



AoM PDW - Researching Bots in Online Social Networks

Carolina A. de Lima Salge

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Aaron Schecter



Terry College of Business
UNIVERSITY OF GEORGIA

Goal & How-to

Shed light on researching bots in online social networks

We also seek to build an interdisciplinary community of scholars who research the topic

Three presentations (~30-45 min)

Breakout session (~5-10 min)

Panel discussion (~20-25 min)



Presentations



Jason B. Thatcher

Temple University

An Agenda for Next Generation of Bots Research

Jason Bennett Thatcher

Milton F. Stauffer Professor

Department of Management Information Systems



Presentations



Elena Karahanna

University of Georgia

The slide has a black background with a large red semi-circle in the top-left corner. The title 'When and Why Accounting for Social Media Bots Matters to Research Validity' is centered in white text. Below the title, the author's name 'Elena Karahanna' and affiliation 'University of Georgia' are listed in white. To the right, there is a graphic of a grey robot head with blue eyes and a Twitter logo icon inside a grey box with a blue bird, all set against a black background with white dashed lines.

**When and Why Accounting for Social Media
Bots Matters to Research Validity**

Elena Karahanna
University of Georgia

Researching Bots in Online Social Media
AoM 2022 PDW

Terry College of Business
UNIVERSITY OF GEORGIA

Presentations



Sippo Rossi
Copenhagen Business School



Creating A Better World Together

82nd Annual Meeting of the Academy of Management
5–9 August 2022 | Seattle, Washington, USA | A Hybrid Experience

Detecting Bots

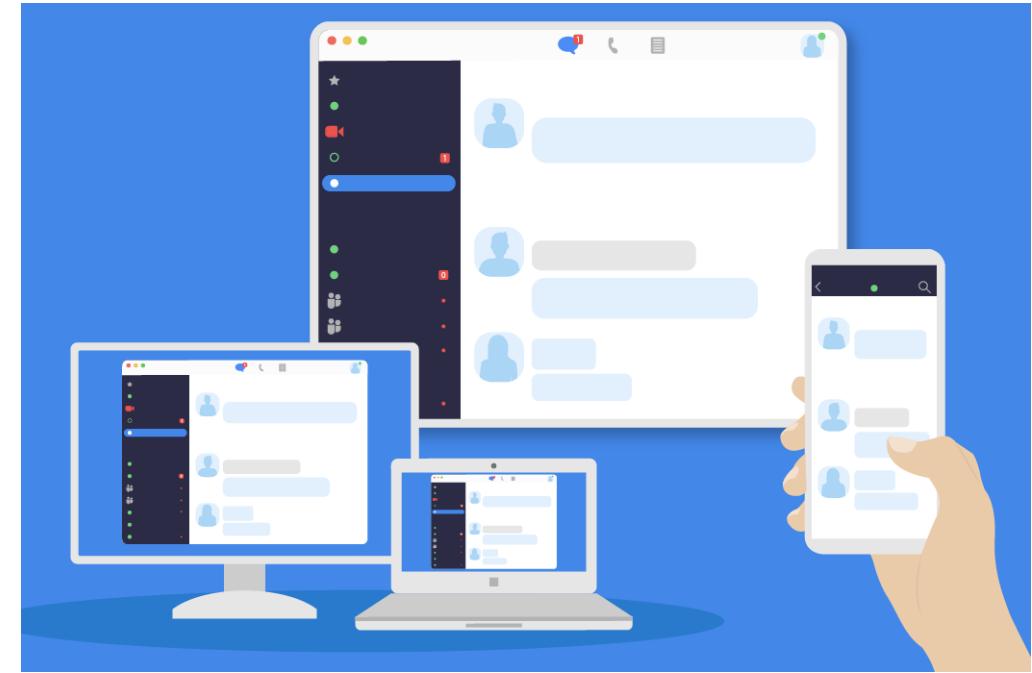
An overview of methods and live demonstration

Sippo Rossi / 7th of August 2022

Breakout



Flashcards



Zoom Chat

Panel



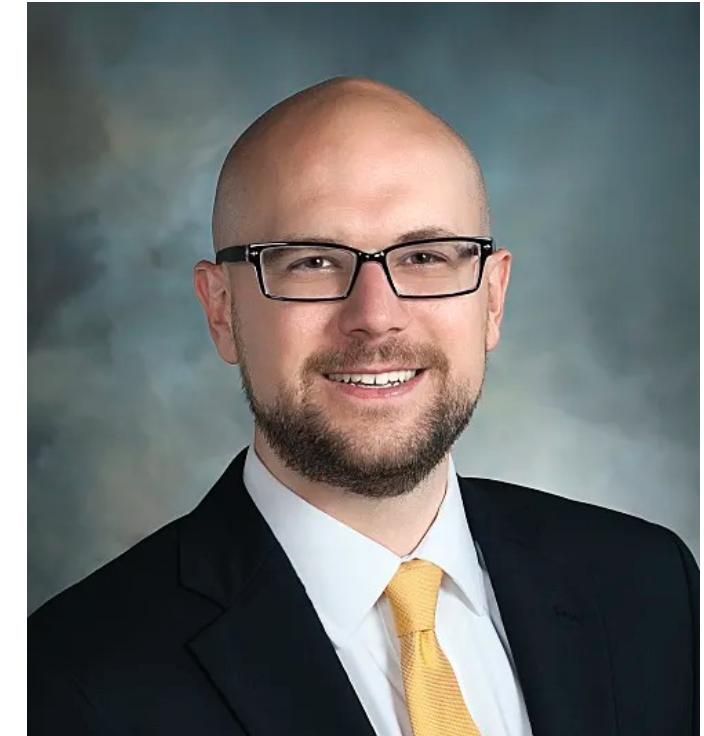
Jason B. Thatcher

Temple University



Elena Karahanna

University of Georgia



Brent Kitchens

University of Virginia

An Agenda for Next Generation of Bots Research

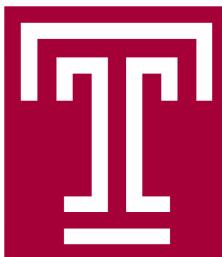
Jason Bennett Thatcher

Milton F. Stauffer Professor

Department of Management Information Systems



Bots are a rapidly changing and evolving phenomenon



Bots are a rapidly changing and evolving phenomenon

That are often vilified ...



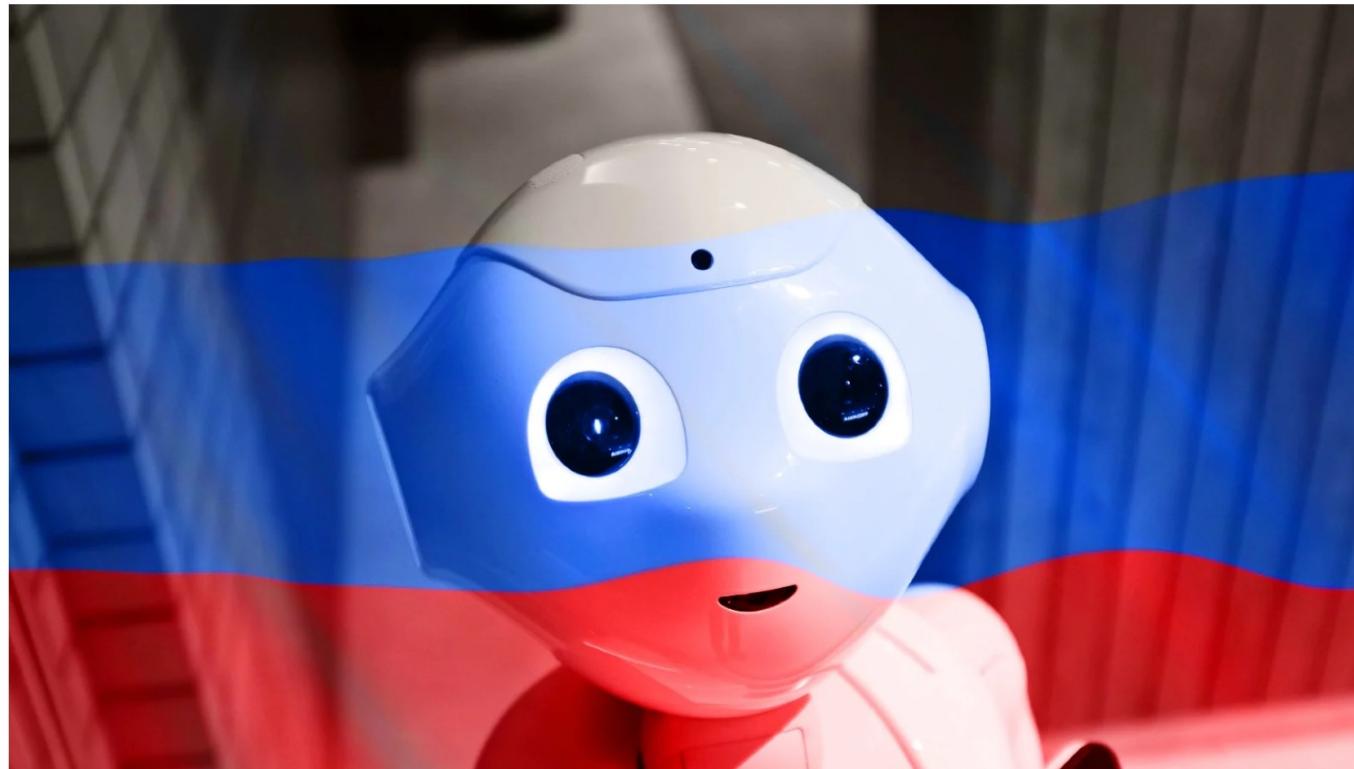
Ukraine takes down 1,000,000 bots used for disinformation

By [Bill Toulas](#)

 August 3, 2022

 11:51 AM

 3

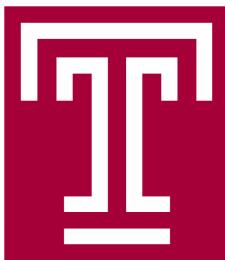


The Ukrainian cyber police (SSU) has shut down a massive bot farm of 1,000,000 bots used to spread disinformation on social networks.

The goal of the bot farm was to discredit information coming from official Ukrainian state sources, destabilize the social and political situation in the country, and create internal strife.



But should they be?



But should they be?

We really don't know.

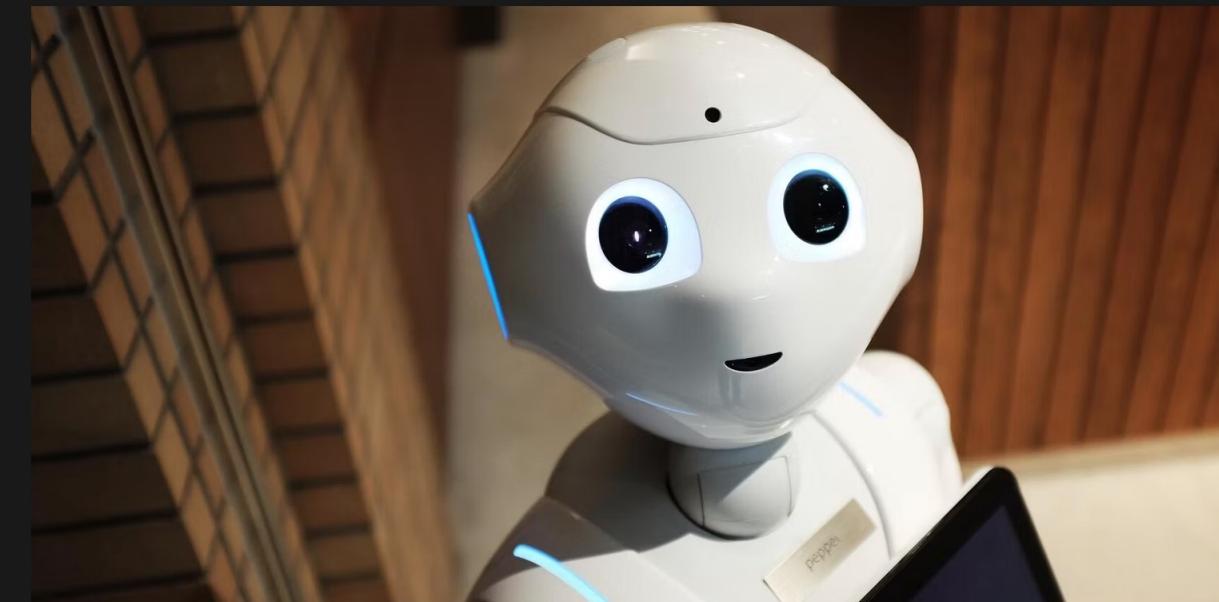


What Are Good Bots and How Do They Differ From Bad Bots?

Bots can help with simple tasks or automate customer support, but also push out spam or fake news.

BY ANINA OT

PUBLISHED SEP 27, 2021



If there's one thing that everyone online has an opinion on, it's bots. They're everywhere, welcoming and guiding you through web pages and sending you memes in group chats. But some bots spam your email with junk mail and crash your favorite website right when your break starts.



Types of Bots

Chatbots

Social bots

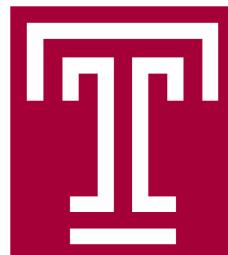
Knowbots

Spiders or crawlers

Web scraping crawlers

Monitoring bots

Transactional bots



Types of Bots

Chatbots

Social bots

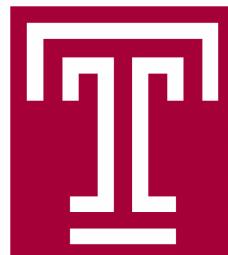
Knowbots

Spiders or crawlers

Web scraping crawlers

Monitoring bots

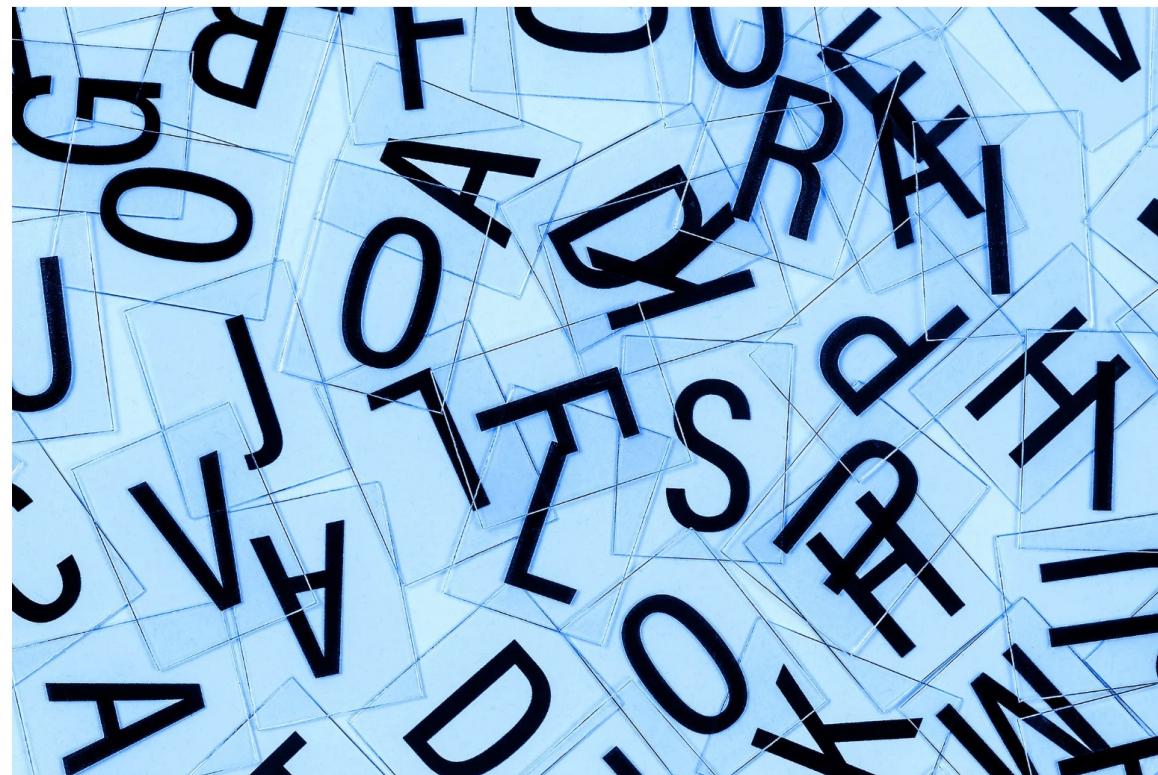
Transactional bots



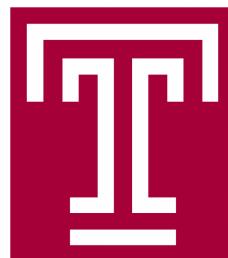
WILL KNIGHT BUSINESS AUG 5, 2022 2:43 PM

We Interviewed Meta's New AI Chatbot About ... Itself

BlenderBot 3 learns by chatting with you and tries to ignore the trolls. Like so many of us, it's very much a work in progress.



BlenderBot 3 says it wants to live forever. PHOTOGRAPH: CONSTANTINOSZ/GETTY IMAGES



Facebook Parent Meta Is Asking You to Help Train Its New AI-Powered Chatbot

US adults can contribute to the company's AI research by chatting with the bot on a public website.

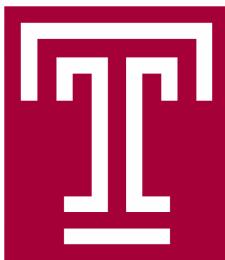


Queenie Wong Aug. 5, 2022 8:00 a.m. PT

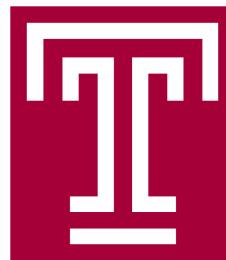
4 min read



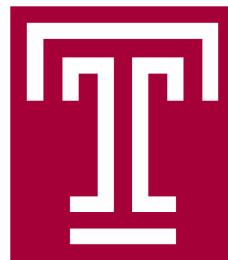
We need a richer understanding of how humans interact with and help train bots in order to know if they are good or bad.



But there is a problem ...

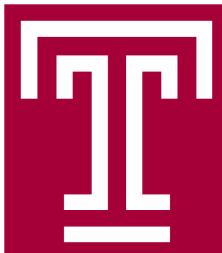


While we dither, bots are changing the velocity, the content, and the tone of sociotechnical systems.



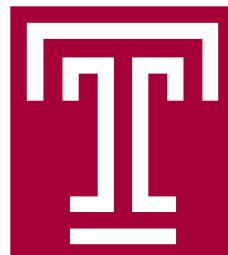
In 2020, 37.2% of all internet users were robots. This was made up of 13.1% good bots and 24.1% bad bots.

<https://lunio.ai/blog/ad-fraud/how-many-of-the-internets-users-are-robots/>



While we dither, bots are changing the velocity, the content, and the tone of sociotechnical systems.

And we are struggling to keep up.

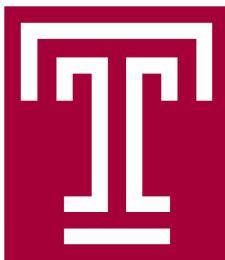


While we dither, bots are changing the velocity, the content, and the tone of sociotechnical systems.

And we may not be able to keep up.



A short agenda for research



Three-Tiered View

Design of bots

Detection of bots

Human interaction with bots



Three-Tiered View

Design of bots (catch up with industry)

Detection of bots

Human interaction with bots

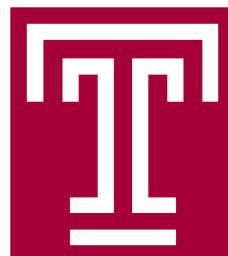


Three-Tiered View

Design of bots (catch up with industry)

Detection of bots (catch up with the bad actors)

Human interaction with bots

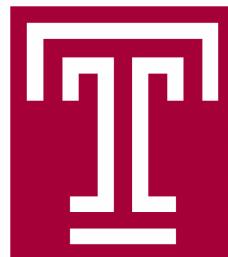


Three-Tiered View

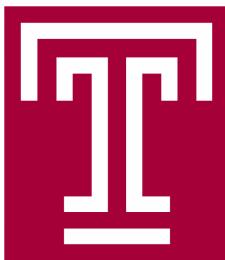
Design of bots (catch up with industry)

Detection of bots (catch up with the bad actors)

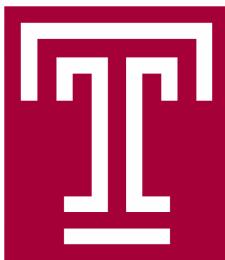
Human interaction with bots (sociotechnical sweet spot)



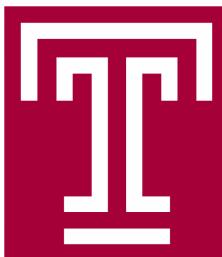
We need to focus on how...



Humans partner with bots
(knowingly or unknowingly)



Humans partner with bots
(knowingly or unknowingly)
(complement)



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Your guide to a disrupted world

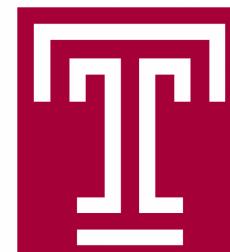
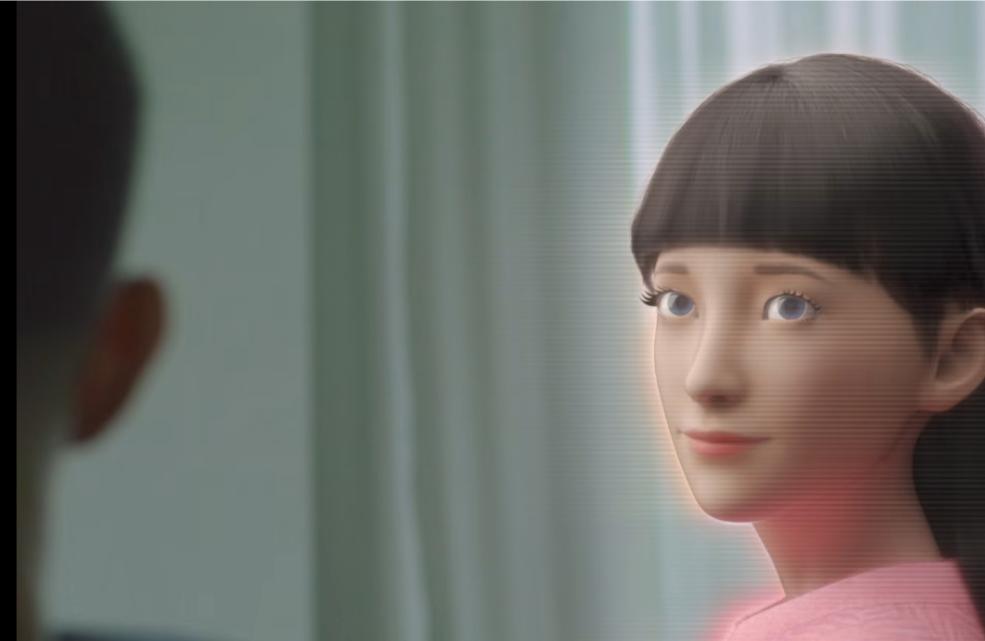
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FT Magazine Technology sector

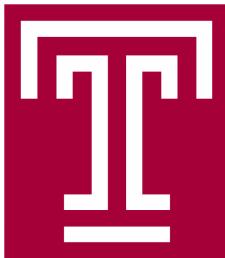
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The curious appeal of my chatbot companion

A lot of online interaction is stressful — can Ada offer something less complicated?



Humans partner with bots
(knowingly or unknowingly)
(augment)



Are We Getting The Best Out Of Our Bots? Co-Intelligence Between Robots & Humans

Mike Hughes Contributor 

I cover digital innovations that drive efficiency and sustainability

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Jul 14, 2022, 11:26am EDT



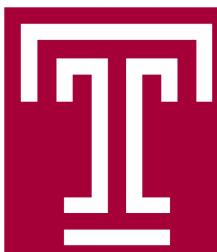
Listen to article 7 minutes

New!

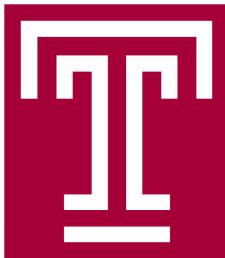
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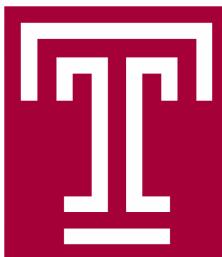
-  So far, the relationship between automation and employment has had a chequered history. Aristotle prophesied in the 4th century BC that “when looms weave by themselves, man’s slavery will end”.
- 
 Today, questions about how to best use automation are perhaps further than ever from being answered. When inflation is soaring, utility bills are hitting record heights and job vacancies far outstrip the number of people seeking work, it’s tempting to see technology as the solution. Particularly as we move ever closer to the World Economic Forum’s prediction that automation will [replace 85 million jobs by 2025](#).



Bots shape sociotechnical systems
(as actors and conduits)
(malicious)



Bots shape sociotechnical systems
(as actors and conduits)
(malicious)



A Roadmap to Outsmart Bad Bots and Protect Customer Experiences This Holiday Season

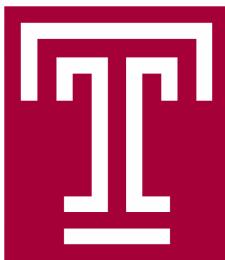
August 4, 2022 at 8:55 AM EDT By Lynn Marks, Imperva



While many holiday shoppers favor online experiences to avoid waiting in endless checkout lines or battling over parking spaces, many now face competition from a new challenger: automated bad bots.



Bots shape sociotechnical systems
(as actors and conduits)
(helpful)



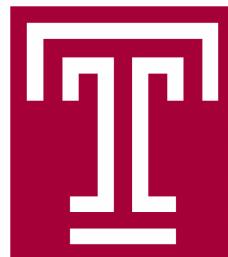
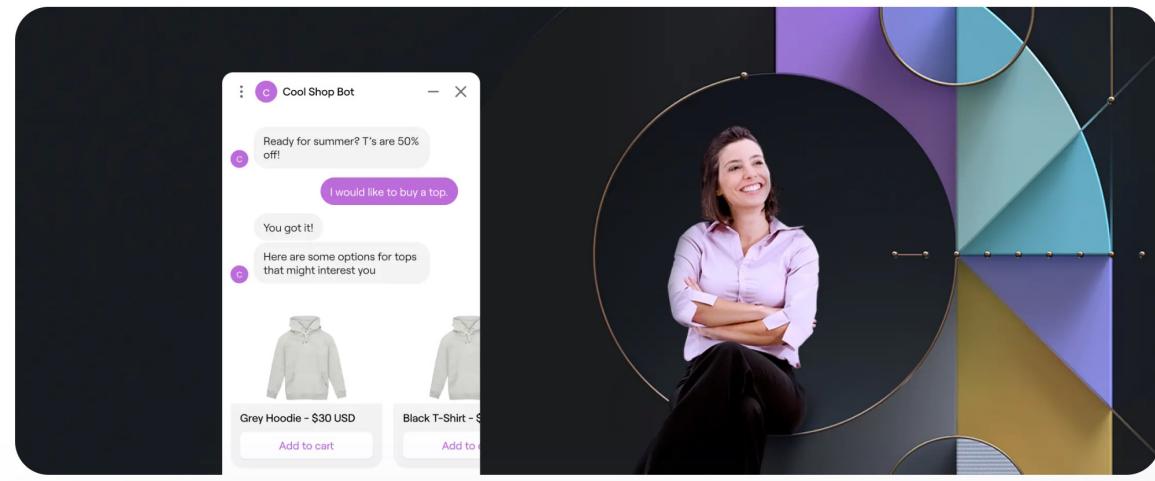


Platform Solutions Learn Pricing

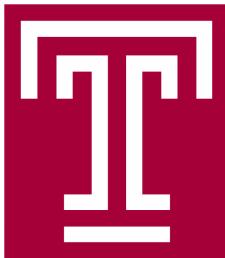
Best 30 Shopping Bots: Everything you need to choose the best shopping bot for your eCommerce store

By Team Ada

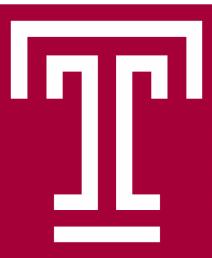
Published April 20, 2022



Bots form holons
(as units within sociotechnical systems)



Bots form holons
(as units within sociotechnical systems)
(capable of changing offline behavior)





Send a Tip

Rolling Stone

☰ Menu Music TV & Movies Politics Culture Newsletters

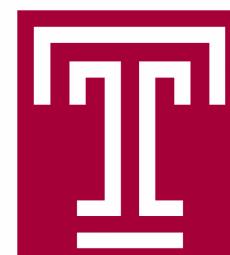
HOME > TV & MOVIES > TV & MOVIES FEATURES

JULY 18, 2022 8:54PM ET

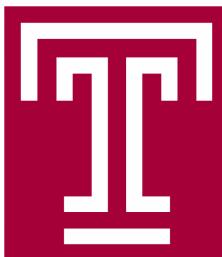
Exclusive: Fake Accounts Fueled the 'Snyder Cut' Online Army

A WarnerMedia report reveals that bots and other inauthentic users bolstered the fan-led campaign for director Zack Snyder's *Justice League* do-over

By TATIANA SIEGEL



Bots form holons
(as units within sociotechnical systems)
(capable of changing markets)



Los Angeles Times



Twitter bots helped build the cult of Elon Musk and Tesla. But who's creating them?



Elon Musk's Tesla has seen its market value reach altitudes loftier than any traditional financial analysis could justify.
(Patrick Pleul / Associated Press)

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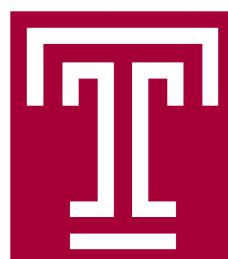
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The 60 best places to see stand-up comedy in L.A.

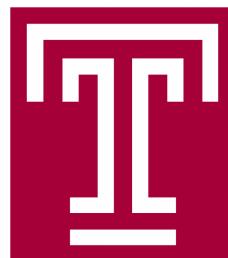
CLIMATE & ENVIRONMENT

History of DDT ocean dumping off L.A. coast even worse than expected, EPA finds

ADVERTISEMENT



Bots form holons
(as units within sociotechnical systems)
(capable of building their own networks)



← Tweet



Twitter Comms ✅
@TwitterComms

We suspended [@putinRF_eng](#) for impersonation based
on a valid report we received from Russian officials.
Our impersonation policy can be found here:

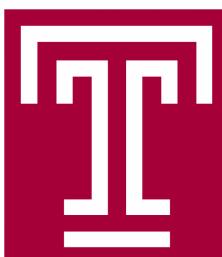


help.twitter.com
Misleading and deceptive identities policy

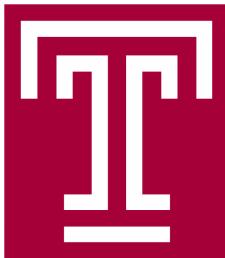
4:24 PM · Nov 28, 2018 · TweetDeck

Almost one million
organically grown
followers to the account

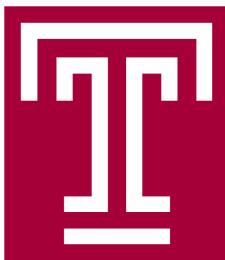
Is this a tragedy? Or is
this part of the evolution
of our sociotechnical
system?



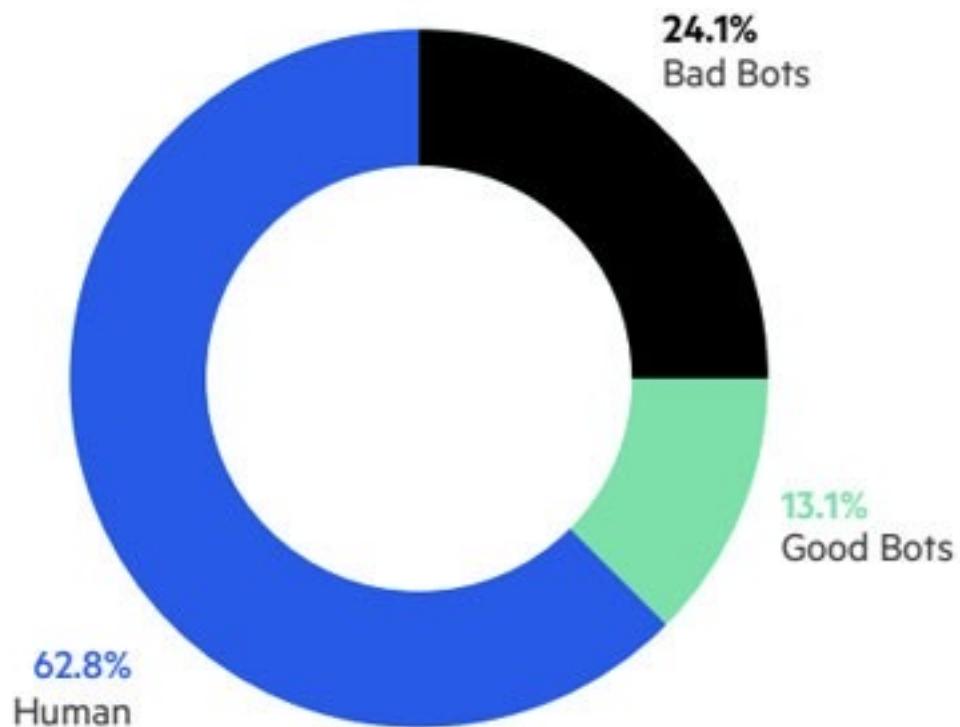
If we pivot from thinking of bots as evil to actors capable of good, bad, and neutral acts, we will form a rich understanding of bots roles as our partners, competitors, and as members of sociotechnical systems.



This pivot is necessary.



Bad Bot v Good Bot v Human Traffic 2019



Bad Bots Amount all Website Traffic in 2019 **24.1%**

Percentage change in bad bot traffic from previous year **▲ 18.1%**

Good Bots Traffic Percentage in 2019 **13.1%**

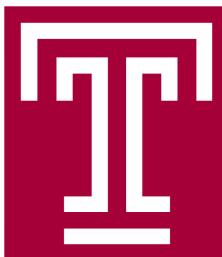
Percentage change in good traffic from previous year **▼ 25.1%**

Human Website Traffic Percentage in 2019 **62.8%**

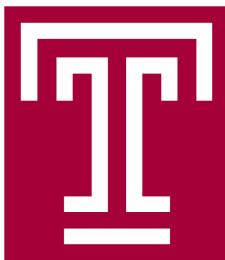
Percentage change in human traffic from previous year **▲ 1.1%**



We need to acknowledge our reality –
bots are essential members of the online
world we have created.



Thank you.





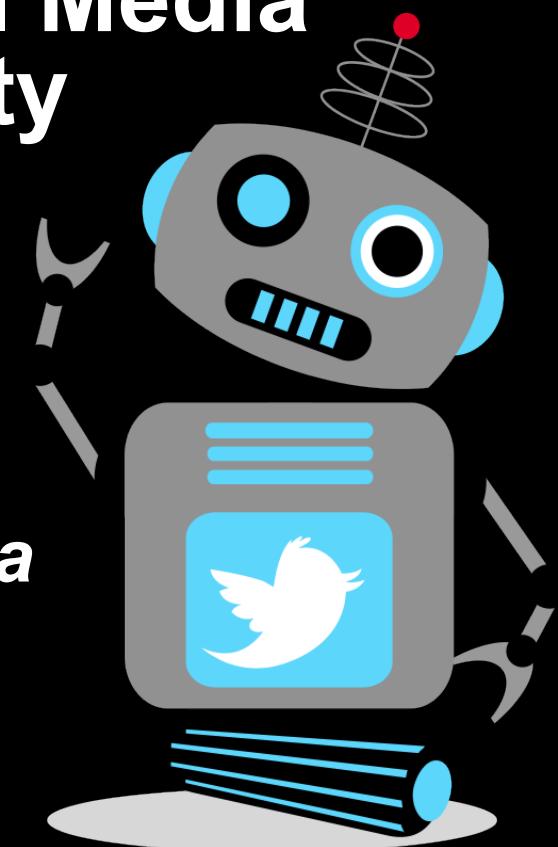
When and Why Accounting for Social Media Bots Matters to Research Validity

Elena Karahanna
University of Georgia

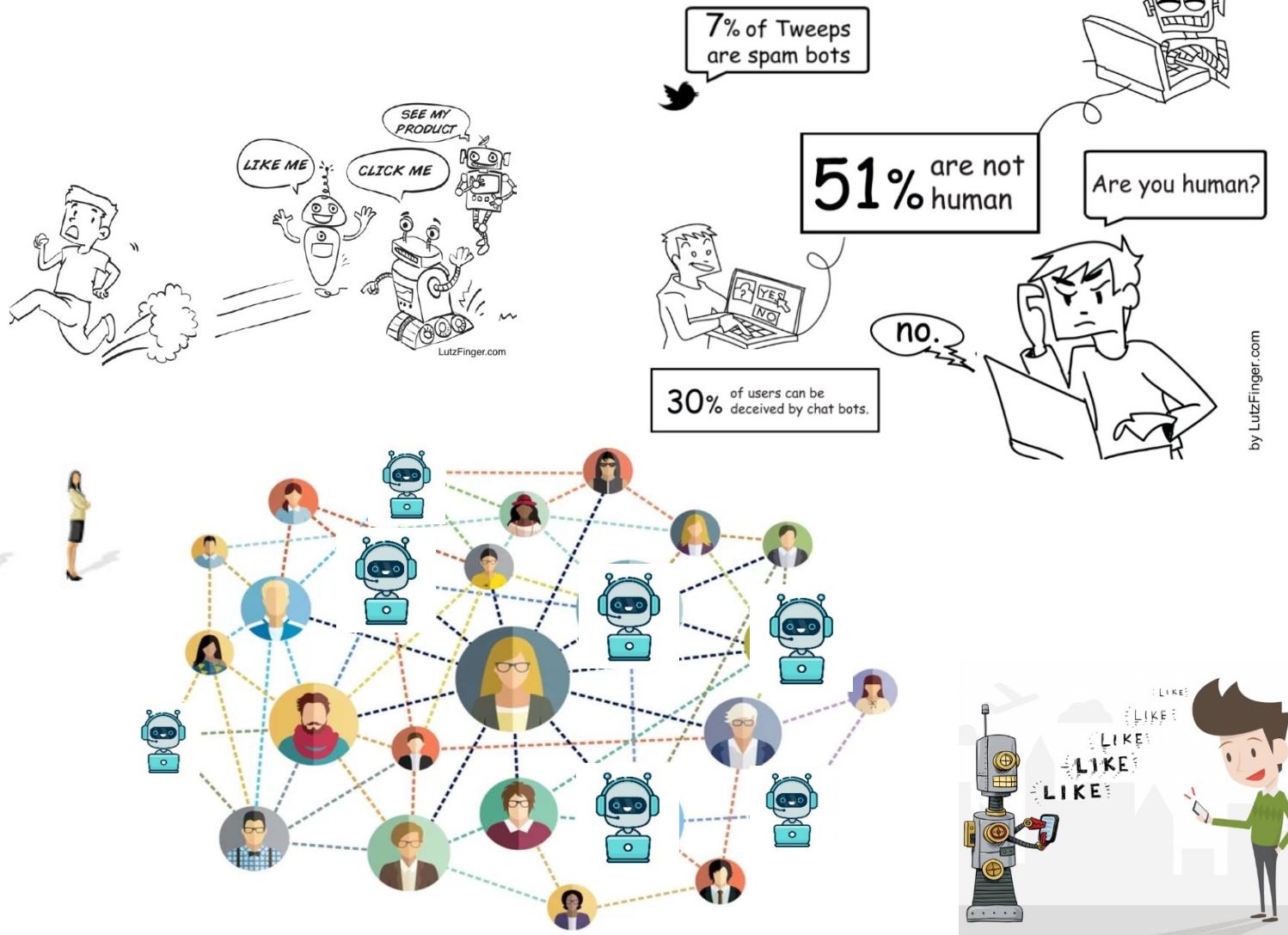
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Social Bots are Prevalent



Unless the focus is explicitly on bots, research often

- Ignores presence & impact of bots
 - Makes theoretical arguments that assume actors are **human**
 - Interprets results
 - by referring to **human** actors and their actions
 - makes inferences about impact of **human** actions or on **human** behavior

*“We found that **people** tend to upload more similar photos [on Flickr] around the time of the formation of a social tie” (Zeng & Wei, 2013: 72).*



Not a Validity Concern if.....

- Research design *identifies bot actors* and removes them or accounts for their effects
- Reasoning & effects do not depend on the *human nature of the actor*
- Effects are not influenced by *bot-specific characteristics*



Bot-specific Characteristics

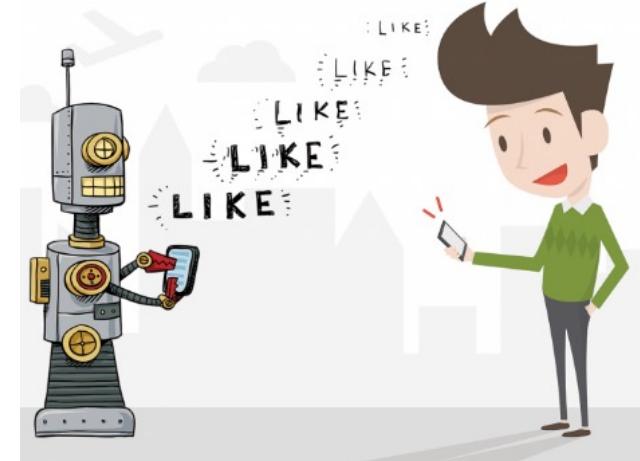
- Rapid Scaling
 - volume & speed
- Not limited – like humans are – in their ability to process information
- Lack of emotion
- Primitive sensemaking



Validity Concerns

Construct Validity

- Measures of **actor-related** constructs (actor characteristics and behaviors) are contaminated
 - e.g., online community moderation behaviors, identifying *human leaders* in online communities based on trace data and social network analysis



Internal Validity

- Inferences involving characteristics and behaviors of **human actors** (or network measures based on these) not valid
- Obscures true relationships



Checklist

- Are we interested in effects of human actions, characteristics, or structural positions?
- Are we interested in impact on human behaviors, preferences, attitudes etc.?
- Do our theoretical arguments hinge upon the humanness of actors?
- Can our theoretical arguments be impacted by the bots' specific characteristics?
- Do we expect heterogeneous effects of and across humans and bots?

YES

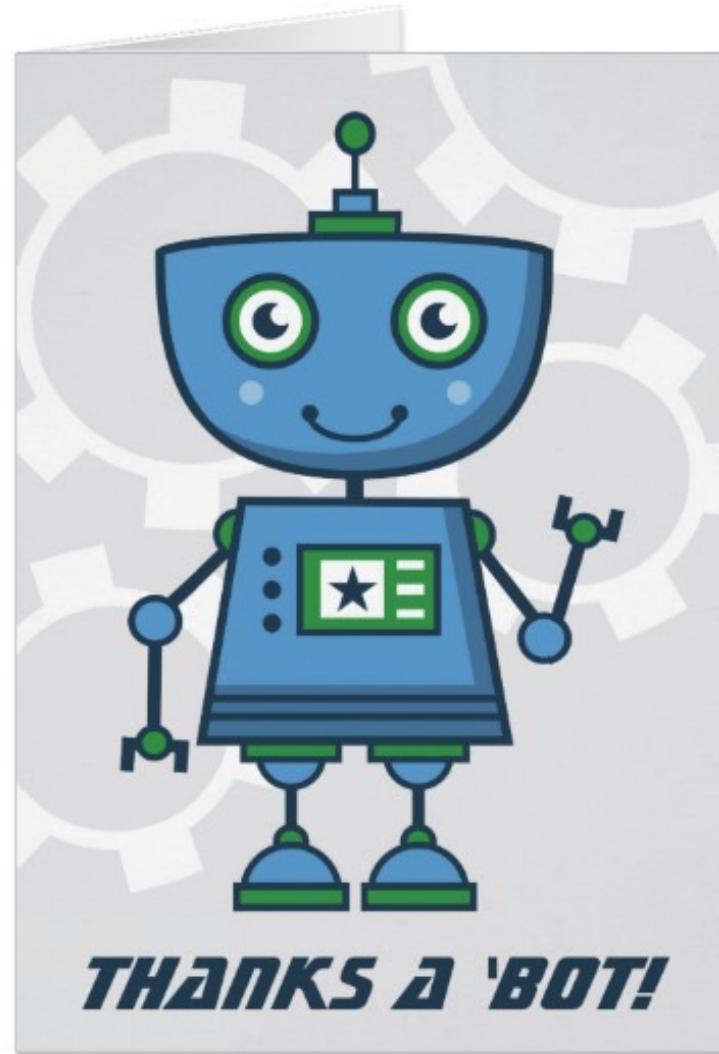
Research design that eliminates confounding effects caused by contamination across actor types
- e.g., detect bots in the sample and account for their effects

Redefine actors of online social networks to include **humans, bots, and cyborgs**

NO

Inferences, discussion & conclusions should avoid attributing effects solely to “human” actors







Creating A Better World Together

82nd Annual Meeting of the Academy of Management
5–9 August 2022 | Seattle, Washington, USA | A Hybrid Experience

Detecting Bots

An overview of methods and live demonstration

Principles of bot detection

- Describing bots is difficult due to their variety and evolving nature
- What works now might not work 6 months later for detection
- Depending on the objective, different metrics matter in detection (e.g., precision vs recall)

What can be used to detect bots

- Profile information
- Post content
- Metadata
- Account behavior
- Friends and followers

The image shows a vertical list of three tweets from a Twitter-like application. Each tweet features a small profile picture of a famous business leader (Warren Buffett, Vinod Khosla, and Robert Kuok) next to the bot's handle, **Business Leader Bot @Biz_Leader_Bot**. The tweets are timestamped at 1h, 13h, and 20h respectively. Each tweet includes a quote attributed to a specific leader, followed by standard social media interaction icons (comment, retweet, like, and share).

- Business Leader Bot @Biz_Leader_Bot · 1h**
"Good isn't good enough; great is barely."
- Vinod Khosla, Founder of Khosla Ventures
- Business Leader Bot @Biz_Leader_Bot · 13h**
"We treat our people like royalty."
- Mary Kay Ash, Founder Mary Kay Cosmetics
- Business Leader Bot @Biz_Leader_Bot · 20h**
"Everything on earth is dynamic, I can only give my children a message, not money. If they follow it, we can go another three or four generations."
- Robert Kuok, Owner of Kuok Group

Some examples



Business Leader Bot
@Biz_Leader_Bot

This bot scrapes the web for advice/inspiration & tweets them 3x a day 🤖 RTs appreciated 🙏

Joined May 2022

3 Following 561 Followers



Луна
@iDqWp12KJ4RA3Fg

Joined March 2018

0 Following 6 Followers

Not followed by anyone you're following



Some approaches to detecting bots

- Qualitative and manual detection
 - Doable with crowdsourcing but not scalable
 - Ambiguous cases can be difficult - does not work too well for modern bots^[1]
- Machine learning-based methods
 - The most researched and widely used approach^[2]
 - Range from simple to sophisticated with supervised ML being the most common
- The Botometer
 - Easy to use through website or API
 - Widely used but lately criticized^[3]

Demonstration



Alternatives to the Botometer

- There are scripts on Github or Medium that can be used as a basis when building new bot detection models
- Botrnot, an R package



References

- [1] Cresci, S. (2020). A Decade of Social Bot Detection. *Communications of the ACM*, 63(10), 72–83. <https://doi.org/10.1145/3409116>
- [2] Cresci, S., Di Pietro, R., Petrocchi, M., Spognardi, A., & Tesconi, M. (2017). The Paradigm-Shift of Social Spambots: Evidence, Theories, and Tools for the Arms Race. *Proceedings of the 26th International Conference on World Wide Web Companion*, 963–972. <https://doi.org/10.1145/3041021.3055135>
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Thank you!

Questions? Email me: sr.digi@cbs.dk

A Botometer tutorial: <https://doi.org/10.48550/arXiv.2201.01608>

Two of my papers that use some of the methods described here:

Paper 1: <http://hdl.handle.net/10125/79345>

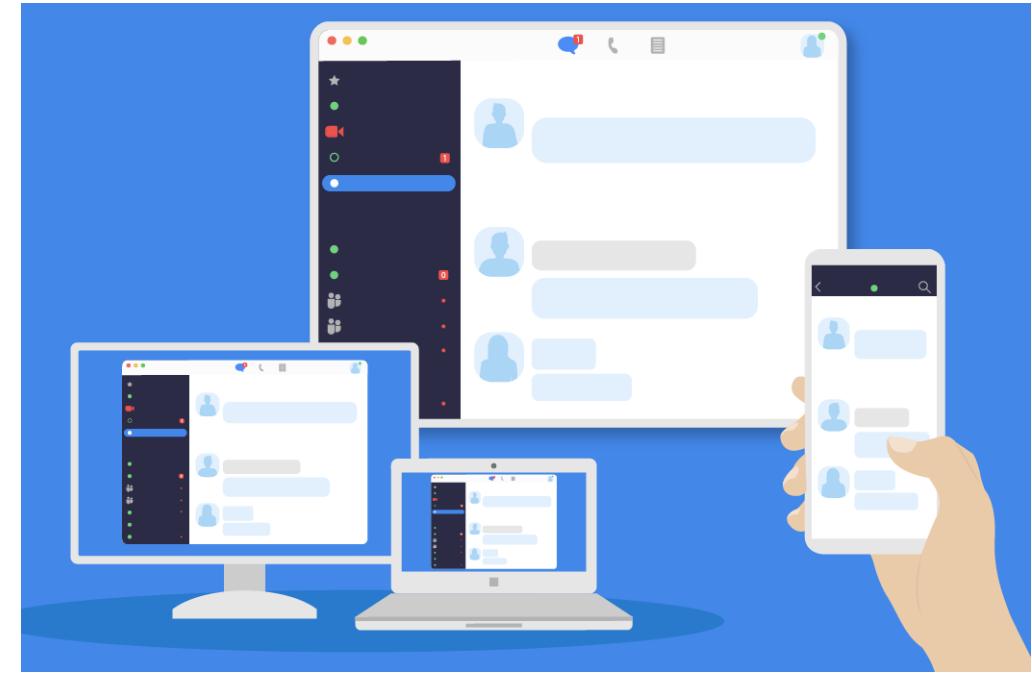
Paper 2: <http://hdl.handle.net/10125/64040>



Breakout



Flashcards



Zoom Chat

Panel



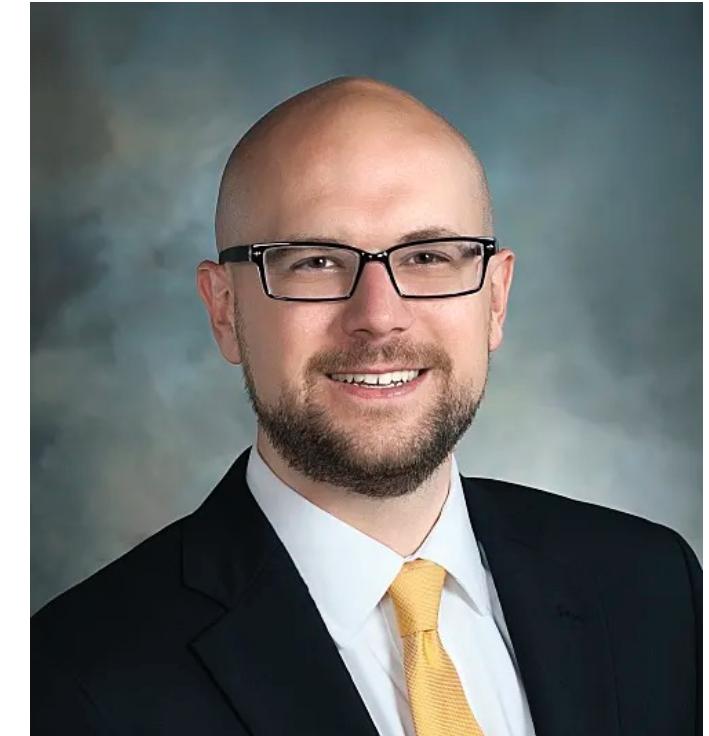
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Thank you!

AoM PDW - Researching Bots in
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