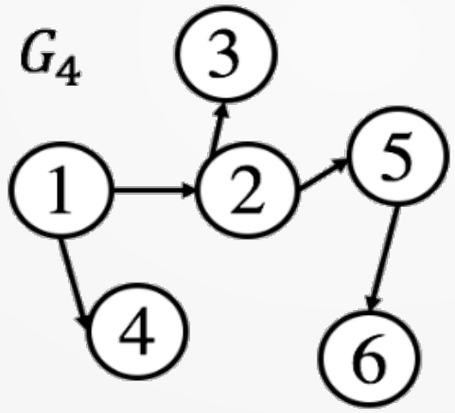
$\varphi(v_i|G_1)$



$\varphi(v_i|G_2)$







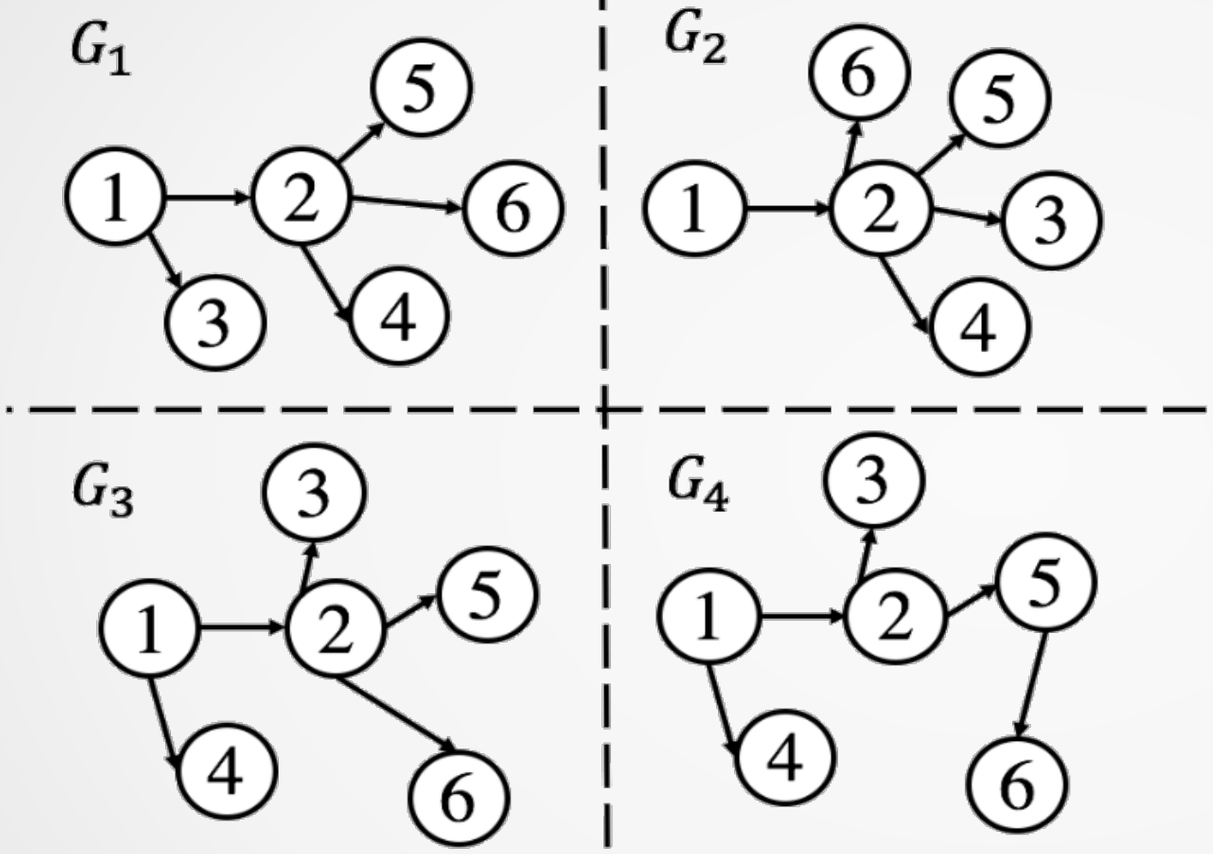
$\varphi(v_i|G_3)$

$\varphi(v_i|G_4)$

$$\varphi(v_i) = \sum_{G_j \in \mathcal{G}} P(G_j)\varphi(v_i|G_j)$$

Influence over a diffusion

$\varphi(v_i|G_1)$ $\varphi(v_i|G_2)$



$\varphi(v_i|G_3)$ $\varphi(v_i|G_4)$

$$\varphi(v_i) = \sum_{G_j \in \mathcal{G}} P(G_j)\varphi(v_i|G_j)$$

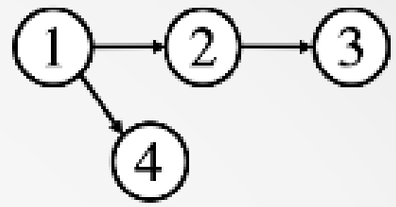
But ...

$(n-1)!$ diffusion scenarios

10^{156} diffusion scenarios for 100 tweets

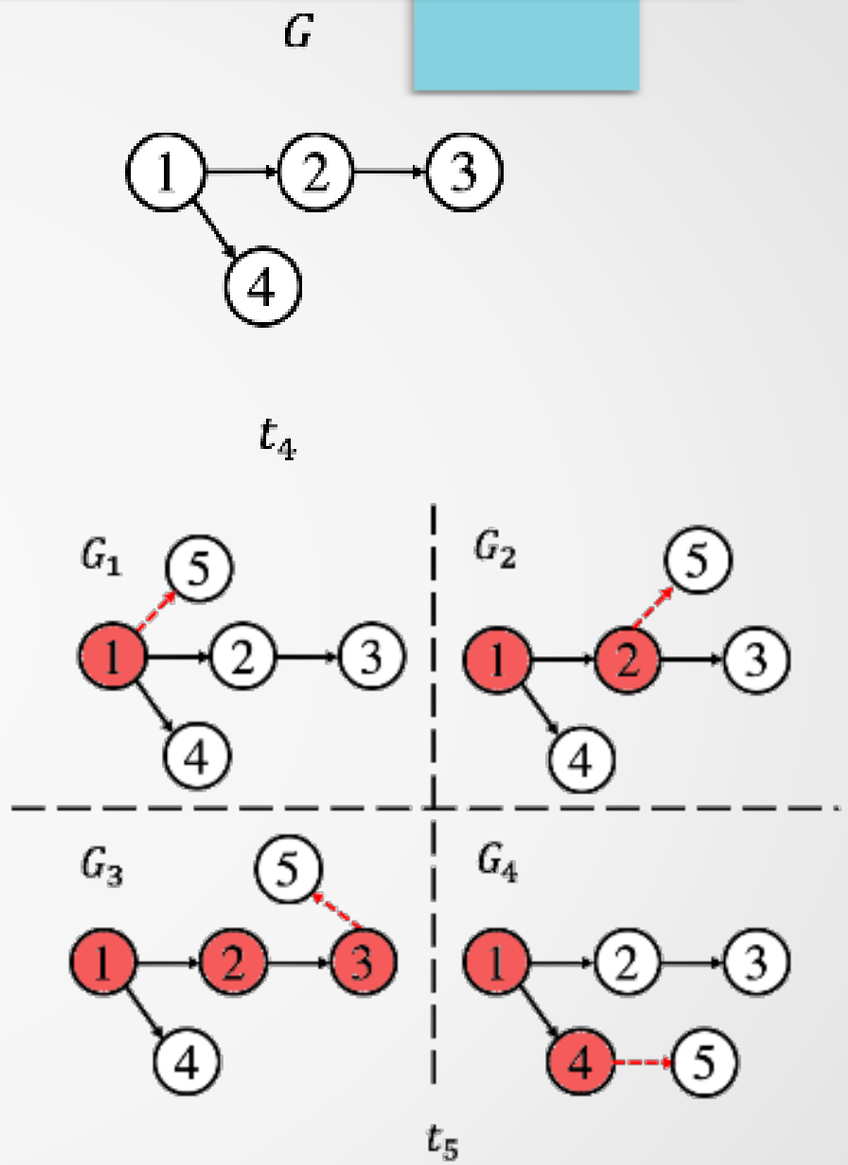
Tractable influence computation

G



t_4

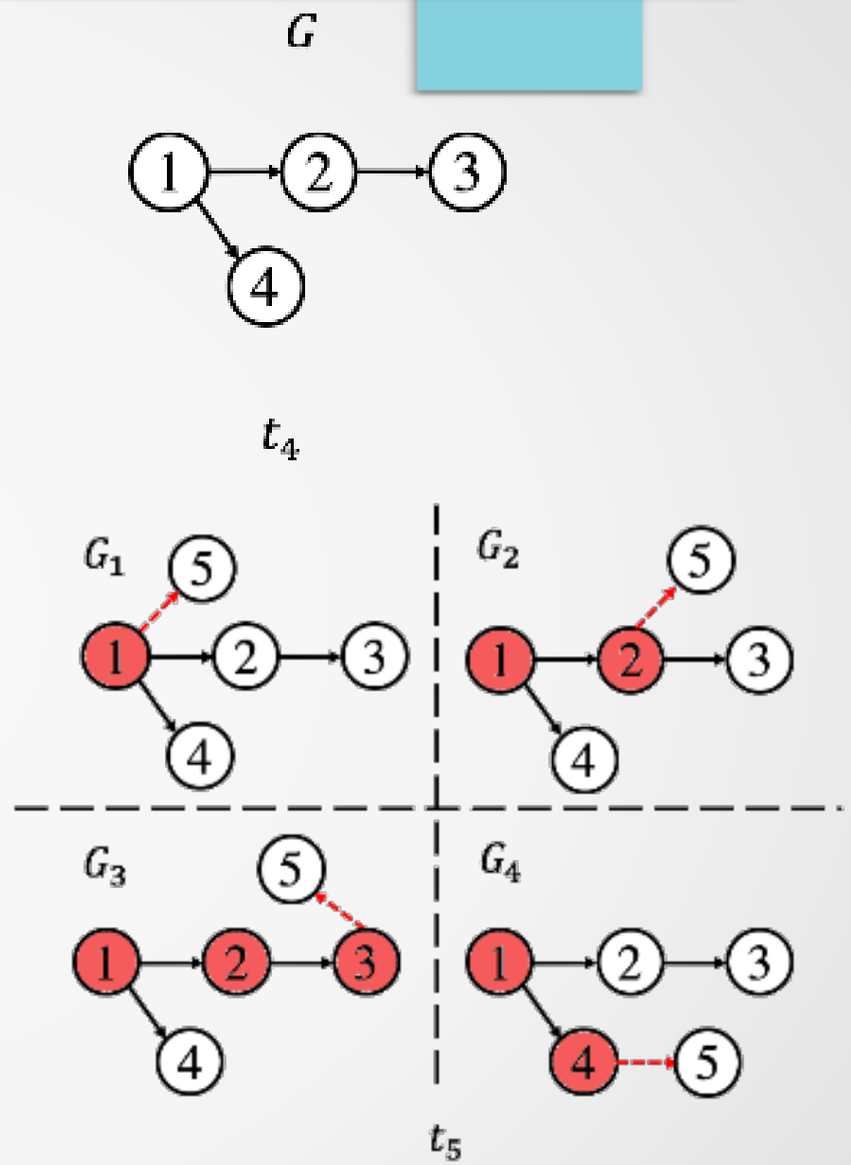
Tractable influence computation



Tractable influence computation

Contribution of k to the influence of i

$$M_{ik} = \begin{cases} \sum_{j=1}^{k-1} M_{ij} P^2\big((v_j, v_k)\big) & , i < k \\ 1 & , i = k \\ 0 & , i > k \end{cases}$$



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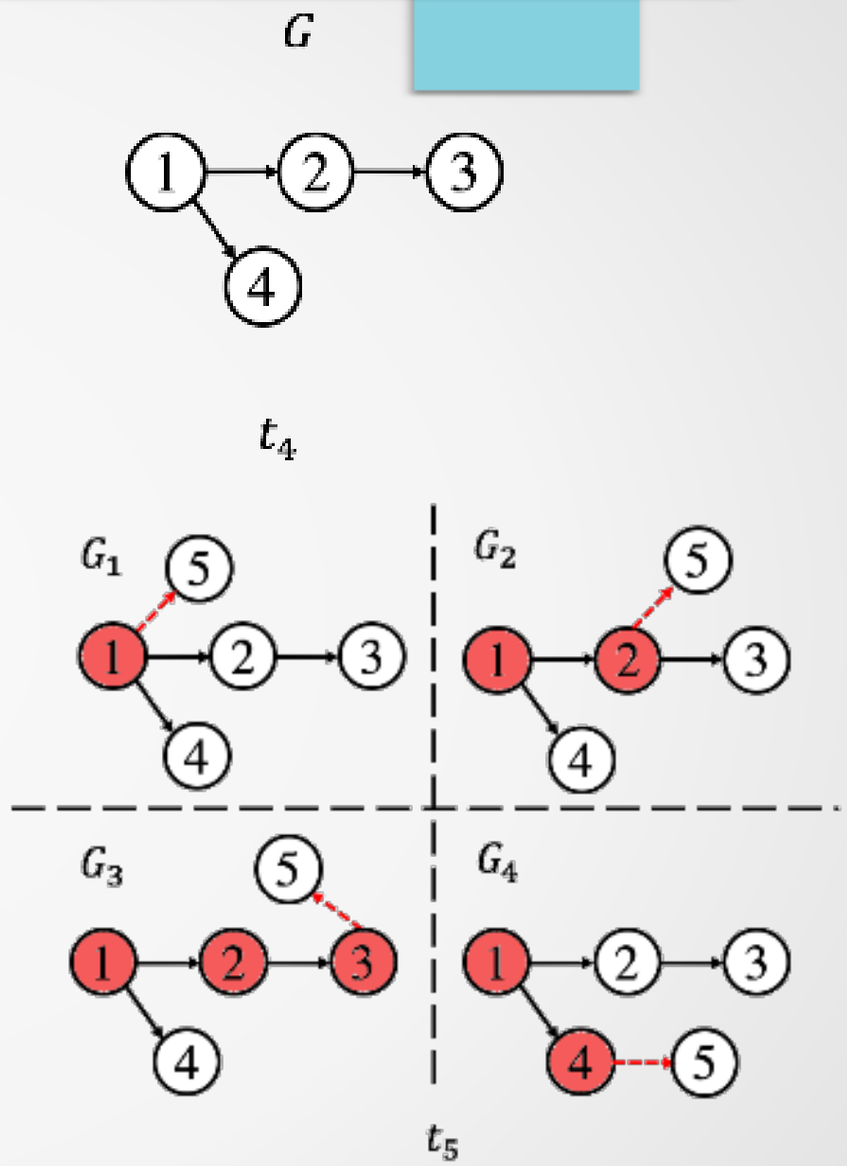


Influence of at time t_k

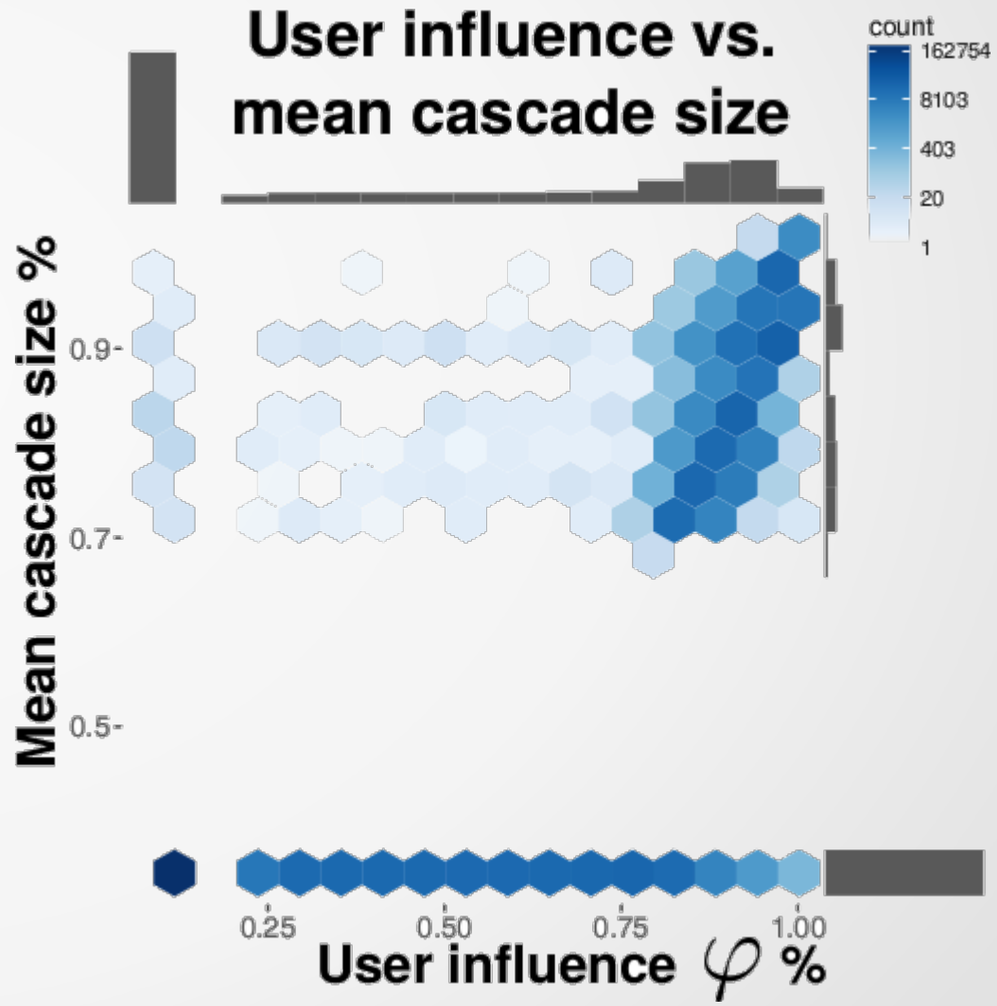
$$\varphi^k(v_i) = \varphi^{k-1}(v_i) + M_{ik}$$

Recursive influence formula:

$$\varphi^k(v_i) = \varphi^{k-1}(v_i) + M_{ik} = \ldots = \sum_{j=1}^{k} M_{ij}.$$

Simpler alternative measures

Mean cascade size



Simpler alternative measures

Mean cascade size

Seth MacFarlane
@SethMacFarlane

The Official Twitter Page of Seth MacFarlane - "THE ORVILLE" Thursdays at 9/8c on Fox

Los Angeles
facebook.com/pages/Seth-Mac...
S-a alăturat în ianuarie 2009

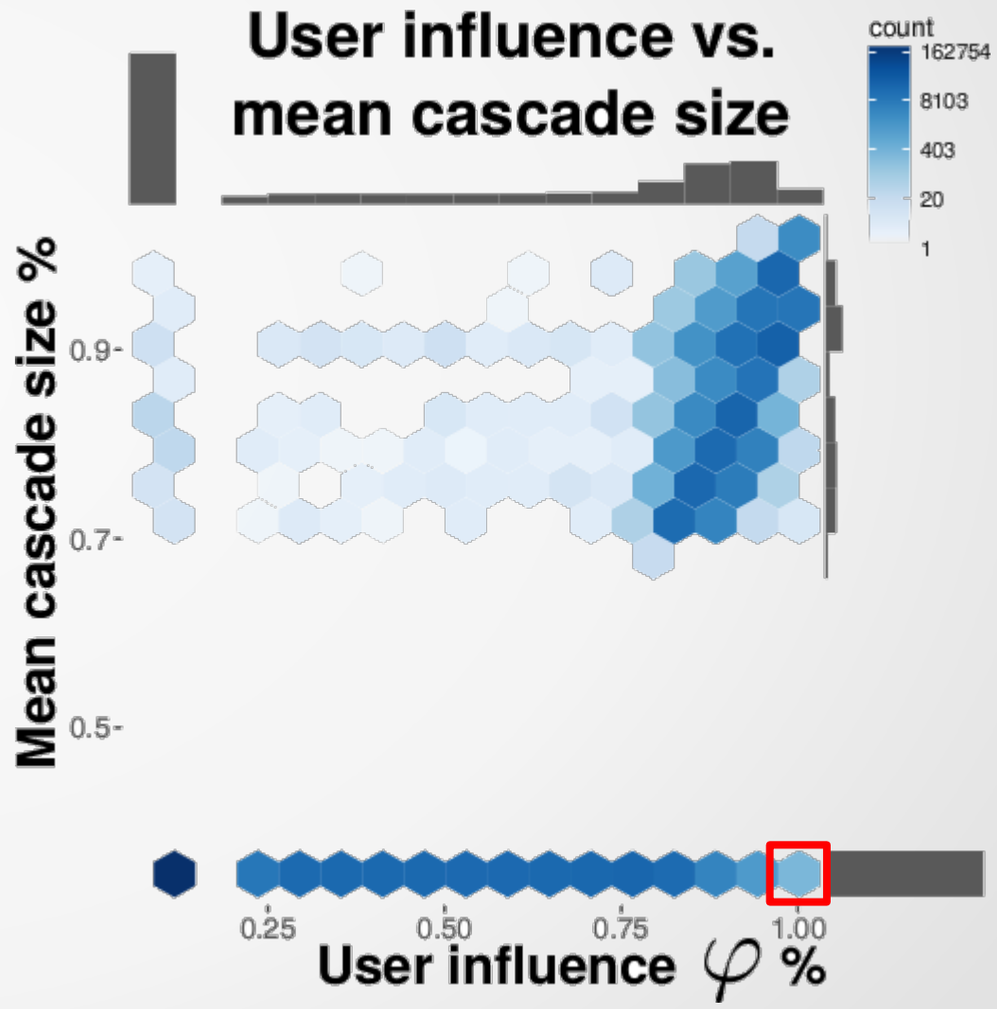
actor and filmmaker
10.8 million followers

Michael Ian Black
@michaelianblack

Nine years in the NFL. Two rings.

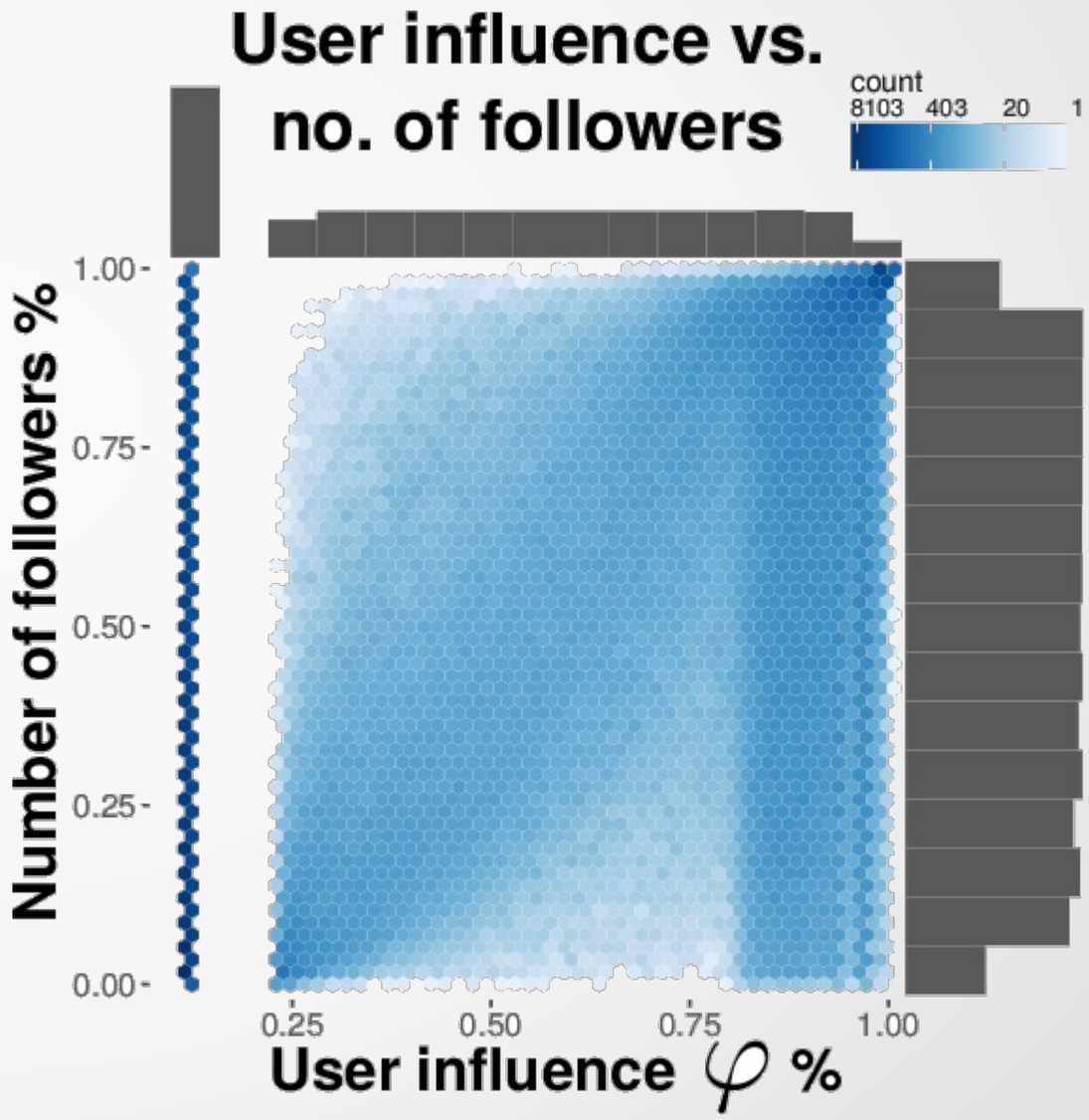
The wilds of Connecticut
michaelianblack.com
S-a alăturat în februarie 2009

comedian
2.1 million followers



Simpler alternative measures

Number of followers



Simpler alternative measures

Number of followers

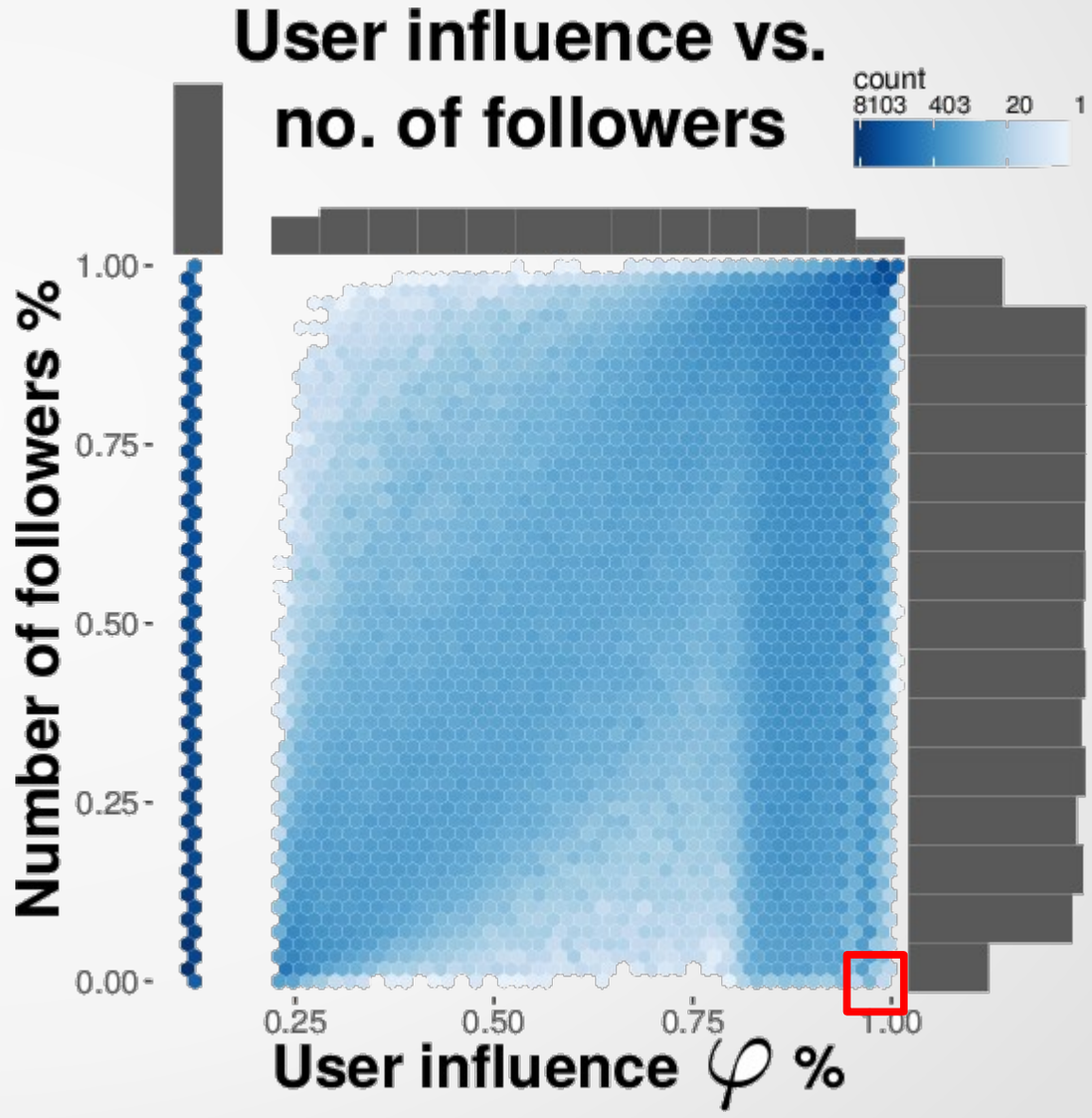
now suspended

2 followers

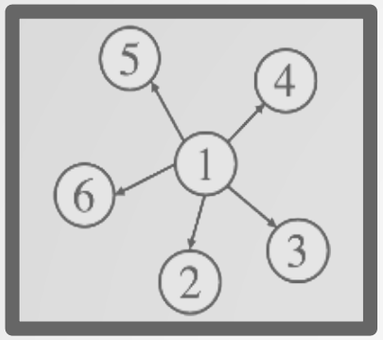
1 follower

Initiated a big cascade

Initiated a big cascade



Presentation outline



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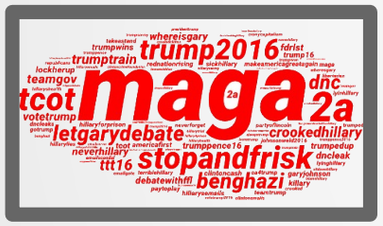
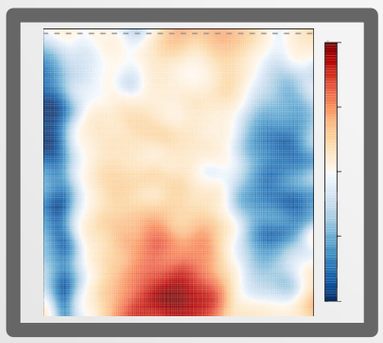


Botness and political partisanship



Analyzing political behavior of bots

Polarization and engagement (1)

Protocol:

- Selected top 1000 most frequent hashtags in tweets;
- Manually labeled as *clearly partisan* pro-democrat or pro-republican;

- dem_i – #democrat hashtags;
- rep_i – #republican hashtags;

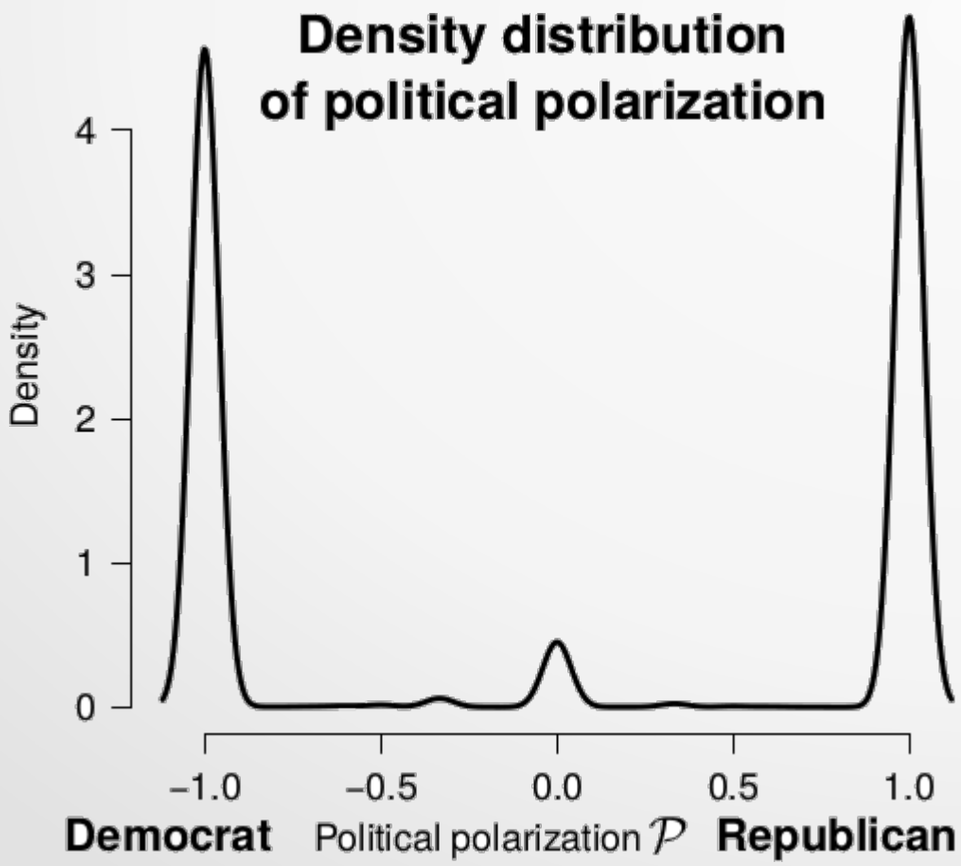
Polarization and engagement (2)

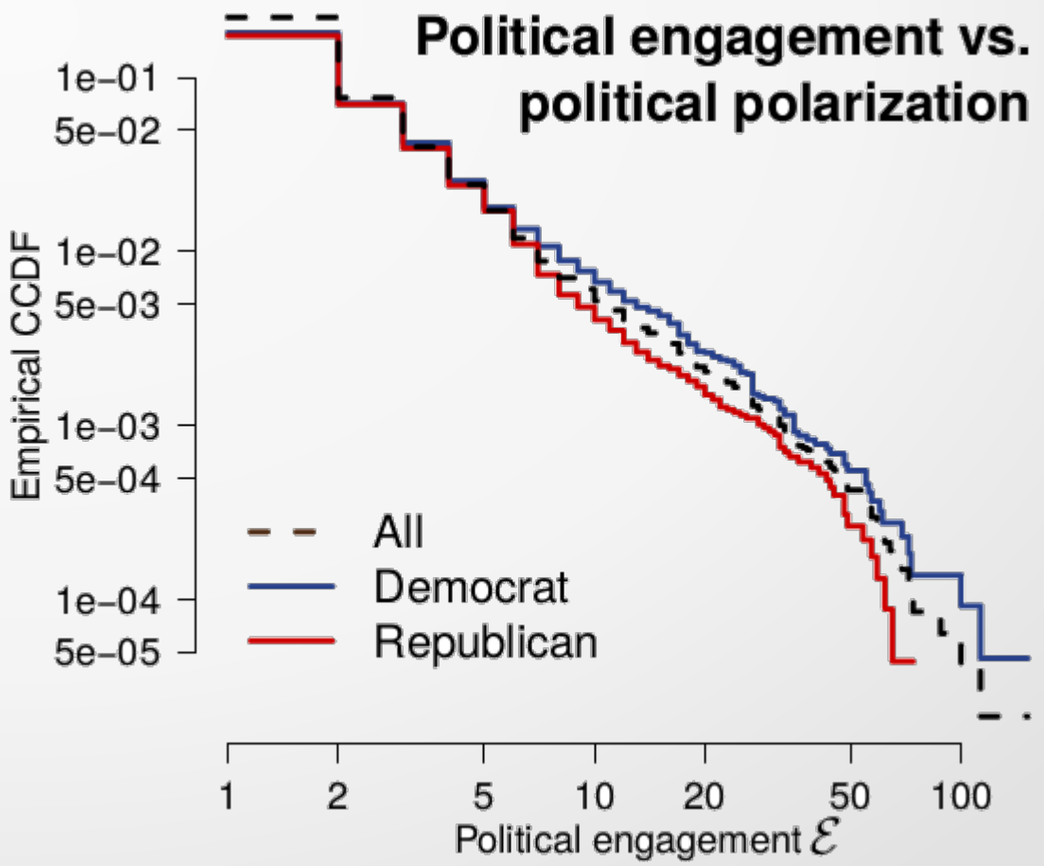
For each user *i*:

- dem_i – #democrat hashtags
- rep_i – #republican hashtags

$$\mathcal{P}(u_i) = \frac{rep_i - dem_i}{rep_i + dem_i}$$

$$\mathcal{E}(u_i) = rep_i + dem_i$$





Botness score and bot detection

Bot detection:

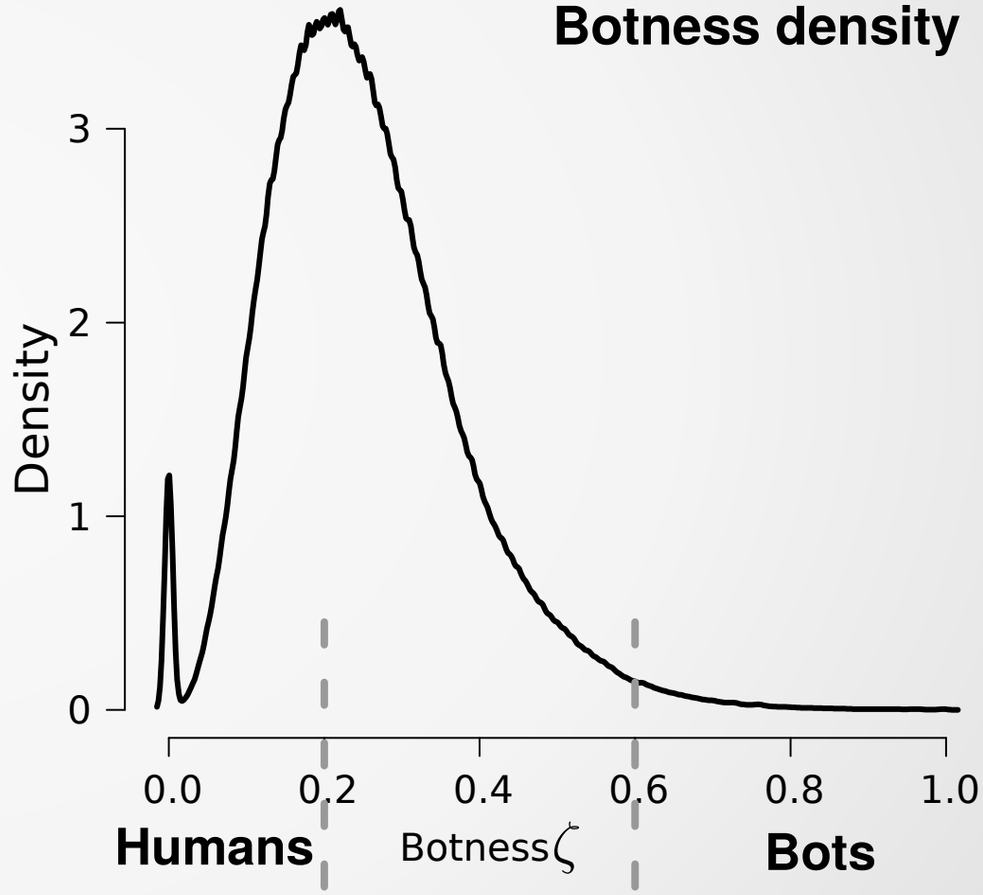
- **BotOrNot** [David et al, ICWSM 2016]
  - RandomForest classifier
  - more than 1000 features from metadata
    - 0 – very likely human
    - 1 – very likely bot

- *1.45*M users

Botness and four populations

Four reference population:

Population	Effective
All	1,451,388
Protected	45,316
Human	499,822
Suspended	10,162
Bot	17,561



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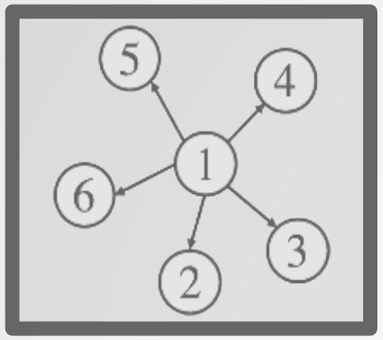

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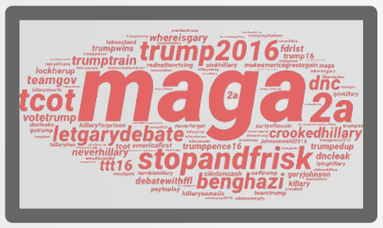

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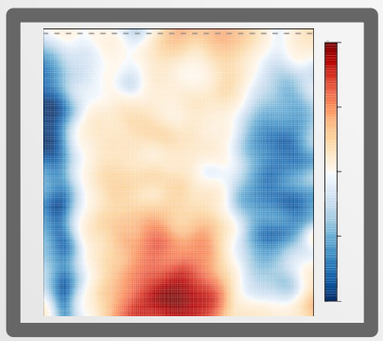
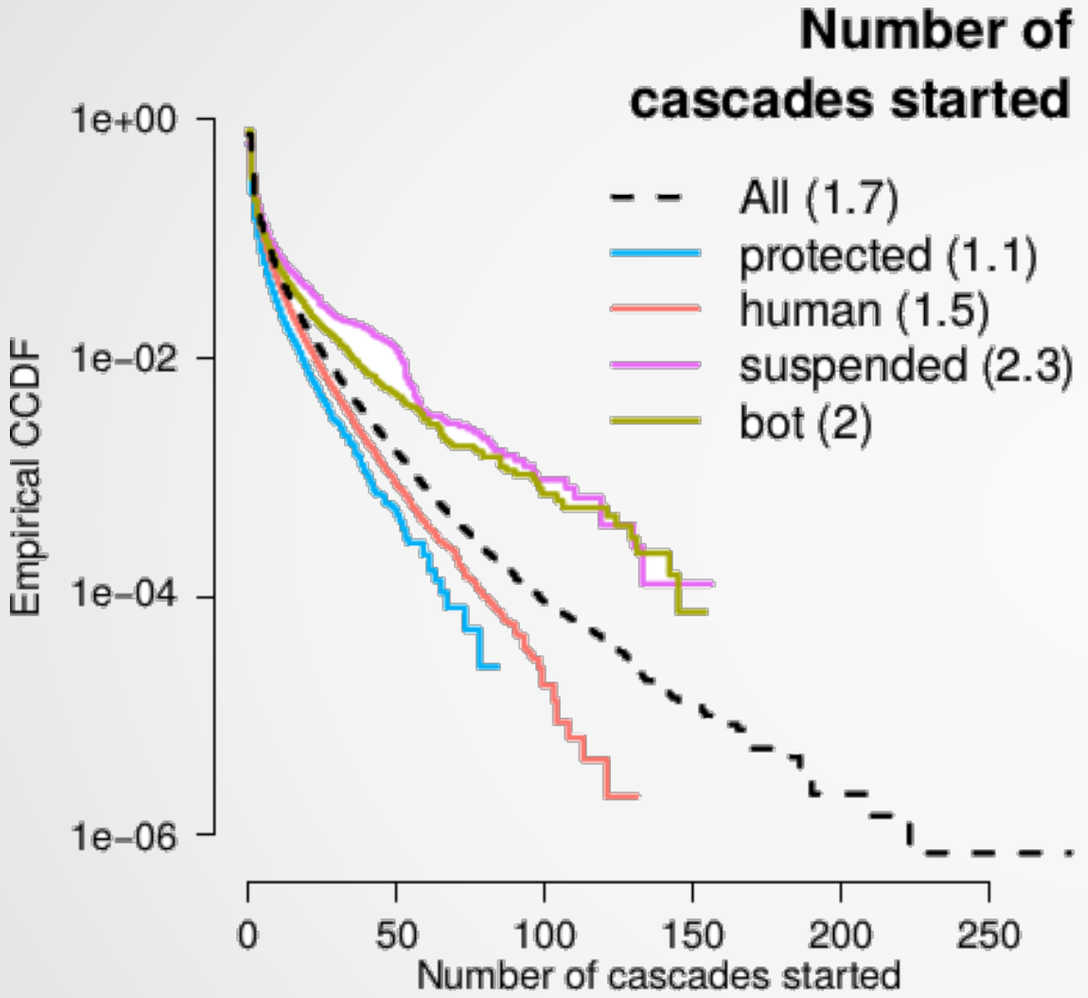
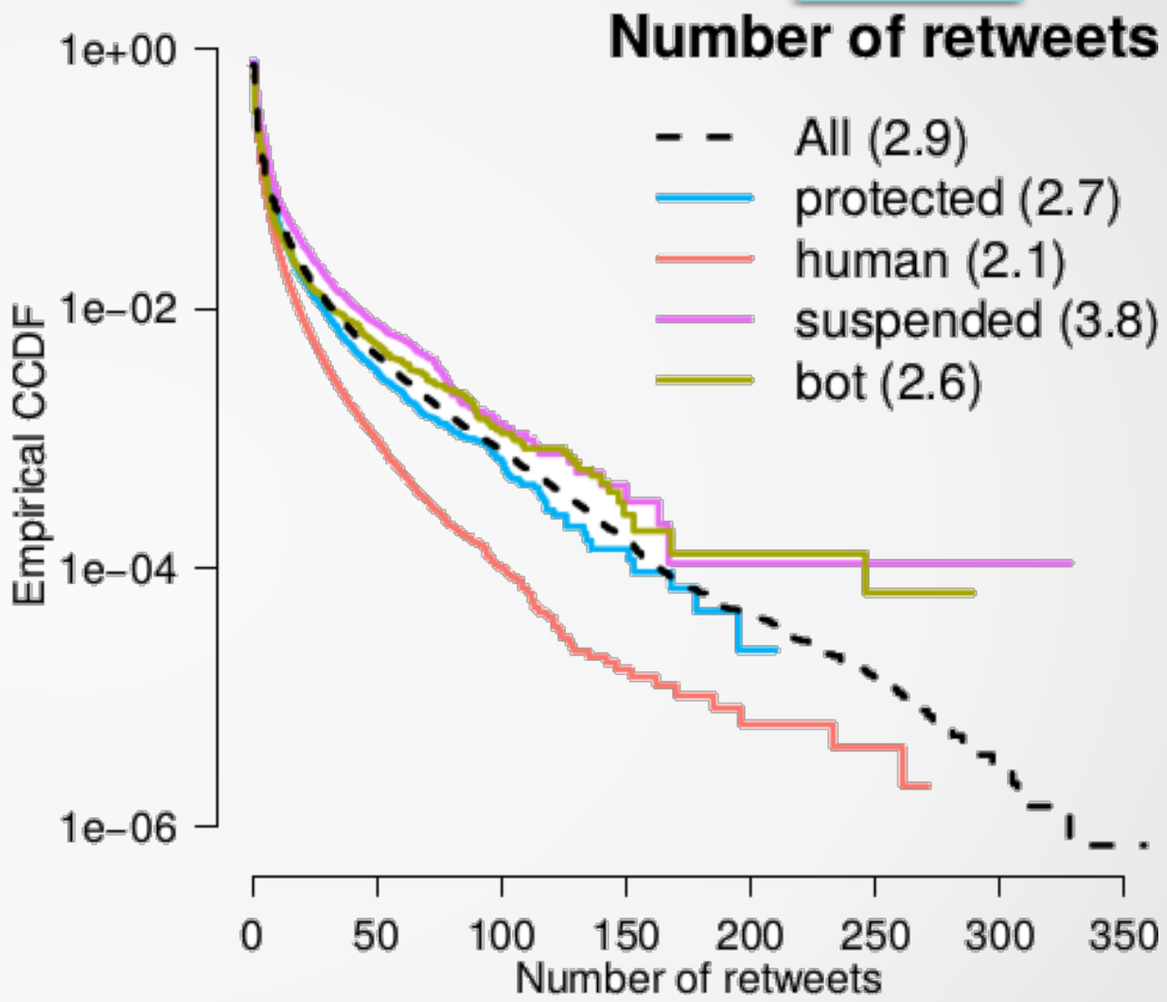


Analyzing political behavior of bots

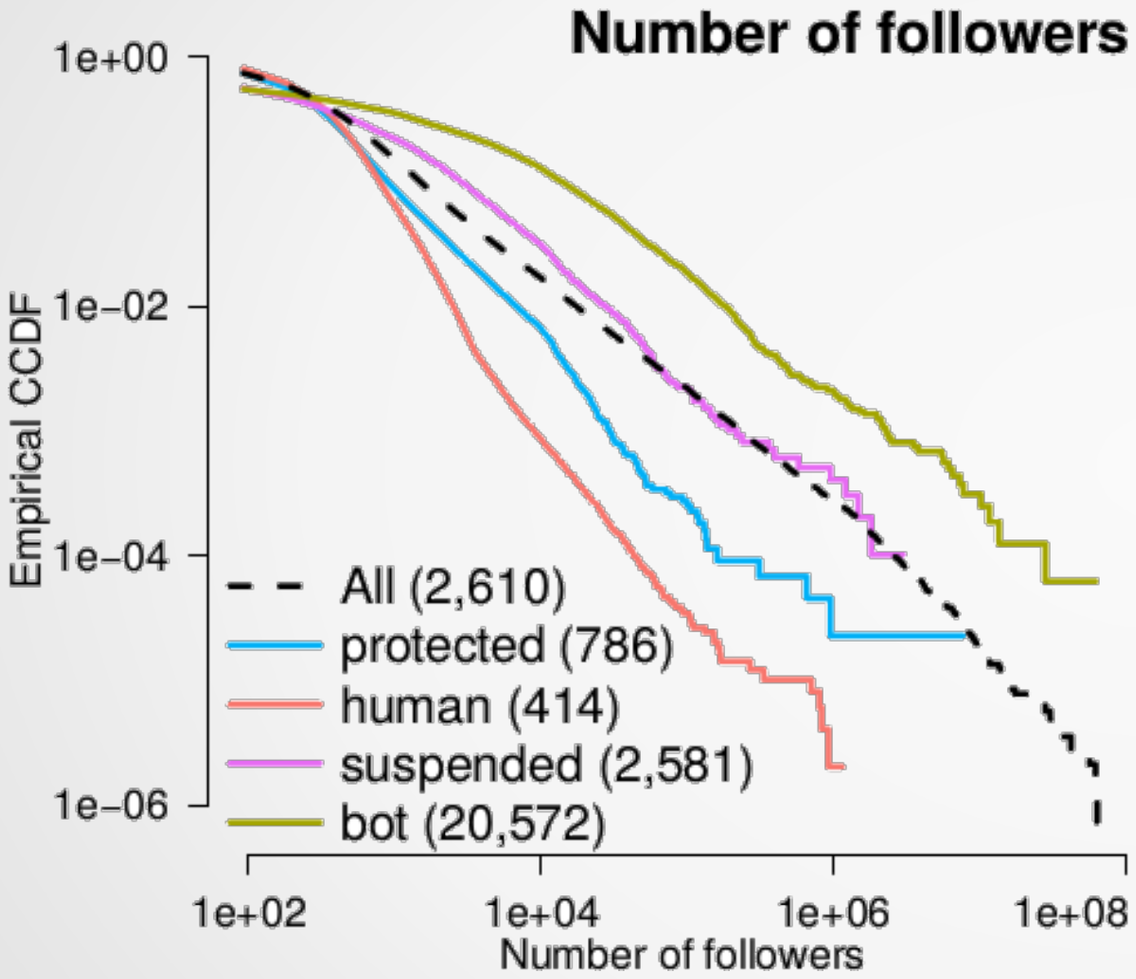
Activity across four populations (1)

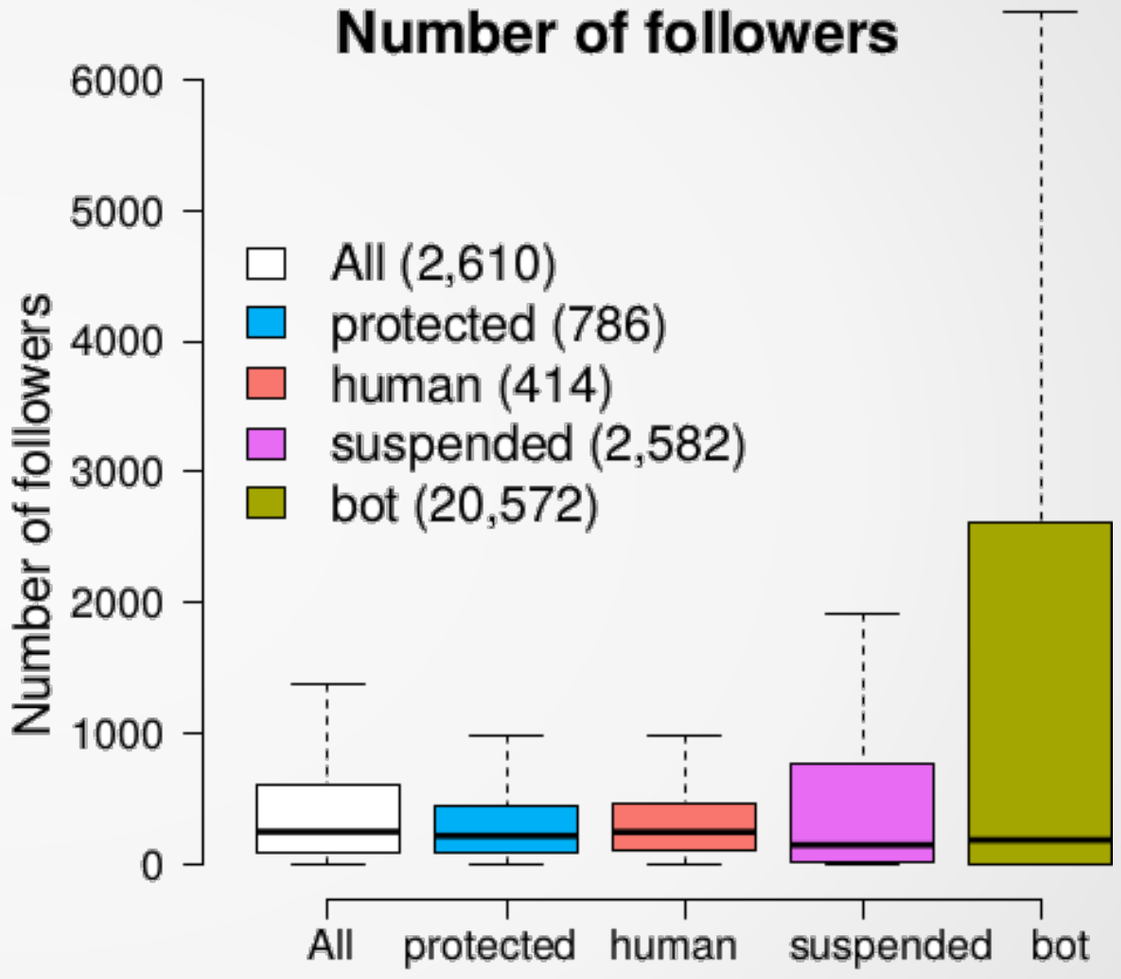




Bots and **Suspended** are more active than **Humans** and **Protected**

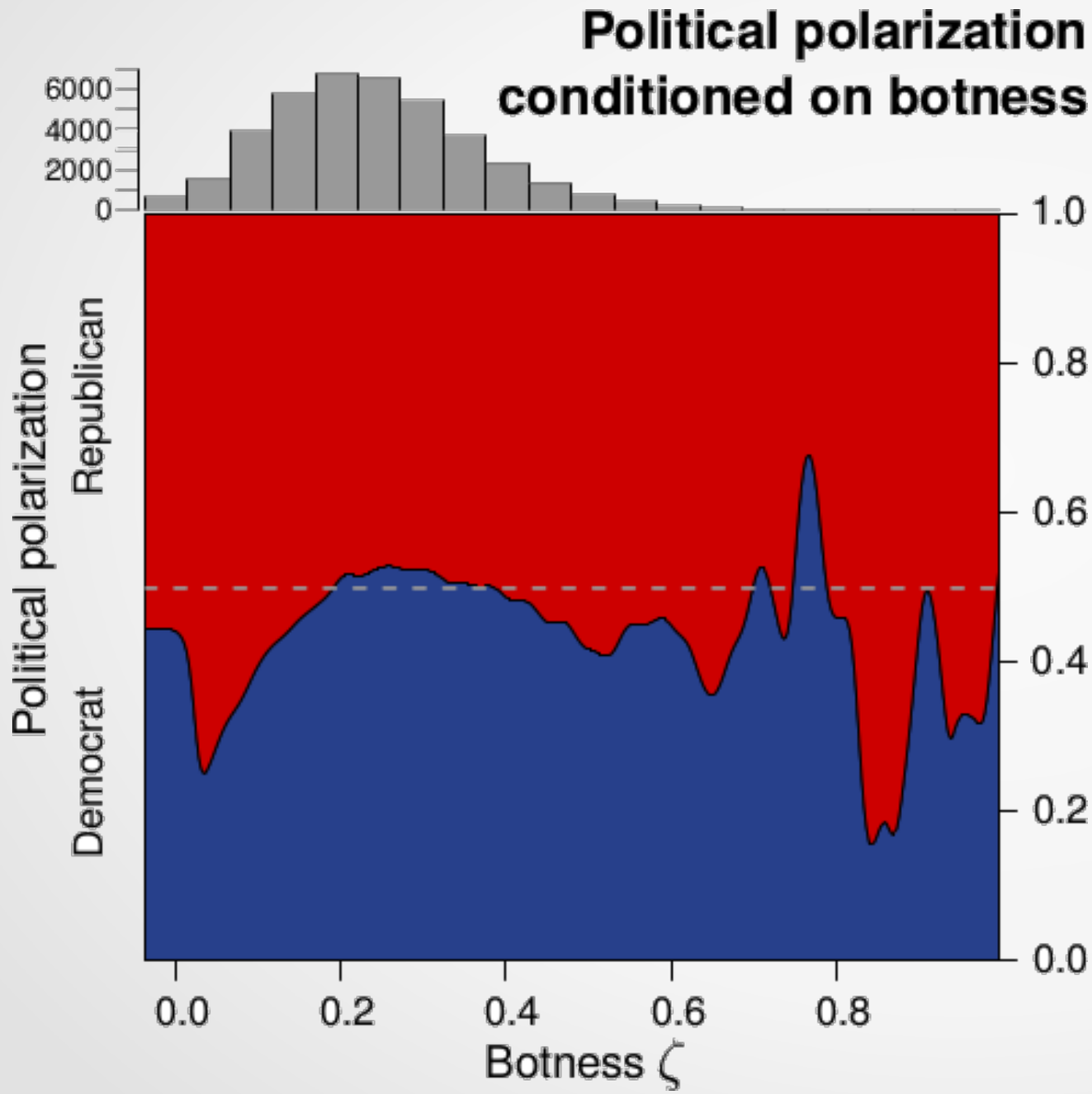
Activity across four populations(2)





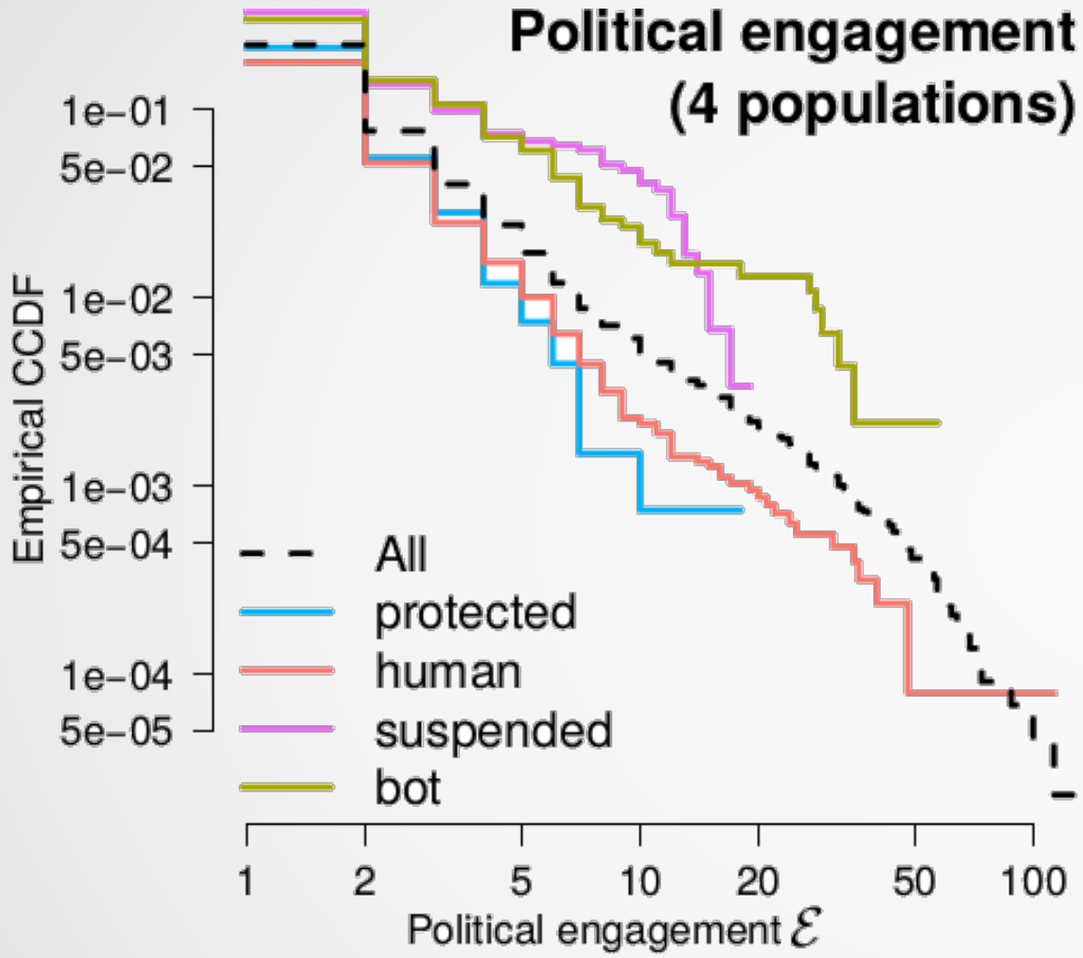
Some **Bots** are highly followed,
while most are ignored

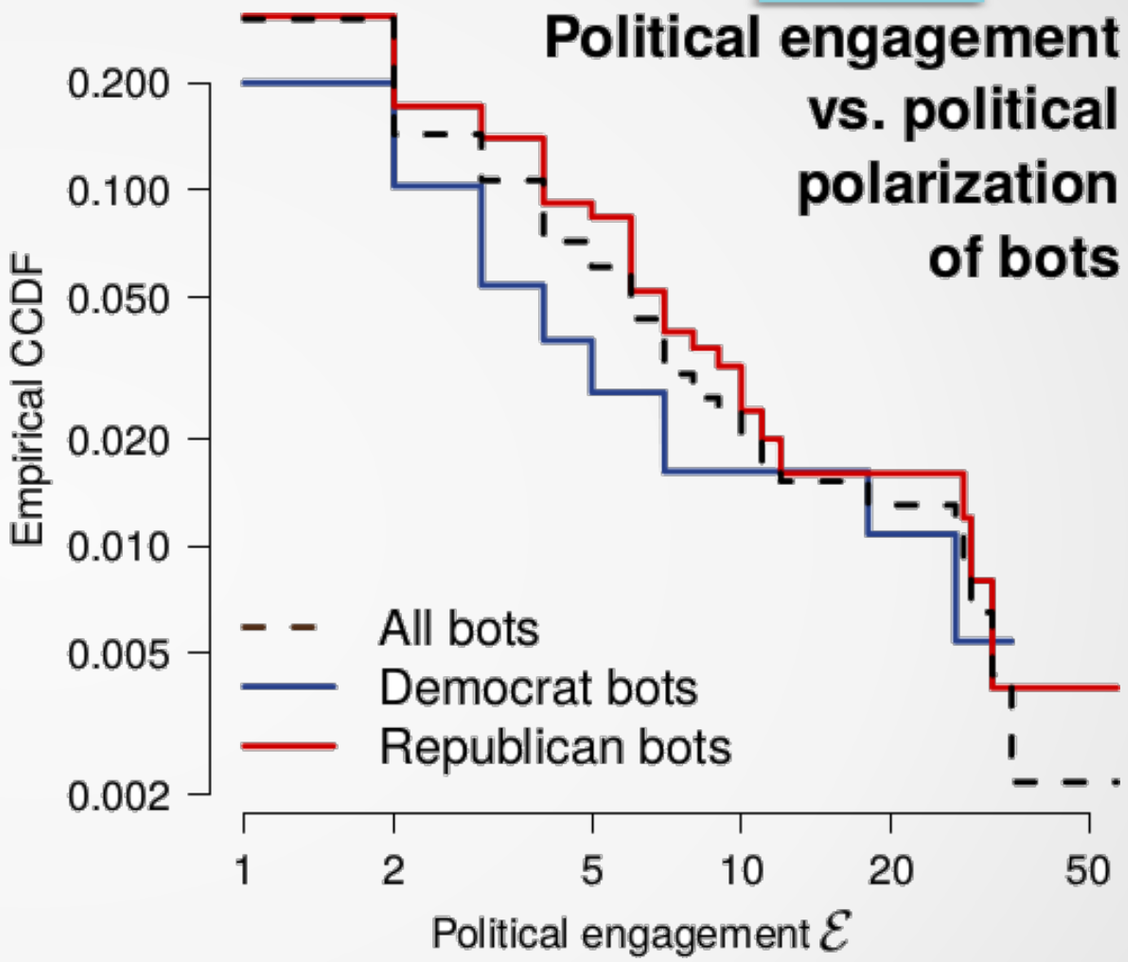
Botness and political polarization



Bots are more likely to be pro-Republican.

Botness and political engagement

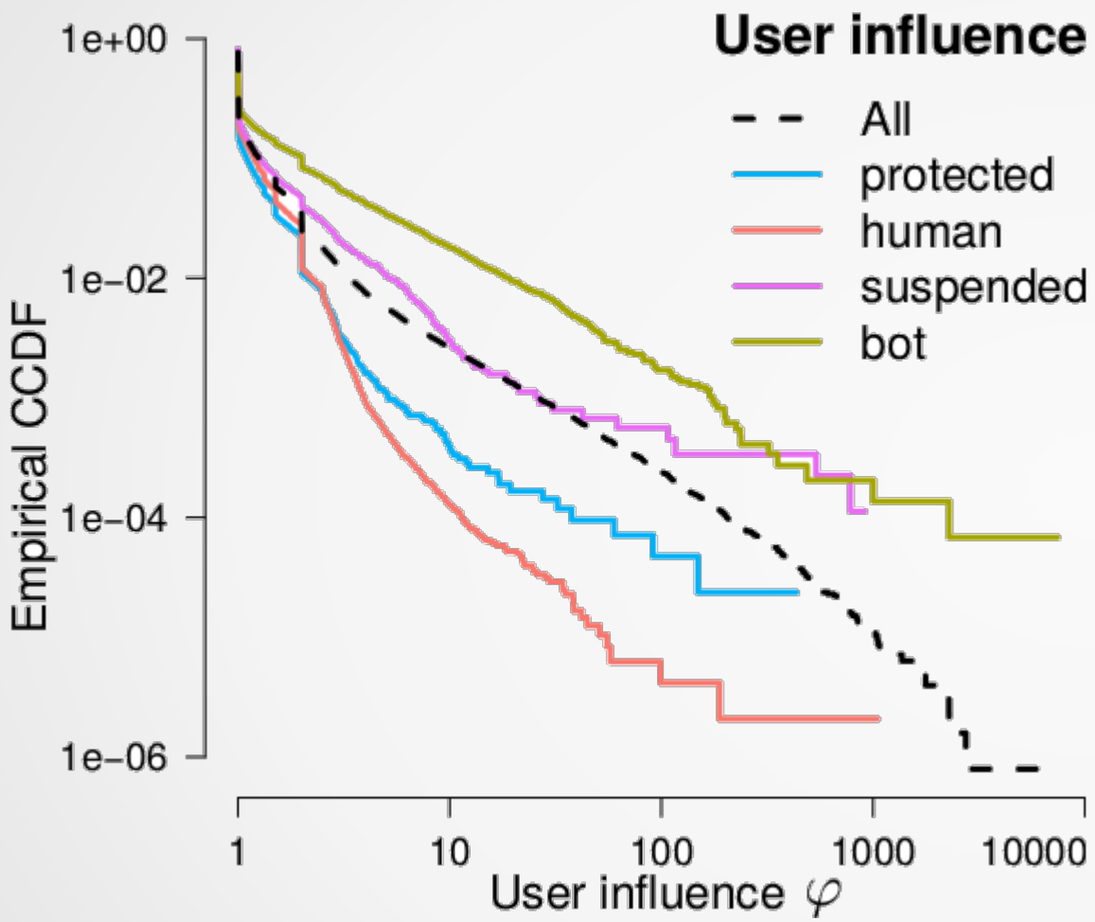


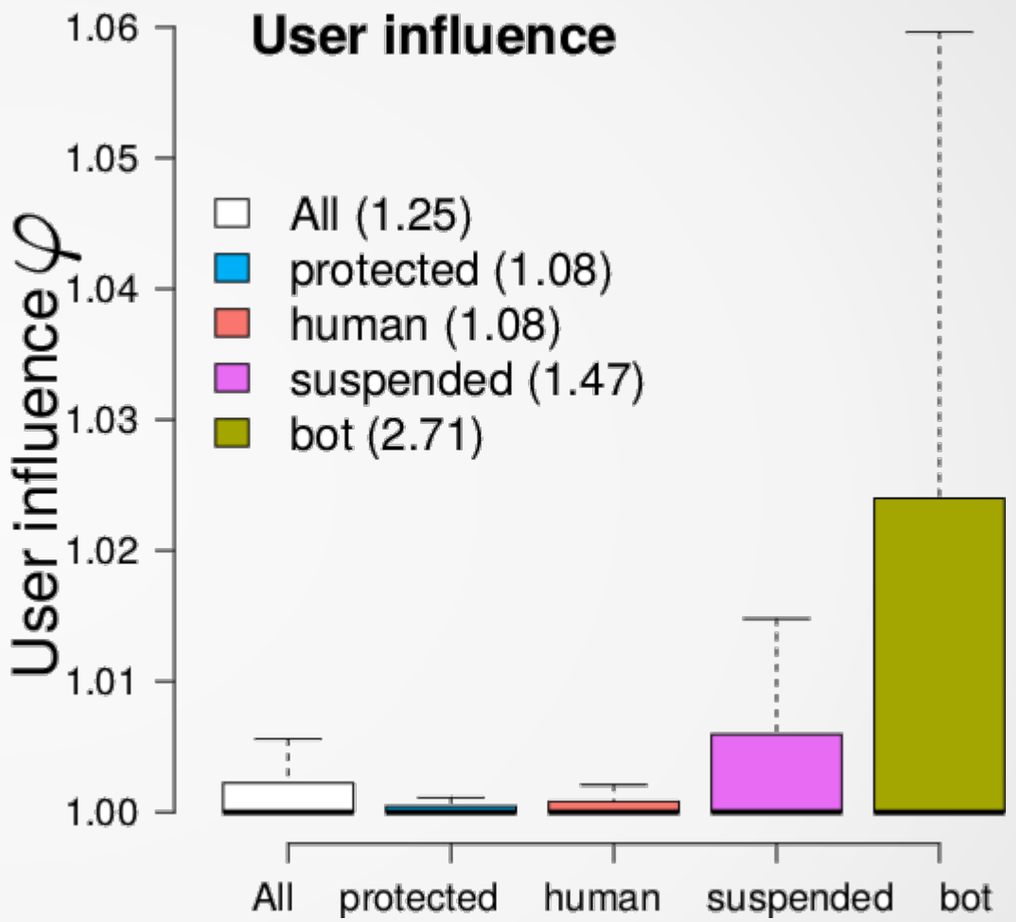


Bots are more engaged than **Humans**

pro-Republican **Bots** are more engaged than pro-Democrat **Bots**

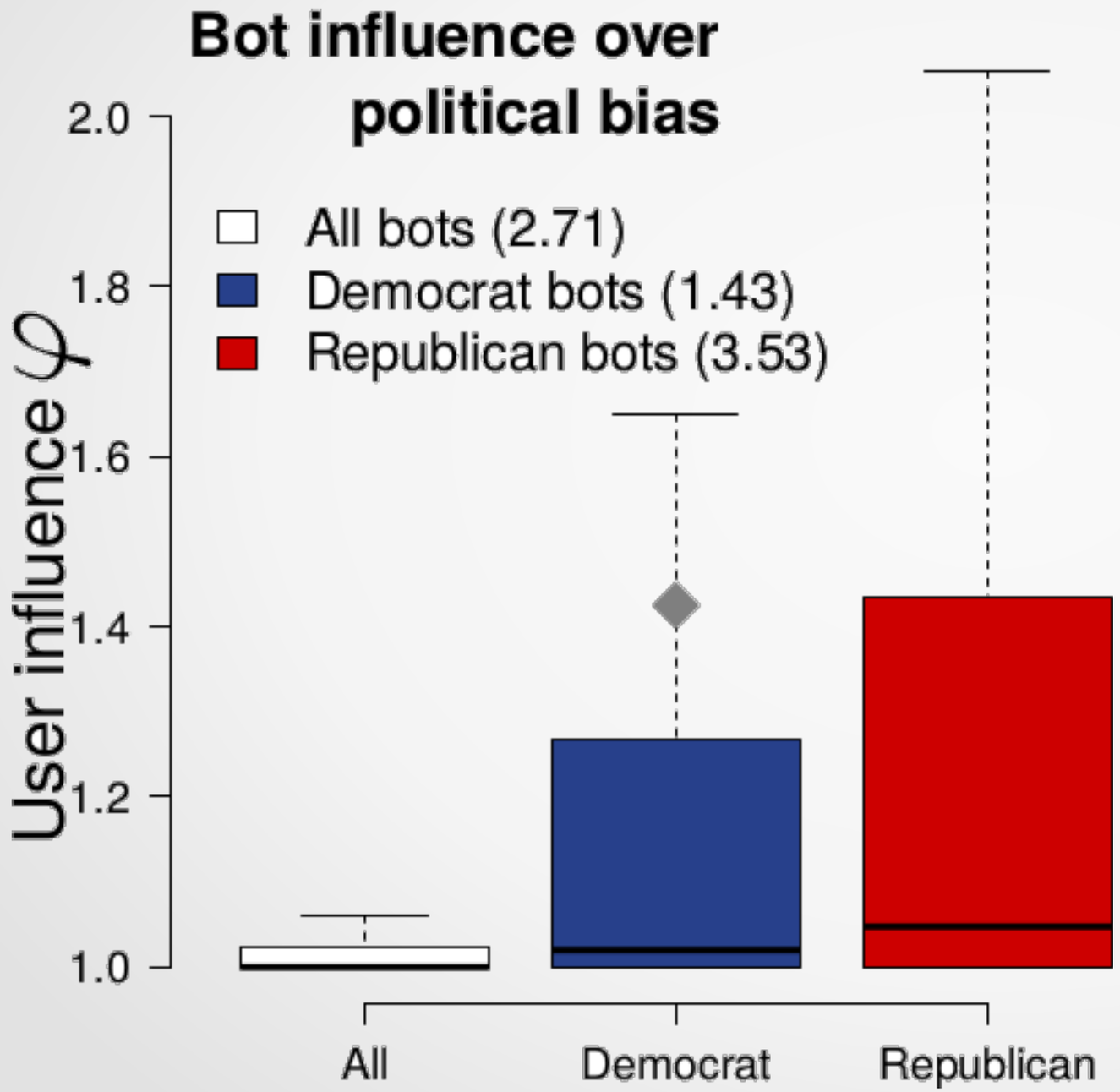
User influence across 4 populations





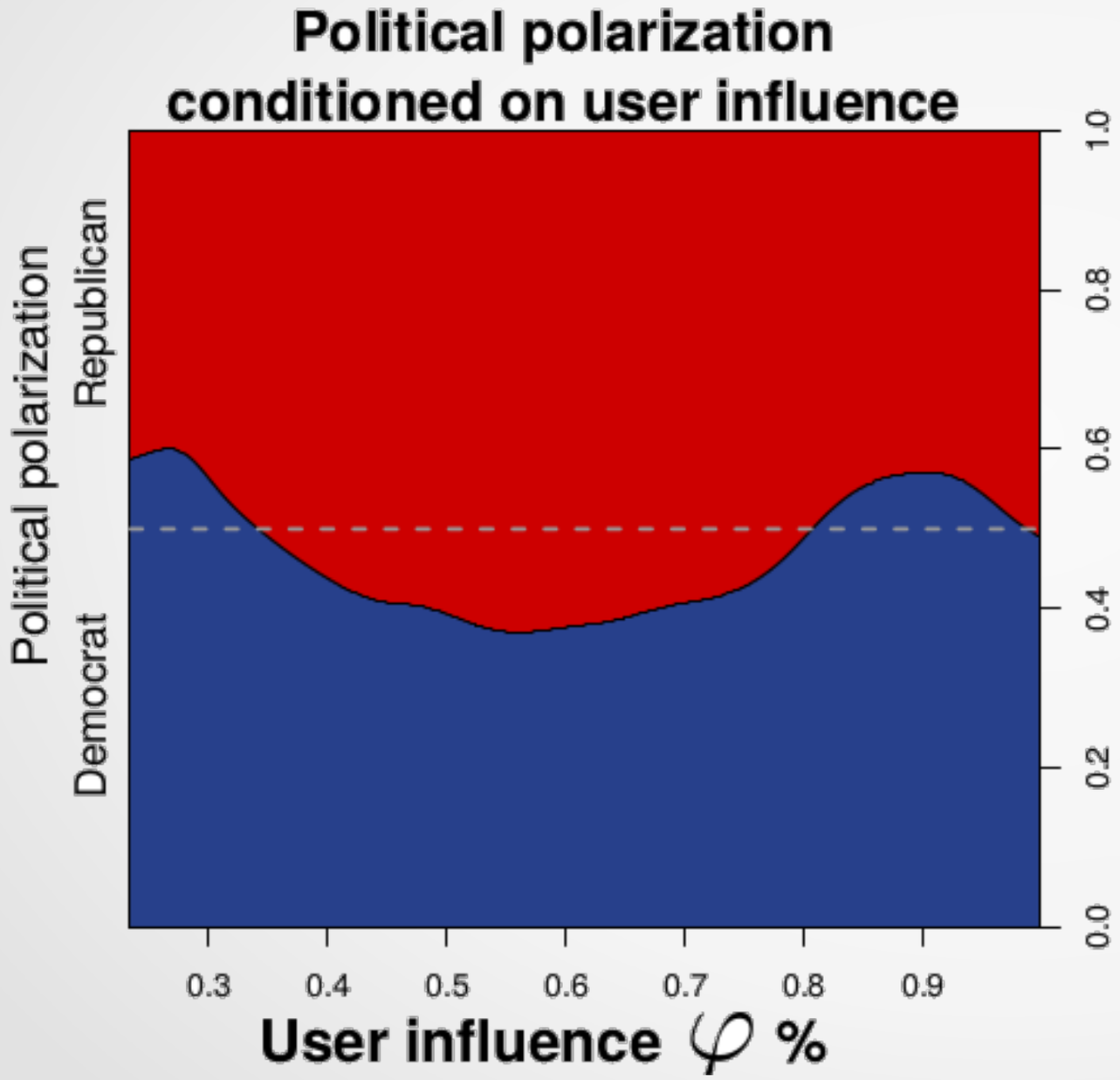
The average **Bot** has 2.5 times more influence than the average **Human**

Influence of Bots



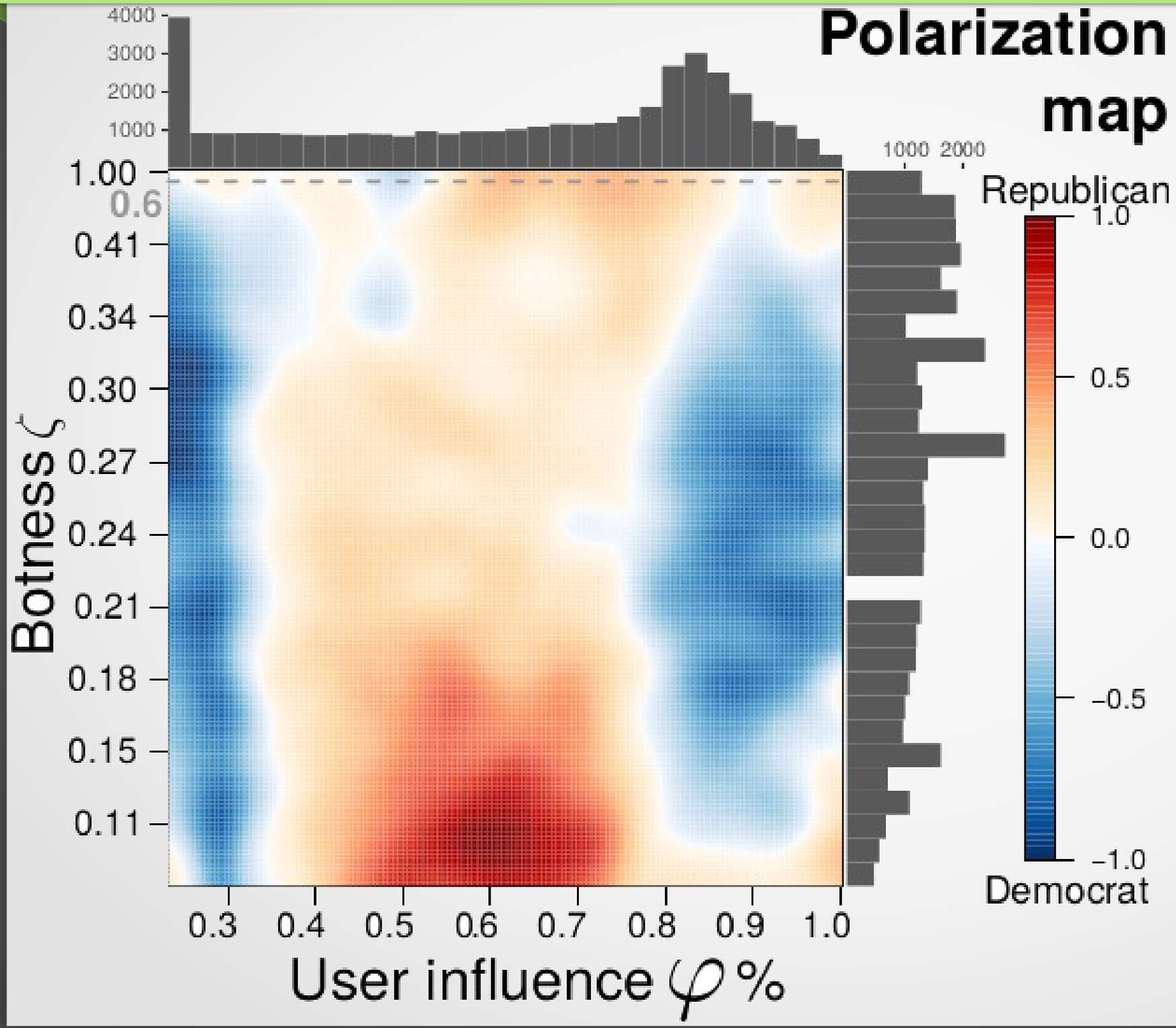
The average pro-Republican **Bot** is twice as influential as the average pro-Democrat **Bot**

User influence & polarization

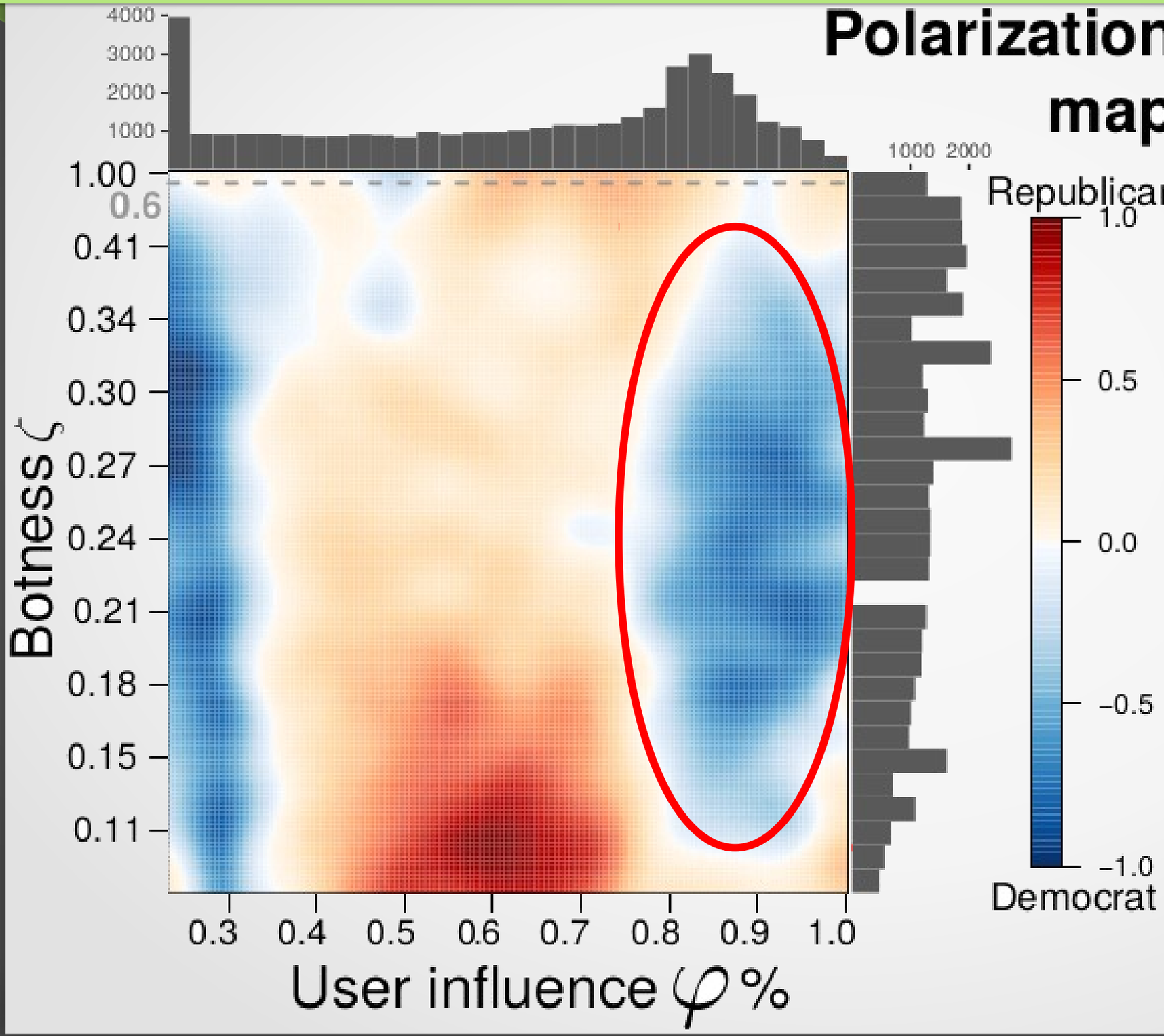


Very highly influential users are more likely to be pro-Democrat

Polarization map



Polarization map



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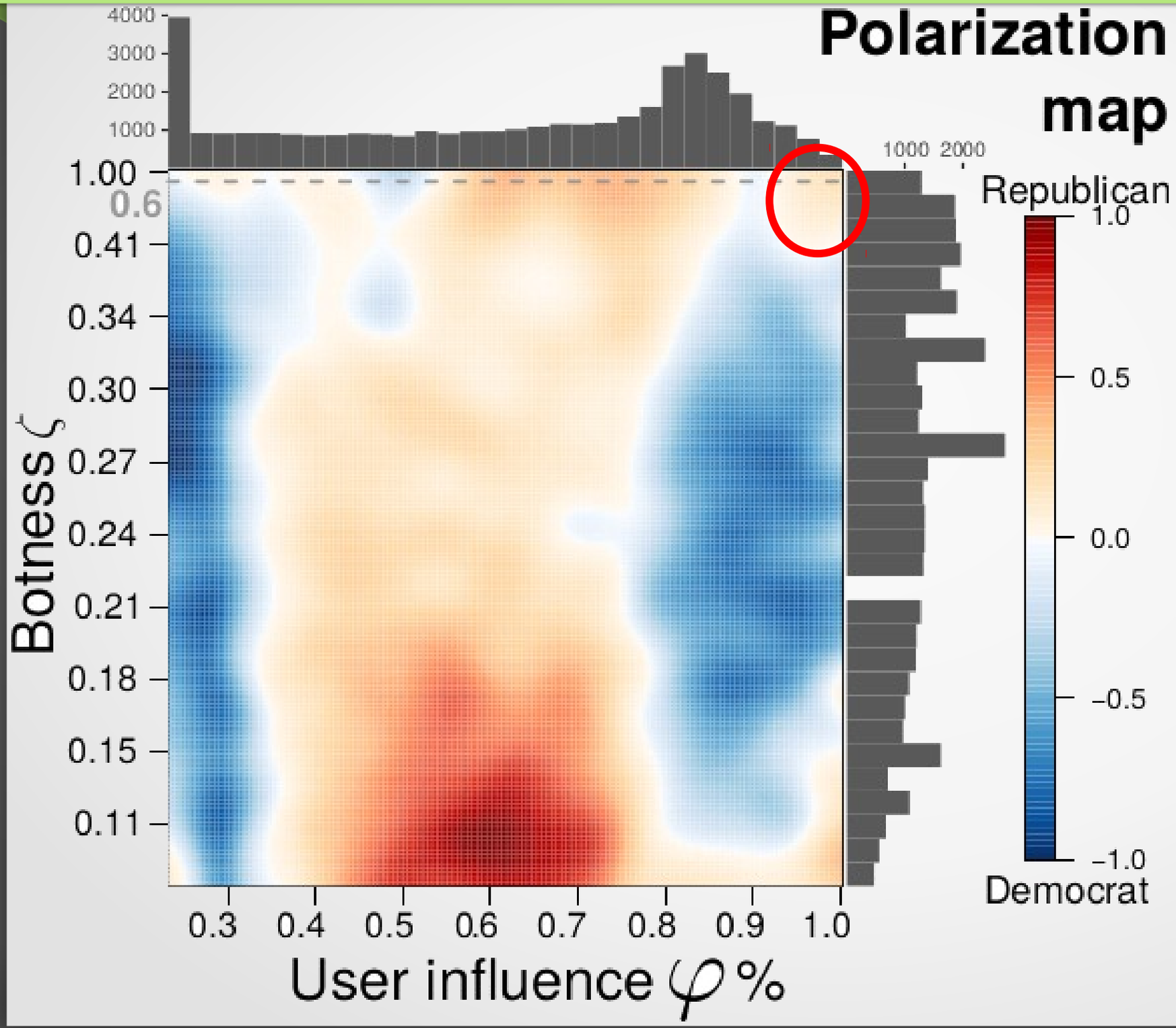

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Highly influential **Bots** are pro-Republican

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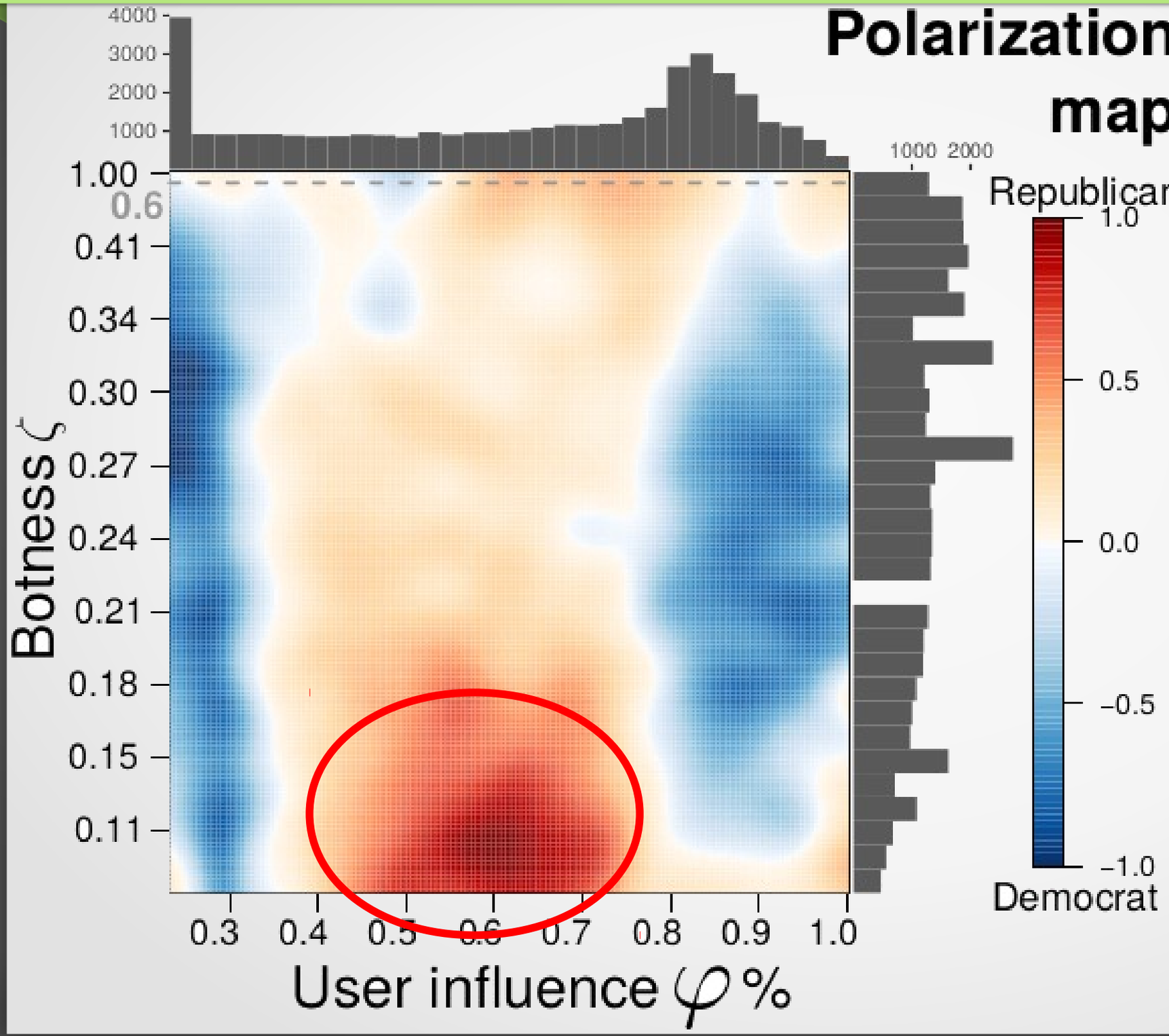

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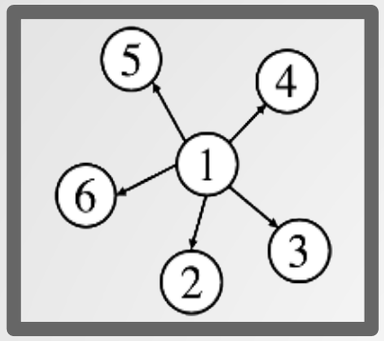
Highly influential **Bots** are pro-Republican

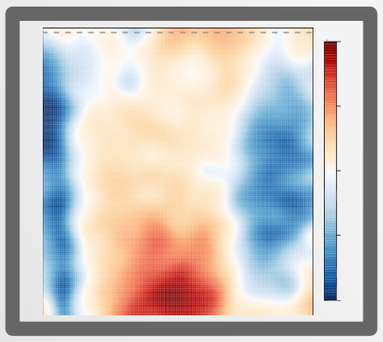
Mid-influential users are Republican humans

Summary



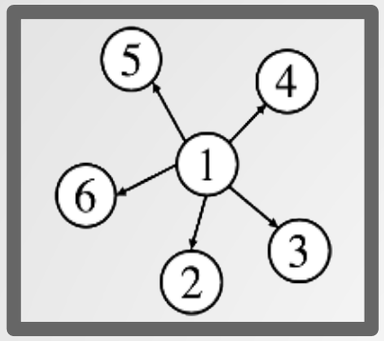
A scalable algorithm to estimate user influence from a large number of retweet cascade, in which structure is not observed

Four new measures to quantify the influence, the political partisanship and botness of Twitter users



An in-detail analysis of the political discussions and the influence of socialbots during the first U.S. Presidential elections debate.

Summary



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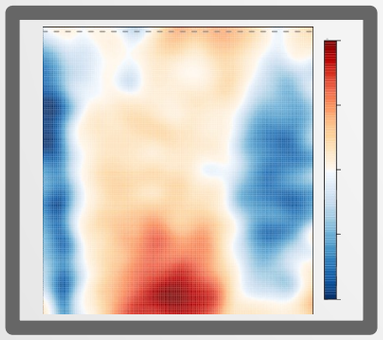

An in-detail analysis of the political discussions and the influence of socialbots during the first U.S. Presidential elections debate.

Limitations:

Organizational accounts appear as **Bots**; Twitter crack-down on bots; simplistic binary partisanship characterization (e.g. independent voters)

Future work

Open/closed questions about automated bots:

- ✓ were they influential during the democratic process?
- ✓ did they have political partisanship?
- ✗ did they infiltrate the political discourse?
- ✗ did they manipulate public opinion at scale?
- ✗ were they instrumental for the results of the elections?

*"Where republican **Bots** more influential than democrat **Humans**?"*

Thank you!

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