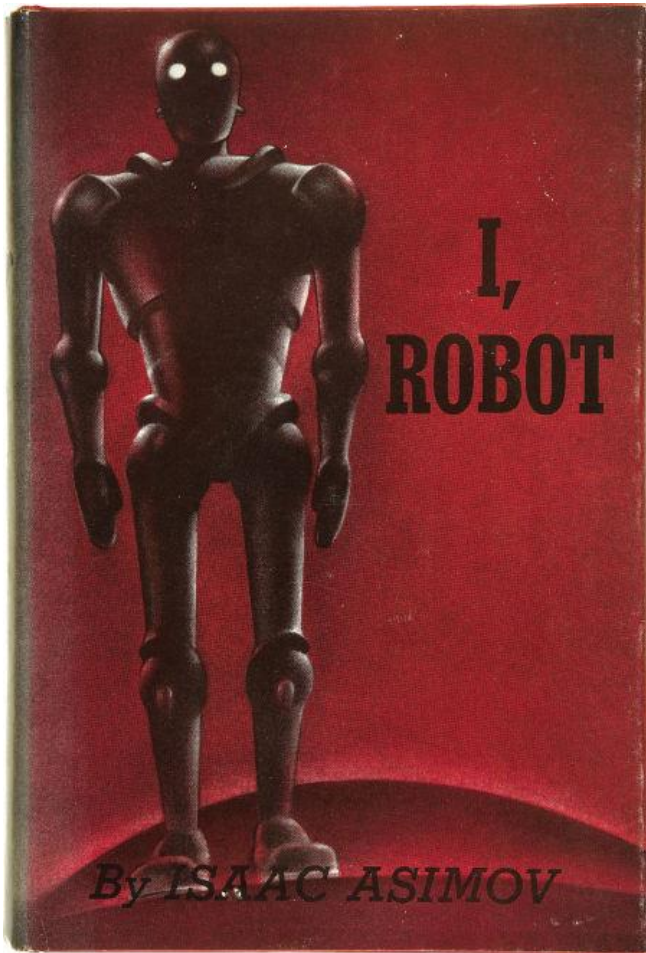


10 years after "I, Robot"



Is that a bot running the social media feed?

C. Edwards, A. Edwards, P. R. Spence, A. K. Shelton

Detecting Automation of Twitter Accounts

Z. Chu, S. Gianvecchio, H. Wang, S. Jajodia

What is Twitter



Marvel Entertainment 

@Marvel



[@starwars](#) Can we borrow some lightsabers? We have...science...to do. [#AskStarWars](#)



Star Wars 

@starwars



We'll trade you for the Mjölnir. RT [@Marvel](#): [@starwars](#) Can we borrow some lightsabers? We have...science...to do. [#AskStarWars](#)

What is Twitter



Marvel Entertainment 

@Marvel



[@starwars](#) Can we borrow some lightsabers? We have...science...to do. [#AskStarWars](#)



Star Wars 

@starwars



We'll trade you for the Mjölnir. RT [@Marvel](#): [@starwars](#) Can we borrow some lightsabers? We have...science...to do. [#AskStarWars](#)

Access

The image shows a screenshot of a Twitter profile page for a user named 'laska'. The profile picture is a person in a yellow suit and hat. The bio reads 'Anakin. Or Anacleto, depending on the mood.' The page shows navigation icons for Home, Notifiche, Messaggi, and Scopri. Below the profile picture, there are statistics: FOLLOWING 21, FOLLOWER 8, PREFERITI 12, and LISTE 2. The main content area is empty, with a 'Tweet' button and '140' characters remaining. Below this, there are two sections: 'Tendenze' (Trends) and 'Chi seguire' (Who to follow). The 'Tendenze' section lists: Switzerland, Vivian, Volk, Zeichen, Zurich, Videos, Swiss, Stream, Stimmt, and #LesAnGes7. The 'Chi seguire' section lists: NASA (@NASA) followed by ESA Rosetta Mis... and HUBBLE (@HUBBLE_spa...). Both have 'Segui' (Follow) buttons.

Access

The screenshot shows a Twitter profile for user 'laska' (larrybird). The profile picture is a yellow mask wearing a brown hat and a yellow suit. The bio reads 'Anakin. Or Anacleto, depending on the mood.' The page includes navigation tabs for Home, Notifiche, Messaggi, and Scopri. The main content area shows a tweet composition box with a 140 character limit and a 'Tweet' button. Below this are sections for 'Tendenze' (Trends) with a 'Modifica' option, and 'Chi seguire' (Who to follow) with entries for NASA and HUBBLE, each with a 'Segui' button.

The screenshot shows an iPhone text message conversation. The status bar at the top indicates AT&T service, a Wi-Fi signal, and the time 1:07 PM. The message header shows 'Messages' and the phone number '404-04', with an 'Edit' button. The conversation starts with a green bubble containing the word 'Start'. The system message reads: 'Welcome to Twitter! Follow people to get great content. Std msg rates apply. Already using Twitter? Reply w/ YES to sign in. Reply w/ your full name to signup.' A green bubble from the user 'Larry Bird' contains the name 'Larry Bird'. The system message continues: 'Congrats Larry Bird, you're now on Twitter! Your username is @LarryBi13921013. If you don't like this username, reply w/ SET USERNAME to change it.' At the bottom, there is a text input field with the placeholder 'Text Message' and a green 'Send' button.

Access

The screenshot shows the Twitter mobile app interface. At the top, there are navigation icons for Home, Notifiche, Messaggi, and Scopri. Below this is a user profile for 'laska' with a profile picture of a person in a yellow suit and hat. The profile statistics are: FOLLOWING 21, FOLLOWER 8, PREFERITI 12, and LISTE 2. The main feed shows a tweet from 'ESA Rosetta Mission' (@ESA_Rosetta) with 28 retweets and 22 likes. Below it is a retweet from 'House of Switzerland' for a tweet from 'SOLAR IMPULSE' (@solarimpulse) with 12 retweets and 14 likes. At the bottom, there is a tweet from 'GeekGirlPenPals HQ' (@IGGPP...) with a photo of a person in a red shirt. The bottom of the screen has a text input field with the placeholder 'What's happening?' and icons for adding photos and videos.

The screenshot shows an iPhone text message conversation. The status bar at the top indicates AT&T service, a Wi-Fi signal, and the time 1:07 PM. The message header shows 'Messages' and the contact name '404-04'. The conversation starts with a green bubble saying 'Start'. A grey bubble from Twitter says: 'Welcome to Twitter! Follow people to get great content. Std msg rates apply. Already using Twitter? Reply w/ YES to sign in. Reply w/ your full name to sign up.' A green bubble from the contact says 'Larry Bird'. Another grey bubble from Twitter says: 'Congrats Larry Bird, you're now on Twitter! Your username is @LarryBi13921013. If you don't like this username, reply w/ SET USERNAME to change it.' At the bottom, there is a text input field with the placeholder 'Text Message' and a green 'Send' button.

Access



Isaska
@isaska

Anakin. Or Anacleto, depending on mood.

FOLLOWING
21

FOLLOWER
8

PREFERITI
12

LISTE
2

Home Notifiche Messaggi Scopri

140 Tweet

AT&T 1:07 PM

Messages 404-04 Edit

Start

Home Discover

ESA Rosetta Mission
First batch of my NA... data (Feb-July '14) r... archives! Full details

House of Switzerland r...
SOLAR IMPULSE @...
Final preparations in... @bertrandpiccard! #...

GeekGirlPenPals HQ @IGGPP... 2d
Photo: gemmafemina: P A R A N O R

What's happening?

TweetCaster

mikez @welosiped

OneLoudier Apps @OneLoudierApps

Add Account

Trends

- #50NTHWALL
- Ben Foster
- Çagn Taner
- #ShotsToNumberOne
- #DearMe
- #MüslümBabaUnutmadiK
- #FoodieBandNames

Who to Follow

- Entertainment
- Funny
- News
- Technology
- Fashion
- Food & Drink

Explore

RECENT SEARCHES

- tweetcaster

SAVED SEARCHES

- AW Casino
- tweetcaster
- sportcaster

BOOKMARKS

- TechCrunch @TechCrunch
- Aziz Ansari @azizansari

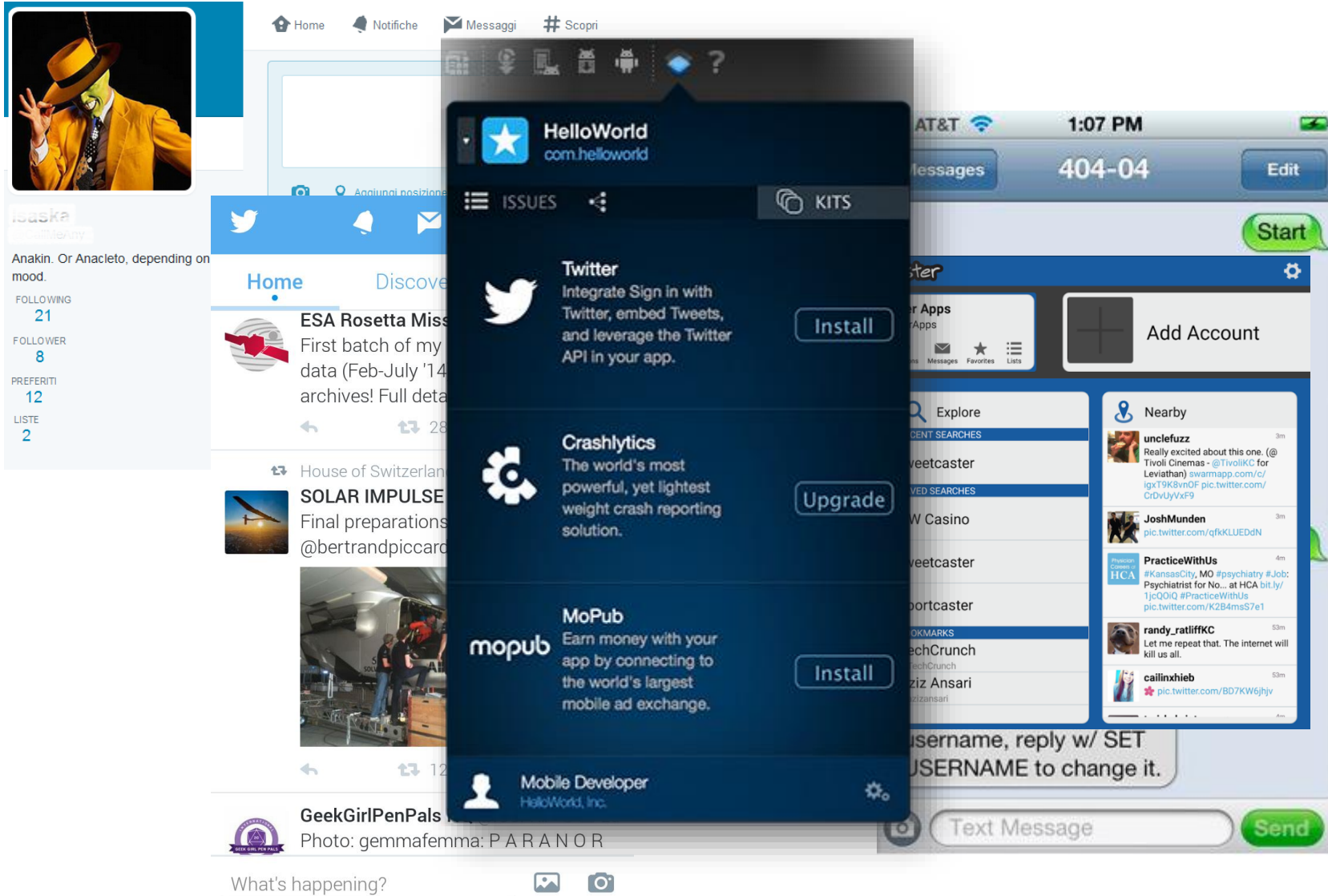
Nearby

- unclefuzz** Really excited about this one. (@TivoliCinemas - @TivolikC for Leviathan) swarmapp.com/c/igxT9K8vn0F pic.twitter.com/CrDvUyVx9
- JoshMunden** pic.twitter.com/qfkKLUEdN
- PracticeWithUs** #KansasCity, MO #psychiatry #Job: Psychiatrist for No... at HCA bit.ly/1jcdQIQ #PracticeWithUs pic.twitter.com/K2B4msS7e1
- randy_ratiffKC** Let me repeat that. The internet will kill us all.
- cailnxhieB** pic.twitter.com/BD7KW6jhy

username, reply w/ SET USERNAME to change it.

Text Message Send

Access



Twitter Evolution



i can't decide if i should pursue my hopes and dreams or start watching Downton Abbey from the start of season one.

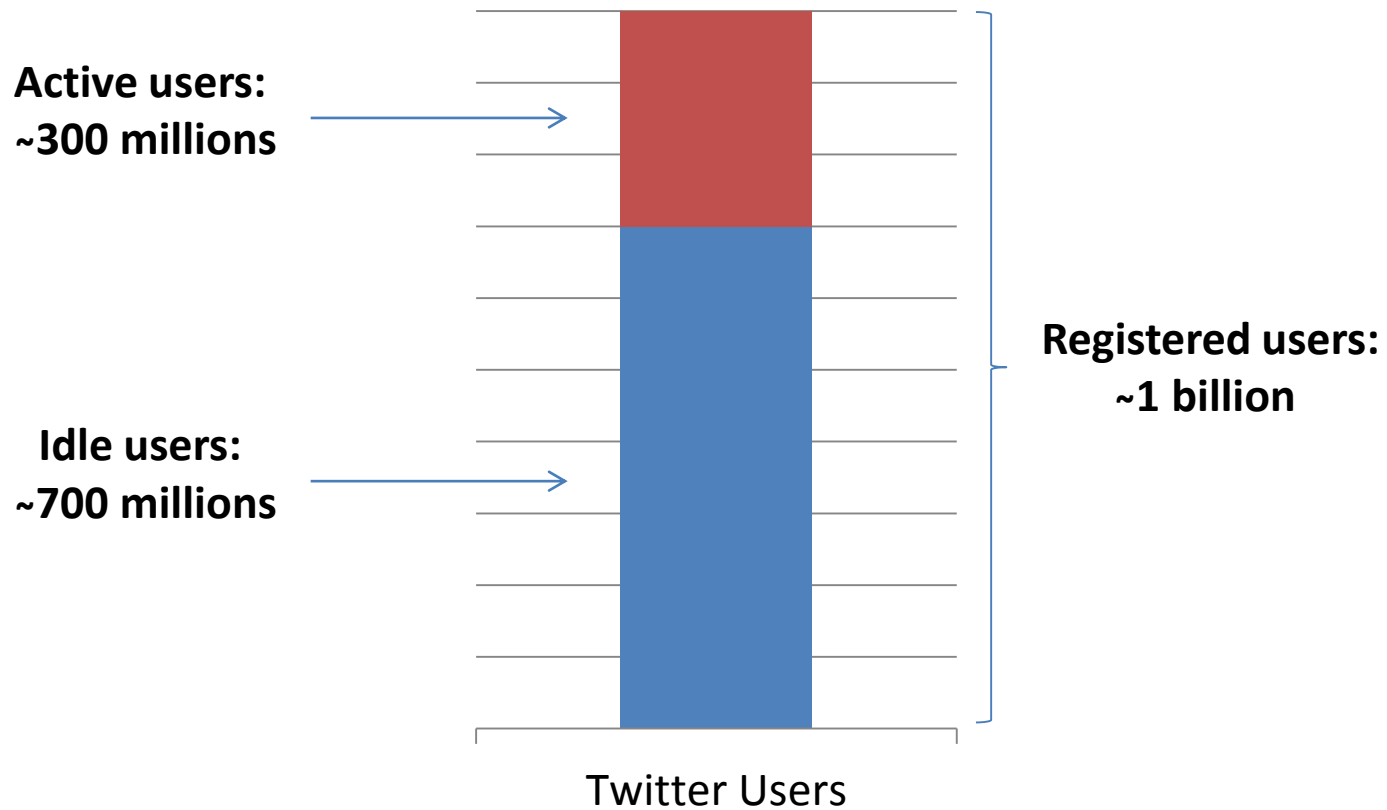


Continues heavy air strikes and counter strikes from all around Sanaa . My god . Hell is on the door. #yemen

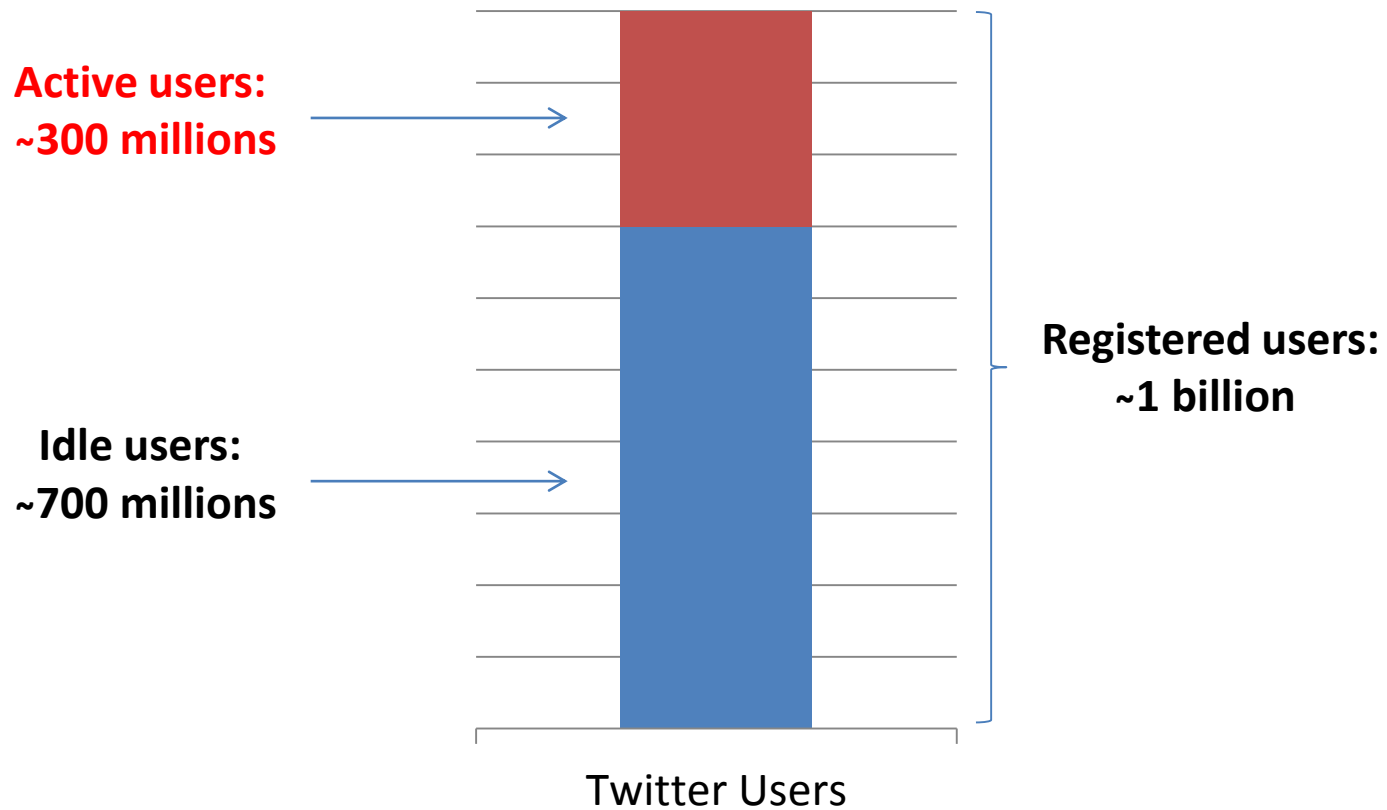


Tunisian authorities say they've killed militant linked to #bardomuseum attack, as march against terrorism begins bbc.in/1EkjpC2

Who are the users?



Who are the users?



Who are the users?



HUMAN



CYBORG



BOT

TWEET
248000

FOLLOWER
14300



Beetle Juice
@Betalgauss 3



Beetle Juice @Betalgauss 3 · 20 ott 2012

@HerrMiM IT'S SHOWTIME!

← ↻ 1 ★ ⋮

Conversazione



Beetle Juice @Betalgauss 3 · 20 ott 2012

@KidHannah Oh look! They've been to Saturn. Hey, I've been to Saturn! Whoa. Sandworms. You hate 'em right? I hate 'em myself!

← ↻ 1 ★ ⋮

Conversazione



Beetle Juice @Betalgauss 3 · 20 ott 2012

@SharaazEasyE IT'S SHOWTIME!

← ↻ ★ ⋮



Beetle Juice @Betalgauss 3 · 12 apr 2012

@zebics IT'S SHOWTIME!

← ↻ ★ 2 ⋮

Conversazione



Beetle Juice @Betalgauss 3 · 10 apr 2012

@MichaelBeek These aren't my rules. Come to think of it, I don't have any rules.

← ↻ 1 ★ 2 ⋮

Conversazione



Beetle Juice @Betalgauss 3 · 6 apr 2012

@a_dilEmma Let's turn on the juice and see what shakes loose.

TWEET
248000

FOLLOWER
14300



Beetle Juice
@Betalgauss 3



Beetle Juice @Betalgauss 3 · 20 ott 2012

[@HerrMiM](#) IT'S SHOWTIME!

↩ ↻ 1 ★ ⋮

Conversazione



Beetle Juice @Betalgauss 3 · 20 ott 2012

[@KidHannah](#) Oh look! They've been to Saturn. Hey, I've been to Saturn! Whoa. Sandworms. You hate 'em right? I hate 'em myself!

↩ ↻ 1 ★ ⋮

Conversazione



Beetle Juice @Betalgauss 3 · 20 ott 2012

[@SharaazEasyE](#) IT'S SHOWTIME!

↩ ↻ ★ ⋮



Beetle Juice @Betalgauss 3 · 12 apr 2012

[@zebics](#) IT'S SHOWTIME!

↩ ↻ ★ 2 ⋮

Conversazione



Beetle Juice @Betalgauss 3 · 10 apr 2012

[@MichaelBeek](#) These aren't my rules. Come to think of it, I don't have any rules.

↩ ↻ 1 ★ 2 ⋮

Conversazione



Beetle Juice @Betalgauss 3 · 6 apr 2012

[@a_dilEmma](#) Let's turn on the juice and see what shakes loose.

BOT

TWEET
37

FOLLOWING
25

FOLLOWER
9



Luca Dolfi
@CrashingBrain



Luca Dolfi @CrashingBrain · 24 gen 2014

Snow! Finally!



Luca Dolfi @CrashingBrain · 27 dic 2013



Luca Dolfi @CrashingBrain · 29 lug 2013

45 ore!!!



Luca Dolfi @CrashingBrain · 9 ott 2012

I estimated where Felix Baumgartner will land when he attempts the @redbullstratos record breaking freefall jump win.gs/4iMskNw



Luca Dolfi @CrashingBrain · 2 ott 2012

I'm in a group video chat with 5 others - Click to watch or join: tinychat.com/lucapizzimenti

TWEET
37

FOLLOWING
25

FOLLOWER
9



Luca Dolfi
@CrashingBrain



Luca Dolfi @CrashingBrain · 24 gen 2014

Snow! Finally!

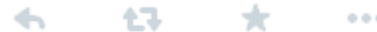


Luca Dolfi @CrashingBrain · 27 dic 2013



Luca Dolfi @CrashingBrain · 29 lug 2013

45 ore!!!



Luca Dolfi @CrashingBrain · 9 ott 2012

I estimated where Felix Baumgartner will land when he attempts the @redbullstratos record breaking freefall jump win.gs/wlMskNw



Luca Dolfi @CrashingBrain · 2 ott 2012

I'm in a group video chat with 5 others - Click to watch or join: tinychat.com/lucapizzimenti

CYBORG

TWEET
6.134

FOLLOWER
677



Stock Market Status
@StockMktStatus



Stock Market Status @StockMktStatus · 5 mar

Analysts suspect that Wal-Mart (WMT) was down -0.95% today because there loyalty usually resides else where.



Stock Market Status @StockMktStatus · 5 mar

Paychex (PAYX) lost -1.09% today amid reports that of the light pollution) but it isn't impossible in dark suburbs.



Stock Market Status @StockMktStatus · 4 mar

Investors traded 2,218,708 shares of Viacom (VIAB) because I'm a miss my people's going to Florida ..



Stock Market Status @StockMktStatus · 4 mar

Investors traded 8,025,449 shares of Coca-Cola (KO) because MY COMPUTER'S STOPPED WORKING AND I CAN'T WATCH



Stock Market Status @StockMktStatus · 4 mar

MARKET REPORT: The S&P 500 lost -0.45% today because tomorrow it could be you.

TWEET
6.134

FOLLOWER
677



Stock Market Status
@StockMktStatus



Stock Market Status @StockMktStatus · 5 mar

Analysts suspect that Wal-Mart (WMT) was down -0.95% today because there loyalty usually resides else where.



Stock Market Status @StockMktStatus · 5 mar

Paychex (PAYX) lost -1.09% today amid reports that of the light pollution) but it isn't impossible in dark suburbs.



Stock Market Status @StockMktStatus · 4 mar

Investors traded 2,218,708 shares of Viacom (VIAB) because I'm a miss my people's going to Florida ..



Stock Market Status @StockMktStatus · 4 mar

Investors traded 8,025,449 shares of Coca-Cola (KO) because MY COMPUTER'S STOPPED WORKING AND I CAN'T WATCH



Stock Market Status @StockMktStatus · 4 mar

MARKET REPORT: The S&P 500 lost -0.45% today because tomorrow it could be you.

BOT

TWEET
6

FOLLOWING
460

FOLLOWER
108



dinusha
@dinusha

Tweet

Tweet e risposte



dinusha @dinusha · 19 gen 2011

HAHAH I JUST GOT A FREE iPhone <http://bit.ly/hd2MqQ>



dinusha @dinusha · 19 gen 2011

<http://bit.ly/e1KsiO>



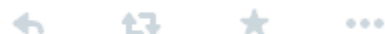
dinusha @dinusha · 18 gen 2011

They are looking for Apple iPhone beta testers <http://bit.ly/hf9nRW>



dinusha @dinusha · 13 dic 2010

Everyone should try acai! I lost 10lbs!! RT This <http://to.ly/8WVB>



dinusha @dinusha · 12 dic 2010

Lose weight instantly using acai <http://acainews8.com>



dinusha @dinusha · 28 lug 2007

Adding Twitter to my iPhone

TWEET
6

FOLLOWING
460

FOLLOWER
108



dinusha
@dinusha

Tweet

Tweet e risposte



dinusha @dinusha · 19 gen 2011

HAHAH I JUST GOT A FREE iPhone <http://bit.ly/hd2MqQ>



dinusha @dinusha · 19 gen 2011

<http://bit.ly/e1KsiO>



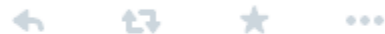
dinusha @dinusha · 18 gen 2011

They are looking for Apple iPhone beta testers <http://bit.ly/hf9nRW>



dinusha @dinusha · 13 dic 2010

Everyone should try acai! I lost 10lbs!! RT This <http://to.ly/8WVB>



dinusha @dinusha · 12 dic 2010

Lose weight instantly using acai <http://acainews8.com>



dinusha @dinusha · 28 lug 2007

Adding Twitter to my iPhone

SPAMBOT

TWEET
10300

FOLLOWING
2.008

FOLLOWER
2.315



GeekGiriPenPals HQ
@IGGPPCHQ

GeekGiriPenPals HQ @IGGPPCHQ · 5 mar

Poll Time! In honour of #WorldBookDay we want to know what your favourite book was as a child....

← ↻ 1 ★ 3 ...

GeekGiriPenPals HQ @IGGPPCHQ · 5 mar

Photo: tearyplant: tearyplant: littlealienproducts: Cat Pot Plant small // \$45
plant blog plant blog tumblr.co/Zutles1f1-7v9

← ↻ ★ ...

GeekGiriPenPals HQ @IGGPPCHQ · 5 mar

It's #WorldBookDay! Show us your costumes!

← ↻ 1 ★ ...

GeekGiriPenPals HQ @IGGPPCHQ · 5 mar

.@adventgeekgirl this is awesome, we love @smrtgrls! There are loads of science women in #GGPPC so hopefully some will take part!

← ↻ ★ 1 ...



GeekGiriPenPals HQ has retweeted



AdventGeekGirl @adventgeekgirl · 5 mar

@IGGPPCHQ Love Science and Women? Check this out!
amysmartgirls.com/2015/02/scienc... #iggppc #iggles

← ↻ 3 ★ 1 ...



GeekGiriPenPals HQ @IGGPPCHQ · 4 mar

Photo: tumblr.co/Zutles1e-J9oc

← ↻ ★ 1 ...

TWEET
10300

FOLLOWING
2.008

FOLLOWER
2.315



GeekGiriPenPals HQ
@IGGPPCHQ

GeekGiriPenPals HQ @IGGPPCHQ · 5 mar

Poll Time! In honour of #WorldBookDay we want to know what your favourite book was as a child....

← ↻ 1 ★ 3 ...

GeekGiriPenPals HQ @IGGPPCHQ · 5 mar

Photo: tearyplant: tearyplant: littlealienproducts: Cat Pot Plant small // \$45
plant blog plant blog tumblr.co/Zutles1f1-7v9

← ↻ ★ ...

GeekGiriPenPals HQ @IGGPPCHQ · 5 mar

It's #WorldBookDay! Show us your costumes!

← ↻ 1 ★ ...

GeekGiriPenPals HQ @IGGPPCHQ · 5 mar

.@adventgeekgirl this is awesome, we love @smrtgrls! There are loads of science women in #GGPPC so hopefully some will take part!

← ↻ ★ 1 ...



GeekGiriPenPals HQ has retweeted



AdventGeekGirl @adventgeekgirl · 5 mar

@IGGPPCHQ Love Science and Women? Check this out!
amysmartgirls.com/2015/02/scienc... #iggppc #iggles

← ↻ 3 ★ 1 ...



GeekGiriPenPals HQ @IGGPPCHQ · 4 mar

Photo: tumblr.co/Zutles1e-J9oc

← ↻ ★ 1 ...

HUMAN

How to distinguish users?



- Friend-to-Follower ratio

- Tweeting timing



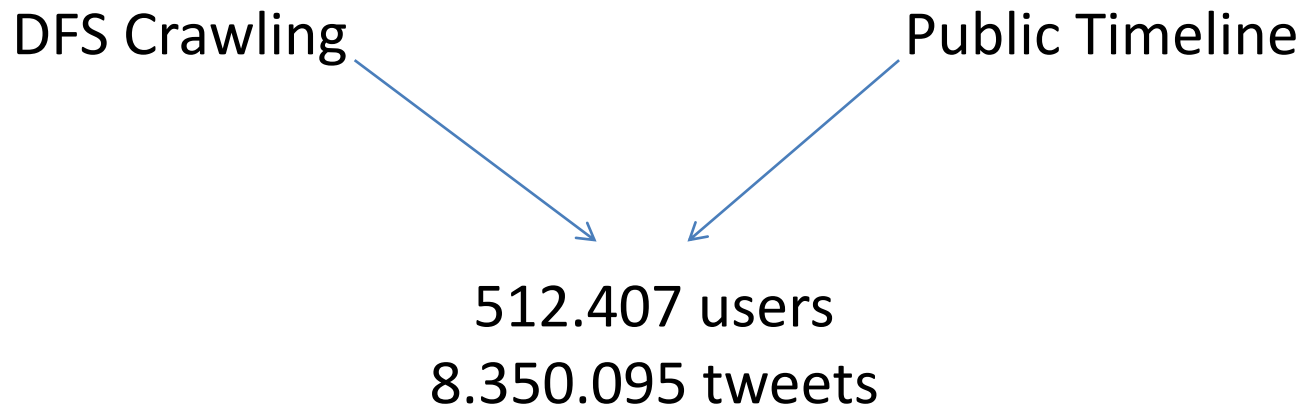
- Access patterns

- Content detection



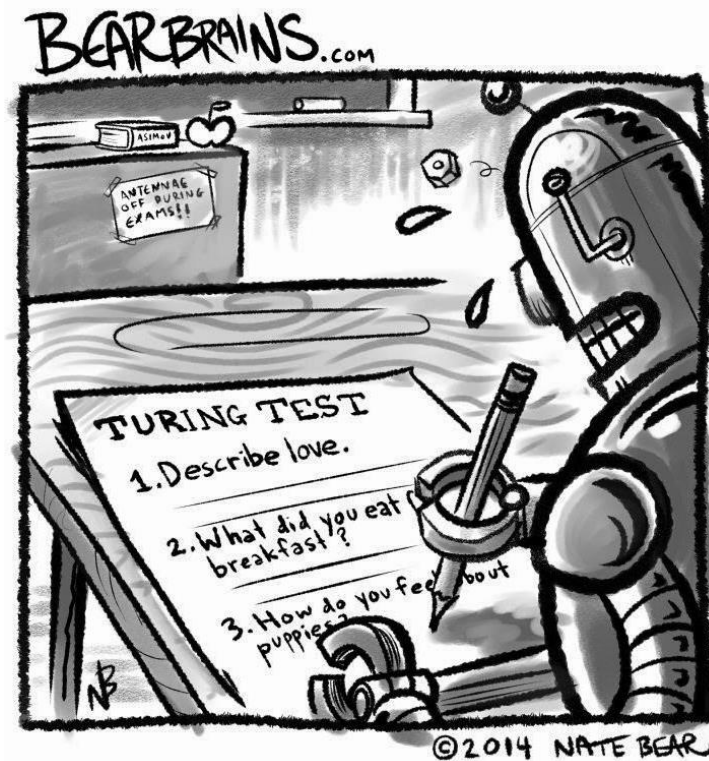
- Account heuristics

Data Collection



Ground Truth Creation

Manual check of logs and homepages to collect 2000 users per category



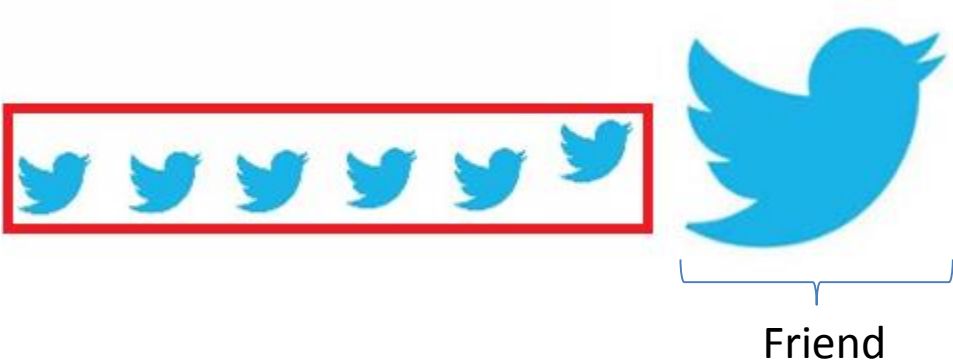
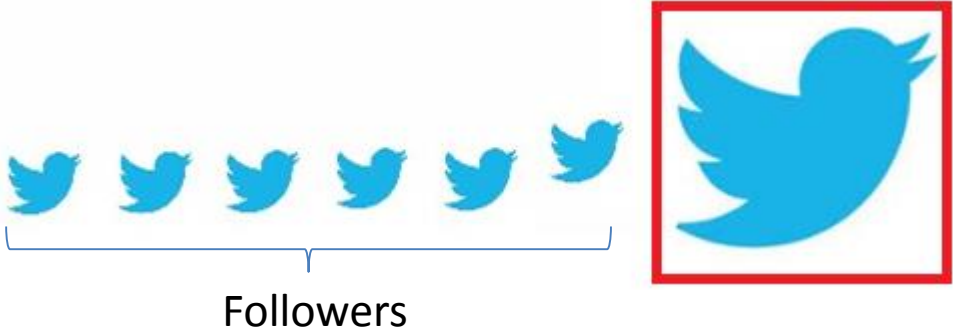
Ground Truth Creation

Intelligence
Originality
Consciousness

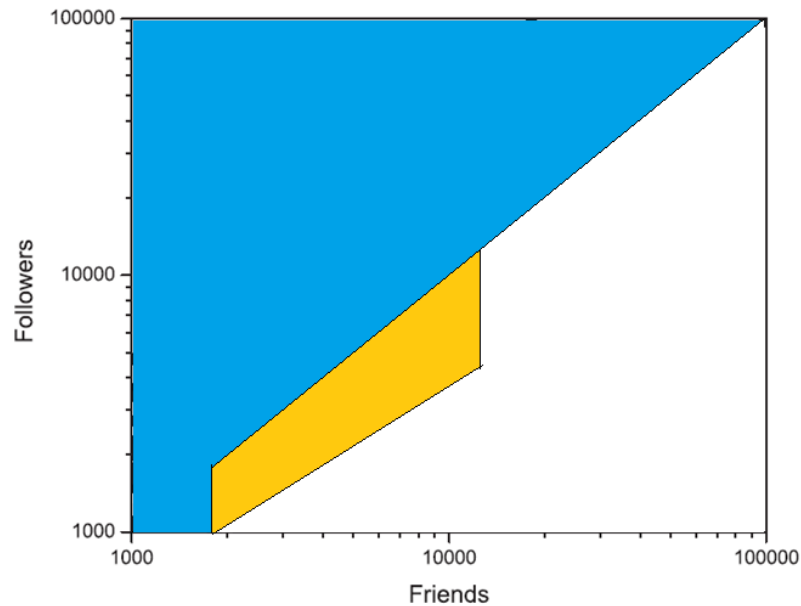
Unintelligent
Unoriginal
Automation



Followers, Friends



Friend-to-Follower Ratio



■ Bot: aggressive following to gain friends

■ Human: reciprocal relationships



Friend-to-Follower Ratio

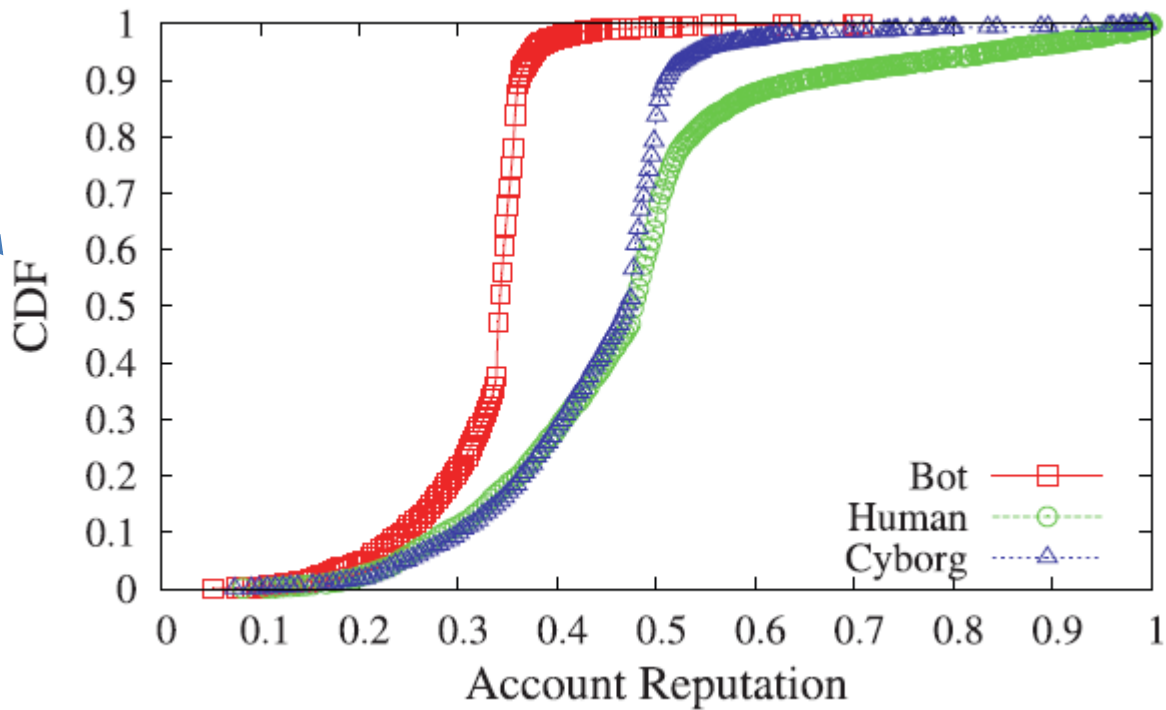
$$\text{Reputation} = \frac{\# \text{ followers}}{\# \text{ followers} + \# \text{ friends}}$$

$$\text{Taste} = \frac{1}{n} \sum_{\text{friends}} (\text{Reputation}(f))$$

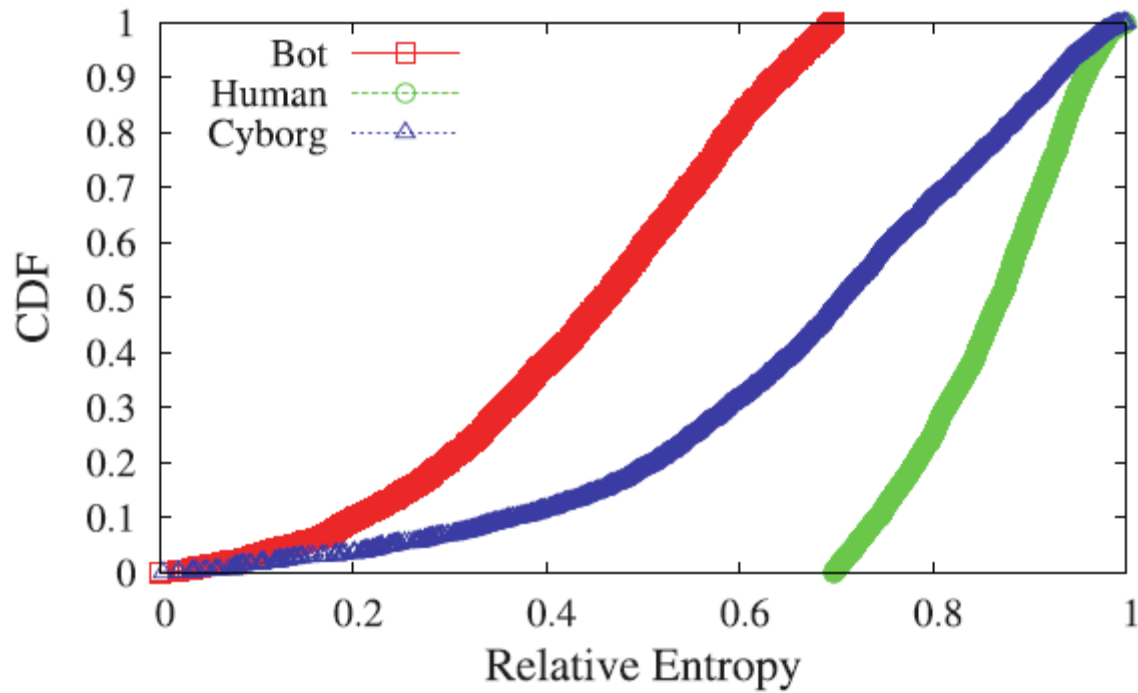


Friend-to-Follower Ratio

Cumulative
Distribution
Function

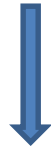


Tweeting Timing

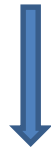


Tweeting Timing

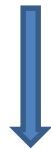
Human Behavior



Irregularities



Larger Coding



High Entropy



Tweeting Timing

Human Behavior



Irregularities



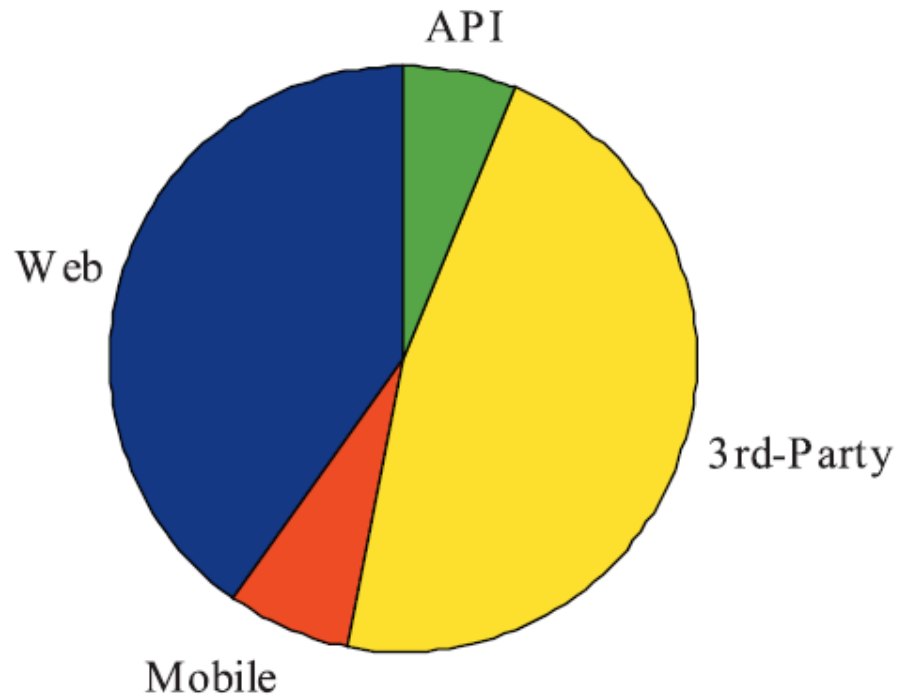
Larger Coding



High Entropy



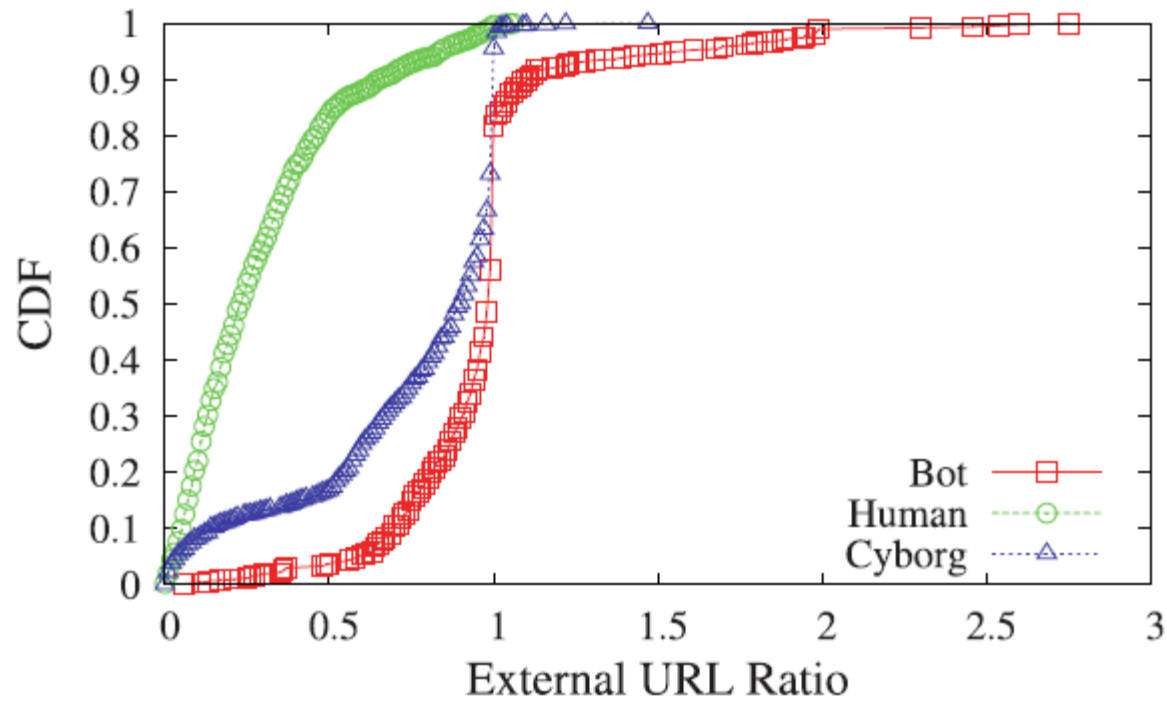
Access Patterns



Content Detection



Content Detection



Content Detection

Malicious URLs:
decide whether a message is spam
based on blacklists



Content Detection

Spam detection:

Bayesian classifier decide whether a message is spam based on its content

$$P(spam|M) = \frac{P(M|spam)P(spam)}{P(M)}$$



Content Detection

Message is Spam



Author is a Bot



Content Detection

Message is Spam



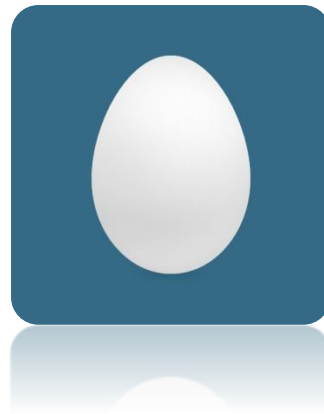
Author is a Bot



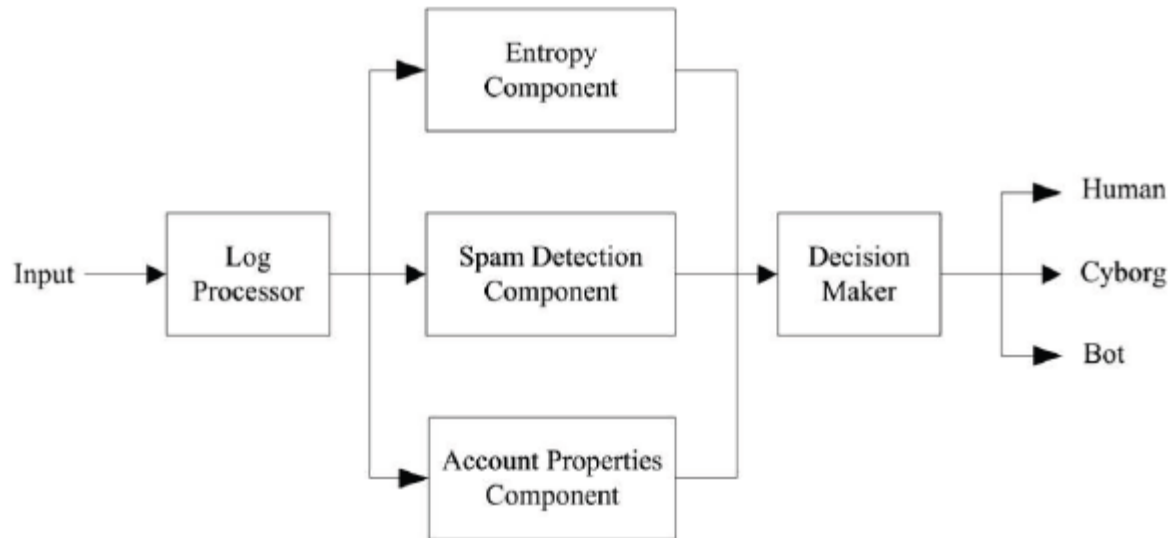
What about non-malicious bots?



Account Heuristics



Decision Maker



TWEET
10300

FOLLOWING
2.008

FOLLOWER
2.315



GeekGiriPenPals HQ
@IGPPCHQ

GeekGiriPenPals HQ @IGPPCHQ · 5 mar

Poll Time! In honour of #WorldBookDay we want to know what your favourite book was as a child....

← ↻ 1 ★ 3 ...

GeekGiriPenPals HQ @IGPPCHQ · 5 mar

Photo: tearyplant: tearyplant: littlealienproducts: Cat Pot Plant small // \$45
plant blog plant blog tumblr.co/Zutles1f1-7v9

← ↻ ★ ...

GeekGiriPenPals HQ @IGPPCHQ · 5 mar

It's #WorldBookDay! Show us your costumes!

← ↻ 1 ★ ...

GeekGiriPenPals HQ @IGPPCHQ · 5 mar

.@adventgeekgirl this is awesome, we love @smrtgrls! There are loads of science women in #GGPPC so hopefully some will take part!

← ↻ ★ 1 ...



GeekGiriPenPals HQ has retweeted



AdventGeekGirl @adventgeekgirl · 5 mar

@IGPPCHQ Love Science and Women? Check this out!
amysmartgirls.com/2015/02/scienc... #iggppc #iggles

← ↻ 3 ★ 1 ...



GeekGiriPenPals HQ @IGPPCHQ · 4 mar

Photo: tumblr.co/Zutles1e-J9oc

← ↻ ★ 1 ...

Decision Maker

Feature	Accuracy (%)
Entropy	82.8
URL Ratio	74.9
Automated Device %	71.0
Bayesian Spam Detection	69.5
Manual Device %	69.2
Registration Date	62.9
Mention Ratio	56.2
Link Safety	49.3
Hashtag Ratio	47.0
Followers to Friends Ratio	45.3
Account Verification	35.0

No single tree works well, a forest gives the best accuracy

Decision Maker

		Classified			Total	True Pos
		Human	Cyborg	Bot		
Actual	Human	1972	27	1	2000	98.6%
	Cyborg	65	1833	102	2000	91.7%
	Bot	2	46	1952	2000	97.6%
					Avg	96.0%

Minimal misclassification between human and bot

Decision Maker

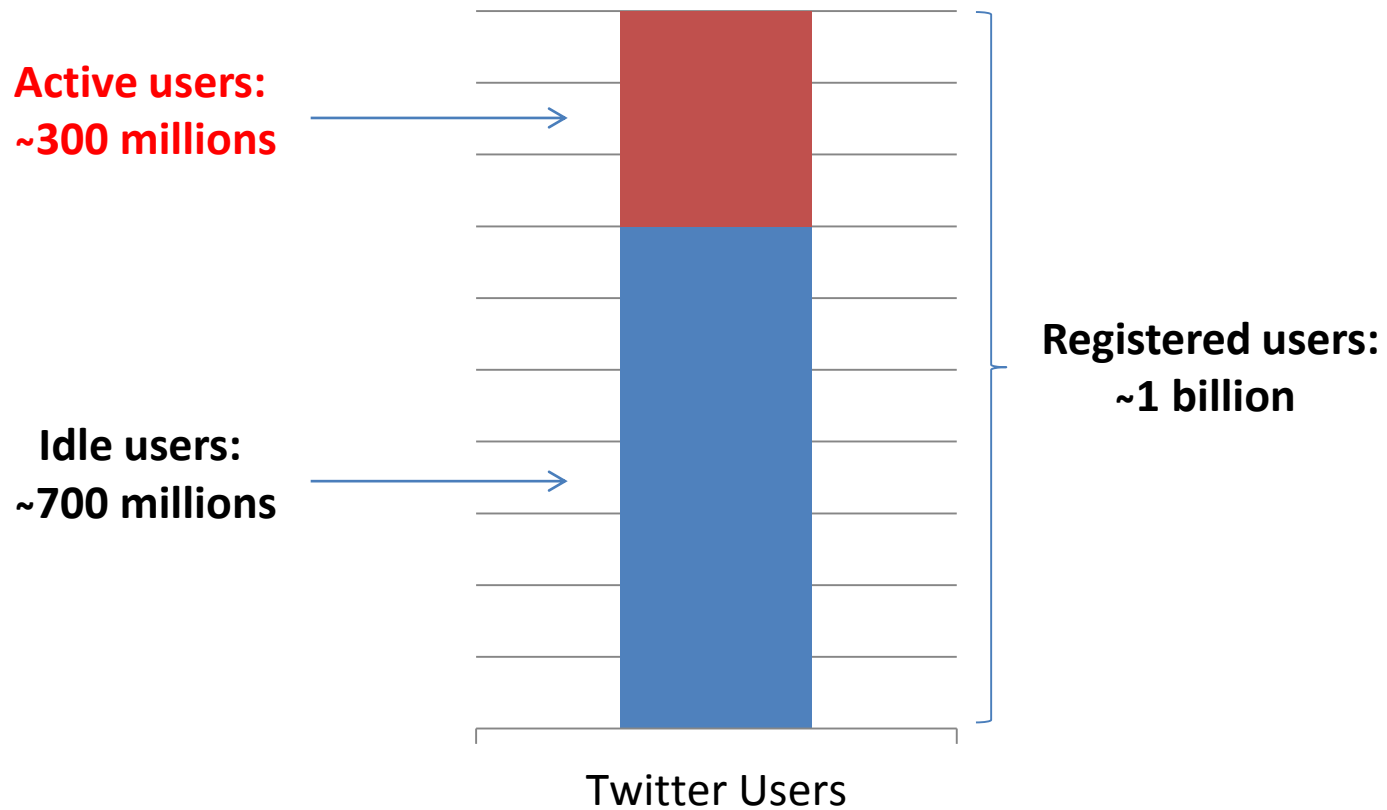
		Classified			Total	True Pos
		Human	Cyborg	Bot		
Actual	Human	1972	27	1	2000	98.6%
	Cyborg	65	1833	102	2000	91.7%
	Bot	2	46	1952	2000	97.6%
					Avg	96.0%



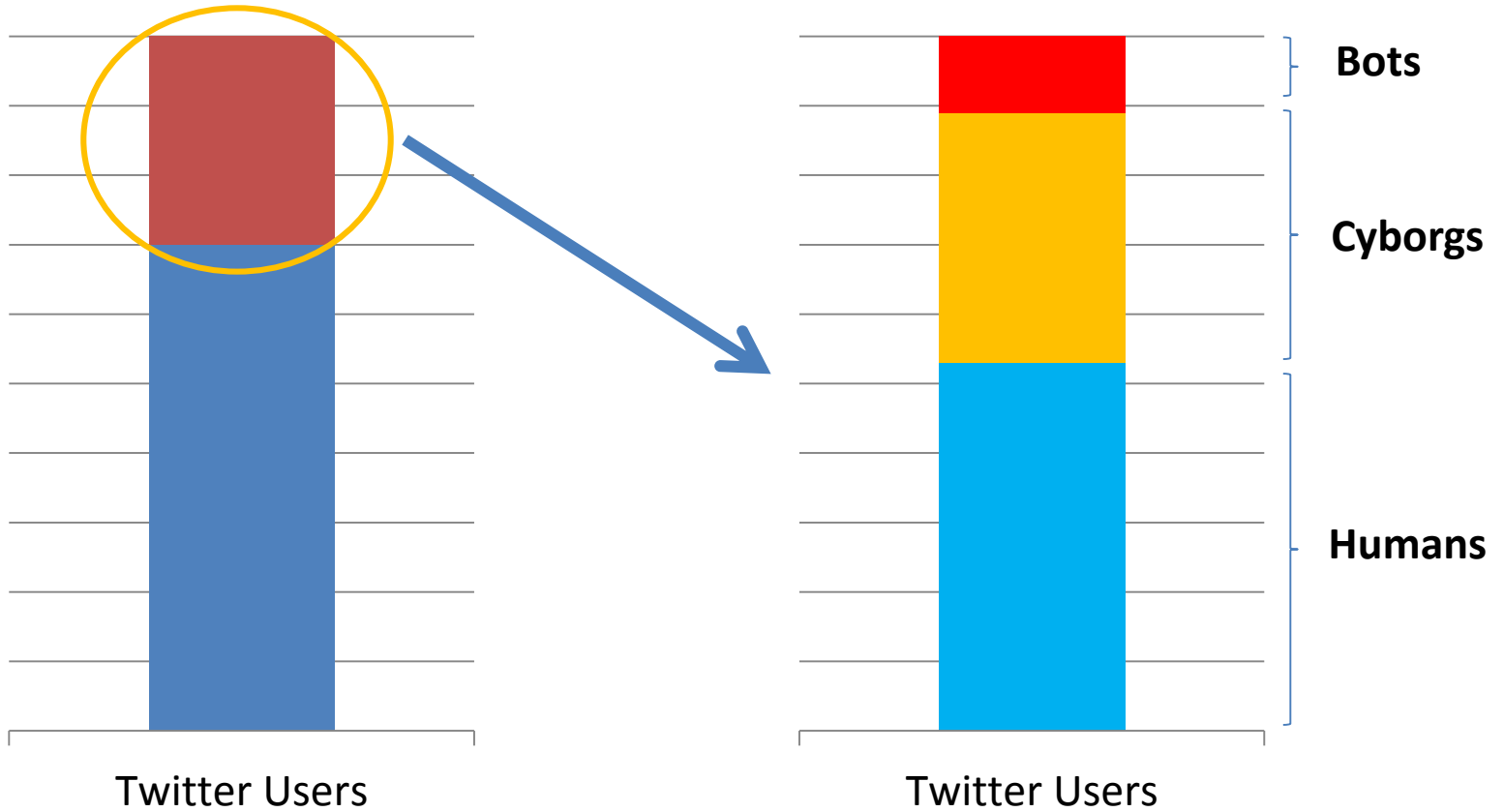
Training dataset (spam/nospam) missing inputs:

- Bot tweets with no URLs left out
- Human and cyborg tweets with URLs left out

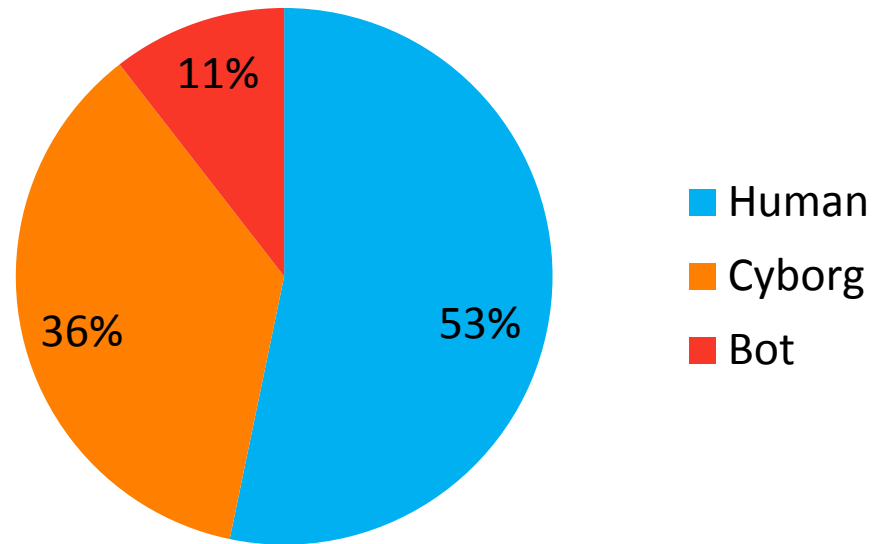
Who are the users?



Twitter composition



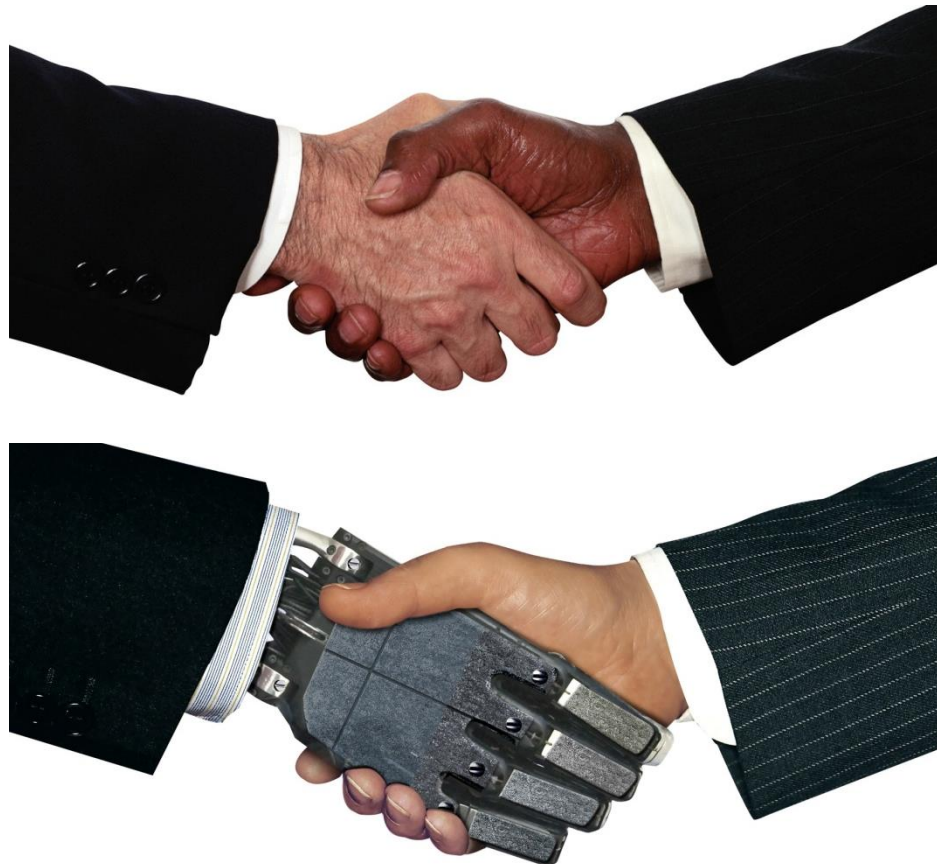
Twitter composition



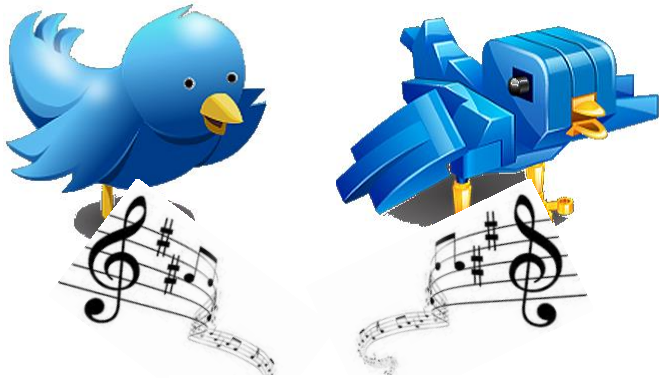
Only one half is human!!!

CASA Paradigm

Social scripts are the same in both
human-human and human-computer interaction



CASA Paradigm



Is the *communication quality* perceived differently between a bot and a human?

Communication Quality



Communication Quality



- Source Credibility
- Interpersonal Attraction
- Communication Competence
- Intent to Interact



Testing Perception

Bots helping people...

Researchers helping people...

CDC STD @CDCSTD

Helping people to be safer and healthier by the prevention of STDs and their complications. Following/being followed/RT ≠ endorsement.

Atlanta, GA | Twitter policy: go.usa.gov/YJNP
Joined March 2010

8,198 Photos and videos

TWEETS 41.8K FOLLOWING 2,996 FOLLOWERS 26.9K FAVORITES 401

CDC STD @CDCSTD · Jun 25

Get more #STD prevention information, resources, and conversation on our new Facebook page: facebook.com/cdcstd

CDC STD Government Organization

Timeline About Photos Reviews Likes

PEOPLE > CDC STD 17 hours ago

46 26 View more photos and videos

Communication Quality - Results

Means and Standard Deviations for the Two Conditions on the Dependent Variables.

Variable	Twitter bot		Twitter human	
	M	(SD)	M	(SD)
Competence	5.12 _a	(1.07)	5.31 _a	(1.05)
Character	5.01 _a	(1.13)	5.27 _a	(1.03)
Caring	4.72 _a	(1.26)	4.95 _a	(1.05)
Task attraction	3.40 _a	(0.63)	3.58 _b	(0.62)
Social Attraction	2.61 _a	(0.74)	2.87 _b	(0.63)
Communication competence	2.98 _a	(0.72)	3.09 _a	(0.73)
Intent to interact	2.62 _a	(1.08)	2.55 _a	(1.00)

Twitterbot got generally lower scores than the human, but it is still **percieved as credible source**

Communication Quality - Results

Means and Standard Deviations for the Two Conditions on the Dependent Variables.

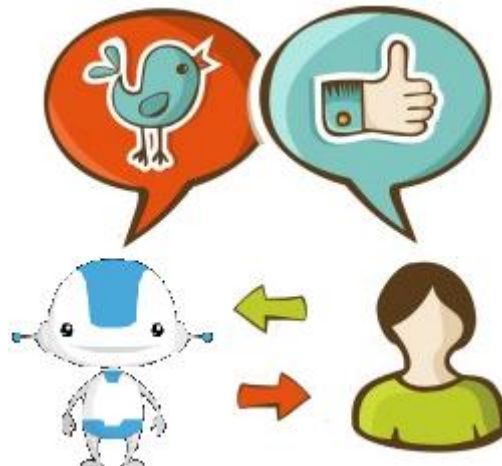
Variable	Twitter bot		Twitter human	
	M	(SD)	M	(SD)
Competence	5.12 _a	(1.07)	5.31 _a	(1.05)
Character	5.01 _a	(1.13)	5.27 _a	(1.03)
Caring	4.72 _a	(1.26)	4.95 _a	(1.05)
Task attraction	3.40 _a	(0.63)	3.58 _b	(0.62)
Social Attraction	2.61 _a	(0.74)	2.87 _b	(0.63)
Communication competence	2.98 _a	(0.72)	3.09 _a	(0.73)
Intent to interact	2.62 _a	(1.08)	2.55 _a	(1.00)



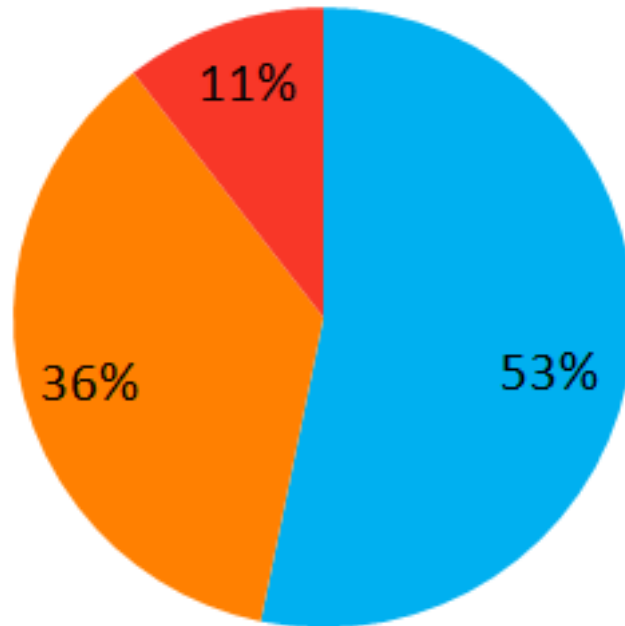
What if they rated the source and not to the author?

Communication Quality - Results

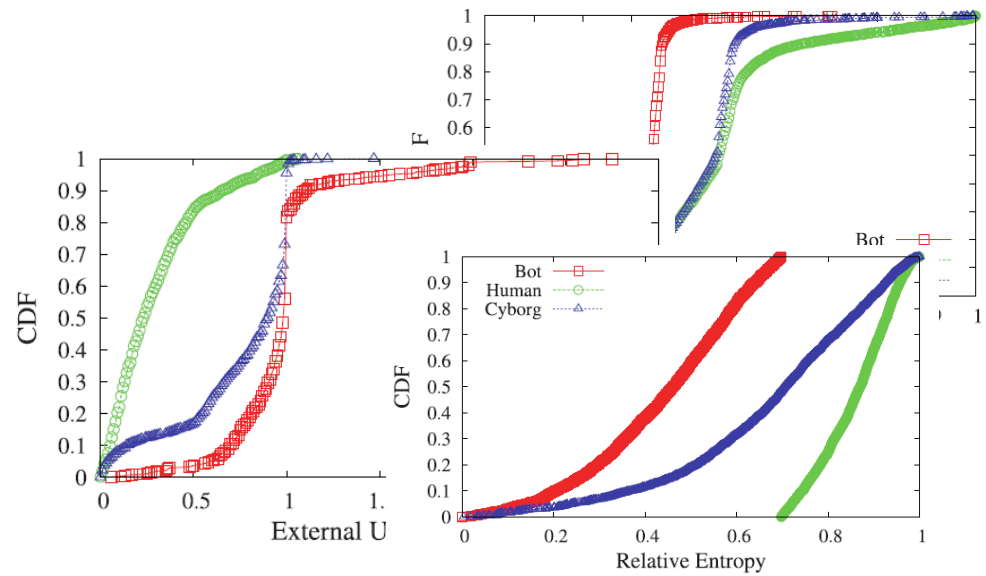
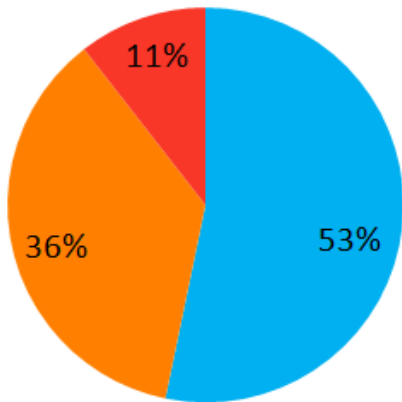
Followers can perceive twitterbots as
credible
attractive
competent in communication
and can have intention to interact



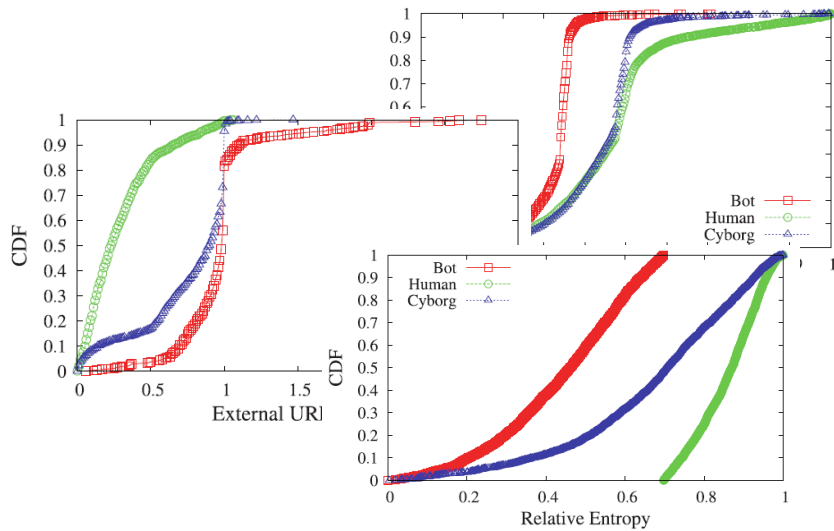
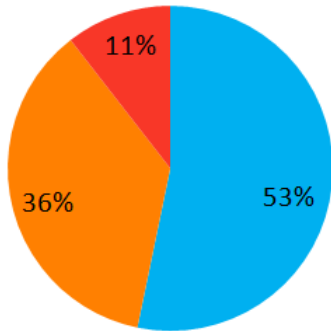
Summary



Summary



Summary



Thank you

