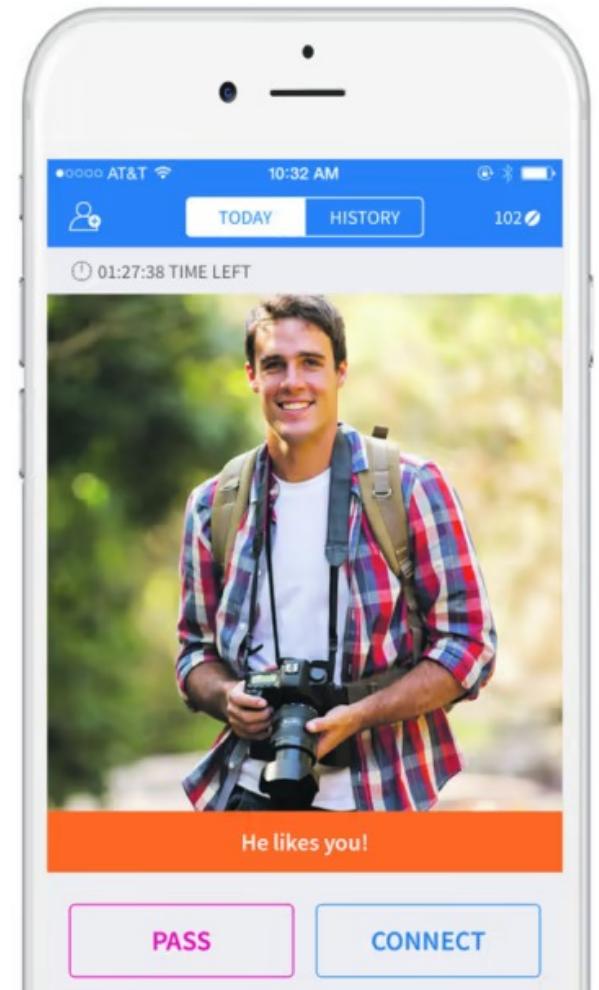
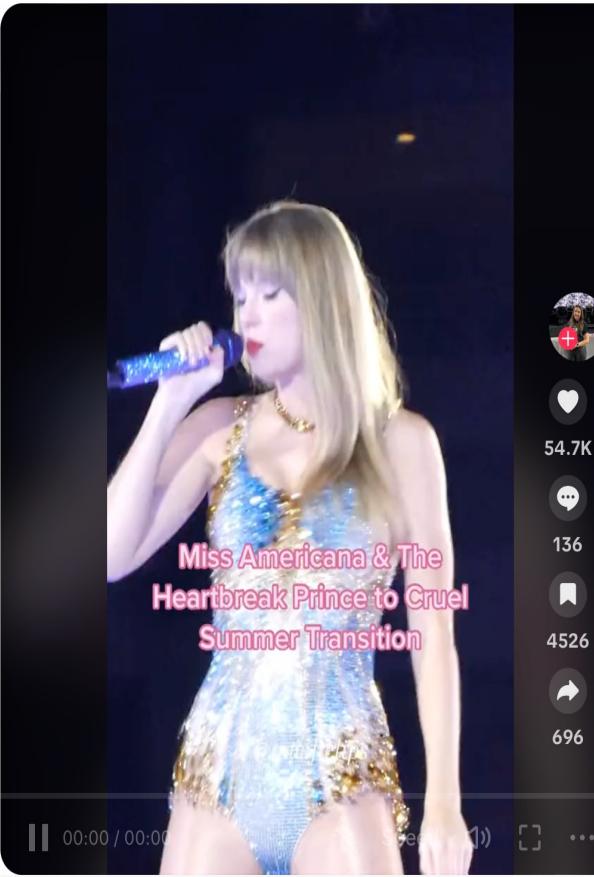
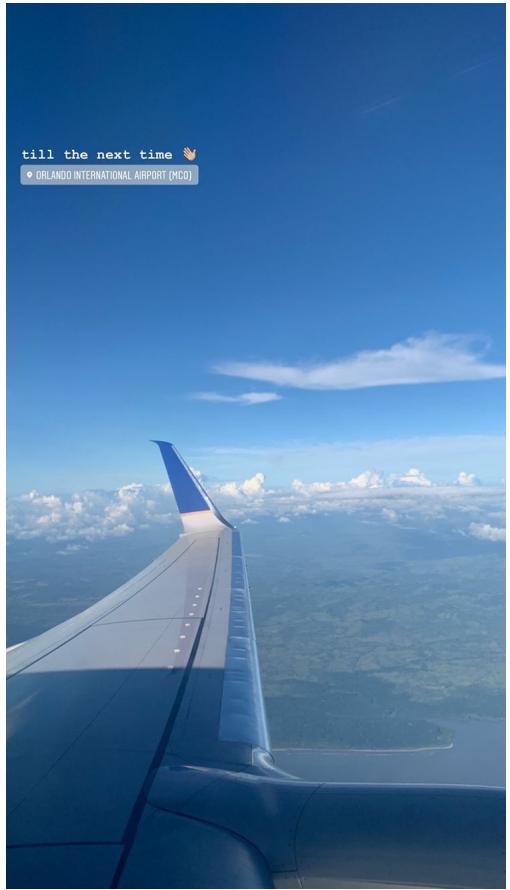


Information Manipulation by Social Media Bots through a Network Analysis View

Lynnette Hui Xian Ng
Carnegie Mellon University
Societal Computing, School of Computer Science



Influencing People



Influencing People



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Warnu

Information Manipulation Persuasion



Warnu

Information Manipulation Persuasion Mind Control Power

EINE KLEINE CLIQUE?

In seiner Radio-Ansprache hat Hitler zugegeben, dass der Friedens-Putsch von deutschen Offizieren organisiert worden ist. Göring nannte in seiner Ansprache die Männer hinter der Bewegung „eine kleine Clique von ehemaligen Generälen.“

Hier sind die unbestreitbaren Tatsachen: Hitler und Himmler haben die militärische Leitung des Krieges gänzlich aus den Händen der Berufsoffiziere genommen. Unter den von Hitler abgesetzten Generälen sind:

Generalfeldmarschall Fedor v. Bock,
Generalfeldmarschall Walter v. Brauchitsch,
Generalfeldmarschall Ewald v. Kleist,
Generalfeldmarschall Wilhelm Ritter v. Leeb,
Generalfeldmarschall Walther von Lossow,
Generalfeldmarschall Erich v. Witzleben,
Generaloberst Ludwig Beck,
Generaloberst Freiherr v. Falkenhhausen,
Generaloberst Fritz Fromm,
Generaloberst Franz Halder,
Generaloberst Erich Höppner,
Generaloberst Richard Ruoff,
Generaloberst Wolfgang Strauss.

Es ist klar, dass es in Deutschland jetzt nur mehr zwei Seiten gibt: Die Seite der Kriegs-Verlängerer und die Seite der Friedens-Beschleuniger.

ZG-85

wochenlang mit Karren müssen. Kaschgar ist oder Chinesisch-Turf nur mehr dem Namen praktisch aber unter hier ein neuer Lieferant über den Hinterkopf hinzu, auf zu rettend!

clear
3) If
propri
no hi
4) I
show
whic

RENTREZ CHEZ VOUS
CHEZ NOUS
DELAI
REMEMBER THAT
AND THINK TWICE

—General Smuts, speaking to the Empire Parliament Association on November 25, 1943.
VORLAGE

Nous avons
l'ordre
d'attaquer tout
bateau de pêche
en haute mer
dans les zones
interdites

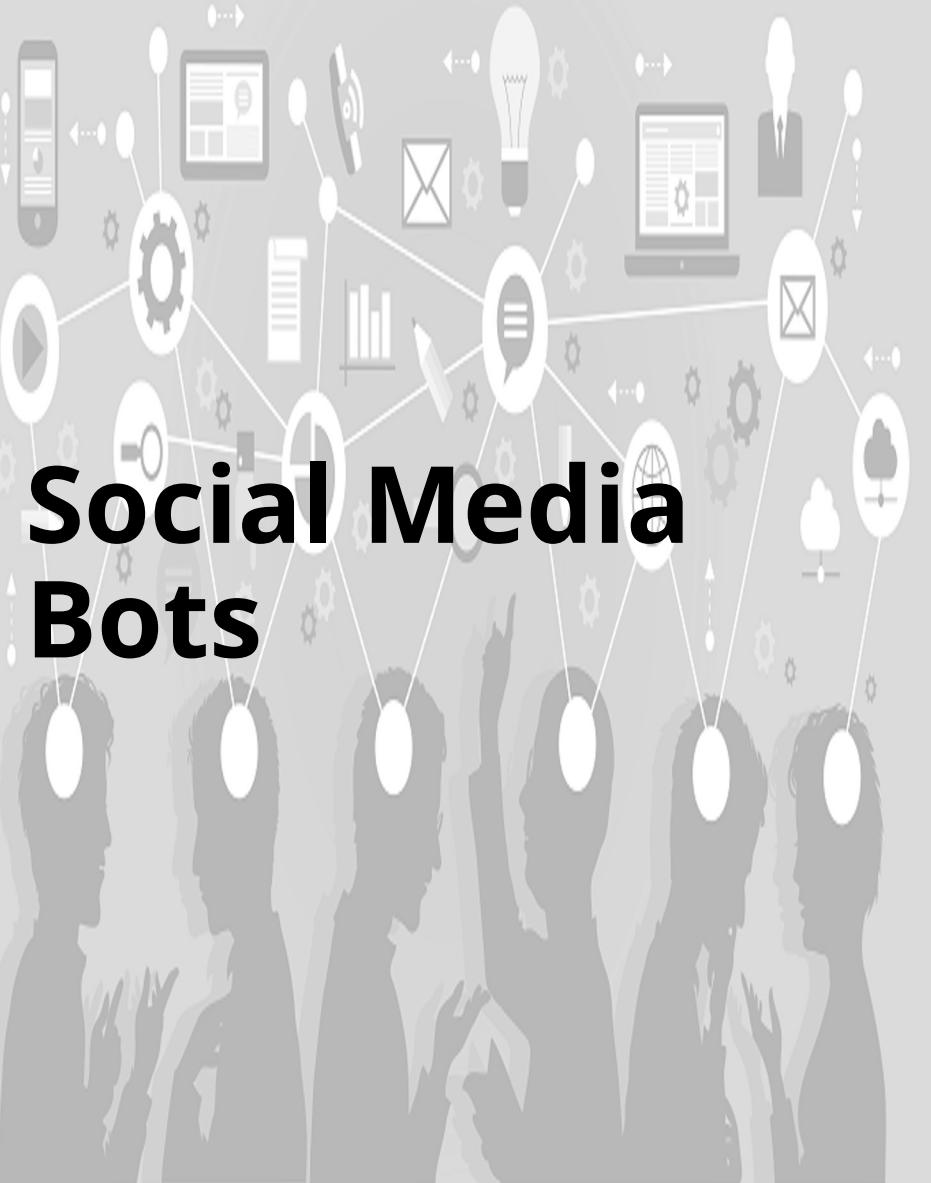
SAID
RENTREZ CHEZ VOUS
CHEZ NOUS
DELAI

REMEMBER THAT
AND THINK TWICE



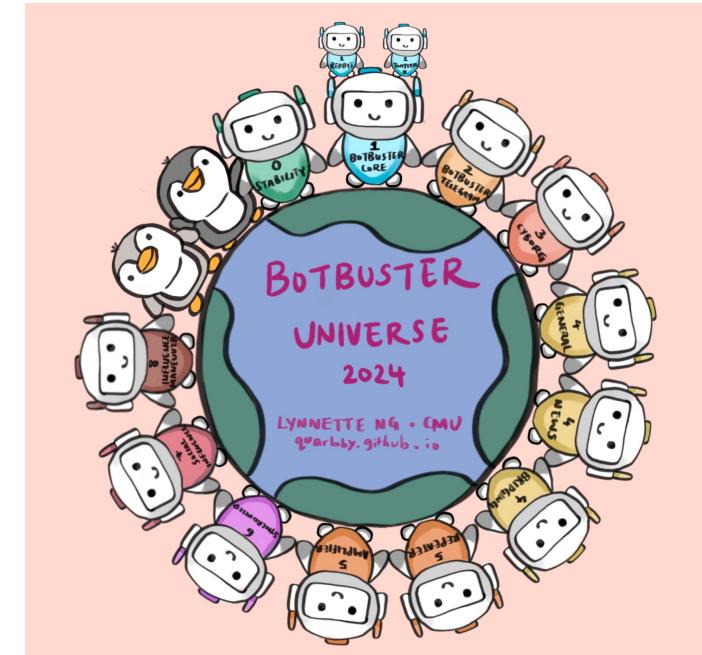
Social media for information manipulation
Reach global audiences
Micro-target
Construct multimodal messages

Social Media Bots



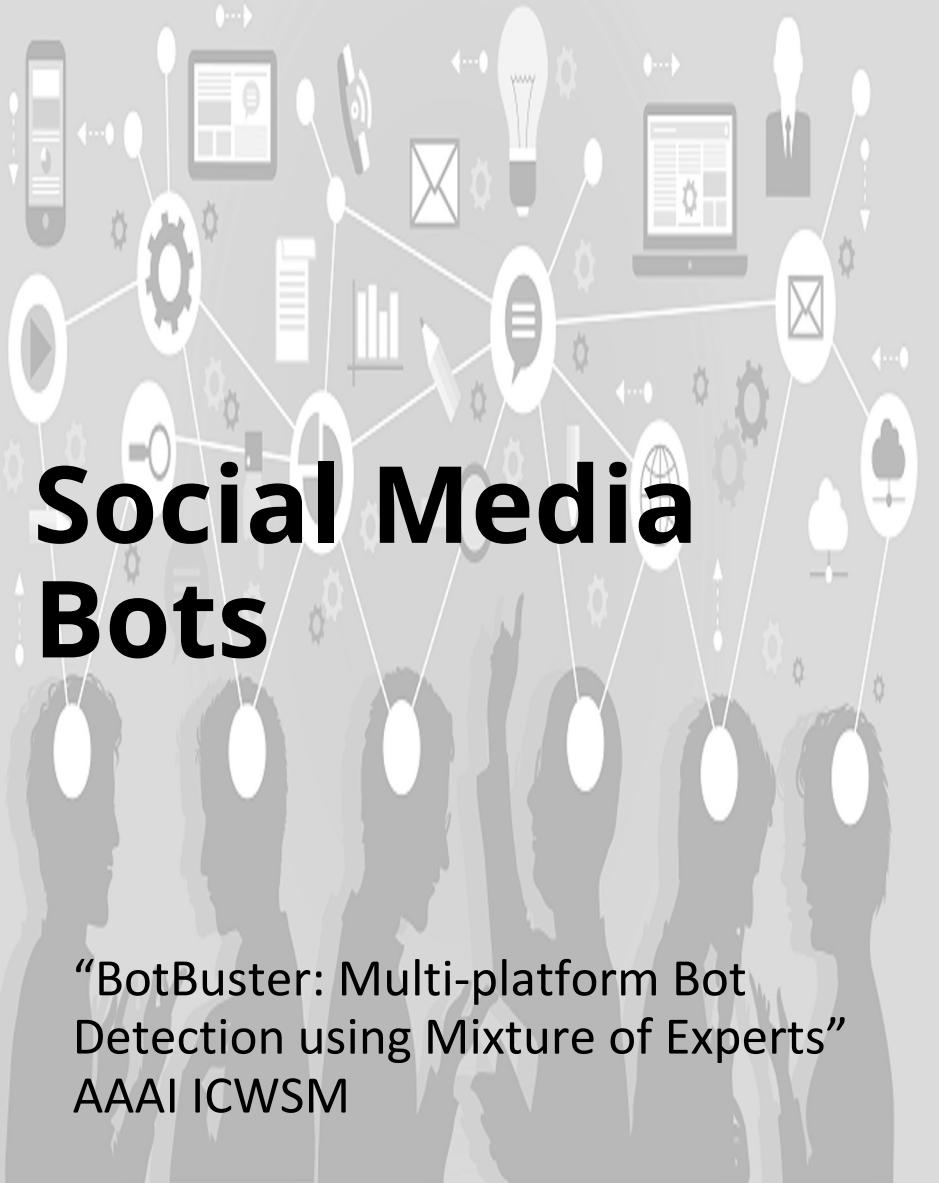
Automated Entities

- Create posts at specified periods of time
- Target posts to specific audience
- Act on posts by heuristics



Social Media Bots

“BotBuster: Multi-platform Bot Detection using Mixture of Experts”
AAAI ICWSM



BotBuster Detection Algorithm

Mixture of Experts algorithm aggregating prediction probabilities per data pillar

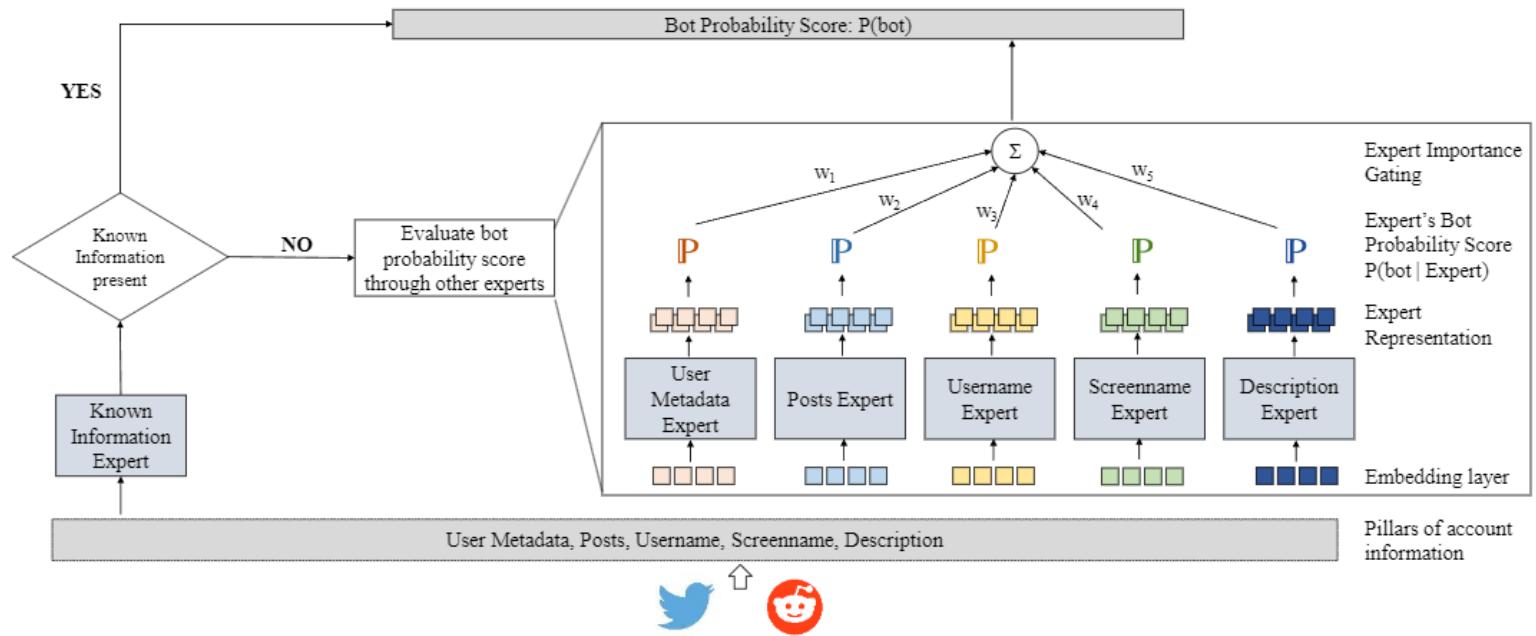
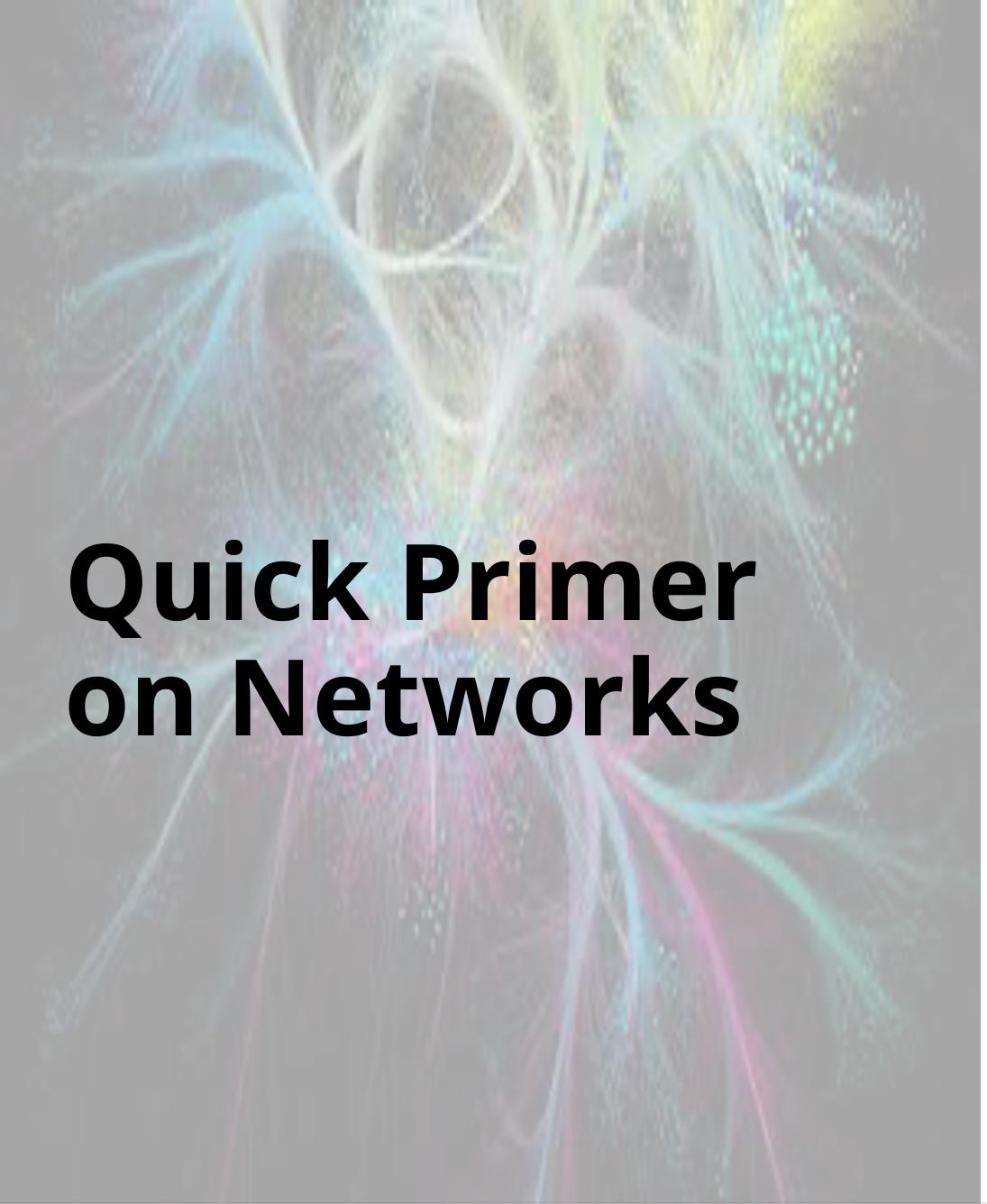
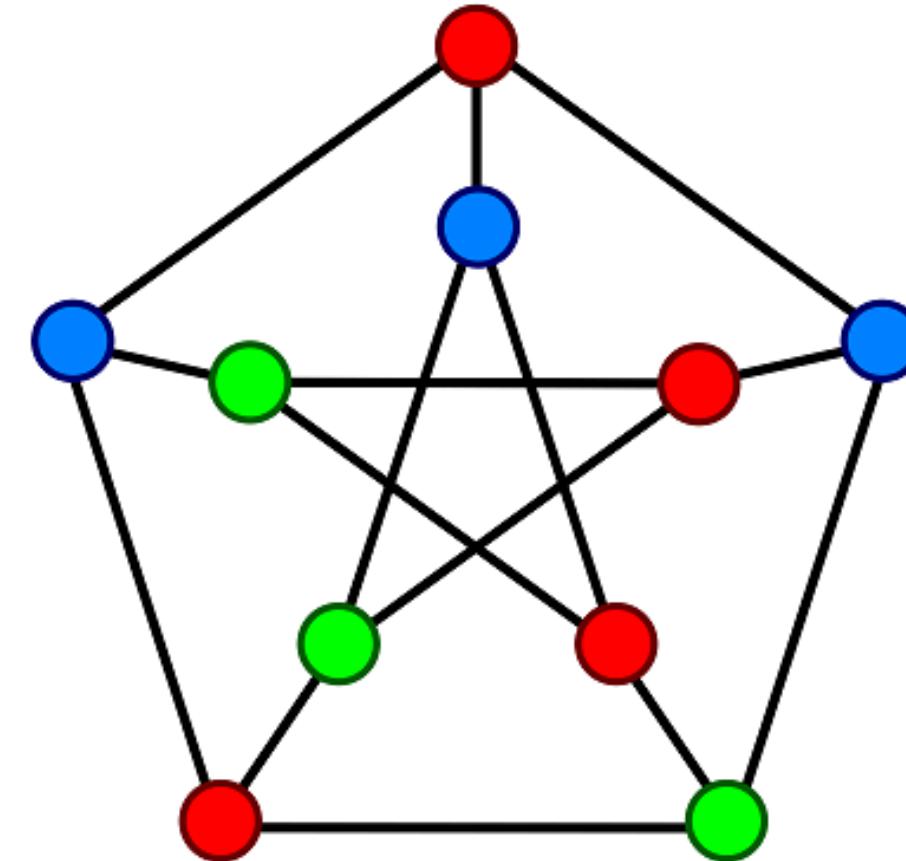


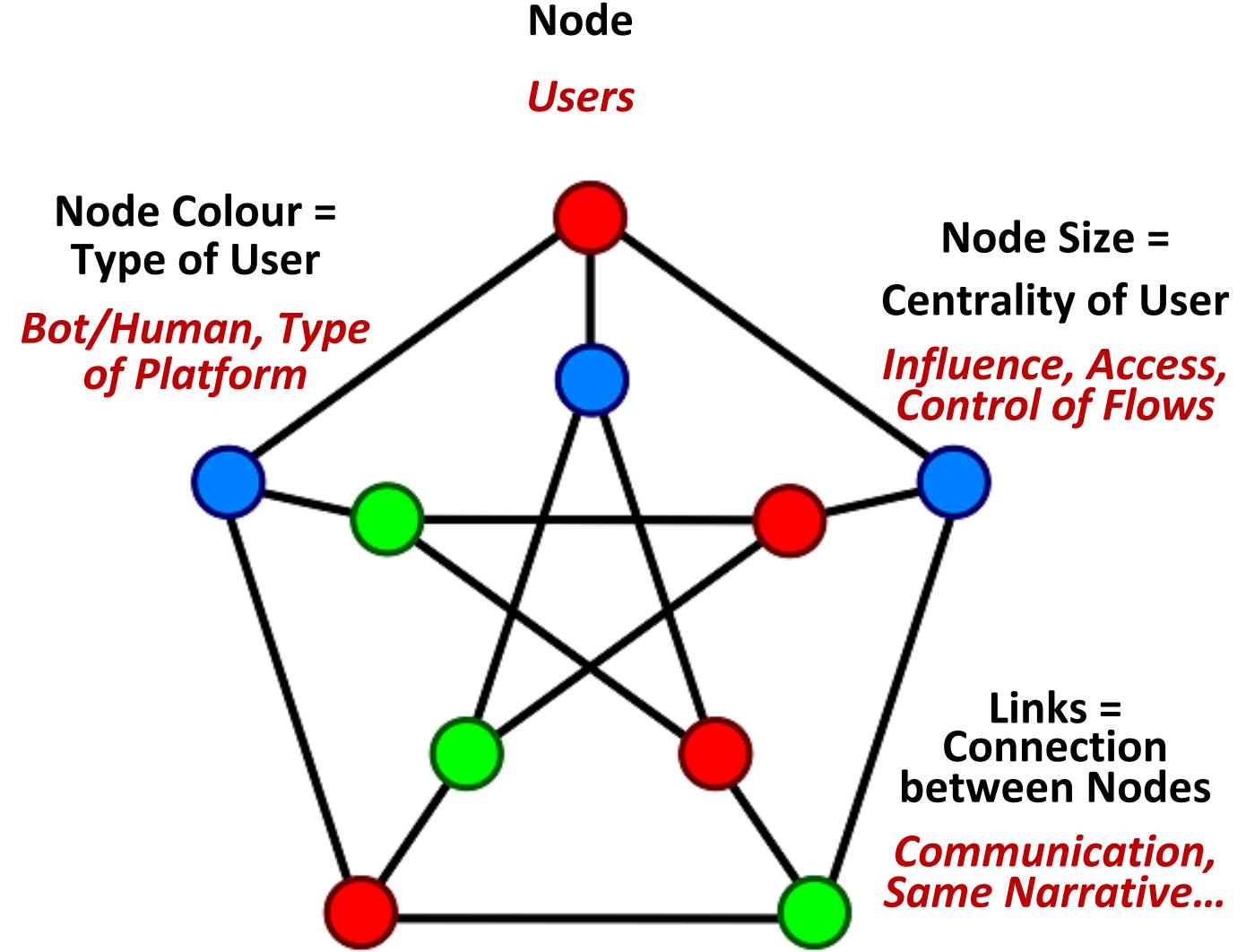
Figure 1: Diagram of the BotBuster Architecture.



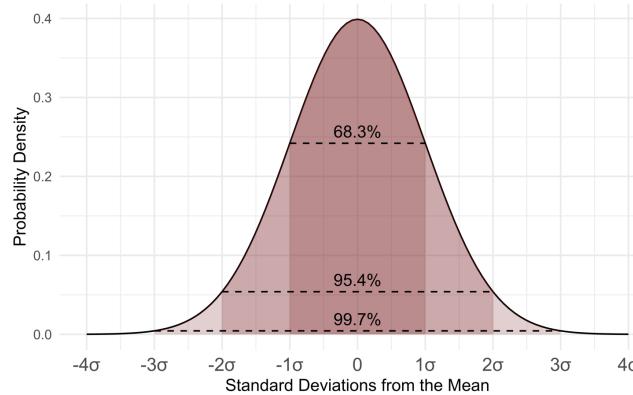
Quick Primer on Networks



Quick Primer on Networks

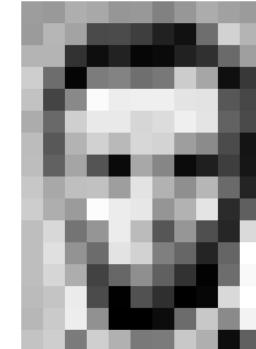


Intersecting Disciplines



Statistics

Computer Vision



157	153	174	168	150	152	129	151	172	161	155	156
155	182	163	74	75	62	33	17	110	210	180	154
180	180	50	14	34	6	10	33	48	106	159	181
206	109	6	124	131	111	120	204	166	15	56	180
194	68	197	251	237	239	239	228	227	87	71	201
172	105	207	233	233	214	220	239	228	98	74	206
188	88	179	203	185	215	211	158	130	75	20	169
189	97	165	64	10	168	134	11	31	62	22	148
199	168	191	193	158	227	178	143	182	105	96	190
205	174	155	282	236	231	149	178	226	43	95	234
190	215	116	149	236	187	85	150	70	38	218	241
190	224	147	104	227	21	127	102	36	101	255	224
190	214	173	64	103	143	90	80	2	109	249	215
187	196	235	75	1	81	47	0	6	217	255	211
183	202	237	125	6	0	12	108	209	138	243	236
195	206	123	207	177	121	123	200	170	13	96	218



Natural Language Processing

Warnu

Information Manipulation Persuasion



Information Manipulation

Why do we care?

Generaloberst Erich von Manstein,
Generaloberst Gerd v. Rundstedt,
Generaloberst Erich von Witzleben,
Generaloberst Ludwig Beck,
Generaloberst Freiherr v. Falkenhagen,
Generaloberst Fritz Fromm,

**y do v
e?**

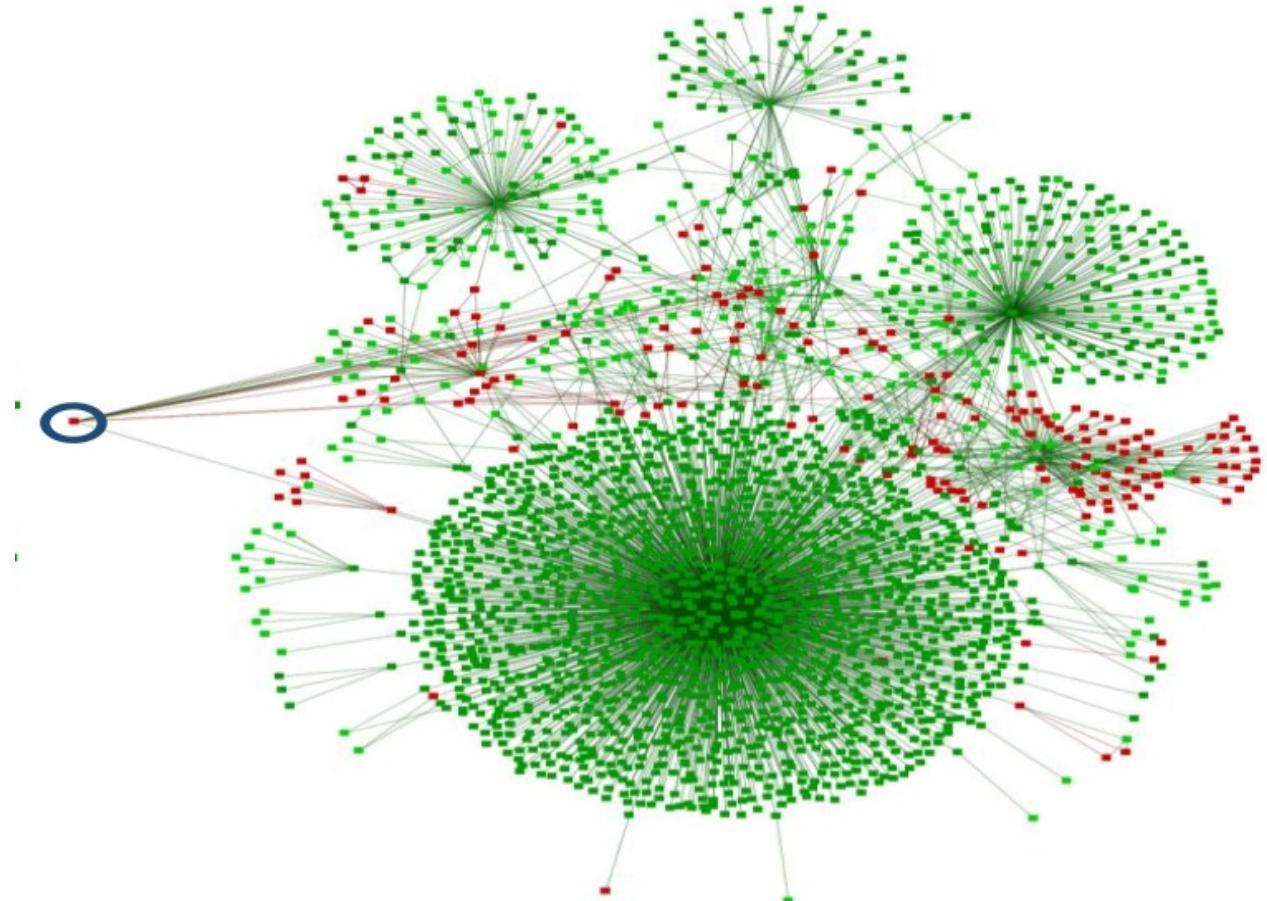
Nous avons l'ordre d'attaquer tout bateau de pêche en haute mer dans les zones interdites

Information Manipulation

Why do we care?

"Pro or Anti, A Social Influence Model of Online Stance Flipping"
IEEE Transactions of Network Science and Engineering

Changing people stances



Green = Pro-Vaccine Users / Red = Anti-Vaccine Users

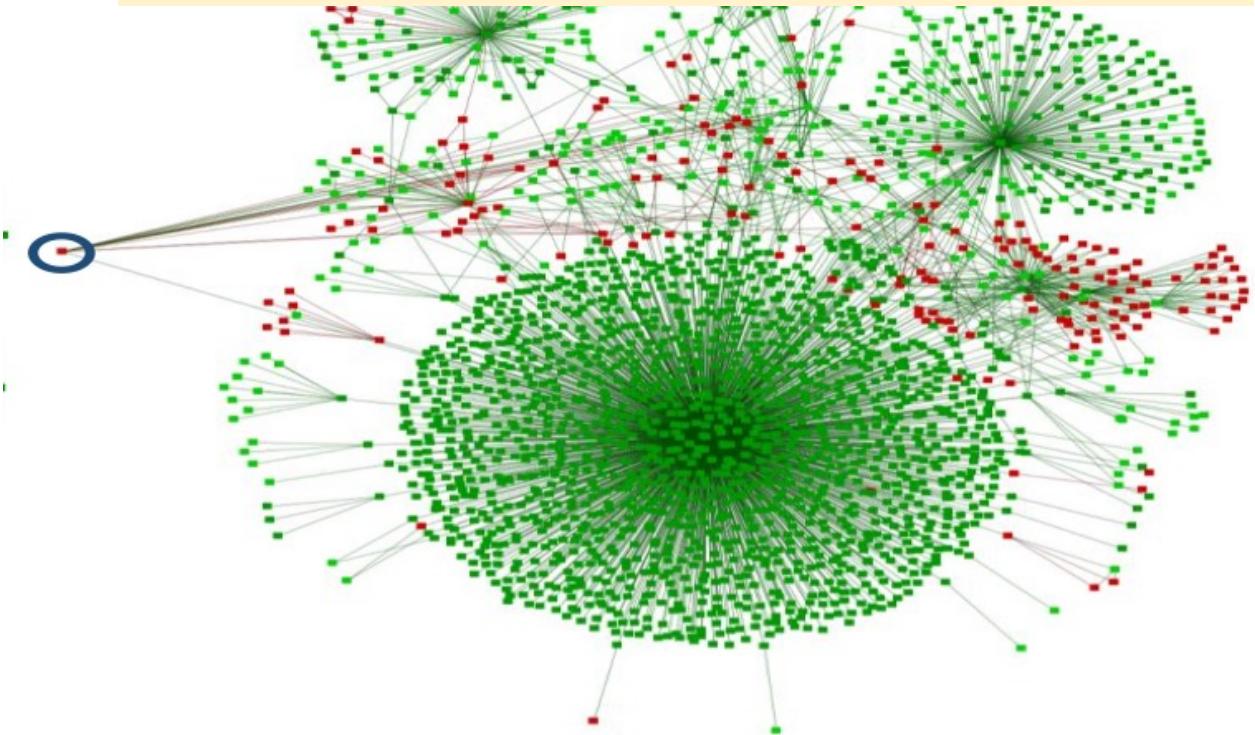
Information Manipulation

Why do we care?

“Pro or Anti, A Social Influence Model of Online Stance Flipping” IEEE Transactions of Network Science and Engineering

Changing people stances

If you apply enough social pressure,
people change their stances



Green = Pro-Vaccine Users / Red = Anti-Vaccine Users

Why do we care?

“From curious hashtags to polarized effect: profiling coordinated actions in Indonesian twitter discourse”

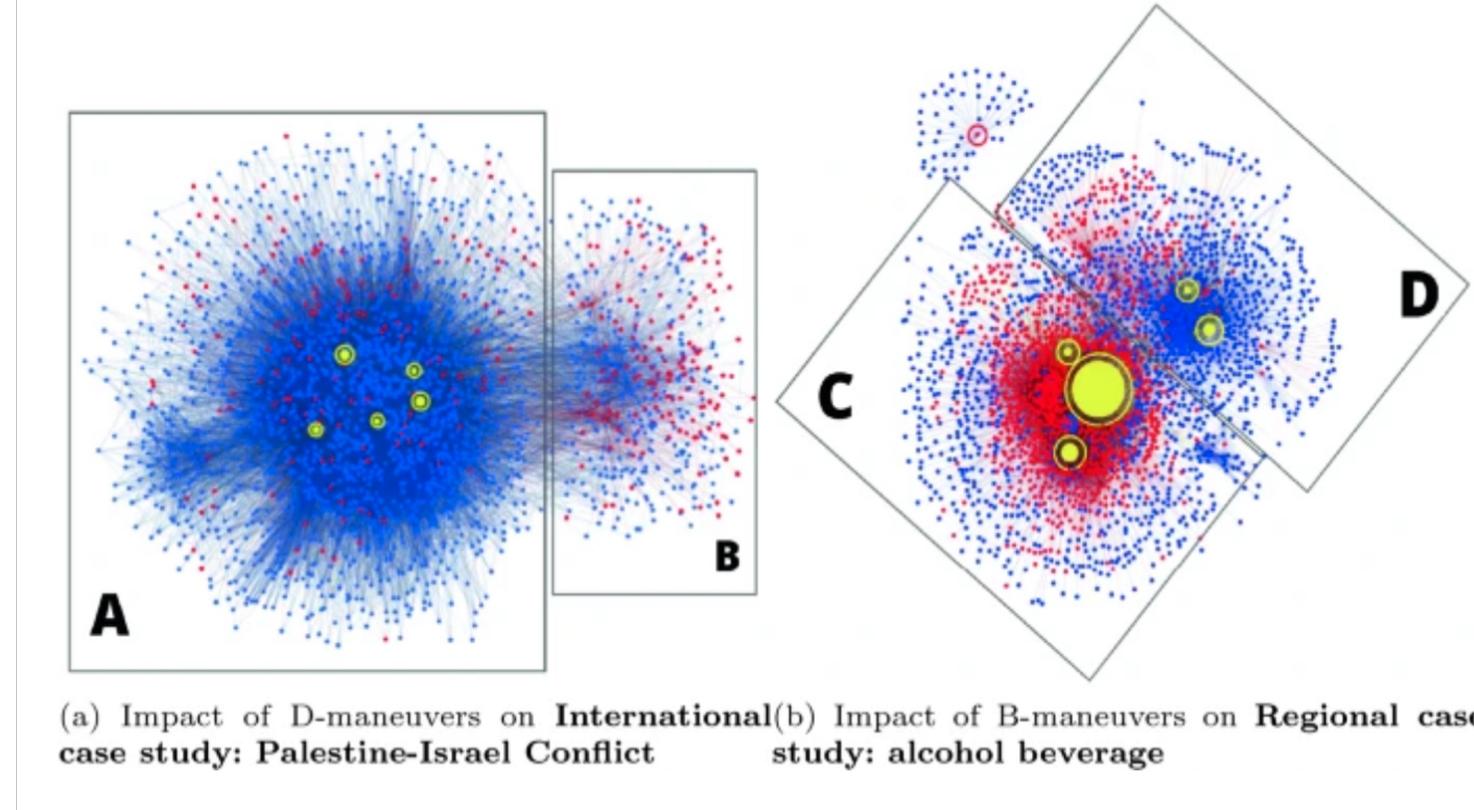
Social Network Analysis and Mining

Information Manipulation

**Generaloberst Ludwig Beck,
Generaloberst Freiherr v. Falkenhausen,
Generalfeldmarschall Erich von Witzleben,
Generalfeldmarschall Gerd von Rundstedt,
Generalfeldmarschall Erich v. Manstein,
Generaloberst Wilhelm Bittr, v. Leeb,
Generalfeldmarschall Walther von Brauchitsch,
Generalfeldmarschall Ewald v. Kleist,**

**y do v
e?**

Polarizing Societies



Blue = Humans/ Red = Bots

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Social Network Analysis and Mining

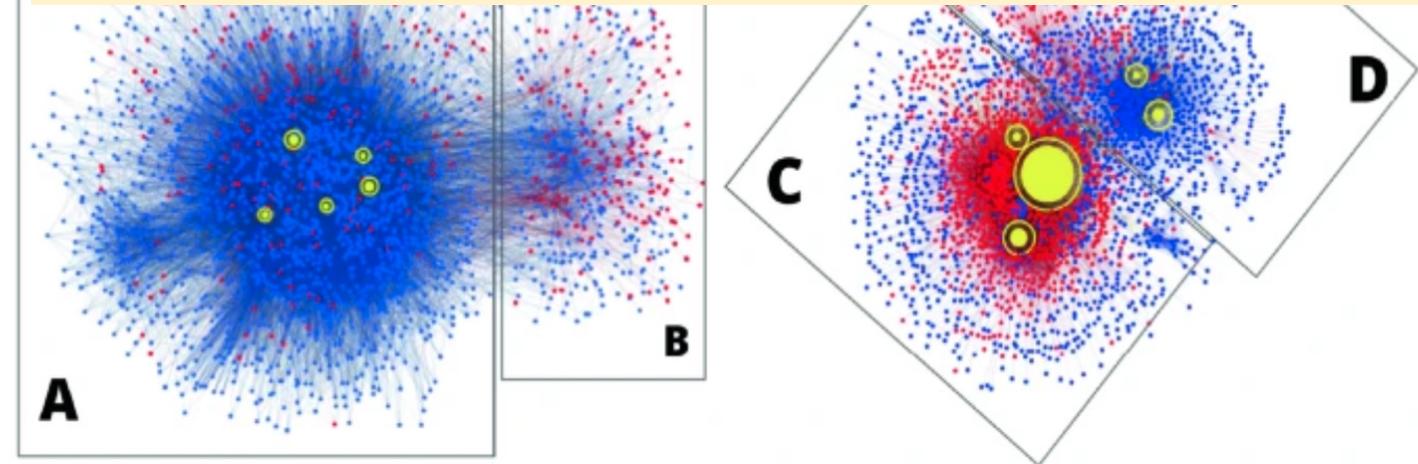
Information Manipulation

Generalfeldmarschall Erich von Falkenhayn, Generaloberst Ludwig Beck, Generaloberst Freiherr v. Falkenhausen, Generalfeldmarschall Fritz Erich Manteuffel, Generalfeldmarschall Gerd von Rundstedt, Generalfeldmarschall Erich von Witzleben, Generalleutnant Wilhelm Ritter v. Leeb, Generalleutnant Walther von Brauchitsch,

**y do v
e?**

Polarizing Societies

If you apply enough social pressure, you can segregate people into clusters (i.e., polarization, echo-chambers)



(a) Impact of D-maneuvers on International case study: Palestine-Israel Conflict (b) Impact of B-maneuvers on Regional case study: alcohol beverage

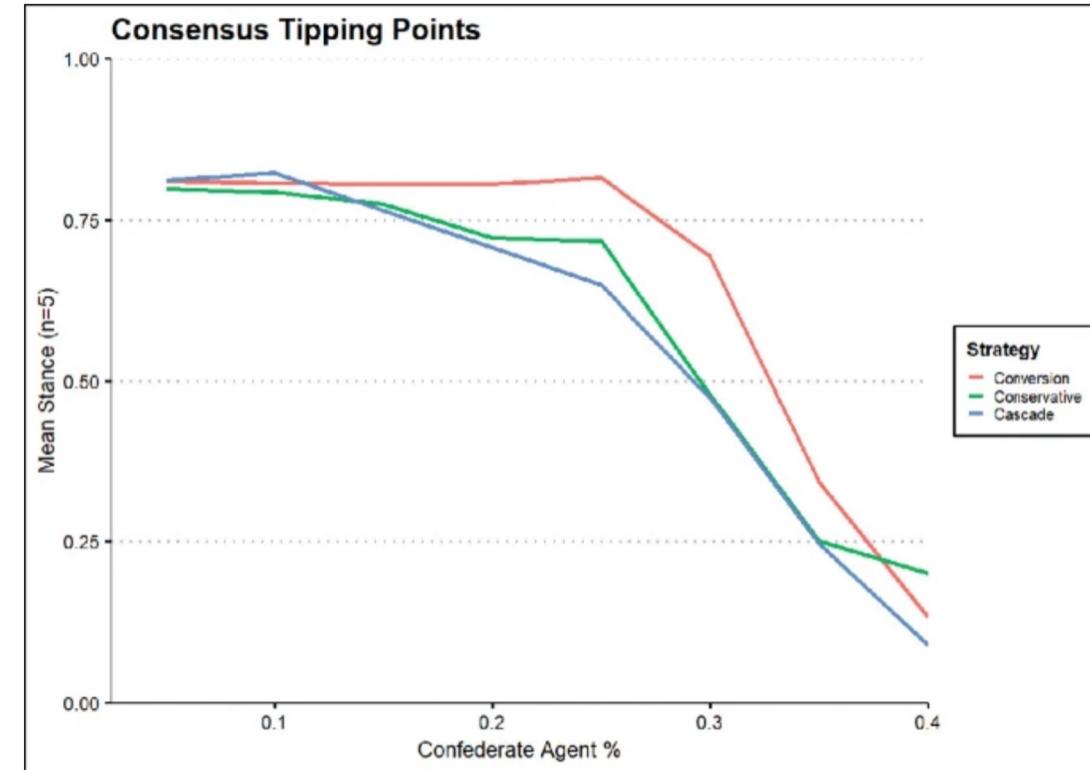
Blue = Humans/ Red = Bots

Information Manipulation

Why do we care?

“Simulation of Stance Perturbations” International Conference of Social Computing, Behavioral-Cultural Modeling

Stance Convergence



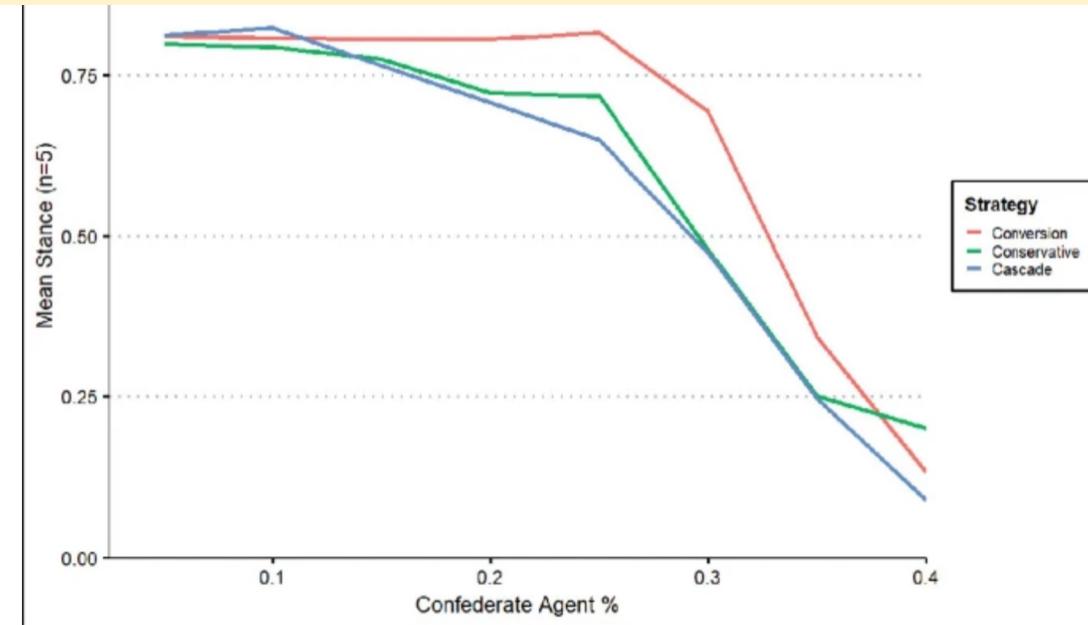
Information Manipulation

Why do we care?

“Simulation of Stance Perturbations” International Conference of Social Computing, Behavioral-Cultural Modeling

Stance Convergence

Stances converge faster if you manage to convert people in a cascade fashion



Information Manipulation

How do we identify information campaigns?



Information Manipulation

How do we identify information campaigns?

“Analyzing Digital Propaganda and the Conflict Rhetoric: A Study on Russian Bot Driven Campaigns and Counter Narratives During the Ukraine Crisis”

BEND Framework

Information maneuvers comprised of narrative & community maneuvers

BEND Maneuvers					
	Community Maneuvers		Narrative Maneuvers		
Affirmative	Back	Discussion that increase the actual, or the appearance of, an actor's importance or effectiveness relative to a community or topic	Excite	Discussion related to a community or topic that cause the reader to experience a positive emotion such as joy, happiness, liking, or excitement	
	Build	Discussion that create a group, or the appearance of a group, where there was none before	Explain	Discussion that clarify a topic to the targeted community or actor often by providing elaborations on the topic	
	Bridge	Discussion that build a connection between two or more groups or create the appearance of such a connection	Engage	Discussion that increase the relevance of the topic to the reader often by providing anecdotes or enabling direct participation and so suggesting that the reader can impact the topic or will be impacted by it	
	Boost	Discussion that increase the size of a group and/or the connections among group members, or the appearance of such	Enhance	Discussion that provide material that expands the scope of the topic for the targeted community or actor often by making the topic the master topic to which other topics are linked	
Adverse	Negate	Discussion that decrease the actual, or the appearance of, an actor's importance or effectiveness relative to a community or topic	Dismay	Discussion related to a community or topic that cause the reader to experience a negative emotion such as worry, sadness, disliking, anger, despair, or fear	
	Neutralize	Discussion that cause a group to be, or appear to be, no longer of relevance, e.g., because it was dismantled	Distort	Discussion that obscure a topic to the targeted community or actor often by supporting a particular point of view or calling details into question	
	Narrow	Discussion that lead a group to be, or appear to be, more specialized, and possibly to fission, or appear to fission, into two or more distinct groups	Dismiss	Discussion that decrease the relevance of the topic to the reader often by providing stories or information that suggest that the reader cannot impact a topic or be impacted by it	
	Neglect	Discussion that decrease the size of a group and/or the connections among group members, or the appearance of such	Distract	Discussion that redirect the targeted community or actor to a different topic often by bring up unrelated topics, and making the original topic just one of many	

Information Manipulation

How do we identify information campaigns?

“Analyzing Digital Propaganda and the Conflict Rhetoric: A Study on Russian Bot Driven Campaigns and Counter Narratives During the Ukraine Crisis”

Persuasion Techniques in 2022 Russian Ukraine Campaign

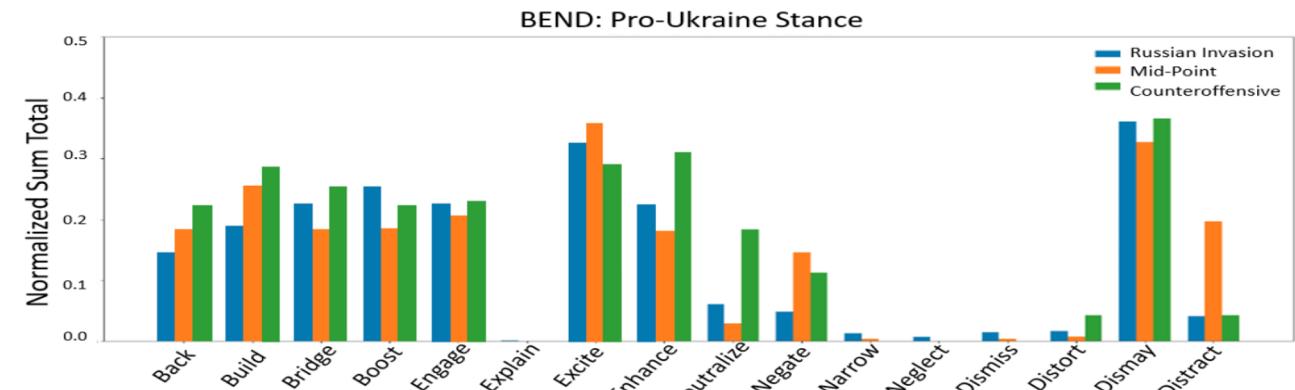
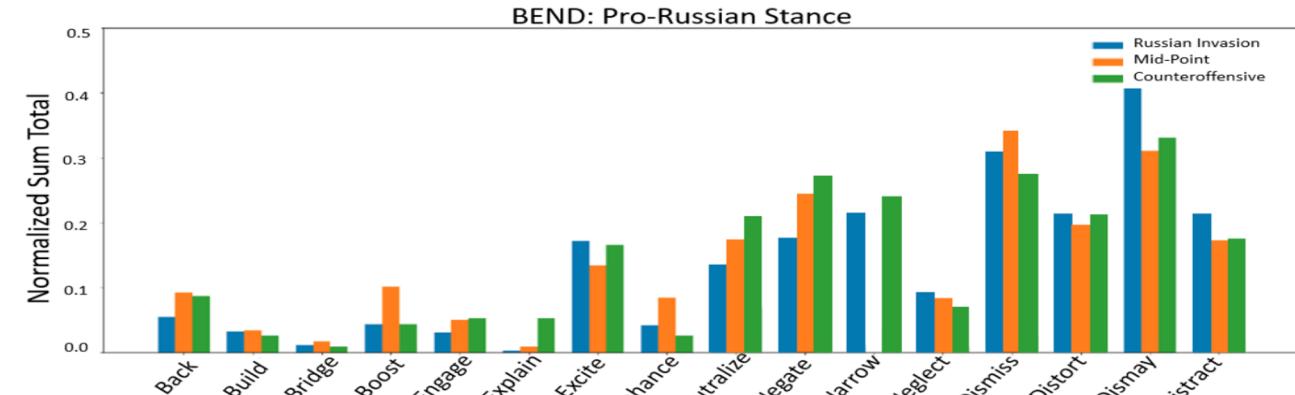


Figure 13. BEND results normalized across all three timeframes for Pro-Ukraine Stance



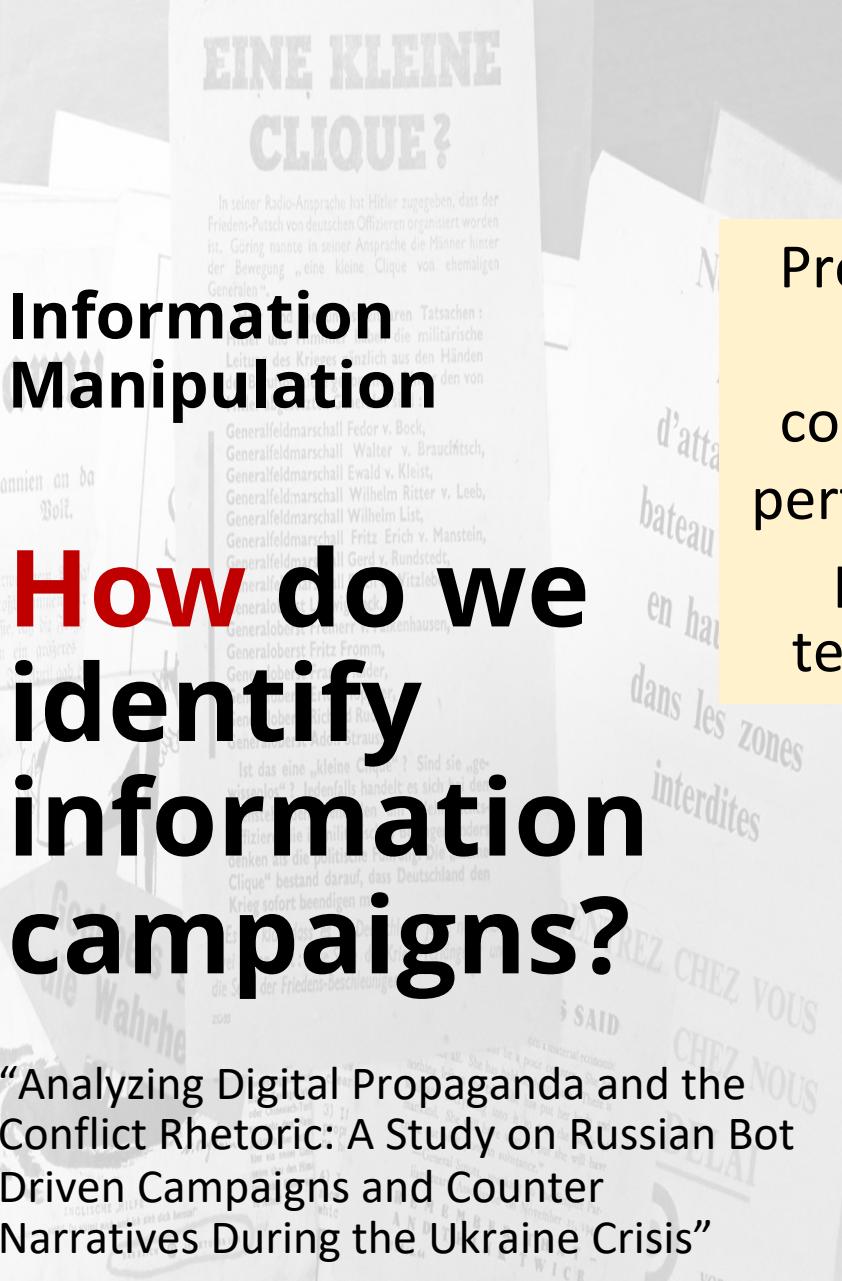
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Information Manipulation

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Pro-Ukraine users consistently perform more positive techniques

Persuasion Techniques in 2022 Russian Ukraine Campaign

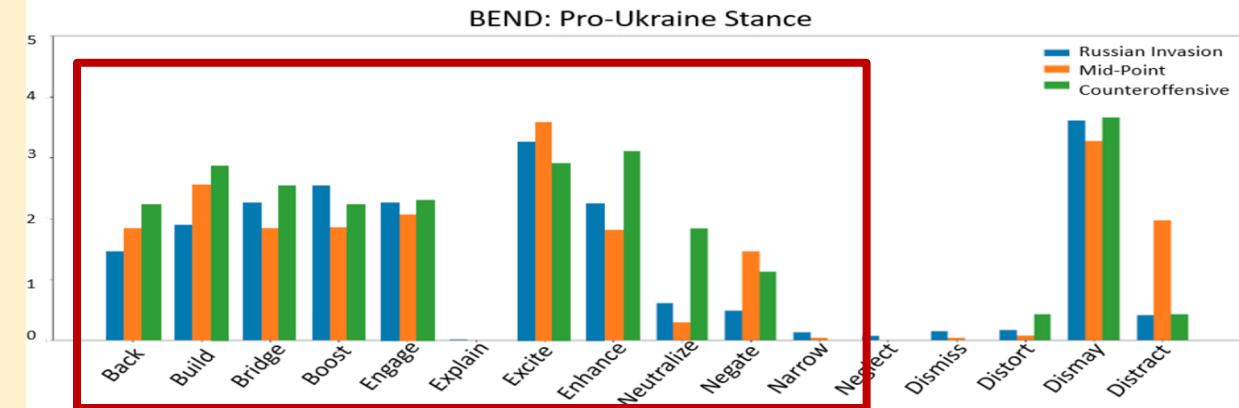
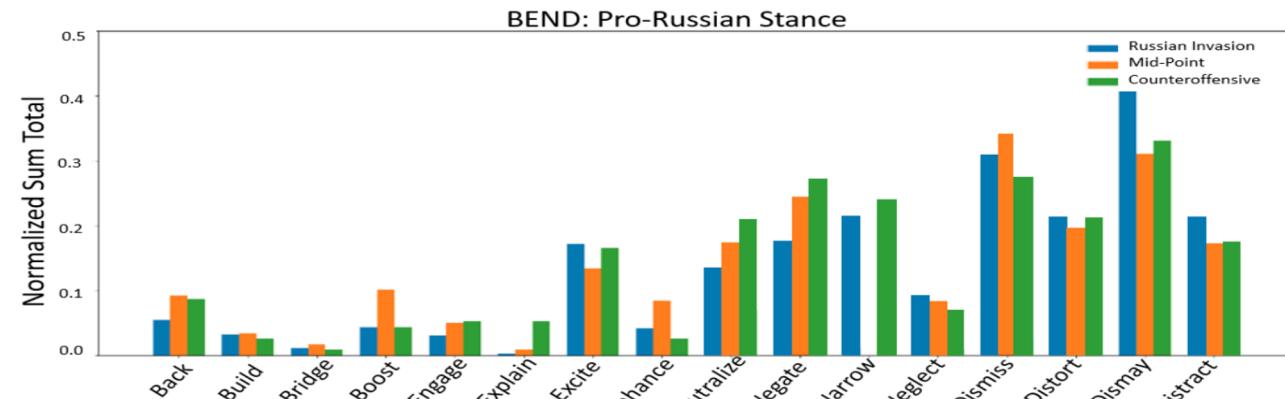


Figure 13. BEND results normalized across all three timeframes for Pro-Ukraine Stance



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"Analyzing Digital Propaganda and the Conflict Rhetoric: A Study on Russian Driven Campaigns and Counter Narratives During the Ukraine Crisis"

Information Manipulation

Pro-Ukraine users consistently perform more positive techniques

Pro-Russian users consistently perform more negative techniques

Persuasion Techniques in 2022 Russian Ukraine Campaign

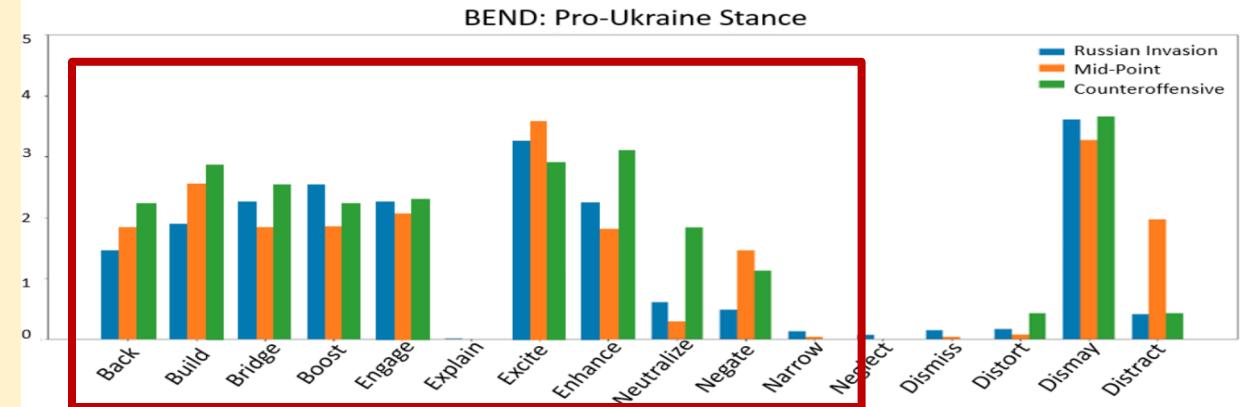
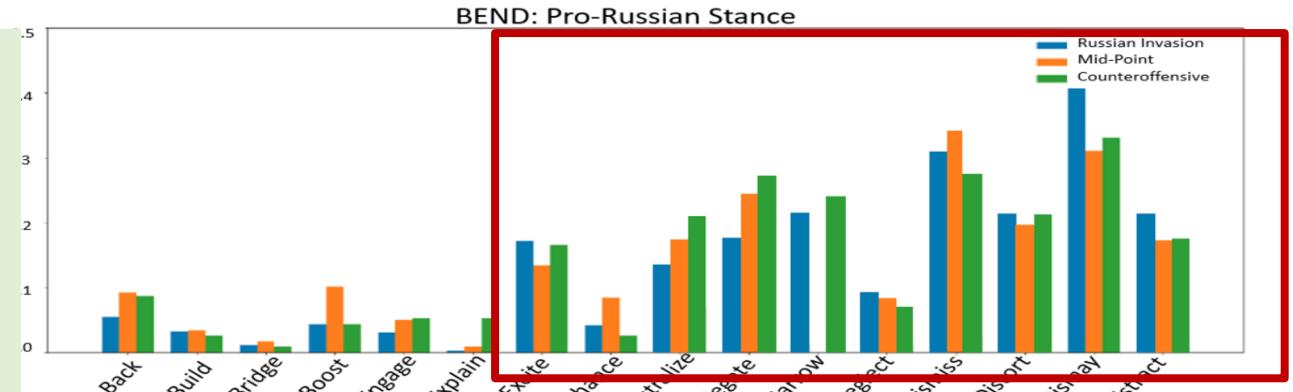


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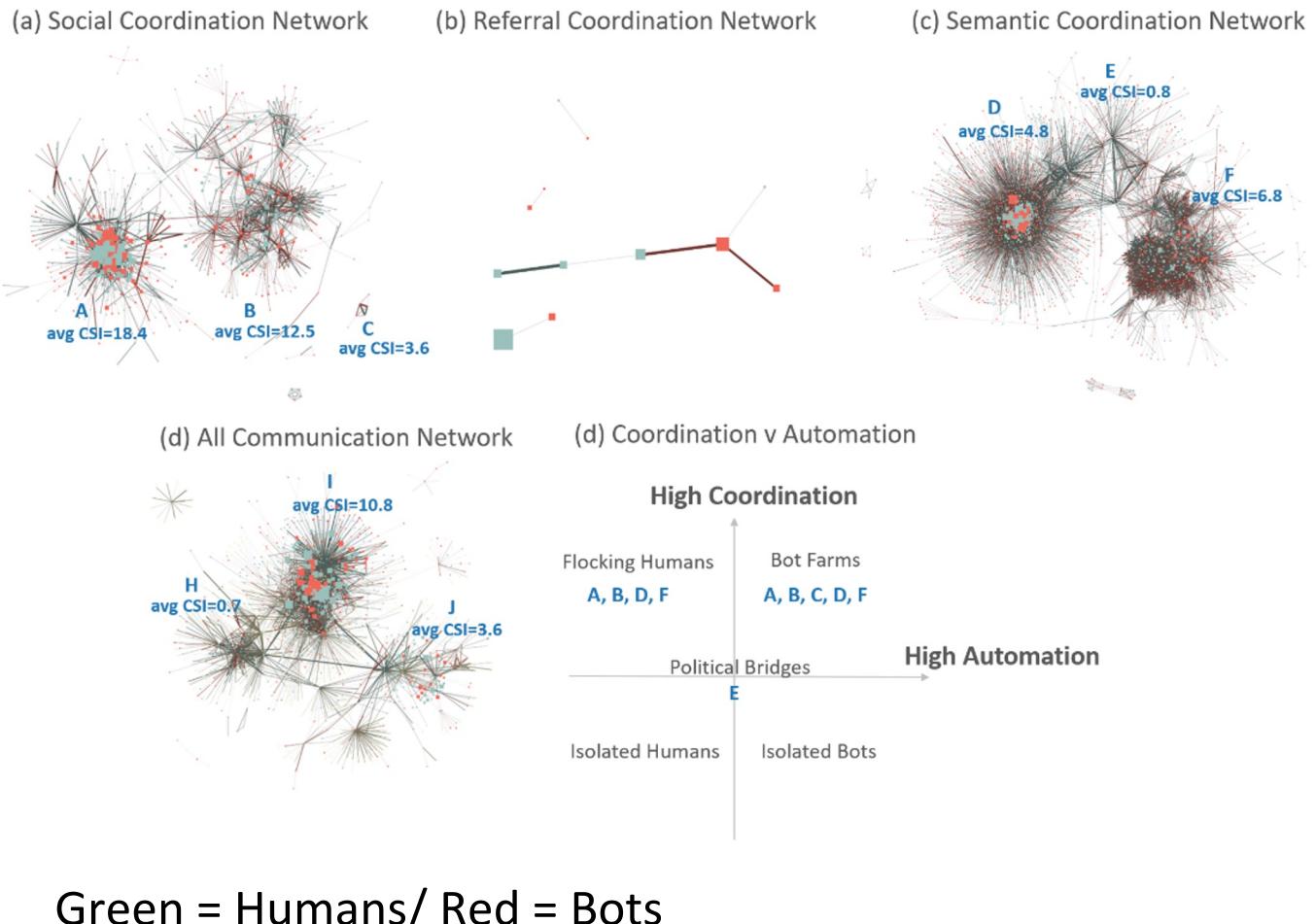


Information Manipulation

How do we identify information campaigns?

“Tiny-BotBuster: Identifying Automated Political Coordination in Digital Campaigns”

Automated Coordination



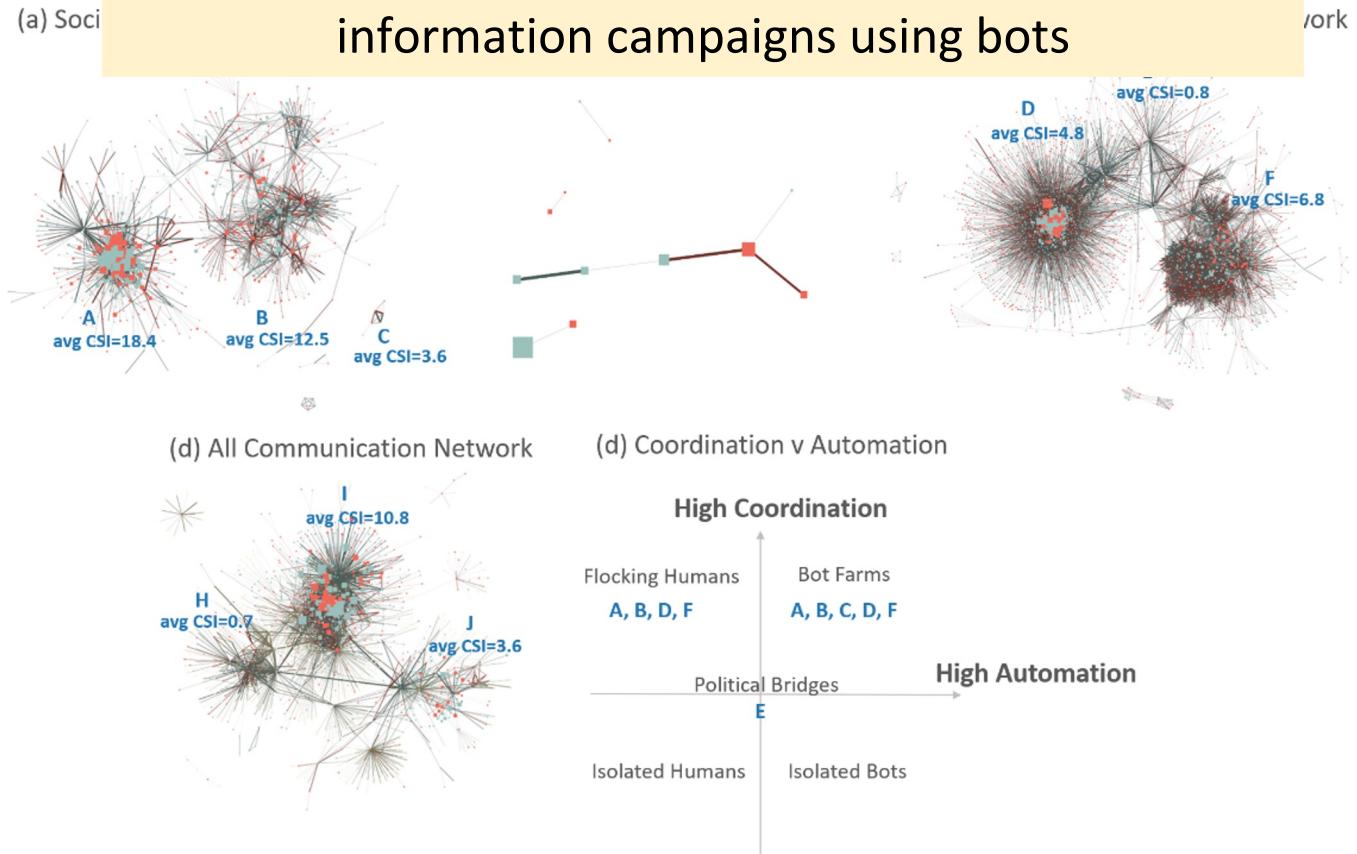
Information Manipulation

How do we identify information campaigns?

“Tiny-BotBuster: Identifying Automated Political Coordination in Digital Campaigns”

2024 Indonesian Election Campaigns

Three Largest Political Parties have clusters of online information campaigns using bots



Green = Humans/ Red = Bots

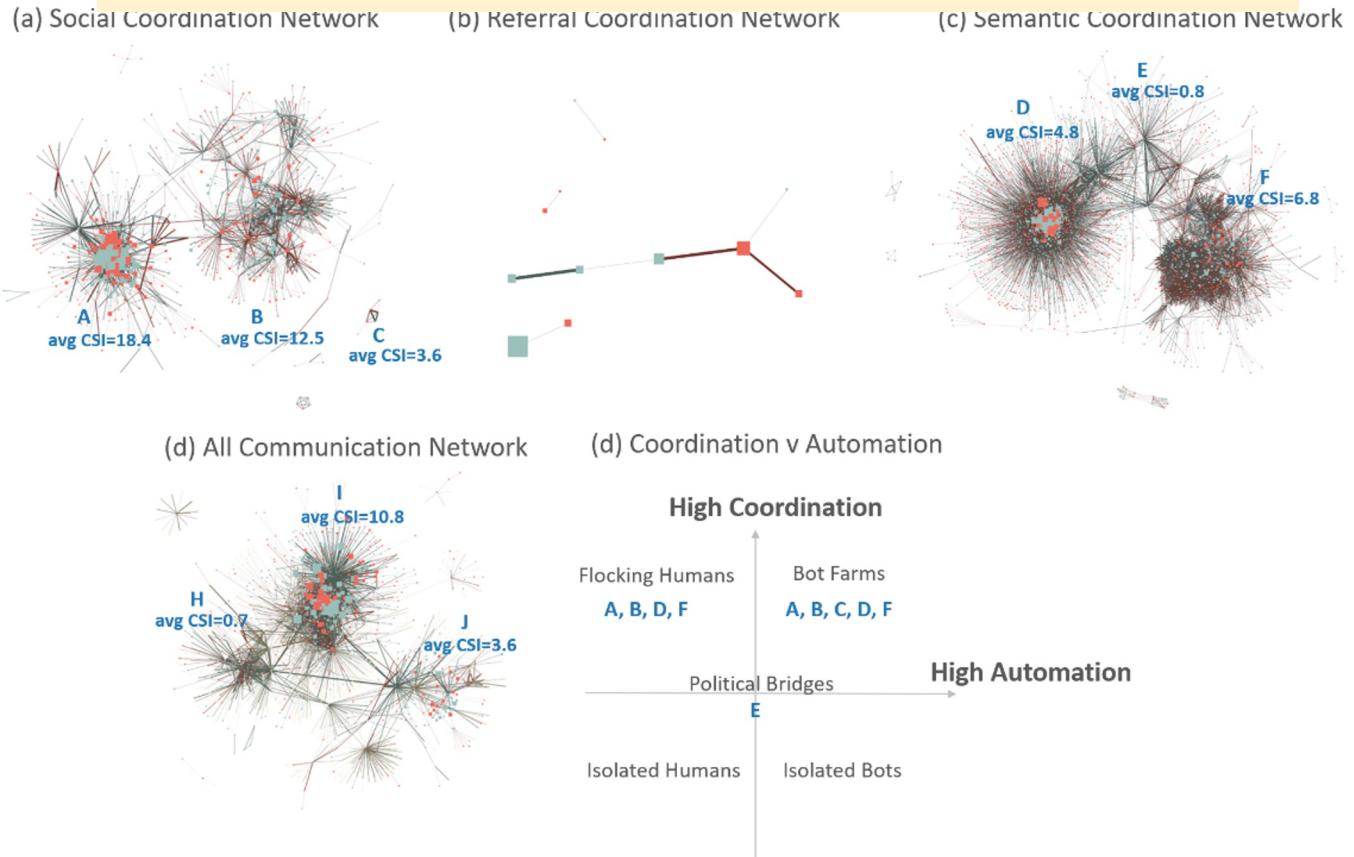
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2024 Indonesian Election Campaigns

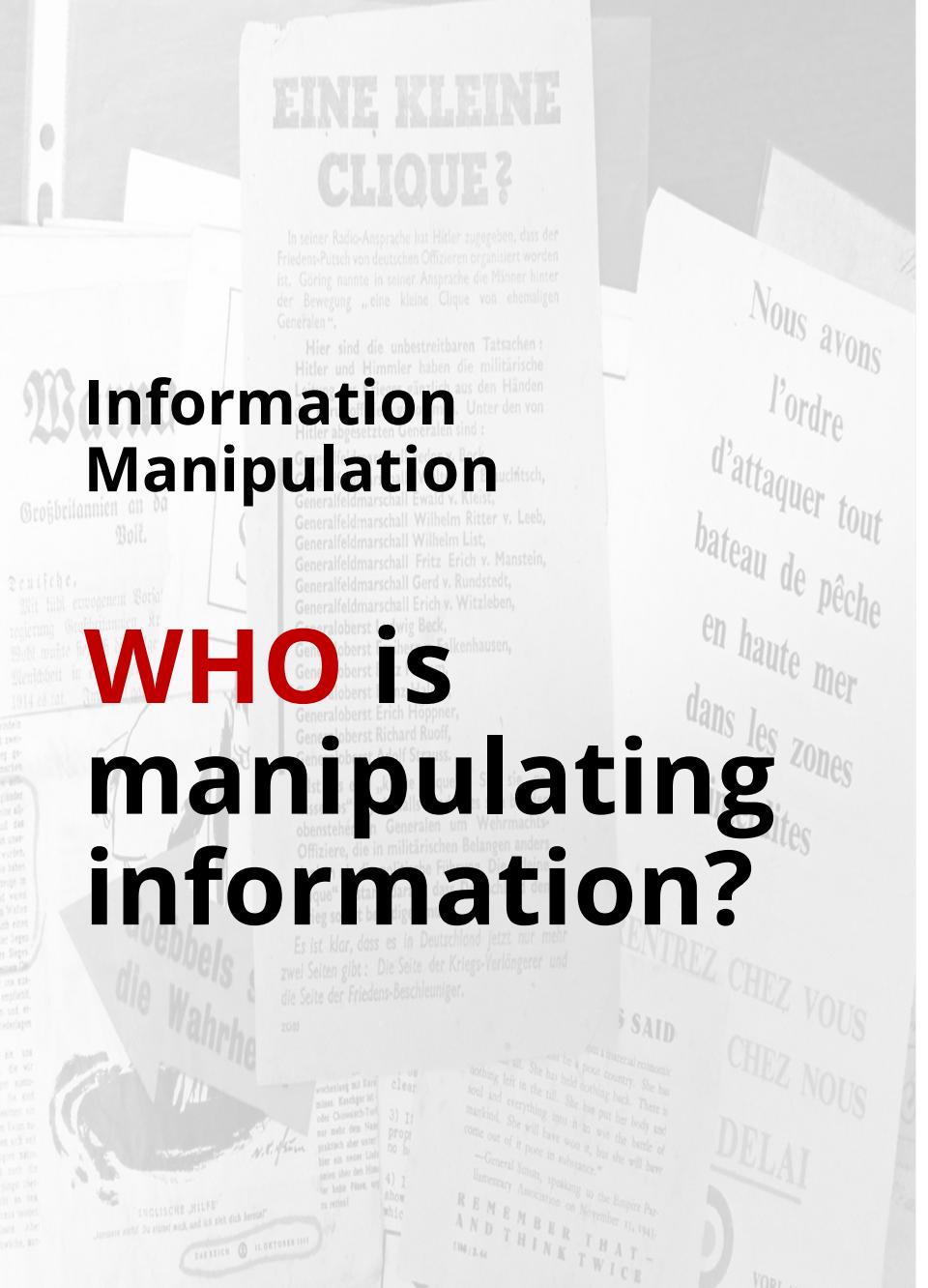
Largest party (PDI-P) used the most % of bots



Green = Humans/ Red = Bots

Information Manipulation

WHO is manipulating information?



Information Manipulation

WHO is manipulating information?

“An Exploratory Analysis of COVID bot and human disinformation dissemination from the Disinformation Dozen on Telegram” Journal of Computational Social Science

EINE KLEINE CLIQUE?

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Generaloberst Walther von Kluge,
Generaloberst Erich Hoepner,
Generaloberst Richard Rüdloff,
Generaloberst Wilhelm List,

Generalfeldmarschall Gerd von Rundstedt,

Generalfeldmarschall Erich von Manstein,

Generalfeldmarschall Walther von Brauchitsch,

Generalfeldmarschall Ewald v. Kleist,

Generalfeldmarschall Wilhelm Ritter v. Leeb,

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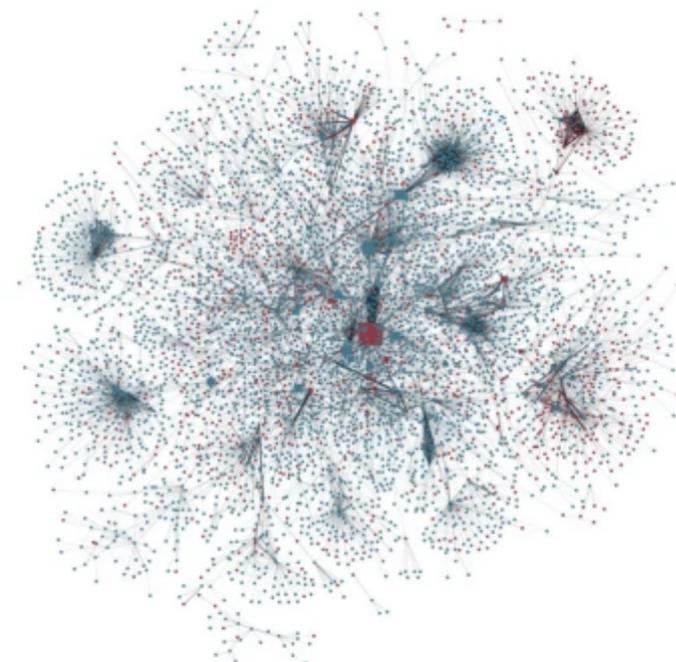
Generaloberst Richard Rüdloff,

Generaloberst Wilhelm List,

COVID disinformation on Telegram



(a) User x User network by Message Forwarding



(b) User x User network by Message Reply

Green = Humans/ Red = Bots

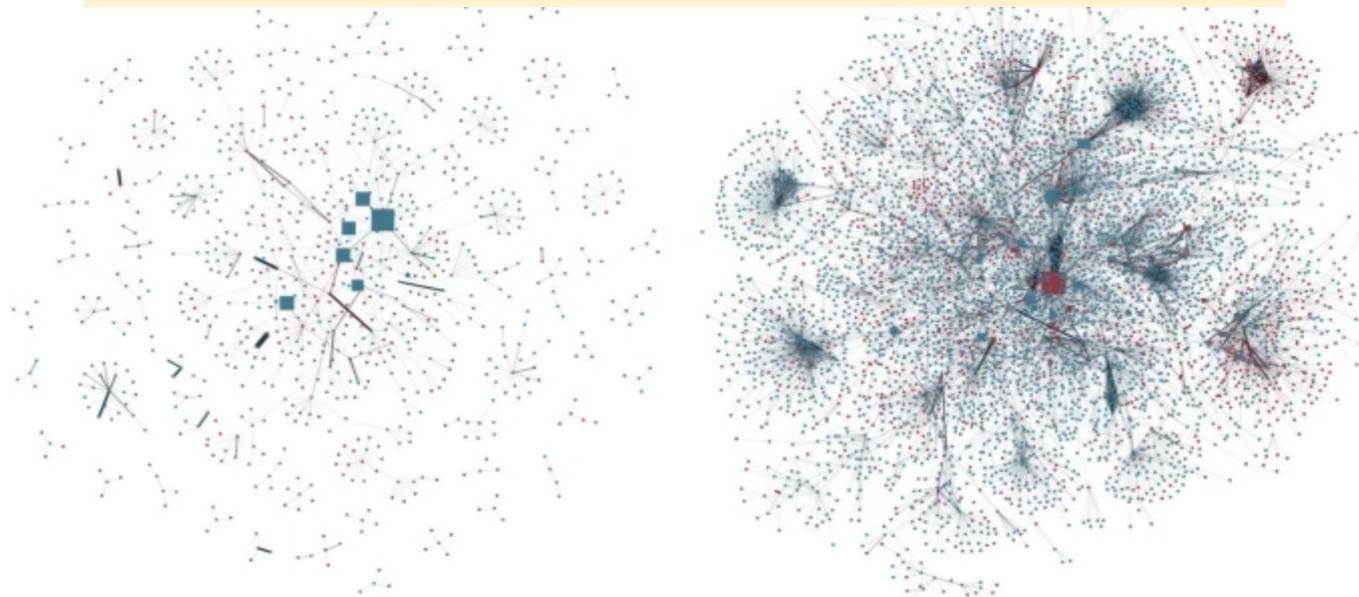
Information Manipulation

WHO is manipulating information?

“An Exploratory Analysis of COVID bot and human disinformation dissemination from the Disinformation Dozen on Telegram” Journal of Computational Social Science

COVID disinformation on Telegram

Bots continue conversations (replies),
Humans spread disinformation (forwards)



(a) User x User network by Message Forwarding

(b) User x User network by Message Reply

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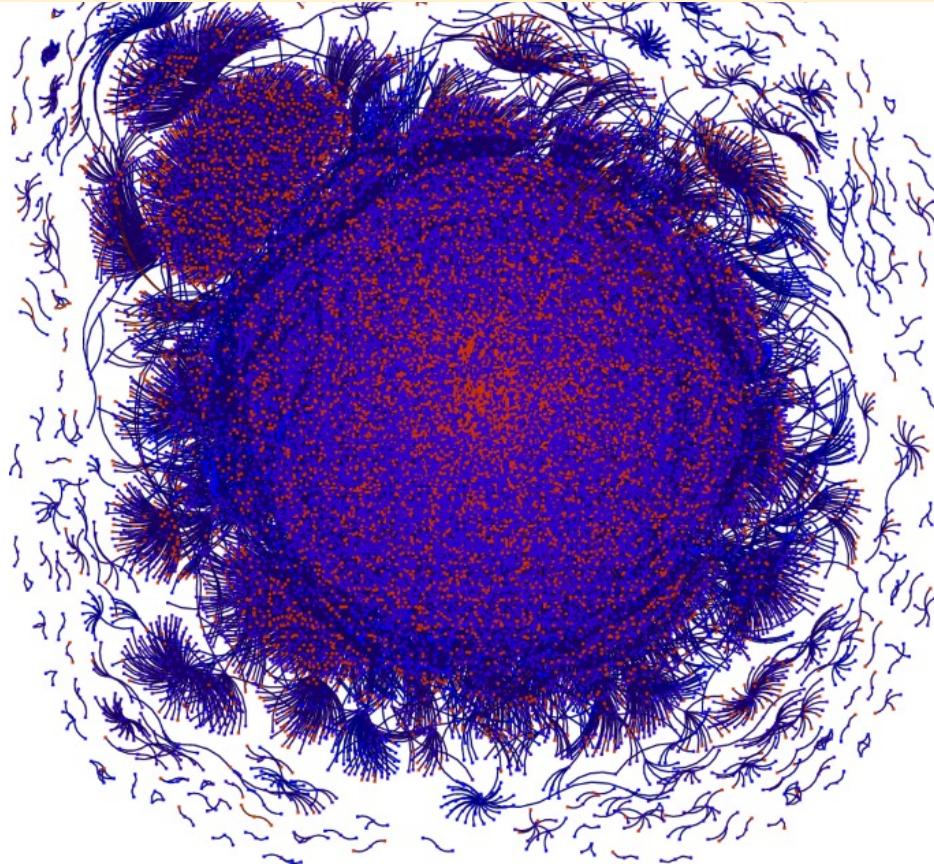
Information Manipulation

WHO is manipulating information?

“Active, Aggressive but to No Avail: Characterizing Bot Activity during the 2020 Singaporean Elections” Computational and Mathematical Organization Theory

2020 Singapore Elections

Bots are embedded in conversation



Green = Humans/ Red = Bots

Information Manipulation

WHAT narratives are being spread?

Information Manipulation

WHAT narratives are being spread?

“Deflating the Chinese Balloon: Types of Twitter Bots in the US-China balloon incident” EPJ Data Science

Hier sind die unbestreitbaren Tatsachen: Hitler und Himmler haben die militärische Führung Süßlachs aus den Händen der Nation abgesetzt. Unter den von Hitler abgesetzten Generälen sind:

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Generalfeldmarschall Gerd v. Rundstedt,
Generalfeldmarschall Erich v. Witzleben,
nachwig Beck,
AT Lübeck-Gollernhausen

2023 US-China Balloon Incident

Bots exaggerate narratives spread by humans



Information Manipulation

WHAT
narratives are
being spread?

“Active, Aggressive but to No Avail:
Characterizing Bot Activity during the
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Computational and Mathematical
Organization Theory

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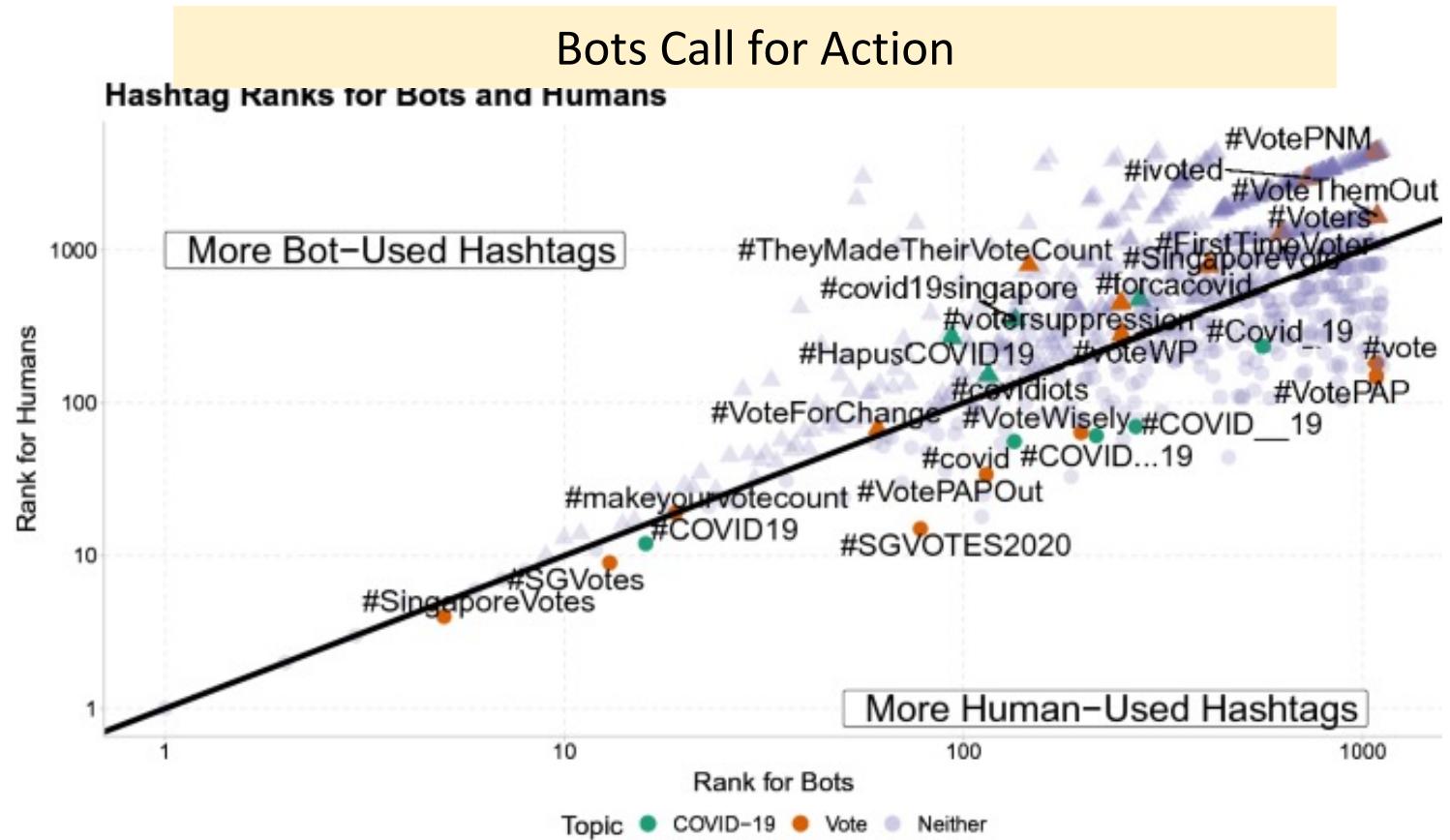
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2020 Singapore Elections



Information Manipulation

WHEN are narratives spread?

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Generaloberst Walther von Fritsch,
Generalfeldmarschall Ewald v. Kleist,
Generalfeldmarschall Wilhelm Ritter v. Leeb,
Generalfeldmarschall Wilhelm List,
Generalfeldmarschall Fritz Erich v. Manstein,
Generalfeldmarschall Gerd v. Rundstedt,
Generalfeldmarschall Erich v. Witzleben,
Generaloberst Ludwig Beck,

Generalfeldmarschall Frommel,
Generaloberst Erich von Manstein,
Generaloberst Erich Höppner,
Generaloberst Richard Orlauff,

Generaloberst Ludwig Beck,
Generaloberst Erich Höppner,
Generaloberst Richard Orlauff,
Generaloberst Ludwig Beck,
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Generaloberst Ludwig Beck,
Generaloberst Erich Höppner,
Generaloberst Richard Orlauff,

Generaloberst Ludwig Beck,
Generaloberst Erich Höppner,
Generaloberst Richard Orlauff,

Nous avons
l'ordre
d'attaquer tout
bateau de pêche
en haute mer
dans les zones
interdites

RENTREZ CHEZ VOUS

CHEZ NOUS

DELAI

VORI

S SAID

"...she is a poor country. She has nothing left in the till. She has put her body and soul and everything into it to win the battle of mankind. She will have won it, but she will have come out of it poor in substance."

—General Smuts, speaking to the Empire Parliamentary Association on November 11, 1941.

REMEMBER THAT AND THINK TWICE

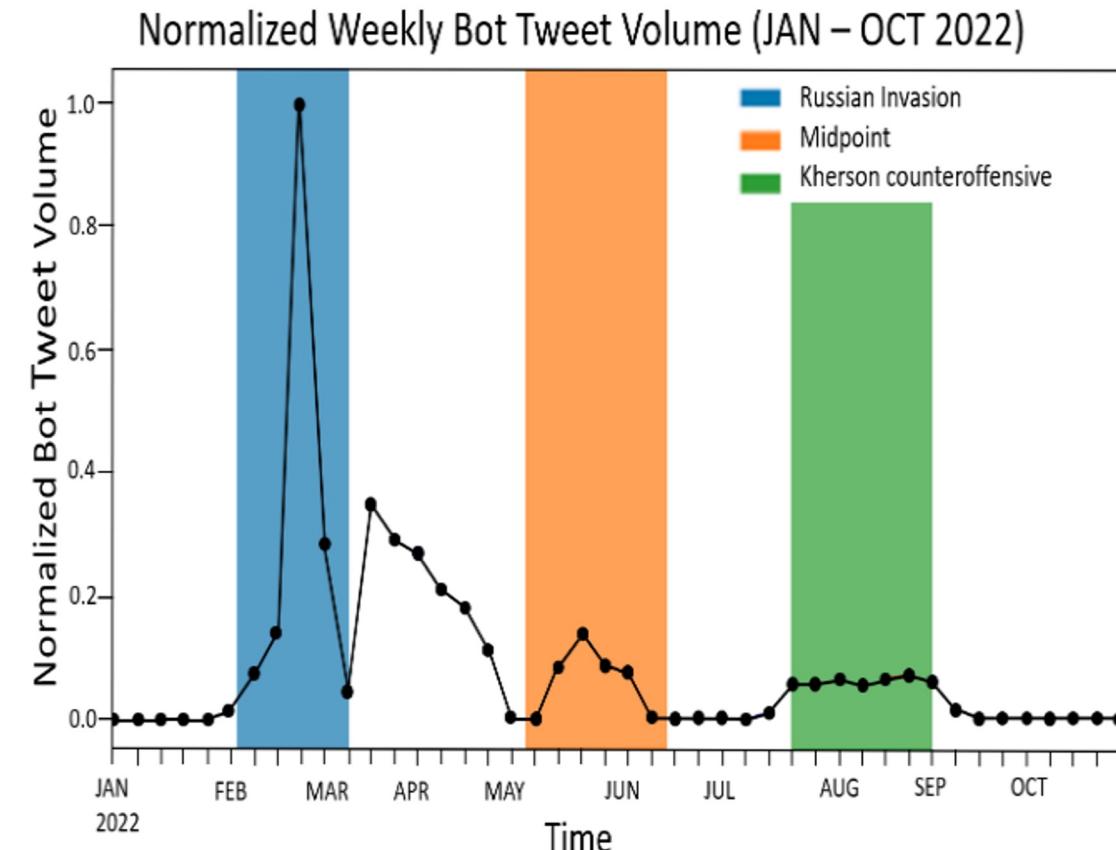
Information Manipulation

WHEN are narratives spread?

“Analyzing Digital Propaganda and the Conflict Rhetoric: A Study on Russian Bot-Driven Campaigns and Counter Narratives During the Ukraine Crisis”

2022 Russia Invasion of Ukraine

Spikes in tweet volume during key points of the invasion
In between key points, the bots maintain activity at lower rate



Information Manipulation

WHEN are narratives spread?

“From curious hashtags to polarized effect: profiling coordinated actions in Indonesian twitter discourse”
Social Network Analysis and Mining

EINE KLEINE CLIQUE?

In seiner Radio-Ansprache hat Hitler zugegeben, dass der Friedens-Putsch von deutschen Offizieren organisiert worden ist. Göring nannte in seiner Ansprache die Männer hinter der Bewegung „eine kleine Clique von ehemaligen Generälen.“

Hier sind die unbeweisbaren Tatsachen: Hitler und Himmler haben die militärische Führung des Staates aus den Händen Hitler abgesetzt. Unter den von

Hitler abgesetzten Generälen sind:

Generaloberst Ludwig Beck,
Generalfeldmarschall Ewald v. Kleist,
Generalfeldmarschall Wilhelm Ritter v. Leeb,
Generalfeldmarschall Wilhelm List,
Generalfeldmarschall Fritz Erich v. Manstein,
Generalfeldmarschall Gerd v. Rundstedt,
Generalfeldmarschall Erich Witzleben,

Generaloberst Ludwig Beck,
Generalfeldmarschall Ewald v. Kleist,
Generalfeldmarschall Wilhelm Ritter v. Leeb,
Generalfeldmarschall Wilhelm List,
Generalfeldmarschall Fritz Erich v. Manstein,
Generalfeldmarschall Gerd v. Rundstedt,
Generalfeldmarschall Erich Witzleben,

Generaloberst Ludwig Beck,
Generalfeldmarschall Ewald v. Kleist,
Generalfeldmarschall Wilhelm Ritter v. Leeb,
Generalfeldmarschall Wilhelm List,
Generalfeldmarschall Fritz Erich v. Manstein,
Generalfeldmarschall Gerd v. Rundstedt,
Generalfeldmarschall Erich Witzleben,

Generaloberst Ludwig Beck,
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Generalfeldmarschall Wilhelm List,
Generalfeldmarschall Fritz Erich v. Manstein,
Generalfeldmarschall Gerd v. Rundstedt,
Generalfeldmarschall Erich Witzleben,

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Generalfeldmarschall Wilhelm Ritter v. Leeb,
Generalfeldmarschall Wilhelm List,
Generalfeldmarschall Fritz Erich v. Manstein,
Generalfeldmarschall Gerd v. Rundstedt,
Generalfeldmarschall Erich Witzleben,

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Generalfeldmarschall Wilhelm List,
Generalfeldmarschall Fritz Erich v. Manstein,
Generalfeldmarschall Gerd v. Rundstedt,
Generalfeldmarschall Erich Witzleben,

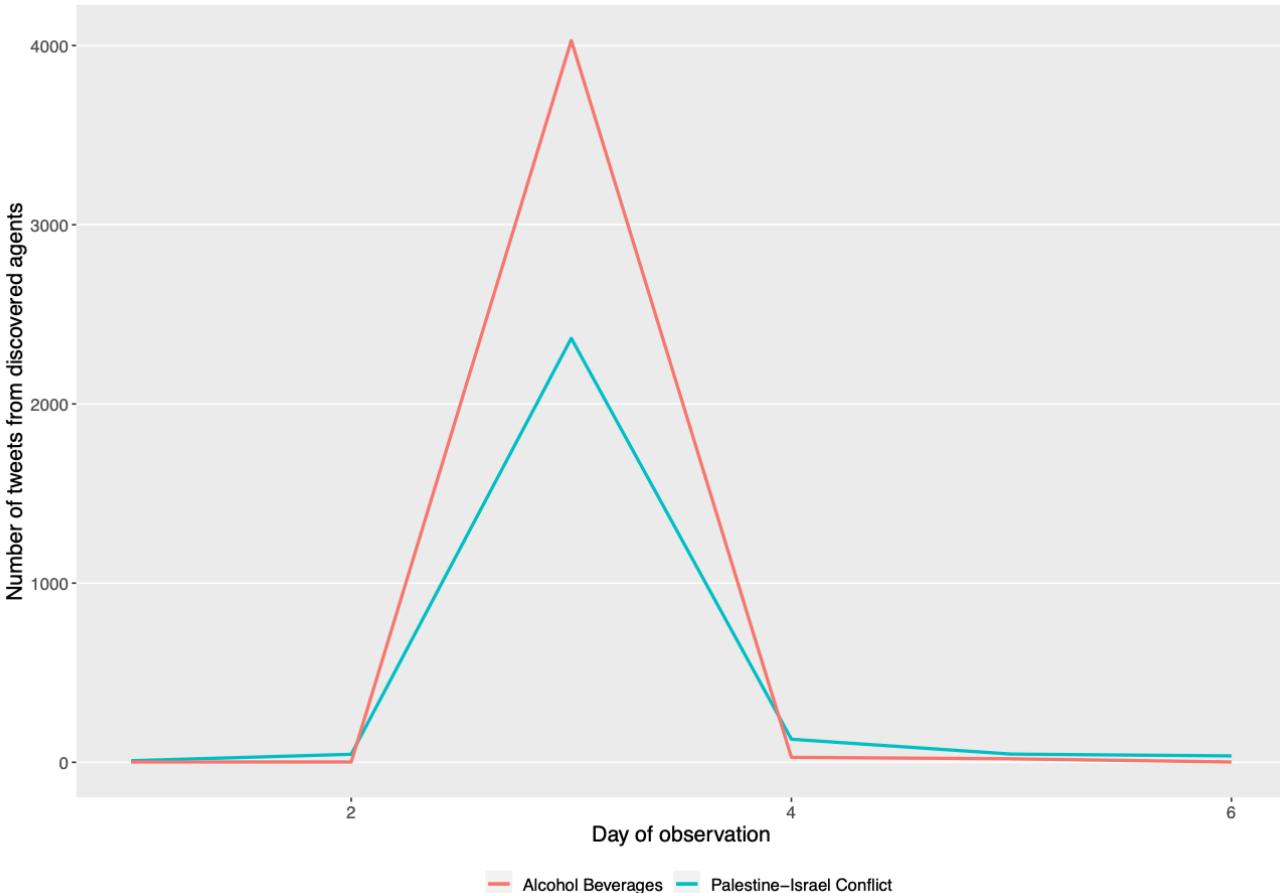
Generaloberst Ludwig Beck,
Generalfeldmarschall Ewald v. Kleist,
Generalfeldmarschall Wilhelm Ritter v. Leeb,
Generalfeldmarschall Wilhelm List,
Generalfeldmarschall Fritz Erich v. Manstein,
Generalfeldmarschall Gerd v. Rundstedt,
Generalfeldmarschall Erich Witzleben,

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Generalfeldmarschall Wilhelm Ritter v. Leeb,
Generalfeldmarschall Wilhelm List,
Generalfeldmarschall Fritz Erich v. Manstein,
Generalfeldmarschall Gerd v. Rundstedt,
Generalfeldmarschall Erich Witzleben,

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Generalfeldmarschall Wilhelm Ritter v. Leeb,
Generalfeldmarschall Wilhelm List,
Generalfeldmarschall Fritz Erich v. Manstein,
Generalfeldmarschall Gerd v. Rundstedt,
Generalfeldmarschall Erich Witzleben,

2021 Indonesian Discourse

Spikes in tweet volumes by bot accounts on the days of key announcements



Information Manipulation

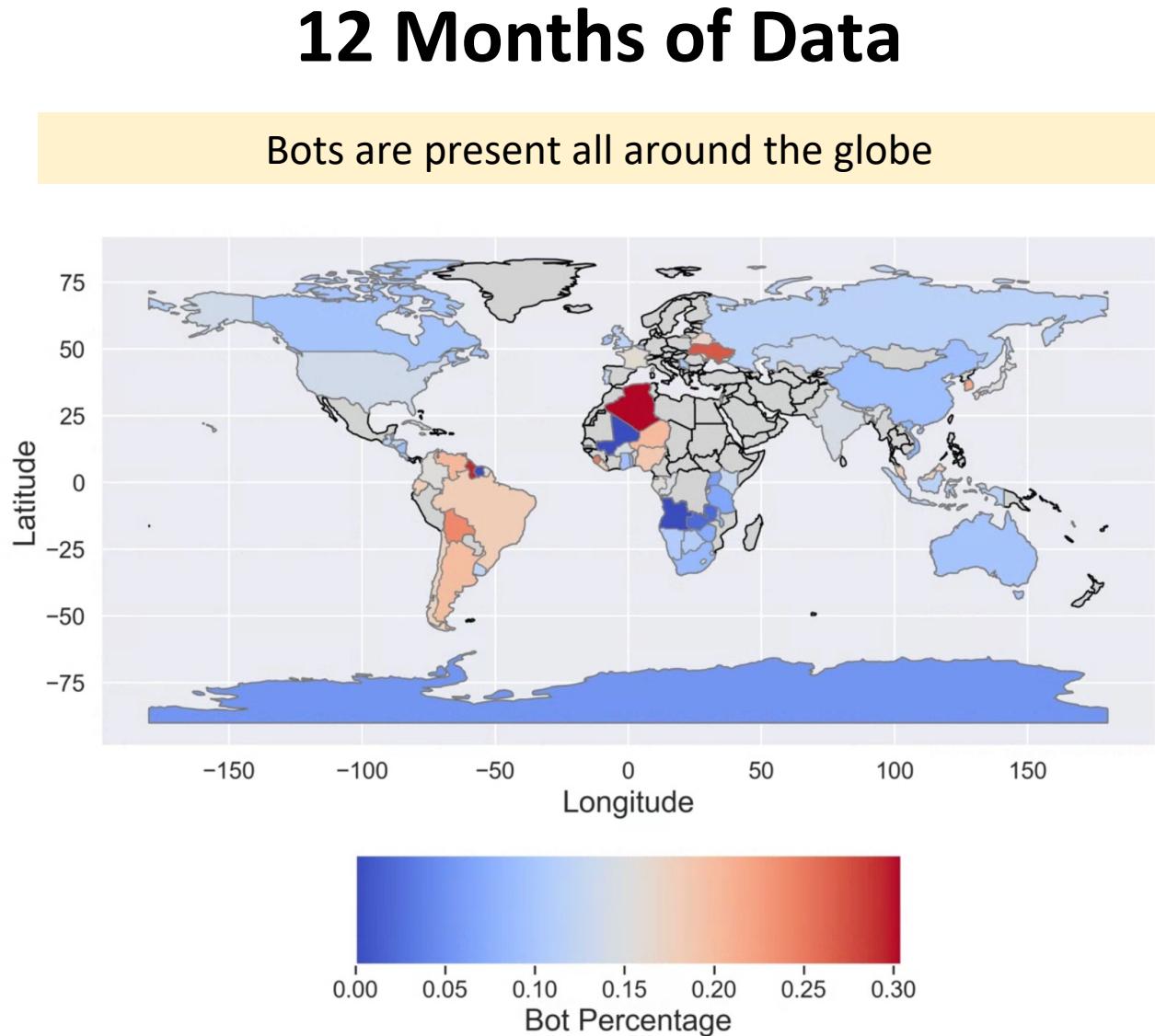
WHERE are narratives targeting?



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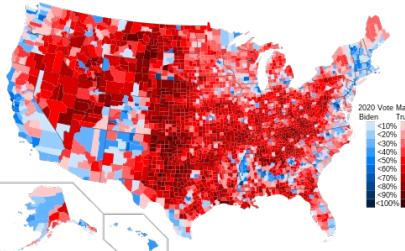
Information Manipulation

WHERE are narratives targeting?



Information Manipulation

WHERE are narratives targeting?



2020 US Elections



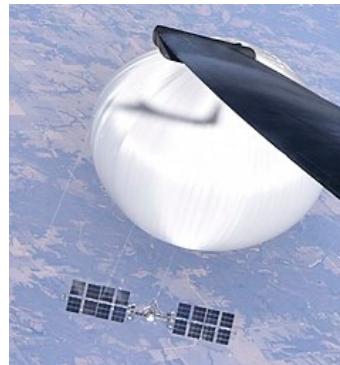
2021 Indonesian Alcohol Beverages/ Palestine-Israel discourse



2020 Brexit



2022 Nancy Pelosi Visit to China



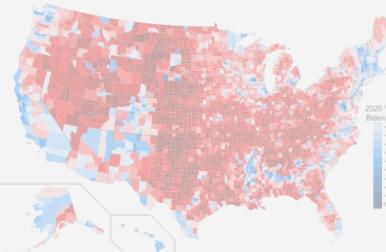
2023 US-China Balloon Incident



2023 Russia-Ukraine Conflict

Information Manipulation

WHERE are narratives targeting?



2020 US Elections

Topics that can divide society

2021 Indonesian Alcohol Beverages, Palestine-Israel discourse

2022 Nancy Pelosi Visit to China

2023 US-China Balloon Incident



2020 Brexit



de society

2022 Nancy Pelosi Visit to China

2023 Russia-Ukraine Conflict

Information Manipulation Summary



WHY

Changing people's stances,
Polarizing Societies, Stance Convergence

HOW

BEND Framework,
Automated Coordination

WHO

Bots keep conversation alive
Humans create and spread narratives

WHAT

Exaggerate human-created narratives, Call for Action

WHEN

Key Events

WHERE

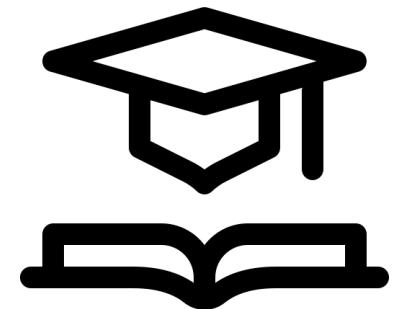
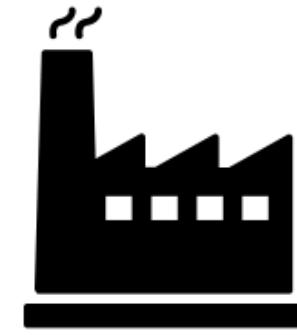
All around the globe, Topics that can divide society



Combatting Information Manipulation

Multi-Pronged Approach

Government, Industry, Academia



Information Manipulation by Social Media Bots through a Network Analysis View

Lynnette Hui Xian Ng

Website: quarby.github.io