Did State-sponsored Trolls Shape the 2016 US Presidential Election Discourse? Quantifying Influence on Twitter

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Joint work with
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Overview

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Motivation

Disinformation campaigns on 2016 US Election

The Russian efforts to manipulate the outcome of the 2016 US Election were unprecedented in terms of the size and scope of the operation.

- Millions of posts across multiple social media platforms – in an effort to mobilize, suppress, or shift votes.

Our goal: We quantify the influence of the so-called "troll" accounts together with the virality of information that they spread on Twitter during that period.

Datasets

Our Twitter dataset: Tweets collected from Sept 21st to Nov 7th, 2016. The Hashtags were related to US elections.

	real-users	trolls
user-IDs	9,9M	822
Total tweets	152,5M	35,5K

Ground-truth data: 25,1 million tweets by 8275 trolls

- Twitter released a large collection of state-sponsored troll activities as part of Twitter's election integrity efforts.
- These troll IDs served as ground-truth identifiers of the troll accounts in our tweets collection.

Retweet Cascades

	Regular Users	Trolls
Total users	3,6M	233
Root users	8,2K	12
Root tweets	46K	423
Retweeters	3,6M	228
Total retweets	19,6M	
Total URLs	44K	

- We focused on retweet cascades with a minimum of 100 retweeters.
  - Each root tweet-text contains at least one web or media URLs (i.e., videos and photos).

Methodology Tools

Analysis Overview

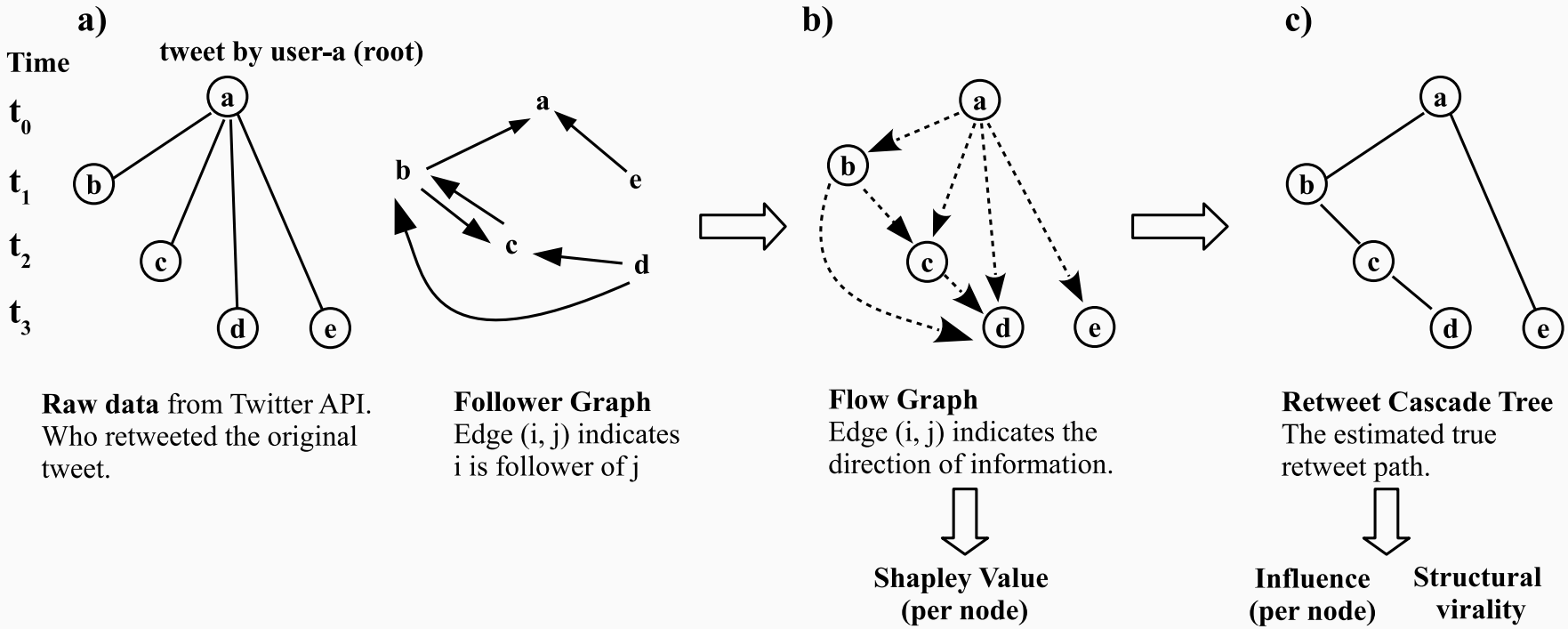
Interaction-graph:

- Users' actions $\Rightarrow$ *Edges*
  - Actions: replies, mentions
  - Directed multigraph (multiple edges may connect the same pair of users)
- Graph Analysis: in–degree; out–degree; k–core

Retweet Cascades:

- Influence metrics:
  - Flow–graphs $\Rightarrow$ Compute the Shapley Value–based centrality
  - Retweet Cascade–trees $\Rightarrow$ Compute the Structural virality
- Top–k Analysis: which are the influential: real–users OR trolls?

A toy-example



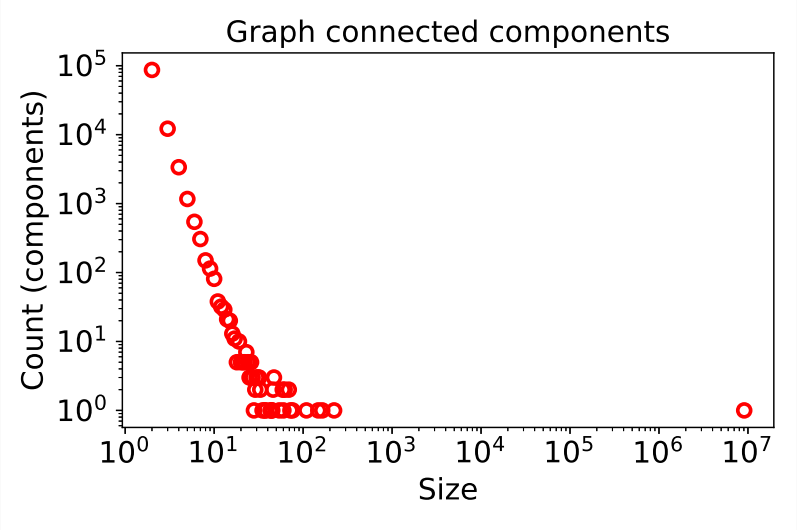
Given a retweet cascade:

- **Flow Graph:** the full information flow between the retweeters
- **Retweet cascade tree:** Each retweeter has been influenced by the friend who recently retweeted the root-tweet (i.e., who was influenced by whom)

Results

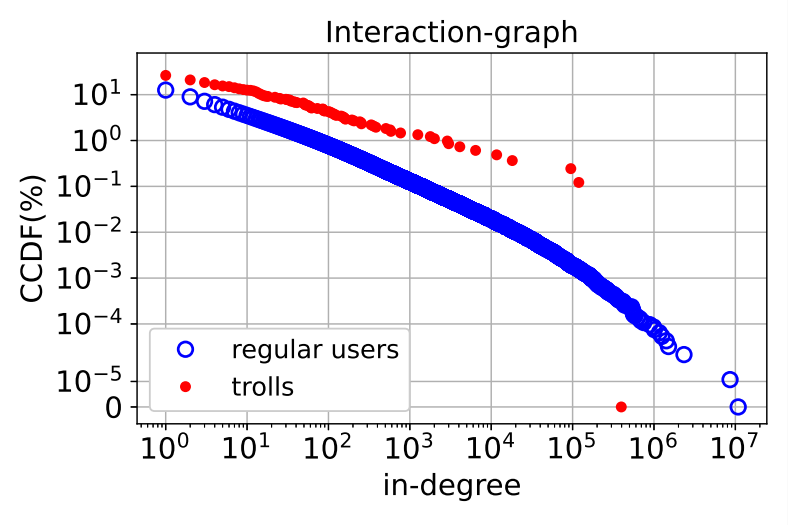
Graph Topology

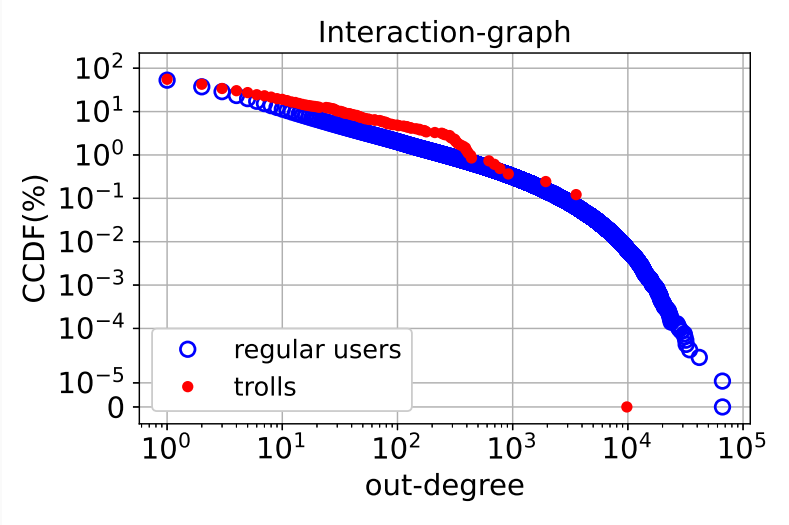
Connected components



- Largest component: 9M users; 82,6M edges and 815 trolls
- 105K connected components, in total
  - The second larger one has 223 nodes, only

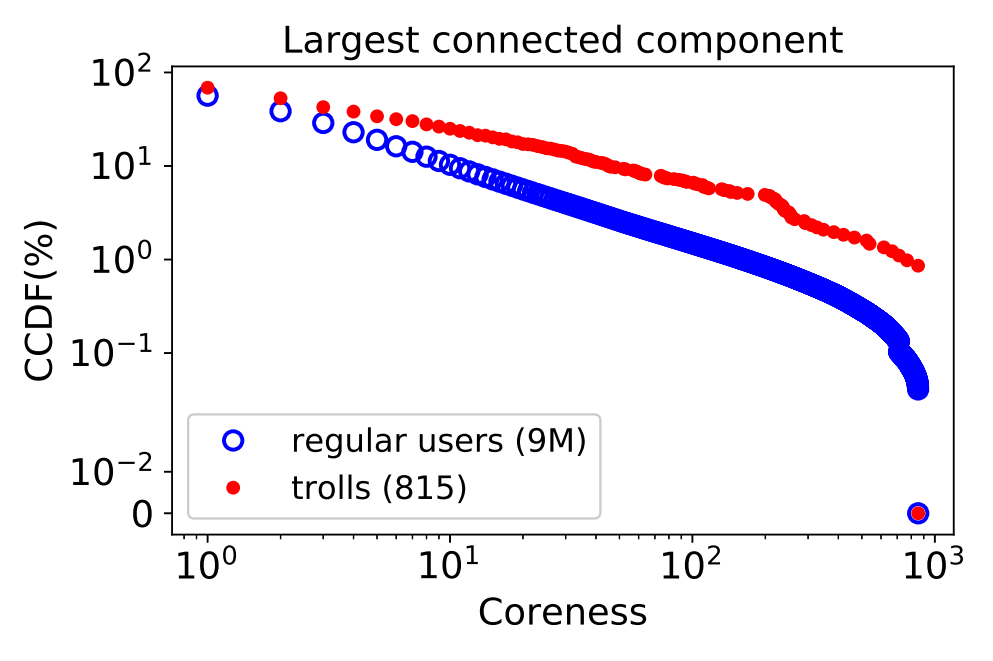
In-Degree & Out–Degree





- In-degree: a measure of popularity
  - **in-degree>1K:** 12 trolls vs 12K regular users
    - 285 trolls and 2.3M regular users have non-zero in-degree
- Out-degree: a measure of sociability/extroversion.
  - **out-degree>1K:** 3 trolls vs 29.6K regular users
    - 675 trolls and 8.5M regular users have non-zero out-degree

k–core decomposition

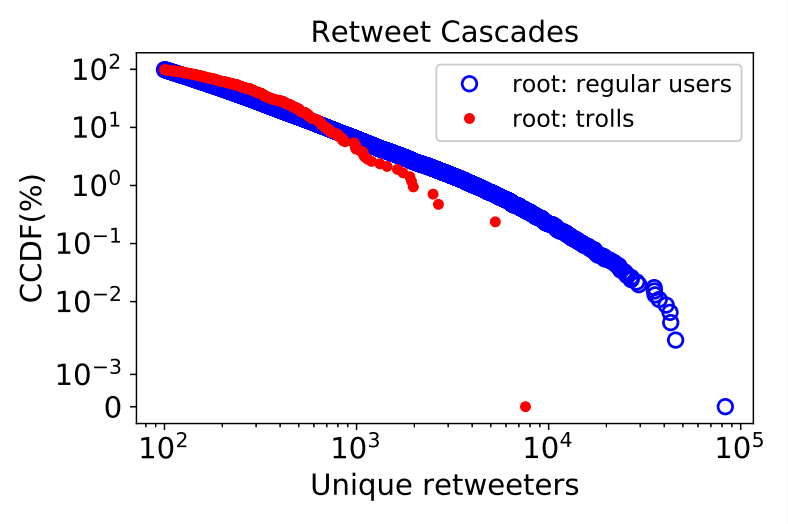


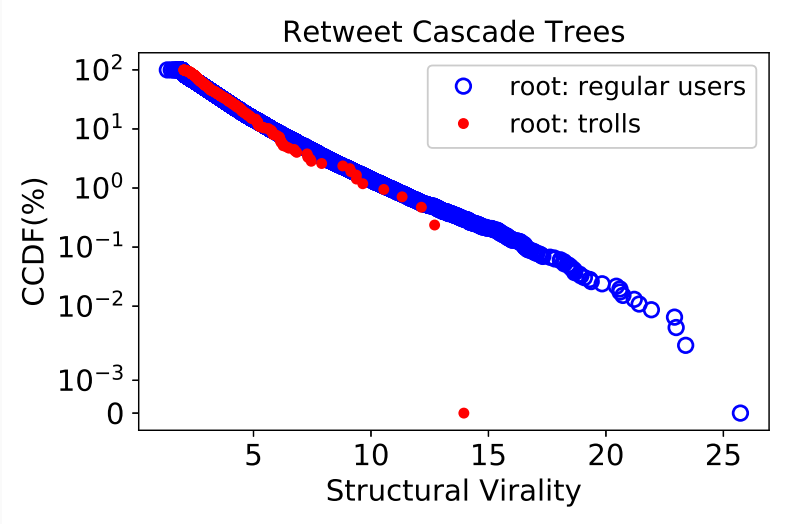
- Only **seven trolls** are part of the largest 854-shell
  - The k-core is the maximal subgraph where each node has a degree of at least k. The k-shell is the subgraph of the nodes that belong to k-core but not to $(k+1)$-core. A node has *coreness* k if it belongs to the k-shell.

Results

Viral Cascades

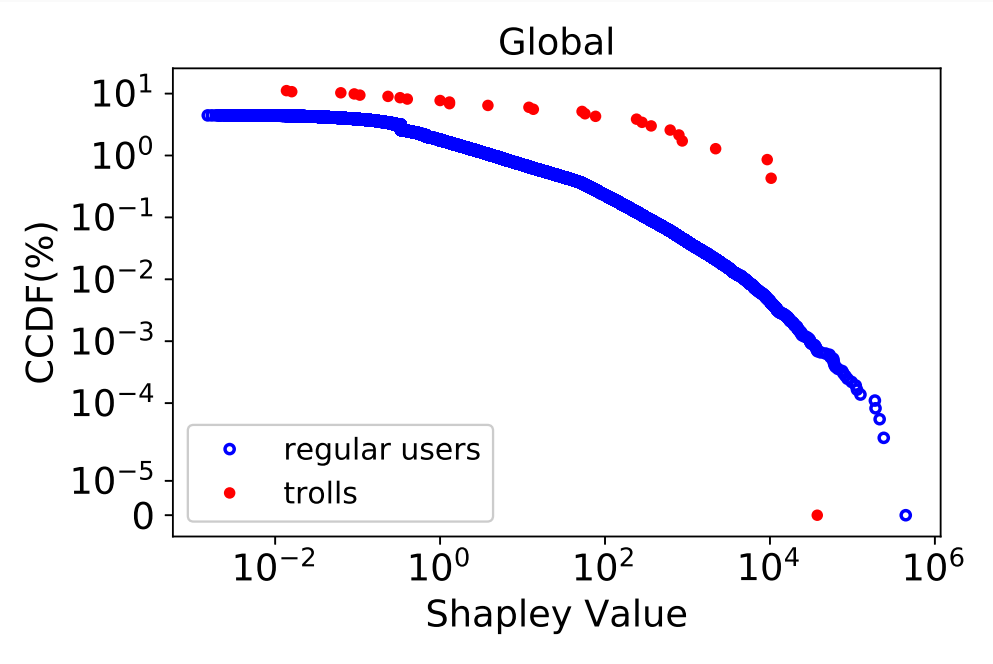
Structural Virality





- **Initiated by trolls:** 18 cascades have more than 1K retweeters
- **Initiated by regular users:** 2,890 cascades have more than 1K retweeters

Shapley Value-base Centrality



- 27 out of 233 trolls and 161K out of 3.6M regular users with non-zero Shapley Value.
  - i.e., only 27 trolls have a non-zero contribution to the diffusion of information by the retweet cascades

Results

Top K Analysis

Top-k influential users

How many trolls are in the top-1000?

Account-info	Ranking by-Shapley	Coreness
TEN_GOP	27	854
Pamela_Moore13	150	854
America_1st_	181	854
tpartynews	769	854

How many regular accounts have been suspended?

- 23% and 22% of regular accounts in the top-100 and top-1000, respectively, have been suspended by Twitter, something that raises questions about their authenticity

Top-10 influential users

Account-info	Ranking by-Shapley	Coreness
HillaryClinton	1	854
LindaSuhler	2	854
realDonaldTrump	3	854
TeamTrump	4	854
wikileaks	5	854
WDFx2EU7 (suspended)	6	854
PrisonPlanet	7	854
FoxNews	8	854
magnifier661 (suspended)	9	854
CNN	10	854

Average values: Regular Users vs Trolls

		Regular Users	Trolls
Interaction-graph:	In-degree	18.16	821.22
	Out-degree	18.23	38.97
Largest Component:	Coreness	9.22	31.75
Retweet Cascades:	Shapley Value	3.21	269.02

The average "influence" of trolls was considerably larger than that of regular users. This indicates that the strategies these trolls followed to attract and engage regular users were sufficiently effective.

Conclusion

- Only four state-sponsored troll accounts were influential
- The driving force of virality and influence in the network came from regular users
- On average, troll accounts were tens of times more influential than regular users were
- 23% and 22% of regular accounts in the top-100 and top-1000, respectively, have now been suspended by Twitter

Thank you!