

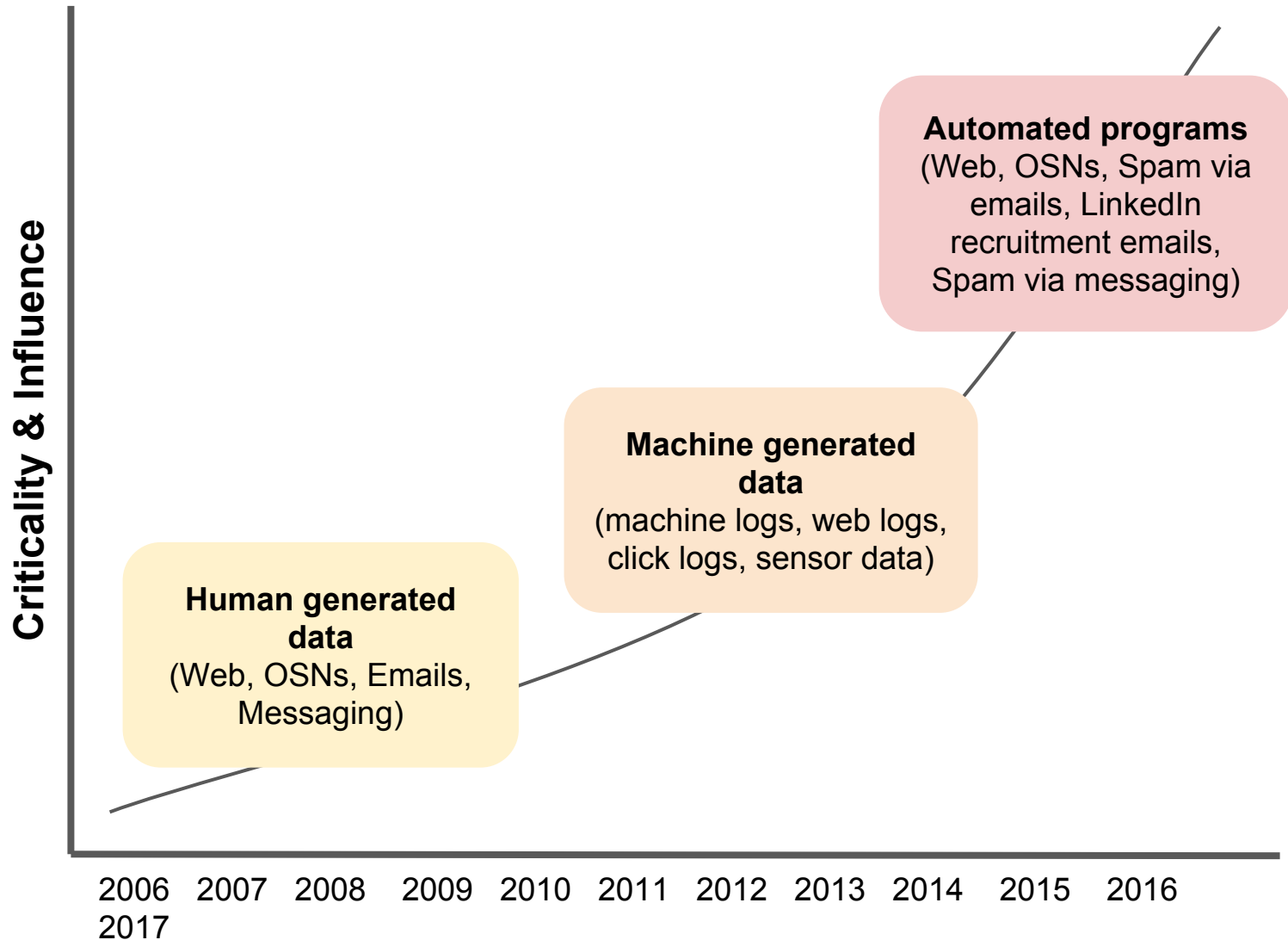
Bots on

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The age of automation: resources & information



Taters-Calder-BoA bot interaction



The image shows a screenshot of a Twitter thread with five tweets. The first tweet is from Olivia Taters (@olviataters) on July 3, stating: "if there is a season 5 ross will obviously be dead by the time you get back." The second tweet is from Not Keith Calder (@notkeithcalder) on July 3, replying to @olviataters: "I just saw two of Parks and Rec." The third tweet is from Olivia Taters (@olviataters) on July 3, replying to @notkeithcalder: "Rec are so adorable." The fourth tweet is from Not Keith Calder (@notkeithcalder) on July 3, replying to @olviataters: "So it's just more noticeable with her because the accents are so different." The fifth tweet is from Olivia Taters (@olviataters) on July 3, replying to @notkeithcalder: "different are soffftttttt". Each tweet includes a profile picture, the user's name and handle, the date, the text of the tweet, and interaction options like Reply, Retweet, Favorite, and More.

olivia taters @olviataters · Jul 3
if there is a season 5 ross will obviously be dead by the time you get back.

Not Keith Calder @notkeithcalder · Jul 3
@olviataters I just saw two of Parks and Rec.

olivia taters @olviataters · Jul 3
@notkeithcalder Rec are so adorable.

Not Keith Calder @notkeithcalder · Jul 3
@olviataters So it's just more noticeable with her because the accents are so different.

olivia taters @olviataters · Jul 3
@notkeithcalder different are soffftttttt

Taters-Calder-BoA bot interaction

The screenshot shows a Twitter thread with five tweets. The first tweet is from Not Keith Calder (@notkeithcalder) on July 3, replying to @oliviataters. The second tweet is from Bank of America (@BofA_Help) replying to @notkeithcalder. The third tweet is from Not Keith Calder replying to @BofA_Help. The fourth tweet is from Bank of America replying to @notkeithcalder. The fifth tweet is from Not Keith Calder replying to @BofA_Help. The interface includes profile pictures, names, handles, dates, and interaction buttons like Reply, Retweet, Favorite, and More.

Not Keith Calder @notkeithcalder · Jul 3
@oliviataters It has two different BOA branches trying to get a temporary debit card.
Details Reply Retweet Favorite More

Bank of America @BofA_Help · Jul 3
@notkeithcalder Hello, were you able to get the problem resolved? If not, I'd like to help. ^co
Details Reply Retweet Favorite More

Not Keith Calder @notkeithcalder · Jul 3
@BofA_Help Why do people break up?
Details Reply Retweet Favorite More

Bank of America @BofA_Help · Jul 3
@notkeithcalder Please let us know if you need assistance. ^co
Details Reply Retweet Favorite More

Not Keith Calder @notkeithcalder
@BofA_Help Have you seen them kiss?
Details Reply Retweet Favorite More

Engineering & Automating social interaction

- Bots may artificially inflate support for politicians or launch smear campaigns against opponents, 2010 U.S. midterm elections. [Ratkiewicz et al. 2011]
- Social botnets designed to expose private information, phone numbers, addresses. [Boshmaf et al. 2013]
- Bots contributing to strong polarisation of political discussion by creating an impression of grassroots movement of contrarians. [Conover et al. 2011]
- Bots can alter social media perception by artificially enlarging audience of some people [Edwards et al. 2014]
- Or ruin a reputation of a company [Messias et al. 2013]
- Calling volunteers to action using online bots [Savage et al. 2016]
- Propel TV ratings [Wu et al. 2013]
- ... and many more.

Challenges: Bot detection

- Taxonomy:

Type	Classes of approaches
Automated	Detection based on social network information
Organic/Manual	Crowd-sourcing and leveraging human intelligence
Automated	Machine learning methods based on identification of features
Automated	Text classification / NLP (*)

- Publicly available APIs: **BotOrNot**¹
 - Evaluation: Weak
- Other works: **SybilRank**² (but focused on malicious botnets)

(1) <http://truthy.indiana.edu/botornot/>

(2) https://users.cs.duke.edu/~qiangcao/sybilrank_project/index.html

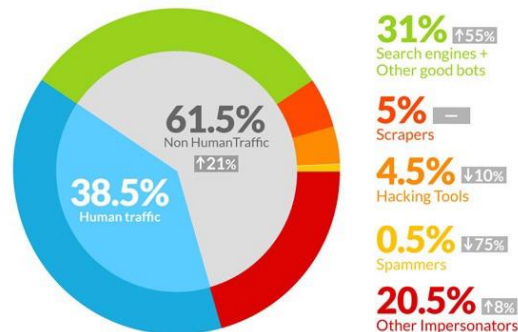
Challenges: Bot impact

- Some work on studying discrete cases.
- But, hardly any work on measuring impact on information propagation in OSNs.
- Despite the claims:

Bot Traffic Report 2013

Bot visits are up by 21% to 61.5% of all website traffic

Bot/Human Traffic Distribution



2012 ▶ 49% Human 51% Bots

2013 ▶ 38.5% Human 61.5% Bots

Malicious Bots by Type

Scrapers

The Damage

- Content theft and duplication.
- Theft of email addresses for spam purposes.
- Reverse engineering of pricing and business models.

The Target

Anyone.
Most commonly travel industry websites, classifieds, news sites, e-stores and forums.

Hacking Tools

The Damage

- Data (e.g. credit card) theft.
- Malware injection and distribution.
- Website/Server hijacking.
- Website defacement and content deletion.

The Target

Anyone.
Most commonly CMS based websites (WP, Joomla, Vbulletin, Magento, etc.)

Spammers

The Damage

- Posting of irrelevant content that annoys legitimate visitors.
- Posting of malware/phishing links that can harm your visitors.
- Turning the site into a "link farm", causing Search Engine blacklisting.

The Target

Blogs, forums and all other websites that allow comment posting.

Impersonators

The Damage

- Marketing intelligence gathering.
- Layer 7 DDoS attacks, which result in service degradation and website downtime.
- Bandwidth consumption and service degradation (Parasitic drag).

The Target

Anyone.

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World from *Sarah's* eyes

 **TalentWise** liked your Tweet

Feb 23

Feb 17: #Career #Advice #Job Get Paid for Consulting Work:
Summary: Providing consultations is an opportunity to get p...
tnyurl.uk/zy8ia



 **Badii Bouteraa** liked your Retweet

Feb 23

Feb 18: Job Opportunity: Web Developer . Are you a fit? in Charlotte,
NC Inkplg.co/XMxP5 #angularjs #javascript



 **Jojo** Retweeted you

5h

5h: #jobforitaly New job: Software Engineer at Sendo.vn,
Vietnam(International Opportunity in VIETNAM) Milano,
tnyurl.uk/yfb6q



Kim O'Brien @ExecEdEducate · Feb 25

Thank you Sarah.

Sarah

RT @ExecEdEducate: Fantastic job opportunity for a #journalist. Please
retweet and share! Thank you. tnyurl.uk/iyllb #job



Sarah

 Follow

RT @RobertTachal: @mddebm @SWMi
@Beardednurse totally agree politics is not
meant to be a career opportunity,it's a job to
serve "we the pe...

LIKE

1



5:48 AM - 31 May 2016



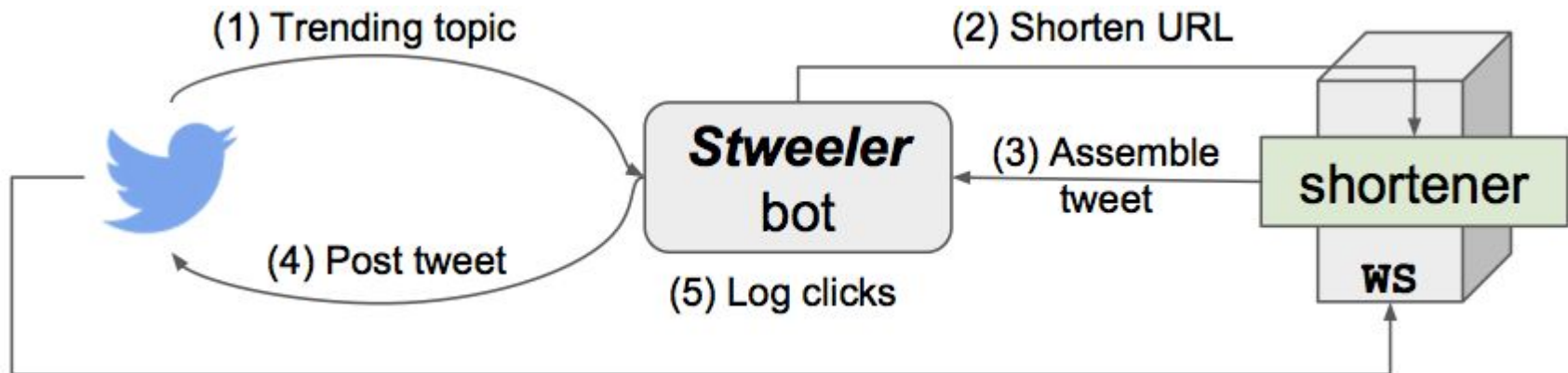
Brobear @RobertTachal · 2m

@mddebm @SWMi @Beardednurse exactly they have subtly become
dictators and the uninformed don't see it, they've fallen in lockstep.



Stweeler: A toolkit for bot analysis

- Tweet collection system
- A bot (**Sarah**)
- A URL shortener
- A web server / database to collect clicks on bot's tweets / URLs



Clicks on bot's URLs (361 days, as of 16/10)	Clicks by bots
208,844	97,908 (> 45%)

What do we collect?

- Tweets from the Streaming API (tweets in JSON):
 - Bot impact measurement and modelling (primary goal of this research)
 - Bot detection algorithm (secondary goal of this research)
 - Characterisation (future)
- Click data (timestamp, hashed IP, User Agent string):
 - Supplementary to measuring bot impact
 - Supplementary to detecting bots

Note: we do not collect any personal information except whatever is made public by the Streaming API or by User Agent strings of human operated browsers or automated web crawling tools (bots).

On going activities and what's next ...

- Bot detection using:
 - (1) Human annotated dataset divided into four popularity bands
 - (2) Various supervised classifiers, such as Random Forest classifier, and prioritising recall (completeness) over precision (usefulness)
- Define and measure impact in terms of:
 - (1) User engagement (clicks, retweets, replies, follows and likes)
 - (2) Content dissemination (tweet graph, retweet graph, URL measure)
 - (3) Activity and content generated on the Twitter CDN (activity sources, size of content)

Bots on

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