Social Media & Text Analysis

lecture 1 - Introduction

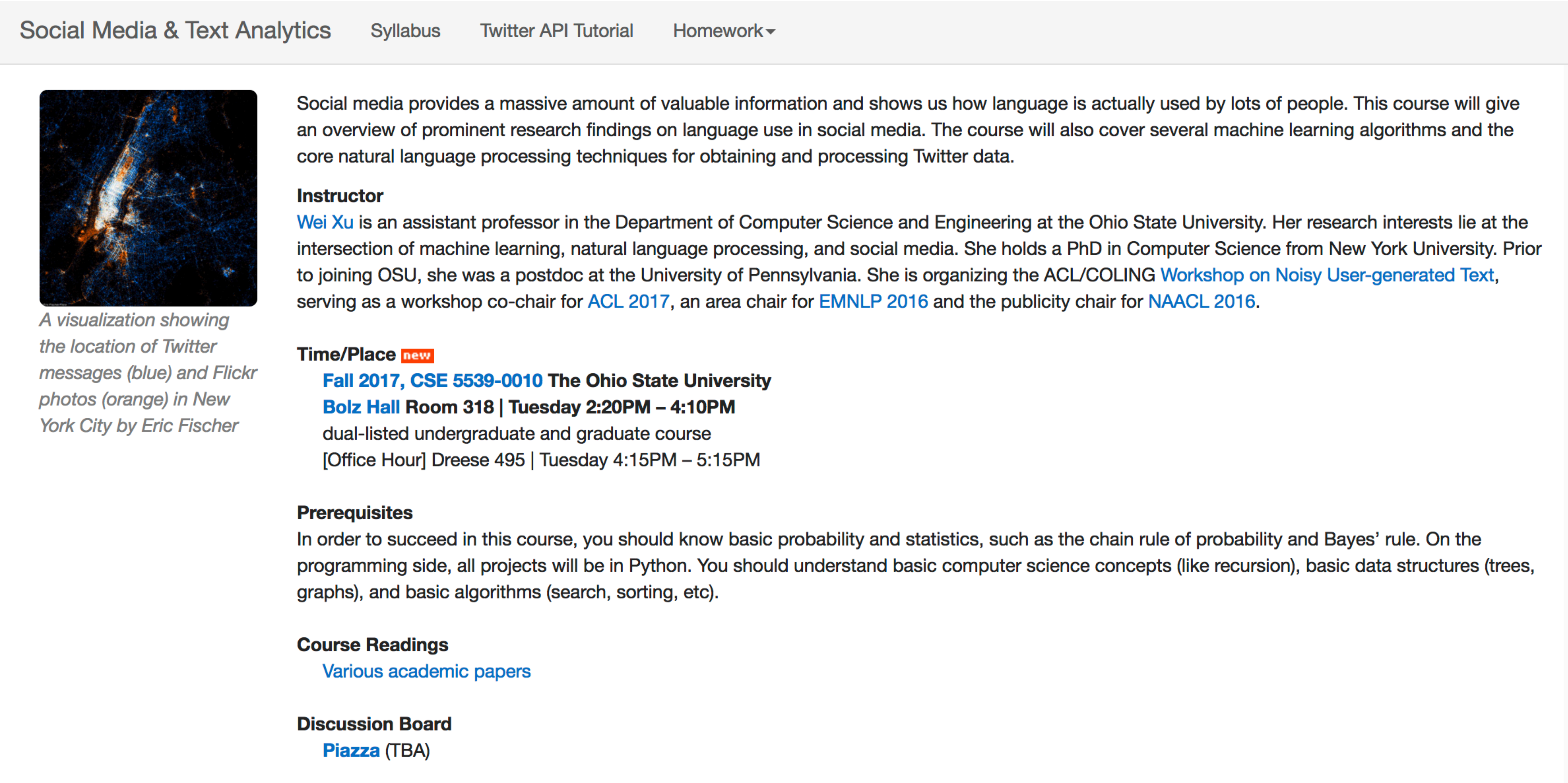
CSE 5539-0010 Ohio State University

Instructor: Wei Xu

Website: socialmedia-class.org

Course Website

http://socialmedia-class.org/



A visualization showing the location of Twitter messages (blue) and Flickr photos (orange) in New York City by Eric Fischer

Social media provides a massive amount of valuable information and shows us how language is actually used by lots of people. This course will give an overview of prominent research findings on language use in social media. The course will also cover several machine learning algorithms and the core natural language processing techniques for obtaining and processing Twitter data.

Instructor
Wei Xu is an assistant professor in the Department of Computer Science and Engineering at the Ohio State University. Her research interests lie at the intersection of machine learning, natural language processing, and social media. She holds a PhD in Computer Science from New York University. Prior to joining OSU, she was a postdoc at the University of Pennsylvania. She is organizing the ACL/COLING Workshop on Noisy User-generated Text, serving as a workshop co-chair for ACL 2017, an area chair for EMNLP 2016 and the publicity chair for NAACL 2016.

Time/Place new
Fall 2017, CSE 5539-0010 The Ohio State University
Bolz Hall Room 318 | Tuesday 2:20PM – 4:10PM
dual-listed undergraduate and graduate course
[Office Hour] Dreese 495 | Tuesday 4:15PM – 5:15PM

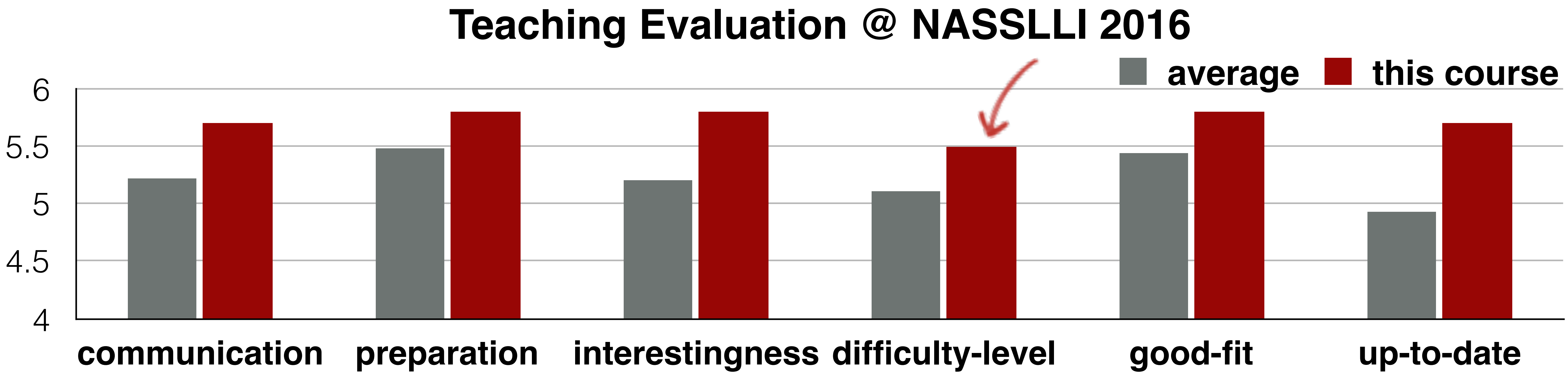
Prerequisites
In order to succeed in this course, you should know basic probability and statistics, such as the chain rule of probability and Bayes' rule. On the programming side, all projects will be in Python. You should understand basic computer science concepts (like recursion), basic data structures (trees, graphs), and basic algorithms (search, sorting, etc).

Course Readings
Various academic papers

Discussion Board
Piazza (TBA)

History of the Course

- Summer 2015, University of Pennsylvania
- Summer 2016, North American Summer School on Logic, Language, and Information (NASSLLI)
- Now, since Fall 2016, Ohio State University



This is a special topic class

- hobby (not a mandatory course)
- but is lecture-based and project-based
- advanced and research-oriented
- but strong undergraduate students (sophomore, junior, senior) are encouraged to take this course

Who am I?

Wei Xu

- Assistant Professor in CSE at the Ohio State University
- Postdoctoral researcher at University of Pennsylvania
- PhD from New York University in Computer Science
- Research Areas:
  - Natural Language Processing
  - Social Media
  - Machine Learning

We have a TA!

(supported by my research fund)

Pravar Mahajan

- 2nd year Masters student in CSE
- Research Intern, IBM Almaden Research Center
- Worked at Goldman Sacks; studied at IIT Madras
- top student in Fall 2016 class, recruited as RA
- Current research project:
    - Semantic Analysis of Hashtags

HashtagMaster

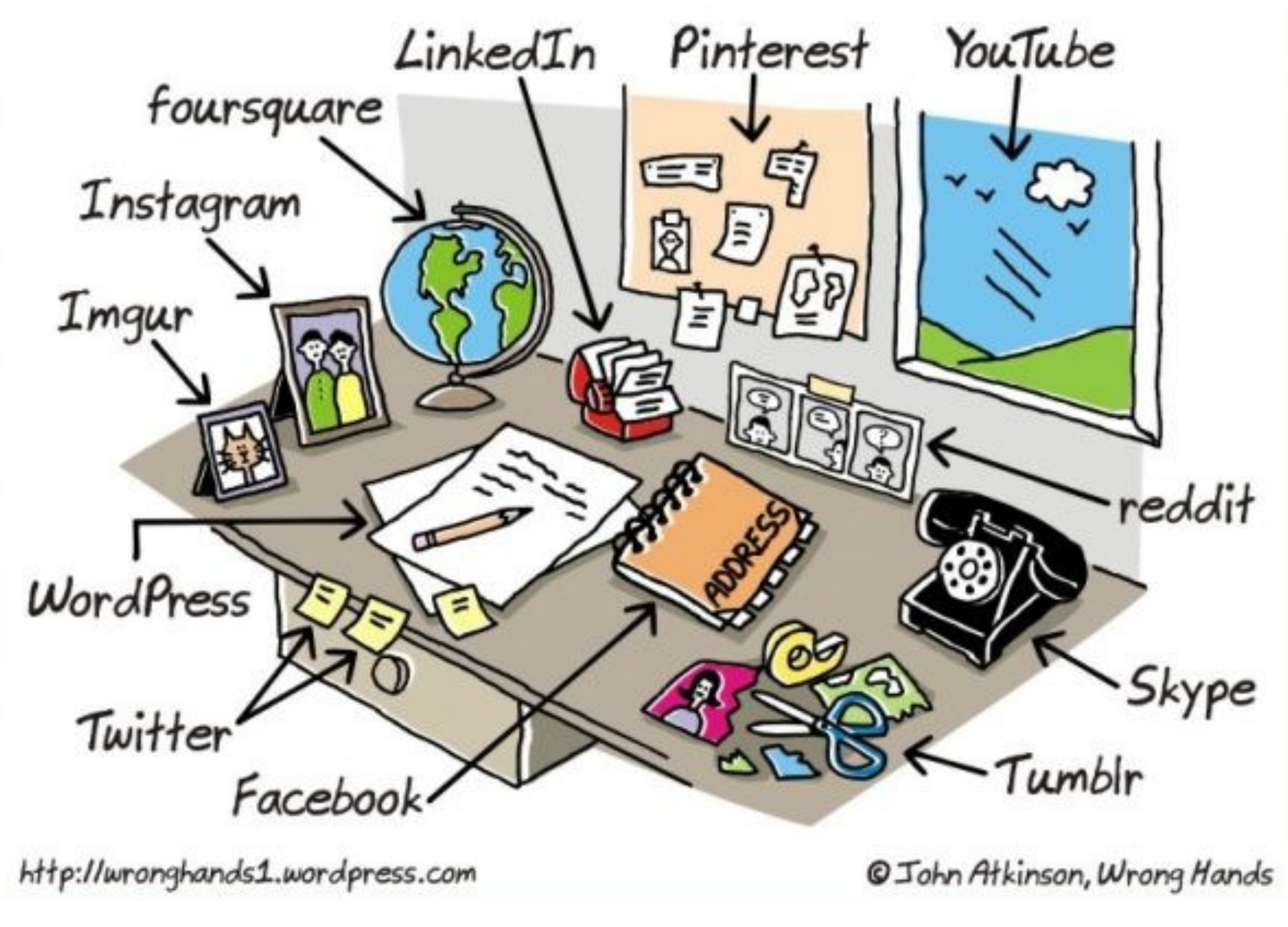
#songsonghaddafisitunes

Songs On Ghaddafis iTunes

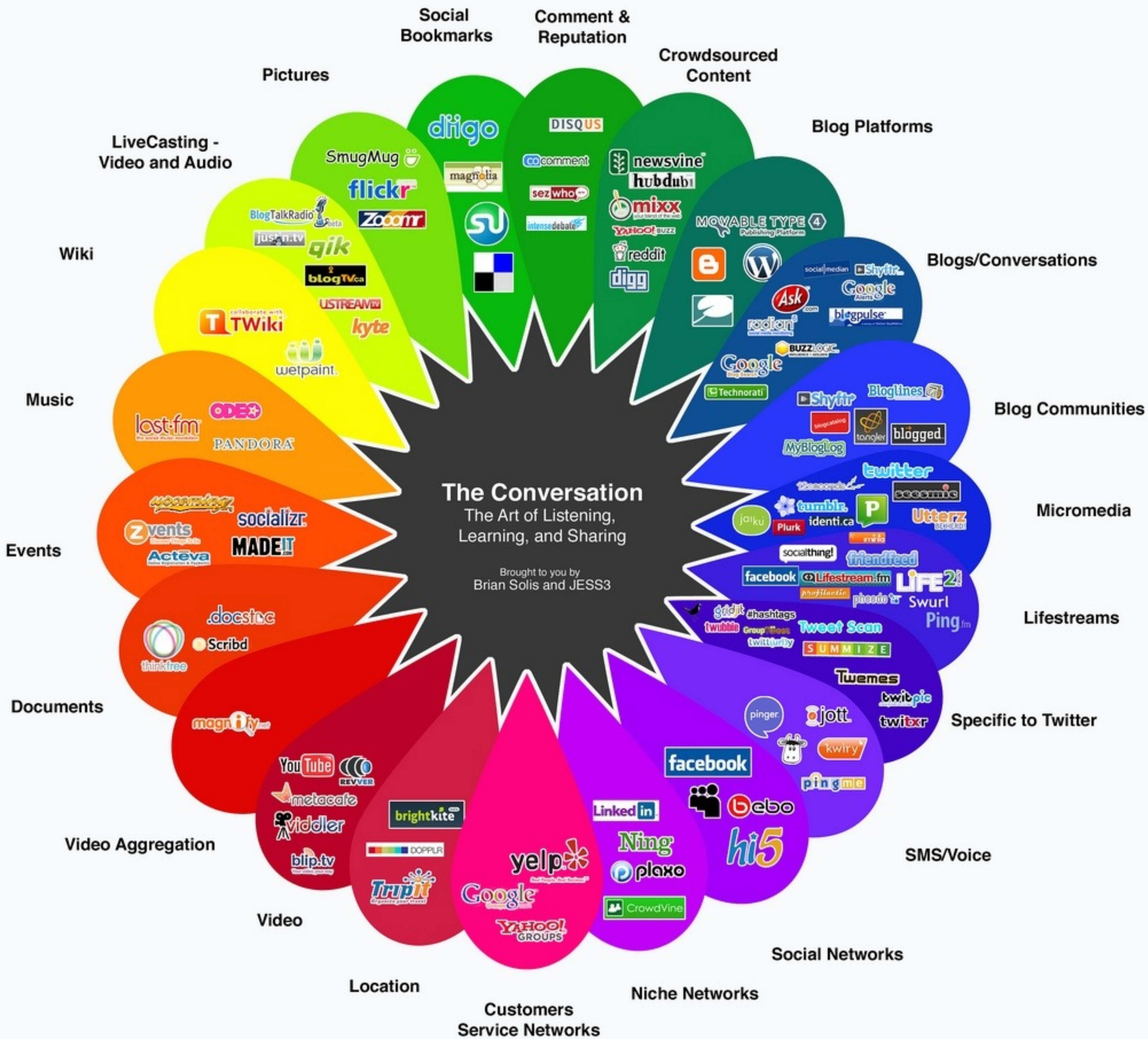
HashtagMaster

Why Social Media?

Vintage Social Media

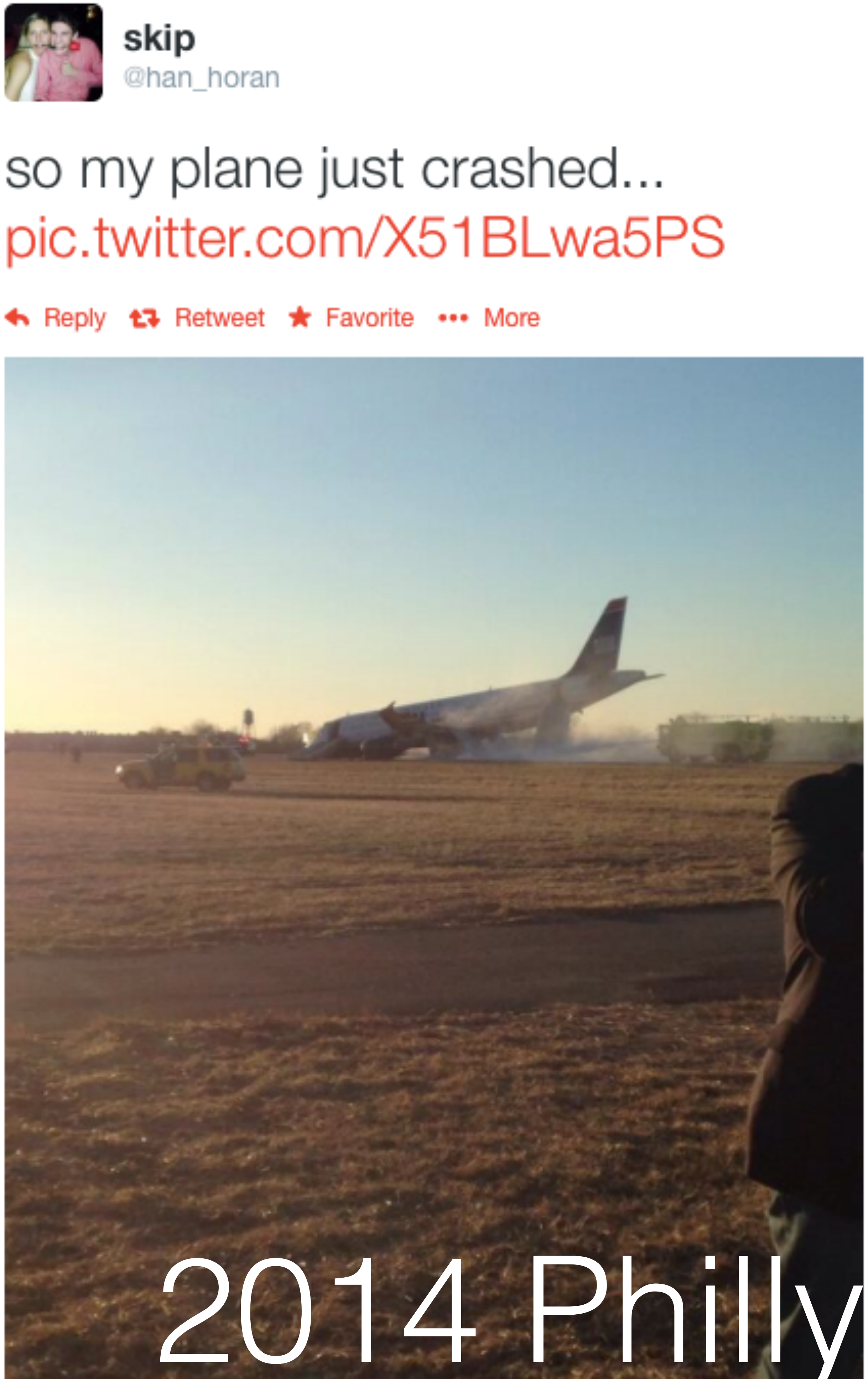


Broader Point of View



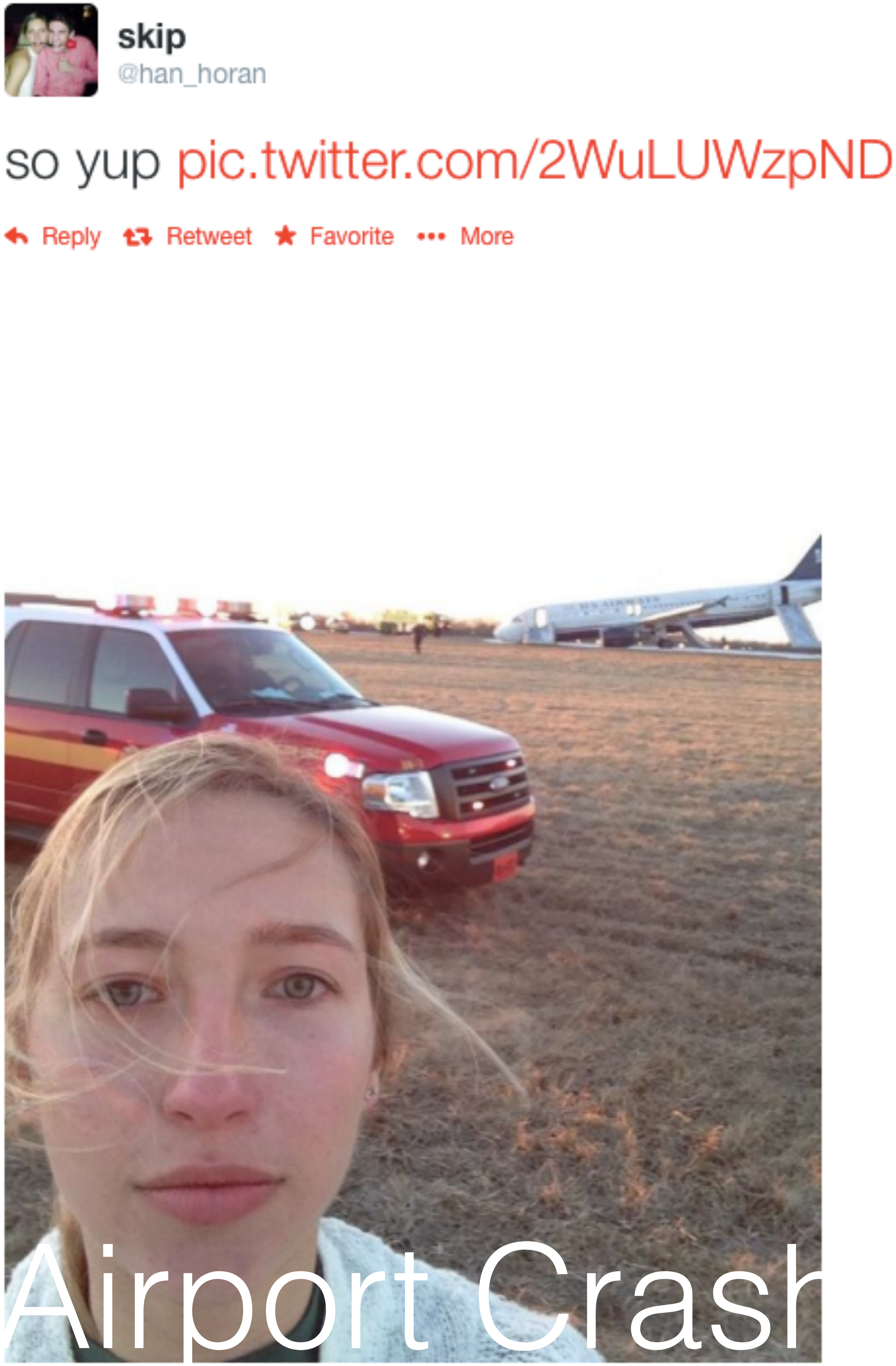
Source: http://www.conversationprism.com/

2014 Philly Airport Crash



skip
@han_horan

so my plane just crashed... pic.twitter.com/X51BLwa5PS

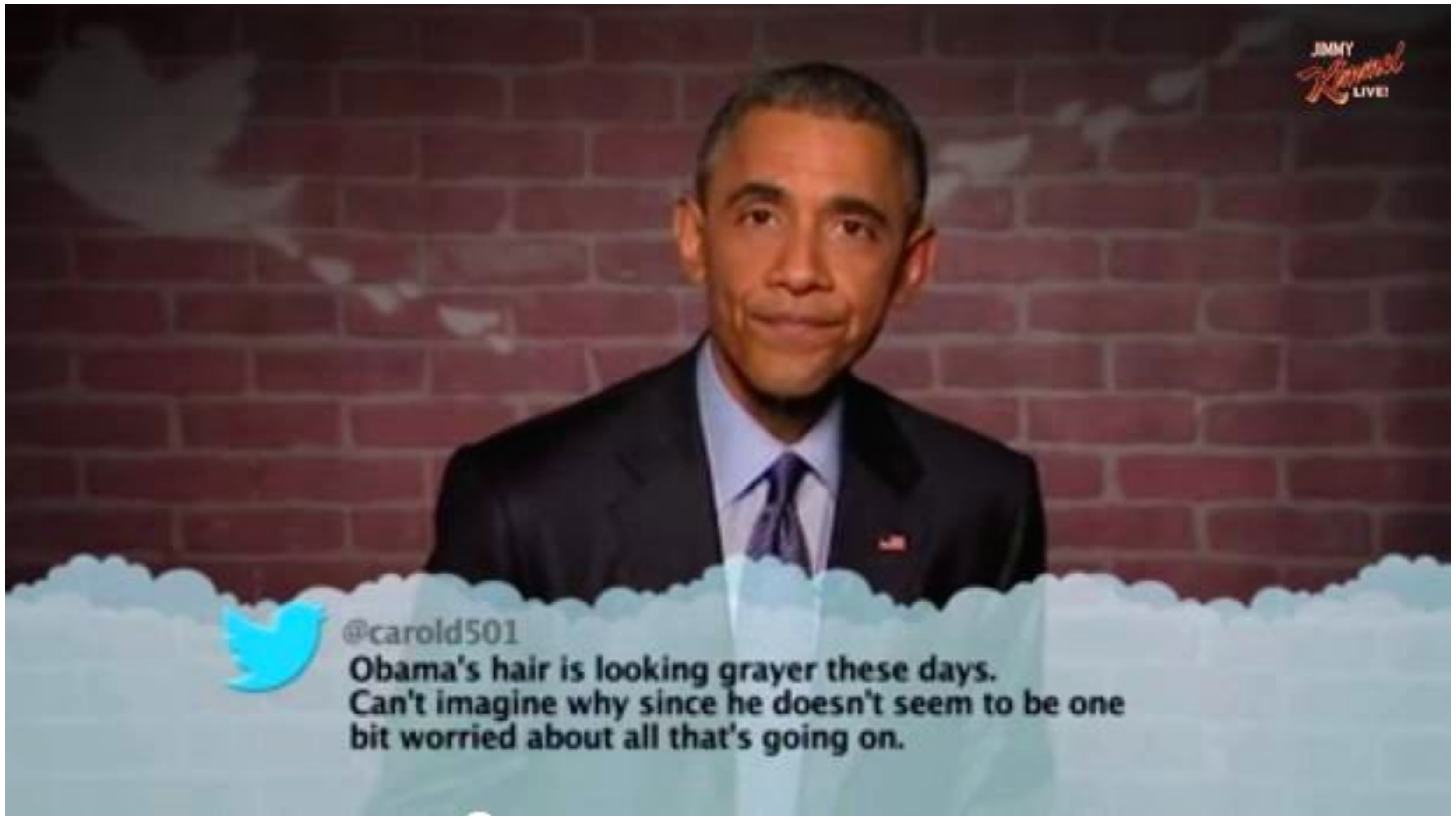


skip
@han_horan

so yup pic.twitter.com/2WuLUWzpND

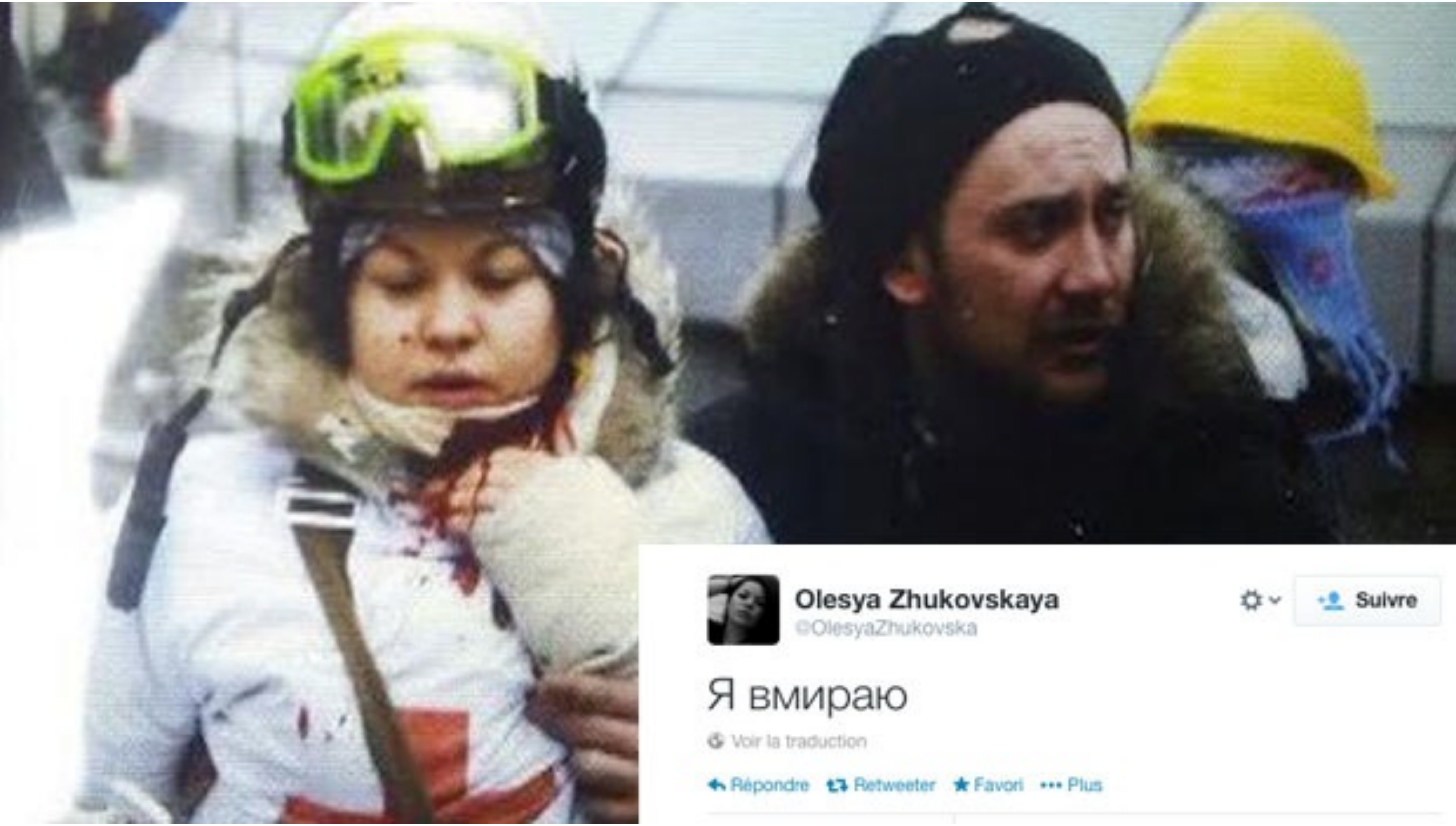
Impact

- Politics
- Business
- Socialization
- Journalism
- Cyber Bullying
- Productivity
- Privacy
- Emotions
- …
- and our language (!)



@carold501
Obama's hair is looking grayer these days. Can't imagine why since he doesn't seem to be one bit worried about all that's going on.

2014 Ukrainian Revolution



Olesya Zhukovskaya
@OlesyaZhukovska

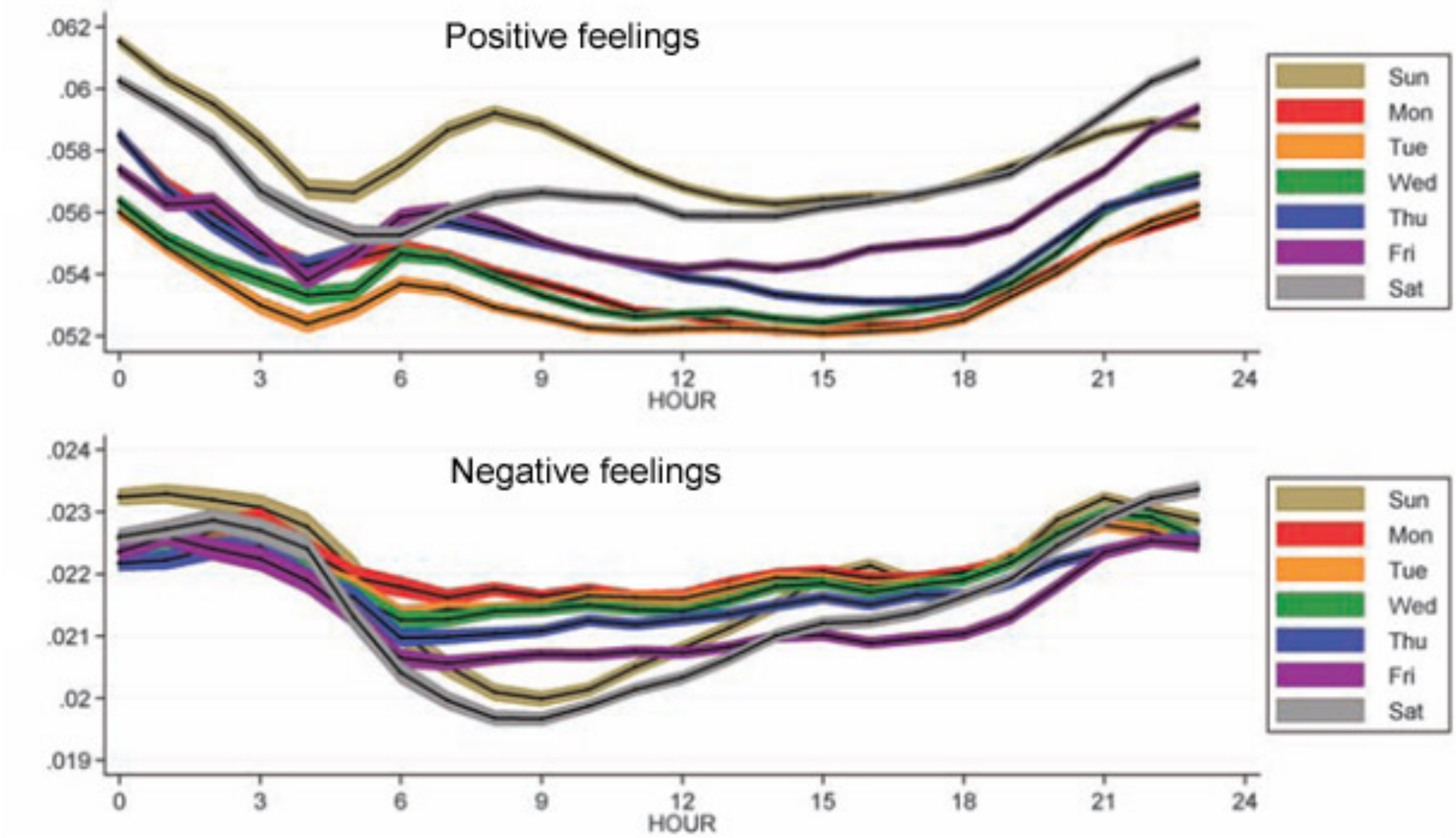
Я вмираю

Voir la traduction

Research Value

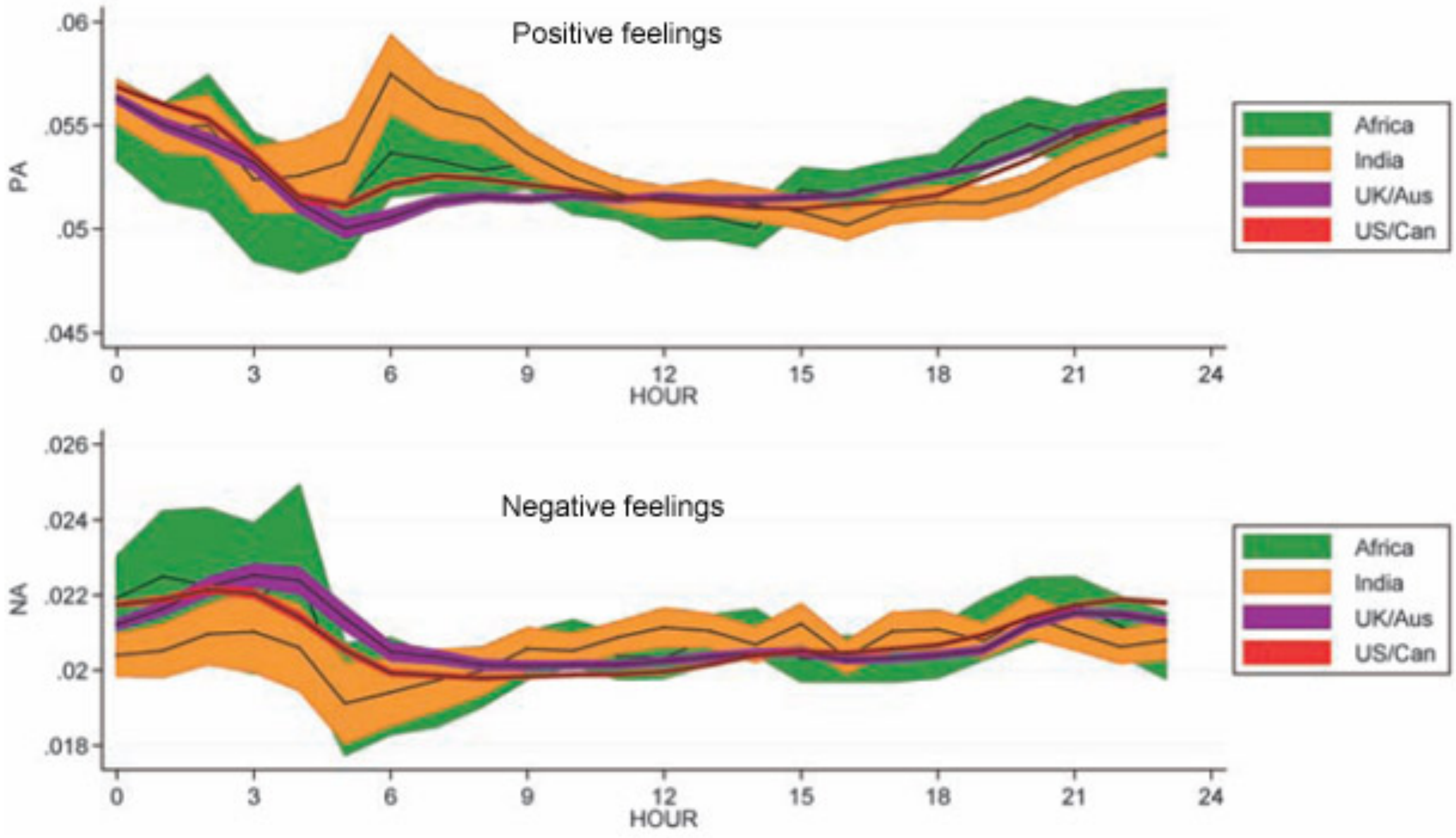
- In contrast to survey/self-report
- A probe to:
  - **real** human behavior
  - **real** human opinion
  - **real** human language use
- Easy to access and aggregate **a lot** of data
- thus **a lot** of information

Mood



Source: Golder & Macy. "Diurnal and Seasonal Mood Vary with Work, Sleep, and Daylength Across Diverse Cultures" Science 2011

Mood



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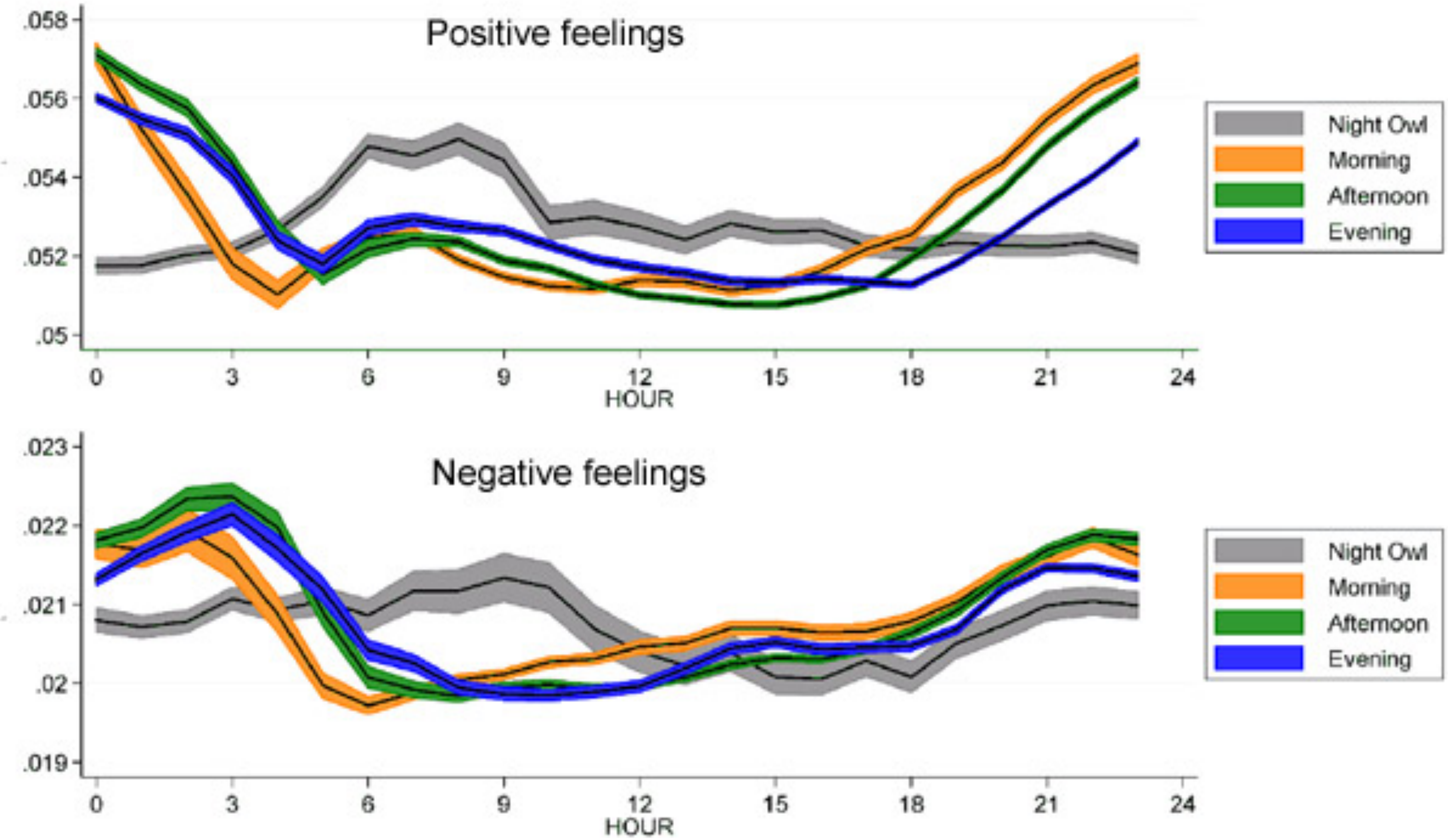
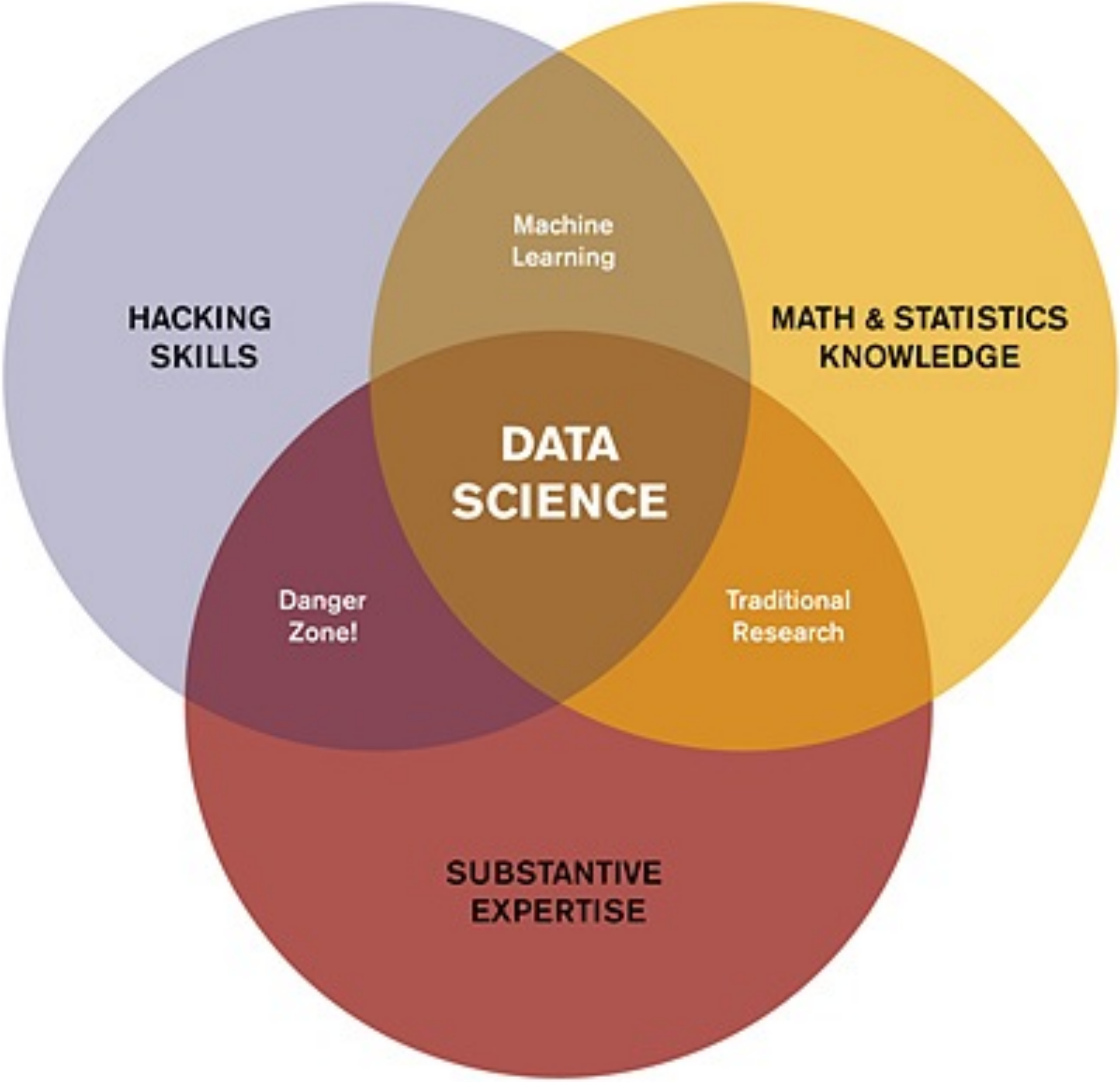
Mood



Source: Golder & Macy. “Diurnal and Seasonal Mood Vary with Work, Sleep, and Daylength Across Diverse Cultures” Science 2011

Data Science



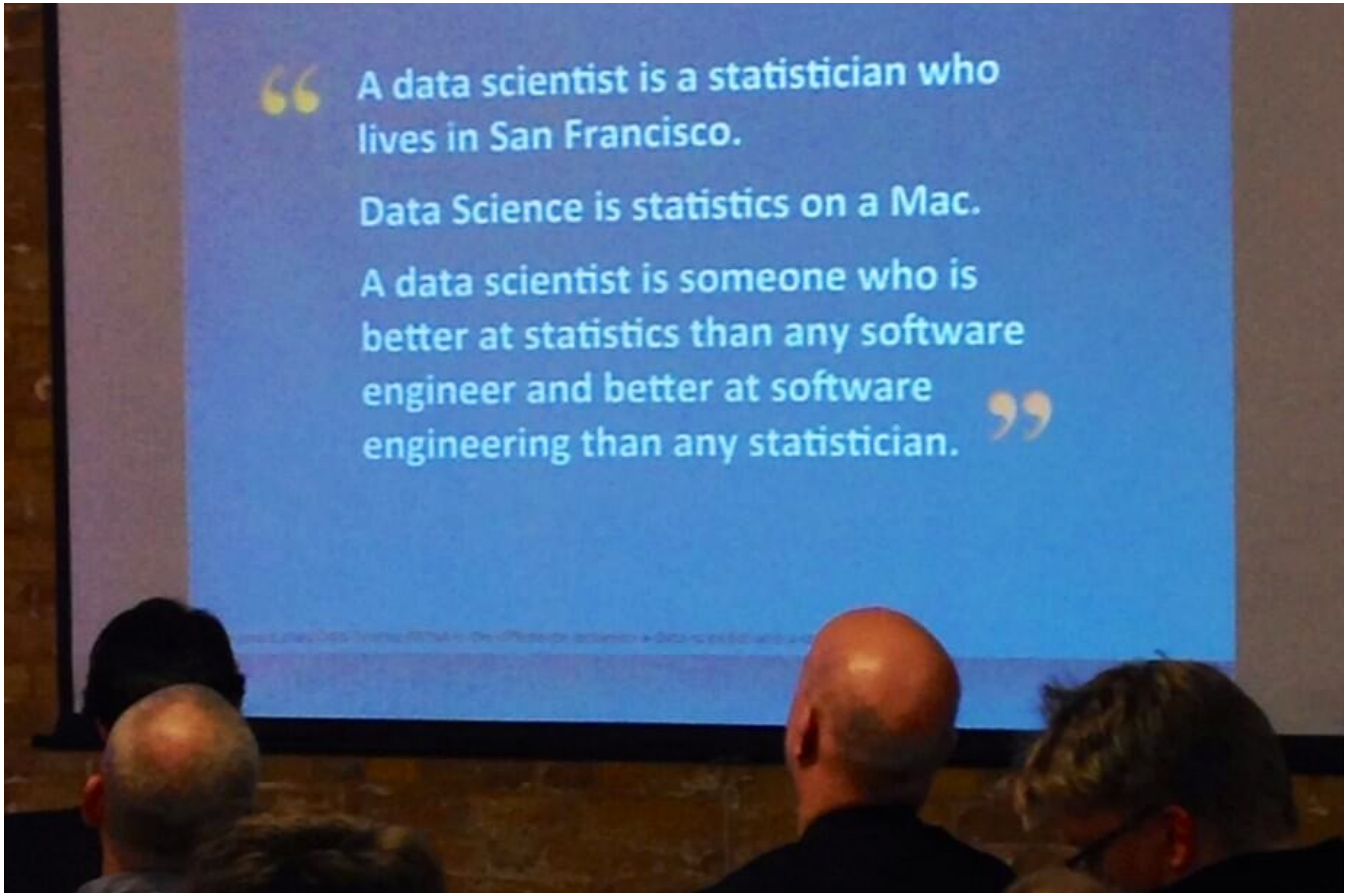
Source: Drew Conway

Data Science

- is the **practice** of:
  - asking question (formulating hypothesis)
  - finding and collecting the data needed
    (often big data)
  - performing statistical and/or predictive analytics
    (often machine learning)
  - discovering important information and/or insights

Data Science

- the infamous definition:

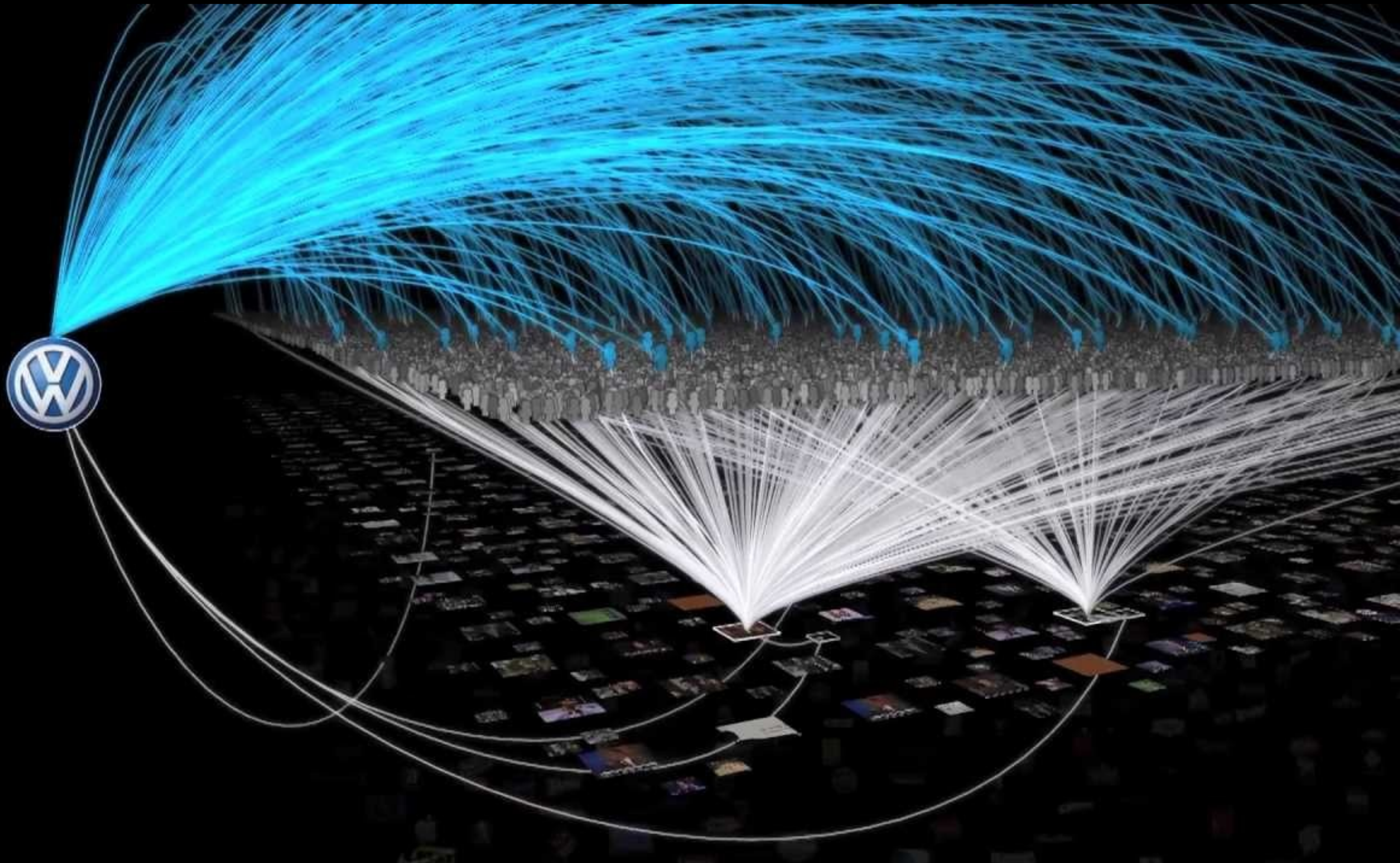


“A data scientist is a statistician who lives in San Francisco.

Data Science is statistics on a Mac.

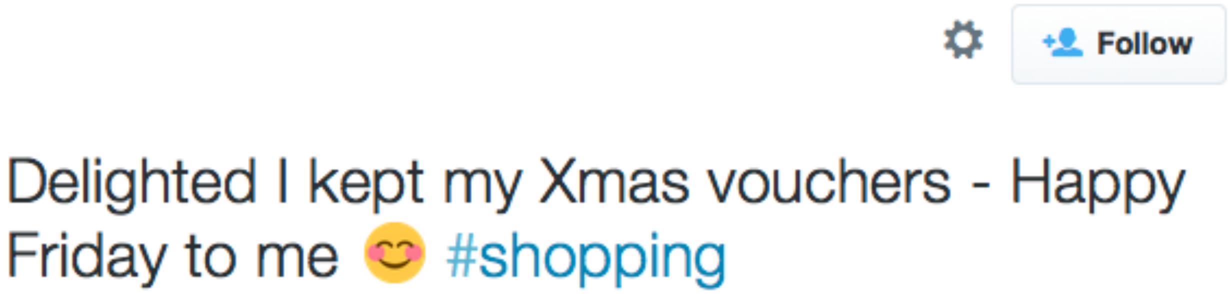
A data scientist is someone who is better at statistics than any software engineer and better at software engineering than any statistician.”

Marketing

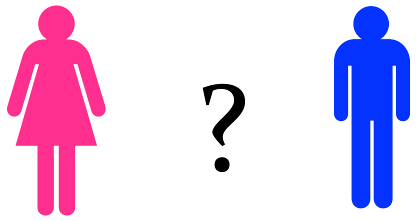


Source: Twitter Ads https://www.youtube.com/watch?v=K8KJWoNk_Rg

User Profiling

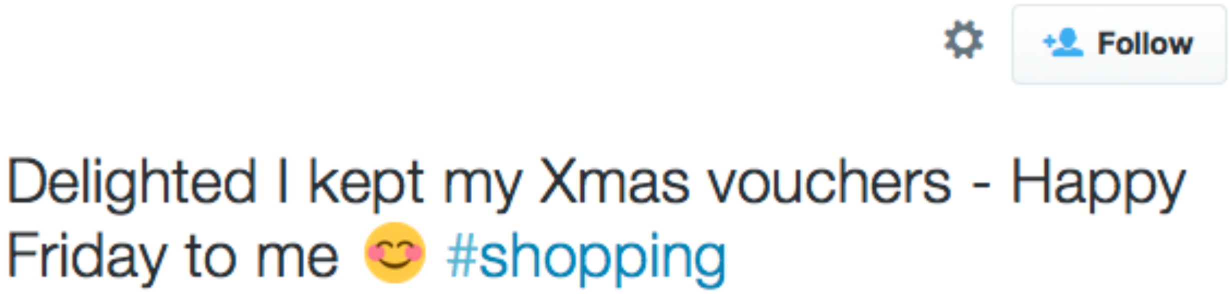


Delighted I kept my Xmas vouchers - Happy Friday to me 😊 #shopping



Source: Volkova, Van Durme, Yarowsky, Bachrach
"Tutorial on Social Media Predictive Analytics" NAACL 2015

User Profiling



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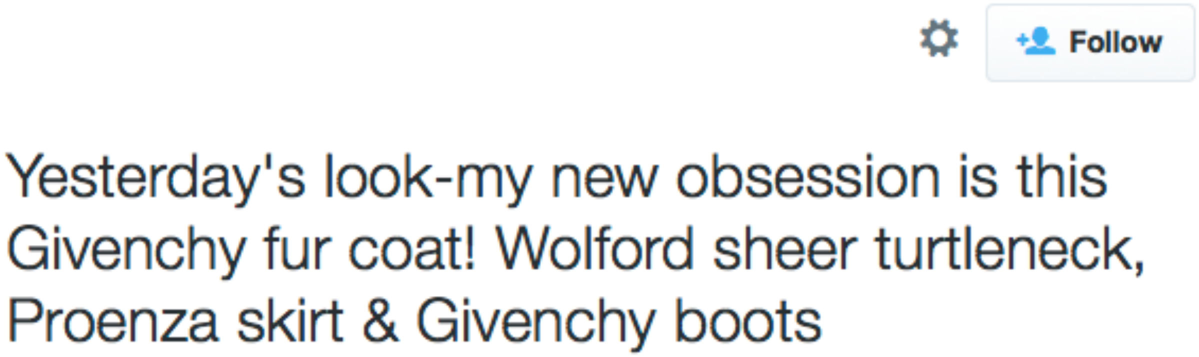
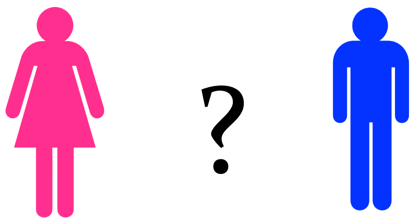


Yesterday's look-my new obsession is this Givenchy fur coat! Wolford sheer turtleneck, Proenza skirt & Givenchy boots



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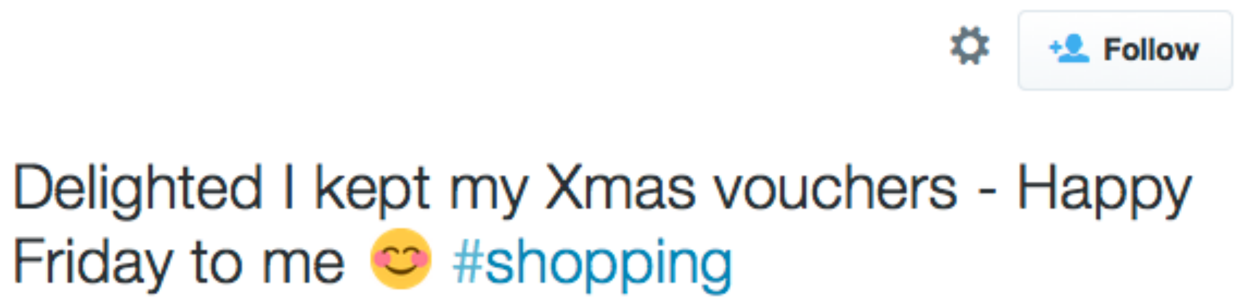

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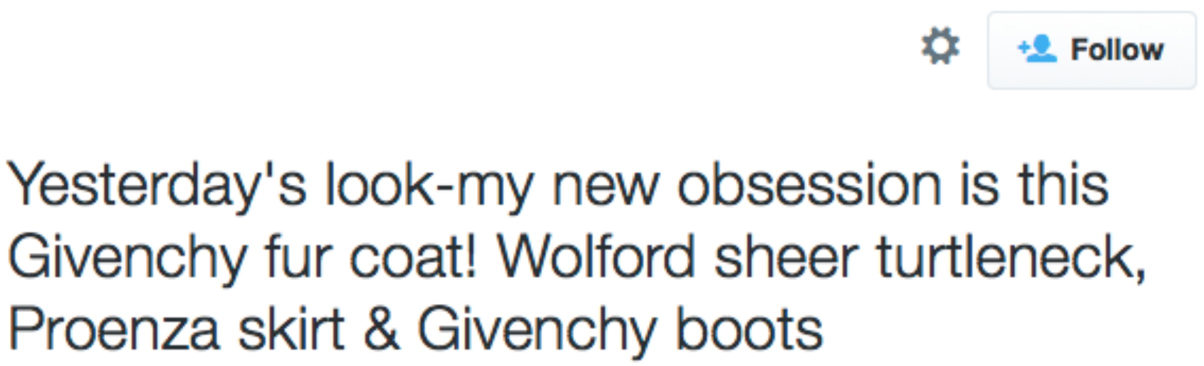

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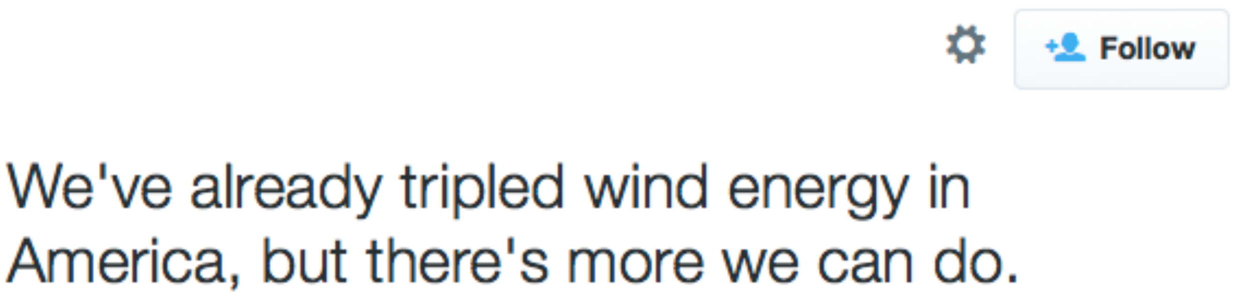
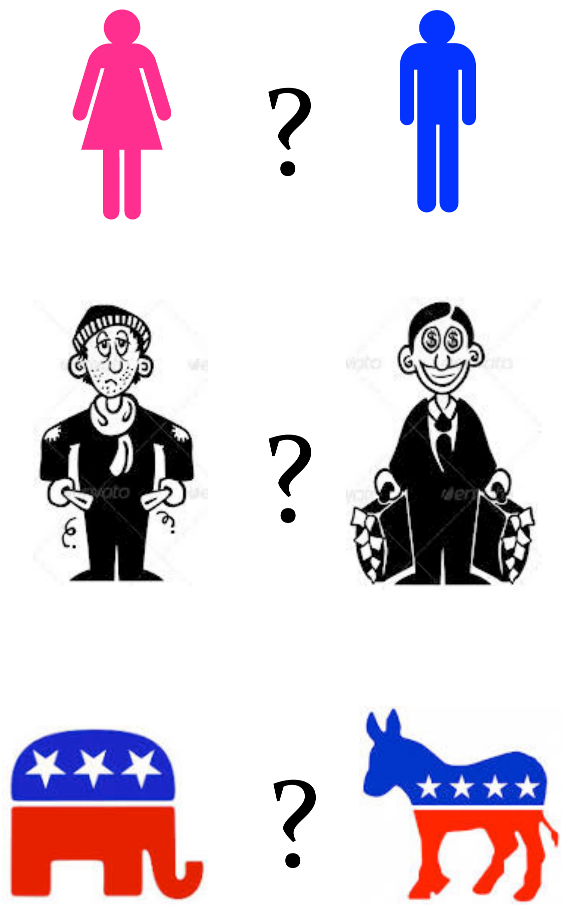


We've already tripled wind energy in America, but there's more we can do.



Source: Volkova, Van Durme, Yarowsky, Bachrach
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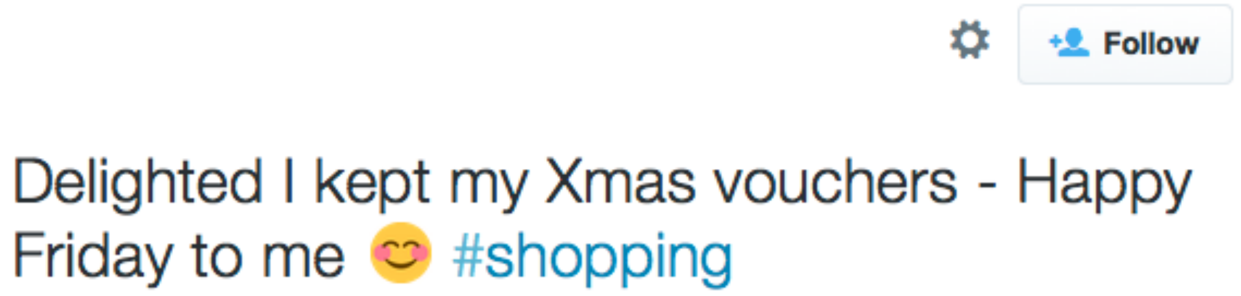
User Profiling



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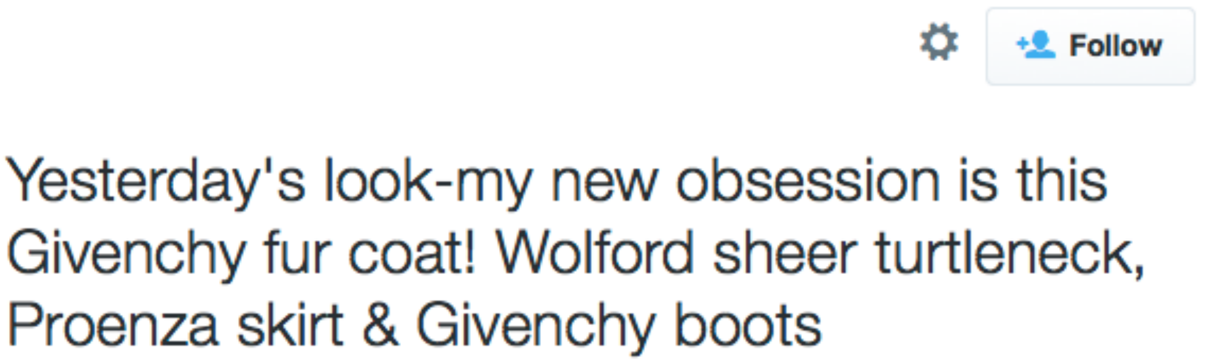

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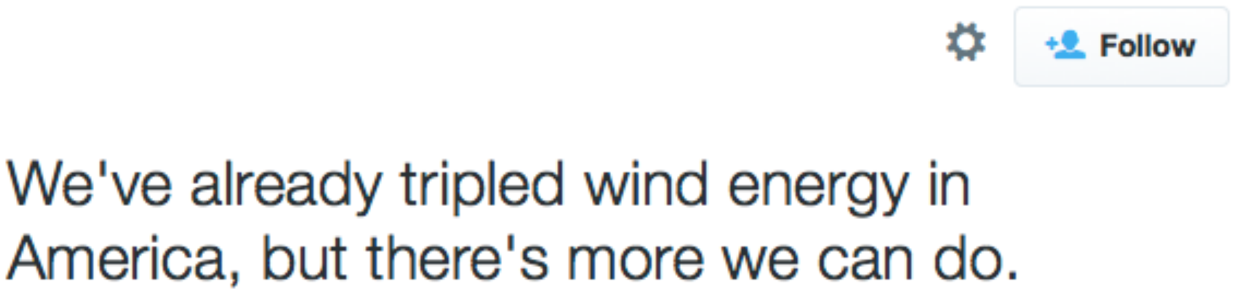

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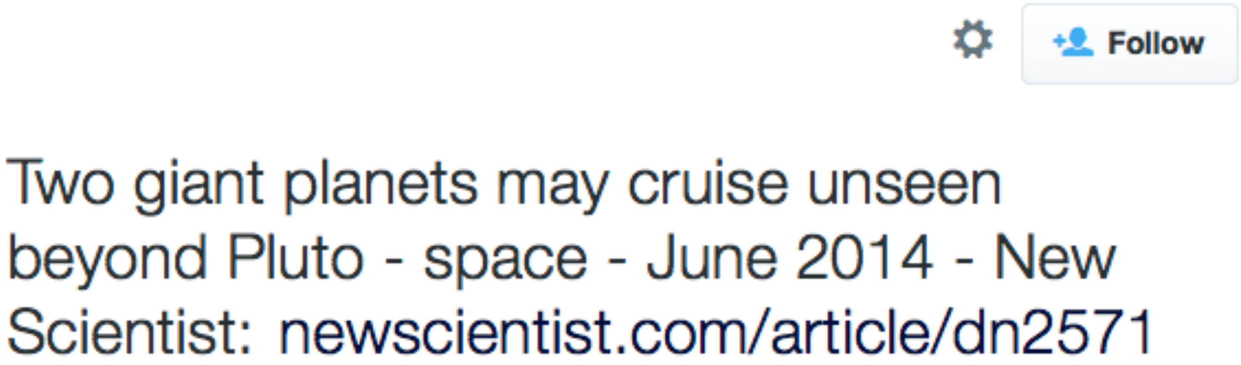
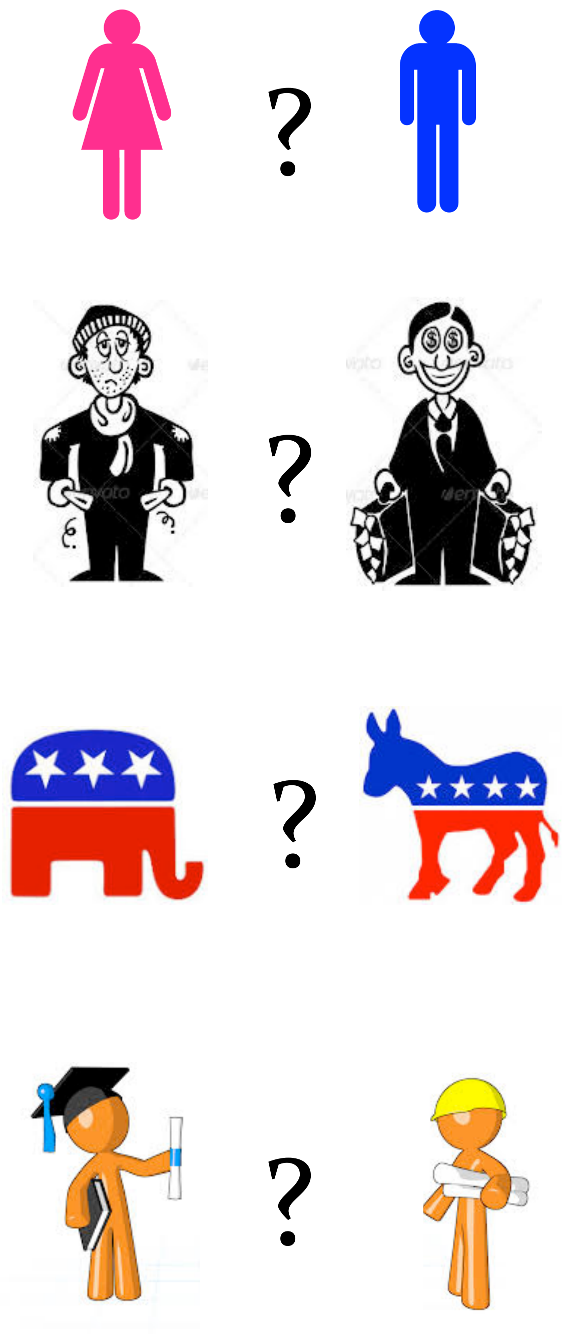


Two giant planets may cruise unseen beyond Pluto - space - June 2014 - New Scientist: newscientist.com/article/dn2571



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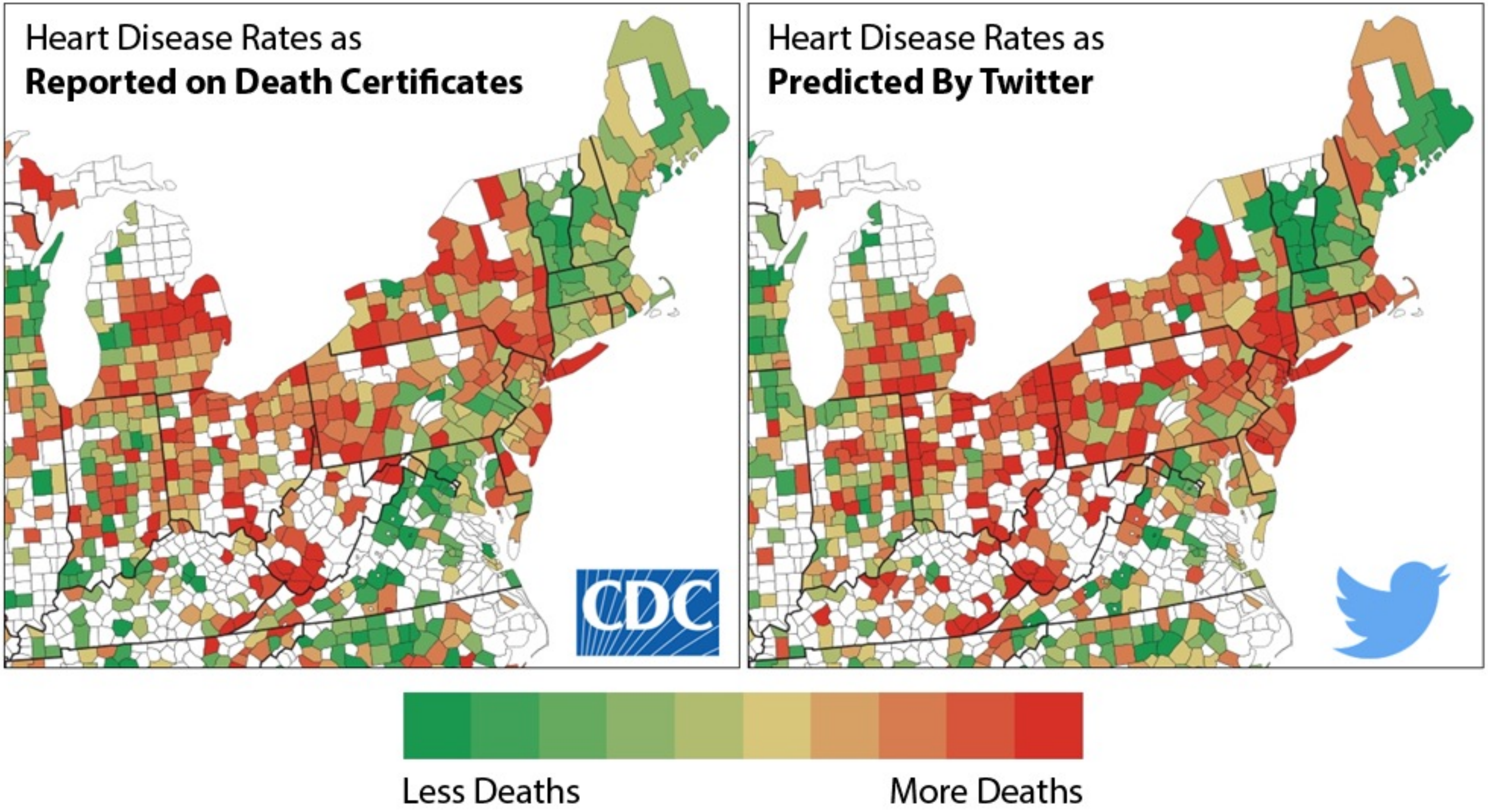
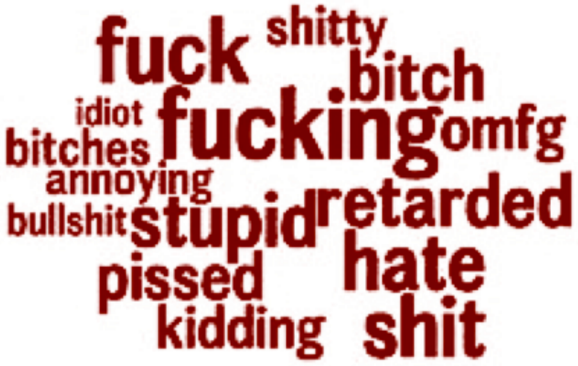
Health



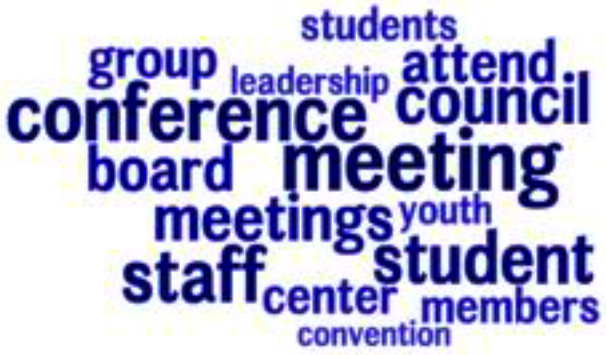
Source: World Well-Being Project @ University of Pennsylvania

Health

Hostility, Aggression



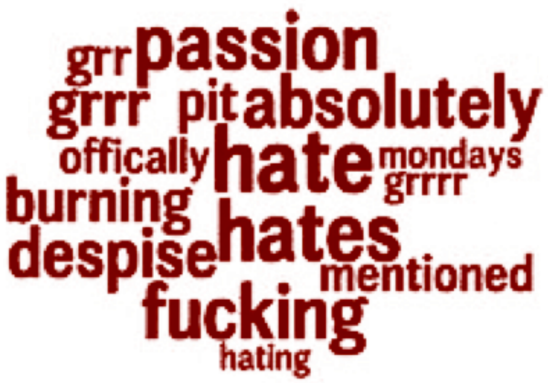
$r = .27$



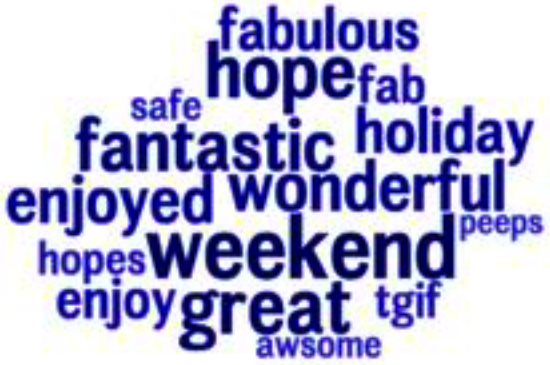
$r = -.17$

Skilled Occupations

Hate, Interpersonal Tension



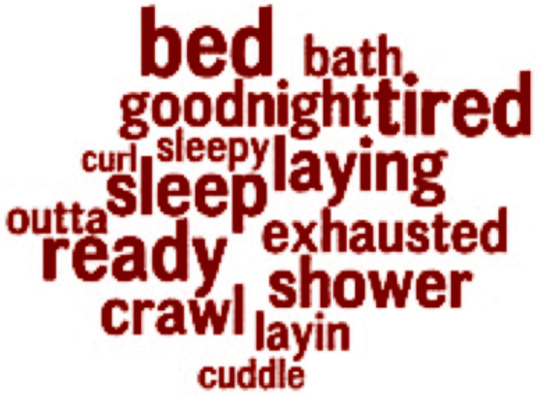
$r = .21$



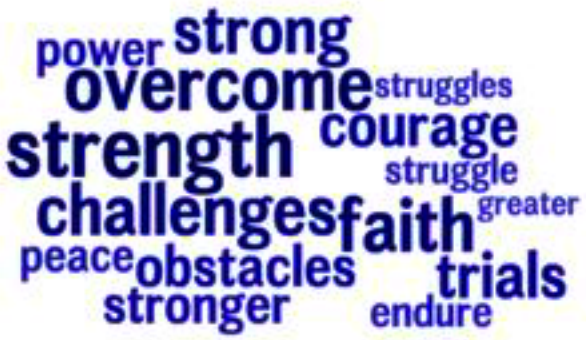
$r = -.15$

Positive Experiences

Boredom, Fatigue



$r = .20$



$r = -.13$

Optimism

Source: World Well-Being Project @ University of Pennsylvania

What is Natural Language Processing?

Sentiment Analysis

🙂 **or** 🙁 **?**

*This nets vs bulls game is **great***

*This Nets vs Bulls game is **nuts***

***Wowsers** to this nets bulls game*

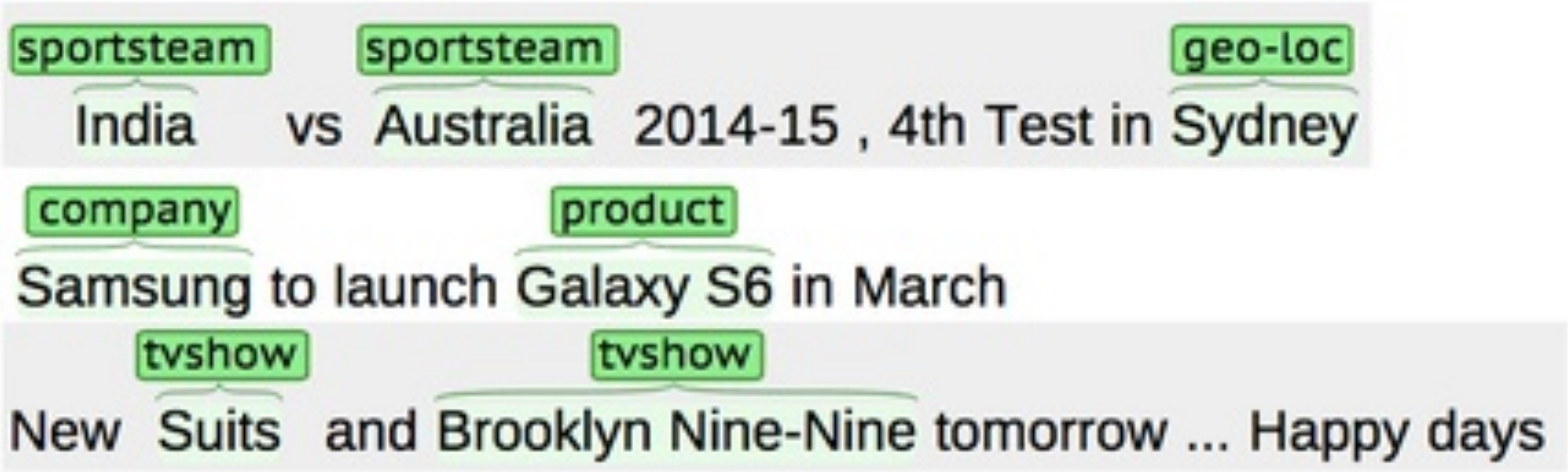
*this Nets vs Bulls game is **too live***

*This Nets and Bulls game is a **good** game*

*This netsbulls game is **too good***

*This NetsBulls series is **intense***

Named Entity Recognition



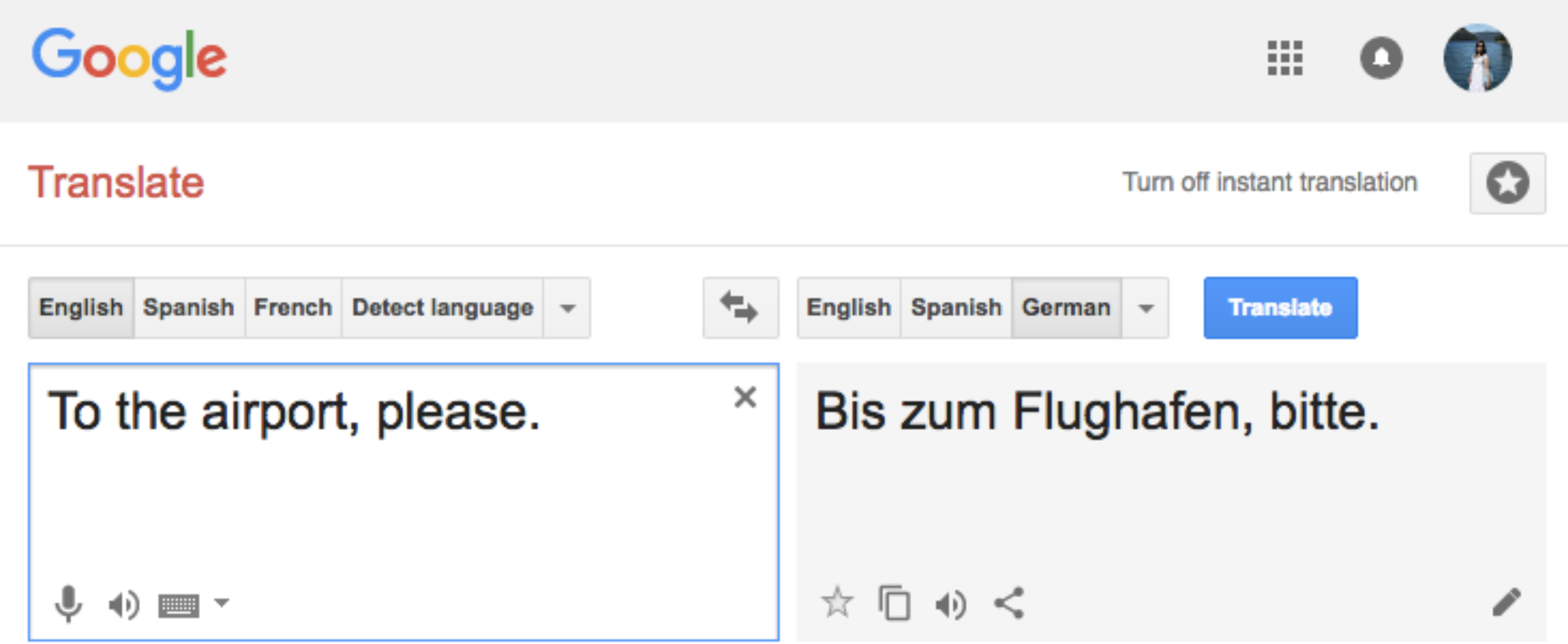
India vs Australia 2014-15 , 4th Test in Sydney

Samsung to launch Galaxy S6 in March

New Suits and Brooklyn Nine-Nine tomorrow ... Happy days

Tim Baldwin, **Marie-Catherine de Marneffe**, Bo Han, Young-Bum Kim, **Ritter**, **Wei Xu**
Shared Tasks of the 2015 Workshop on Noisy User-generated Text: Twitter Lexical Normalization and Named Entity Recognition

Machine Translation



To the airport, please.

Bis zum Flughafen, bitte.

Mingkun Gao, **Wei Xu**, Chris Callison-Burch. “Cost Optimization for Crowdsourcing Translation” In TACL (2014)

Information Extraction

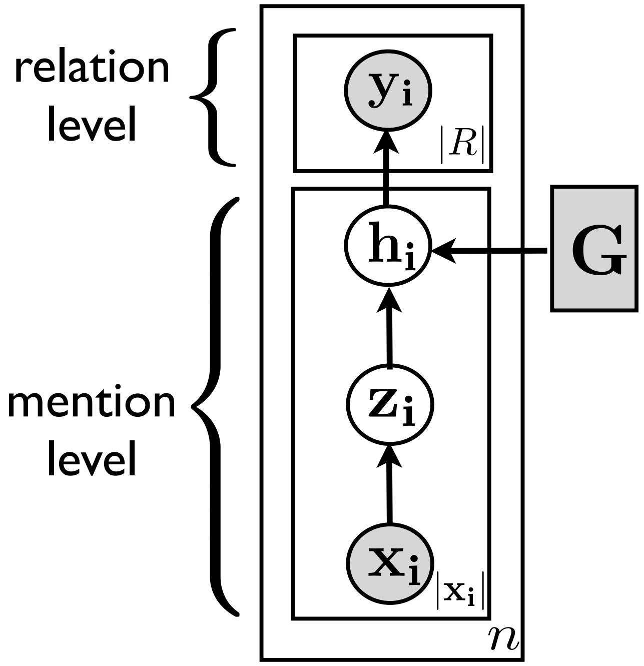
… the forced <u>resignation</u> of the CEO of Boeing, Harry Stonecipher, for …

→

Harry Stonecipher

CEO, Boeing

In office
2003-2005



Maria Pershina, Bonan Min, **Wei Xu**, Ralph Grishman. “Infusion of Labeled Data into Distant Supervision for Relation Extraction” In ACL (2014)

Wei Xu, Raphael Hoffmann, Le Zhao, Ralph Grishman. “Filling Knowledge Base Gaps for Distant Supervision of Relation Extraction” In ACL (2013)

Wei Xu, Alan Ritter, Ralph Grishman. “A Preliminary Study of Tweet Summarization using Information Extraction” in LASM (2013)

Wei Xu, Ralph Grishman, Le Zhao. “Passage Retrieval for Information Extraction using Distant Supervision” In IJCNLP (2011)

Paraphrase

cup	**word**	*mug*
the king's speech	**phrase**	*His Majesty's address*
… the forced resignation of the CEO of Boeing, Harry Stonecipher, for …	**sentence**	*… after Boeing Co. Chief Executive Harry Stonecipher was ousted from …*

Wei Xu, Chris Callison-Burch, Bill Dolan. "SemEval-2015 Task 1: Paraphrase and Semantic Similarity in Twitter" In SemEval (2015)

Wei Xu. "Data-driven Approaches for Paraphrasing Across Language Variations" PhD Thesis. (2014)

Wei Xu, Alan Ritter, Chris Callison-Burch, Bill Dolan, Yangfeng Ji. "Extracting Lexically Divergent Paraphrases from Twitter" In TACL (2014)

Wei Xu, Alan Ritter, Ralph Grishman. "Gathering and Generating Paraphrases from Twitter with Application to Normalization" In BUCC (2013)

Wei Xu, Alan Ritter, Bill Dolan, Ralph Grishman, Colin Cherry. "Paraphrasing for Style" In COLING (2012)

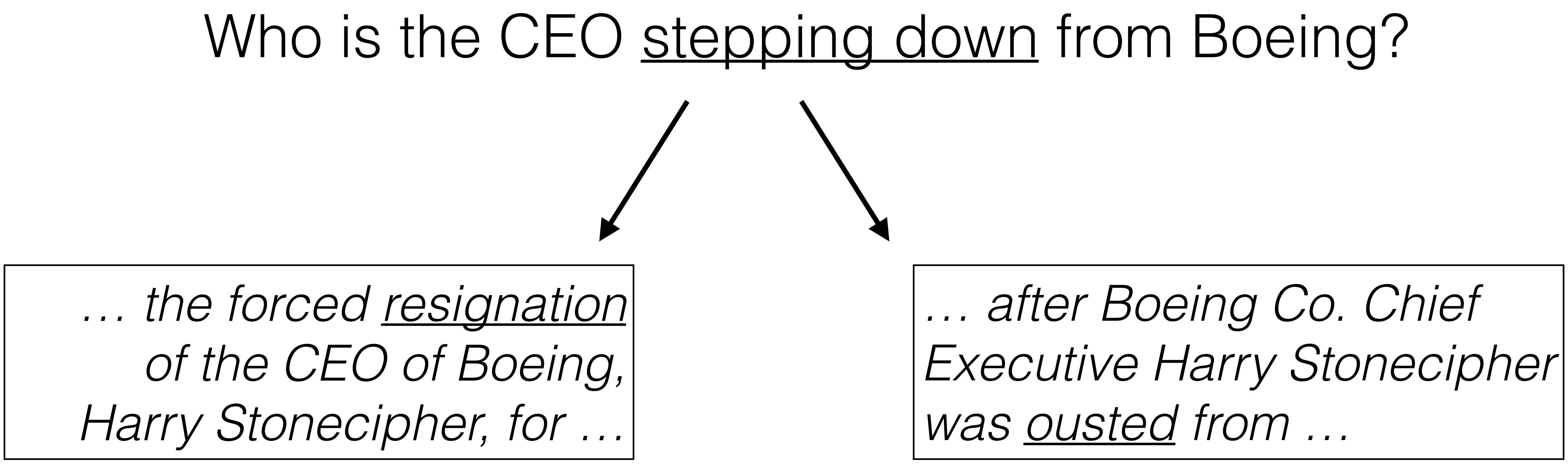
Question Answering

Who is the CEO stepping down from Boeing?

… the forced resignation of the CEO of Boeing, Harry Stonecipher, for …

… after Boeing Co. Chief Executive Harry Stonecipher was ousted from …

Question Answering



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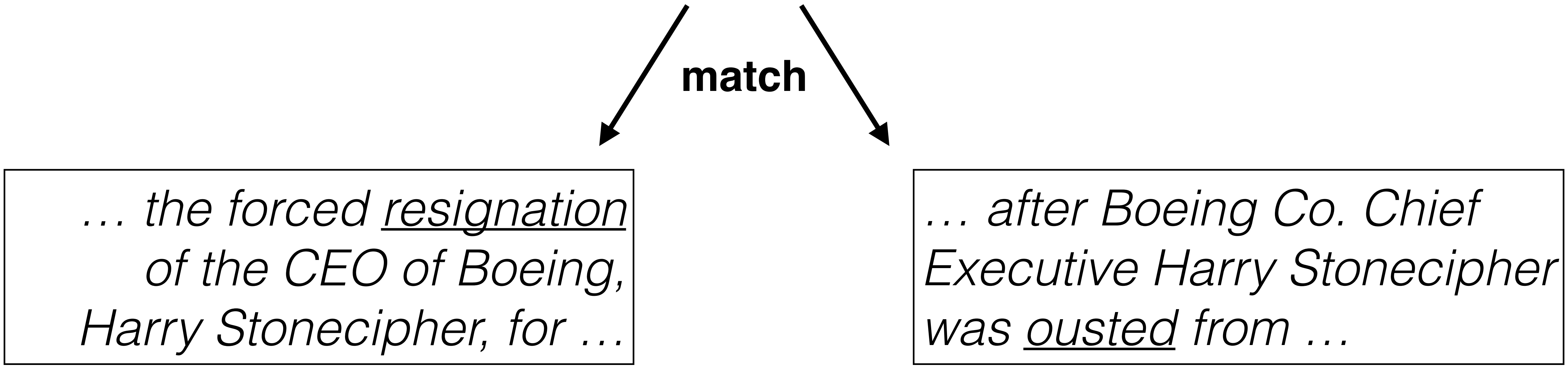
Question Answering

Who is the CEO stepping down from Boeing?

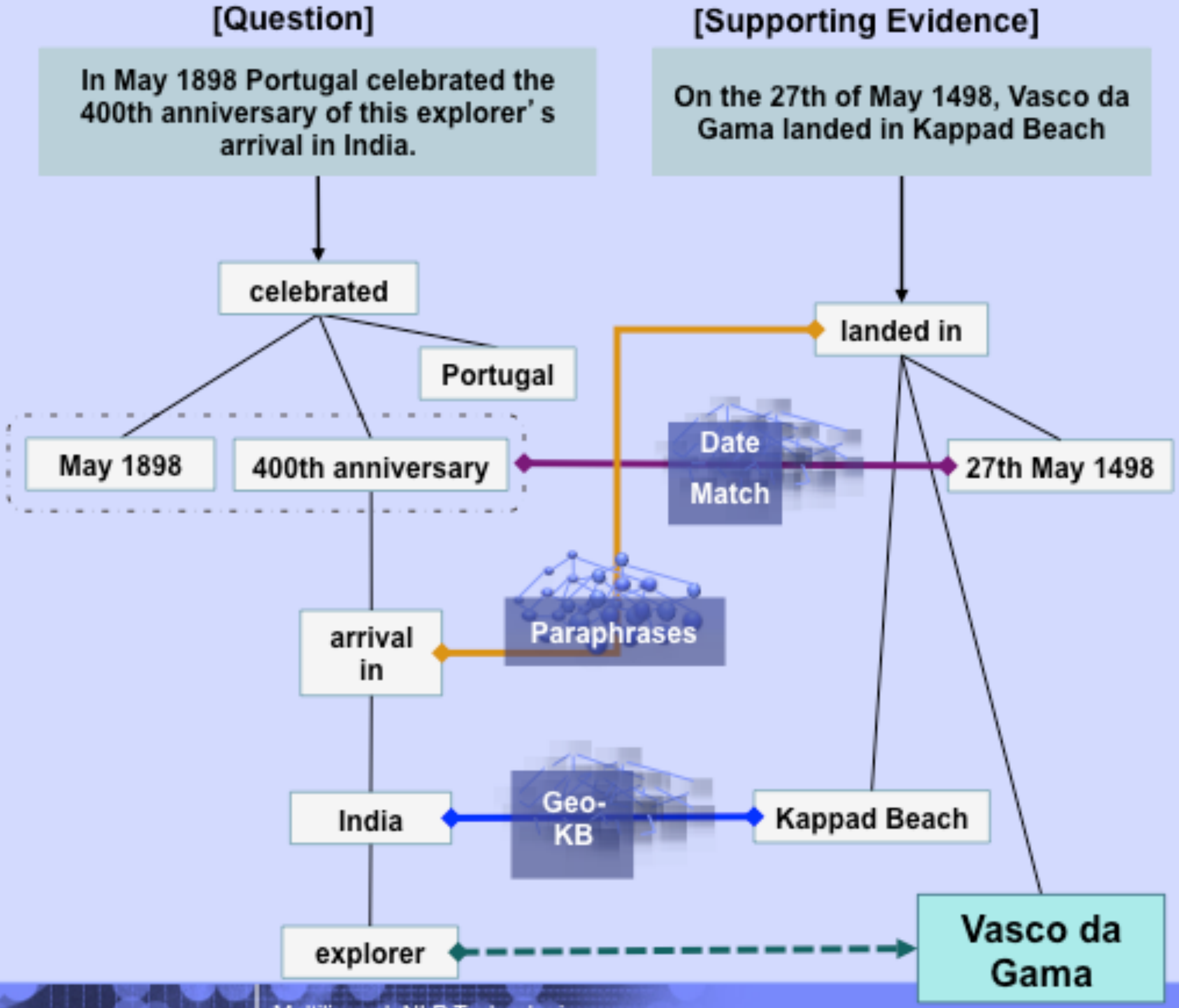


match

… the forced resignation of the CEO of Boeing, Harry Stonecipher, for …

… after Boeing Co. Chief Executive Harry Stonecipher was ousted from …

Watson leverages multiple algorithms to perform deeper analysis



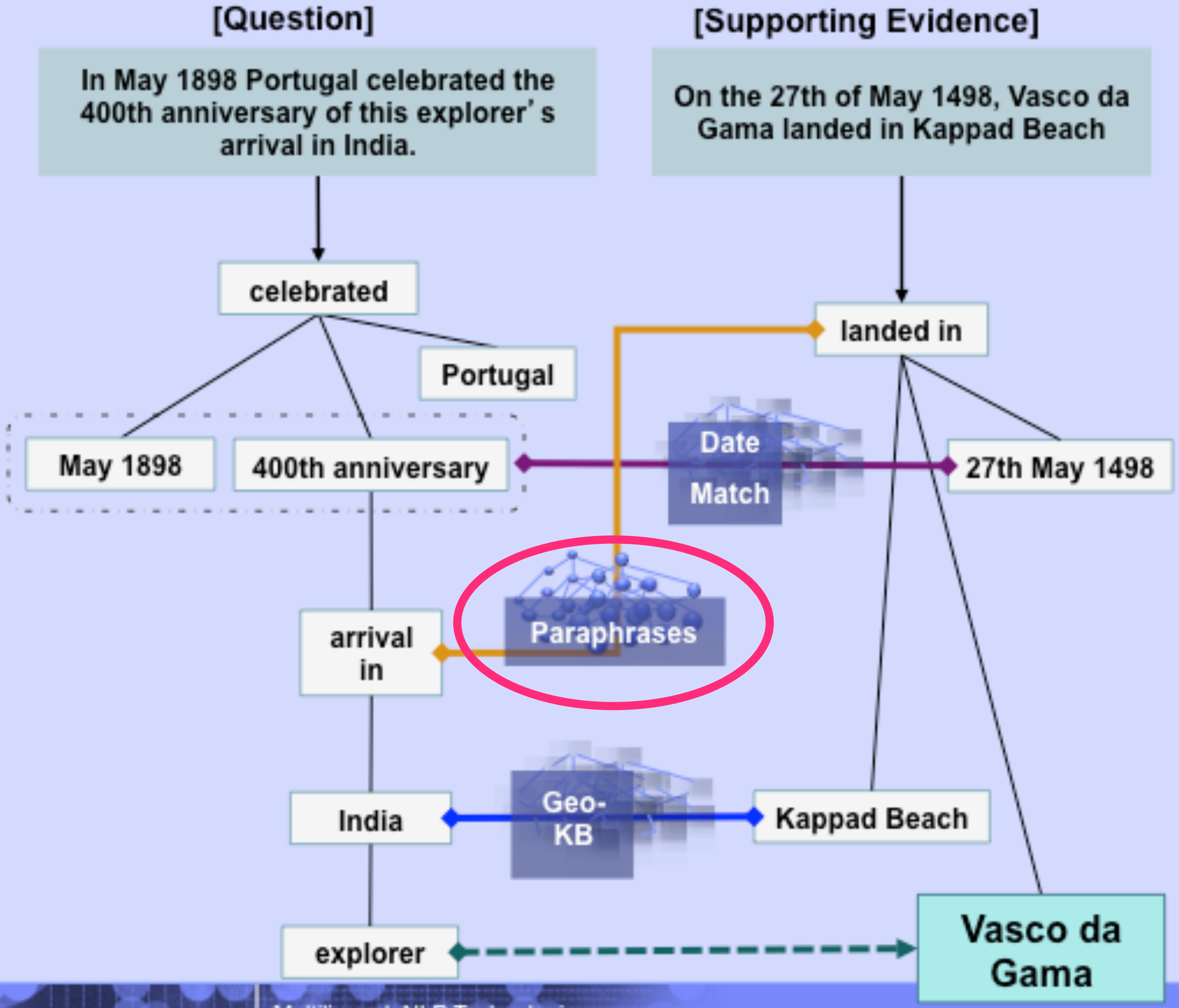
Legend	
◆—◆	Temporal Reasoning
◆—◆	Statistical Paraphrasing
◆—◆	GeoSpatial Reasoning
☐	Reference Text
🟦	Answer

Stronger evidence can be much harder to find and score…

- Search far and wide
- Explore many hypotheses
- Find judge evidence
- Many inference algorithms

(courtesy: Salim Roukos)

Watson leverages multiple algorithms to perform deeper analysis



[Question]

In May 1898 Portugal celebrated the 400th anniversary of this explorer's arrival in India.

[Supporting Evidence]

On the 27th of May 1498, Vasco da Gama landed in Kappad Beach

celebrated

Portugal

May 1898

400th anniversary

arrival in

India

explorer

landed in

27th May 1498

Kappad Beach

Vasco da Gama

Date Match

Paraphrases

Geo-KB

Legend

- ◆—◆ Temporal Reasoning
- ◆—◆ Statistical Paraphrasing
- ◆—◆ GeoSpatial Reasoning
- □ Reference Text
- 🟦 Answer

Stronger evidence can be much harder to find and score…

- Search far and wide
- Explore many hypotheses
- Find judge evidence
- Many inference algorithms

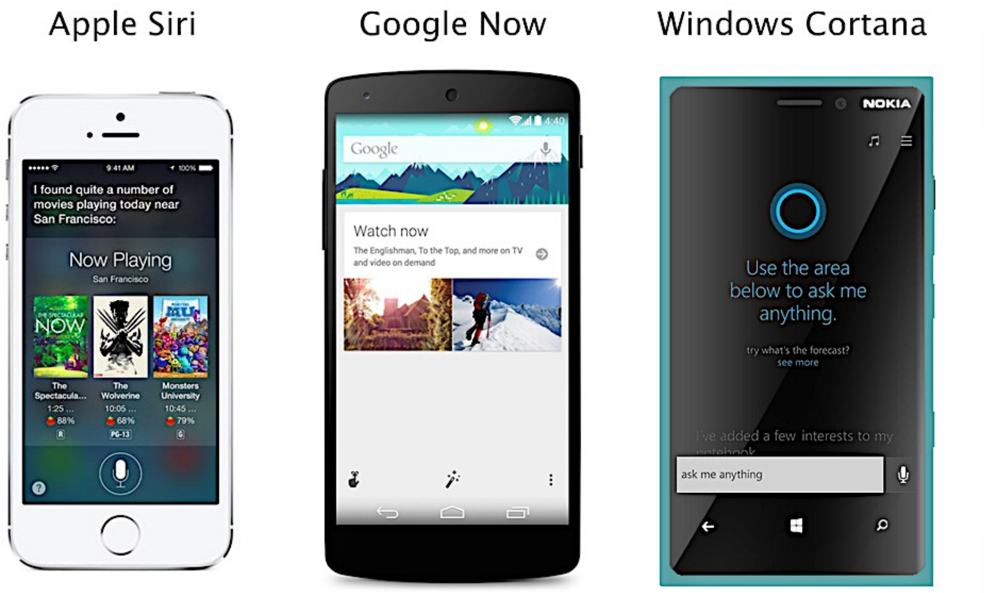
(courtesy: Salim Roukos)

Natural Language Generation

who wants to get a beer? →

- want to get a beer?
- who else wants to get a beer?
- who wants to go get a beer?
- who wants to buy a beer?
- who else wants to get a beer?
- trying to get a beer?

… (21 different ways)


Apple Siri
Google Now
Windows Cortana
I found quite a number of movies playing today near San Francisco:
Now Playing
Watch now
Use the area below to ask me anything.
ask me anything

Xu, Courtney Napoles, Ellie Pavlick, Chris Callison-Burch. “Optimizing Statistical Machine Translation for Simplification” in TACL (2016)

Wei Xu, Chris Callison-Burch, Courtney Napoles. “Problems in Current Text Simplification Research: New Data Can Help” in TACL (2015)

Wei Xu, Alan Ritter, Ralph Grishman. “Gathering and Generating Paraphrases from Twitter with Application to Normalization” In BUCC (2013)

Language Technology

mostly solved

Spam detection

Let's go to Agra! ✓

Buy V1AGRA … ✗

Part-of-speech (POS) tagging

ADJ	ADJ	NOUN	VERB	ADV
Colorless	green	ideas	sleep	furiously.

Named entity recognition (NER)

PERSON			ORG		LOC
Einstein	met with	UN	officials	in	Princeton

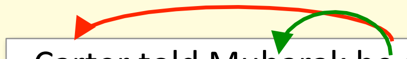
making good progress

Sentiment analysis

Best roast chicken in San Francisco! 👍

The waiter ignored us for 20 minutes. 👎

Coreference resolution

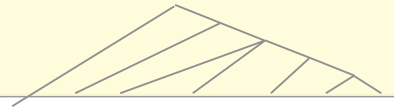


Carter told Mubarak he shouldn't run again.

Word sense disambiguation (WSD)

I need new batteries for my ***mouse***.

Parsing



I can see Alcatraz from the window!

Machine translation (MT)

第13届上海国际电影节开幕… ⇨

The 13th Shanghai International Film Festival…

Information extraction (IE)

You're invited to our dinner party, Friday May 27 at 8:30

Party
May 27
add

still really hard

Question answering (QA)

Q. How effective is ibuprofen in reducing fever in patients with acute febrile illness?

Paraphrase

XYZ acquired ABC yesterday

ABC has been taken over by XYZ

Summarization

The Dow Jones is up
The S&P500 jumped
Housing prices rose

⇨ Economy is good

Dialog

Where is Citizen Kane playing in SF?

Castro Theatre at 7:30. Do you want a ticket?

What will we cover in this class (and should you take it)?

What do you expect to learn

- Twitter API for obtaining Twitter data
- cutting edge research on:
  - Natural Language Processing (NLP)
  - Machine Learning
- useful NLP tools, especially for Twitter text
- basic machine learning algorithms:
  - Naïve Bayes, Logistic Regression
  - Probabilistic Graphical Models
  - Some deep learning basics

Guest Lectures

- At least one guest lecture from other NLP faculty members and/or industry, student researchers

Grading

- two programing assignments (45 pts/individual)
- A 3rd assignment/research project (**optional**, 20 bonus pts)
- in-class presentation (20 pts/group of two)
- paper summaries (20 points/individual, about 10 papers)
- several take-home Quizzes (10 points/individual)
- participation in class discussions (5 pts)

Programming Assignments

- All in Python
- two programing assignments (45 points — individual)

  1. Twitter’s Language Mix (on the course website **now**)
  2. Logistic Regression Algorithm (use Numpy package)

- a third assignment (**optional** — group recommended)

  3. Deep Learning Basics and Word2Vec

In-class Presentation

- a 10 minute presentation (20 points)
  - A Social Media Platform
  - Or a NLP Researcher

Quizzes

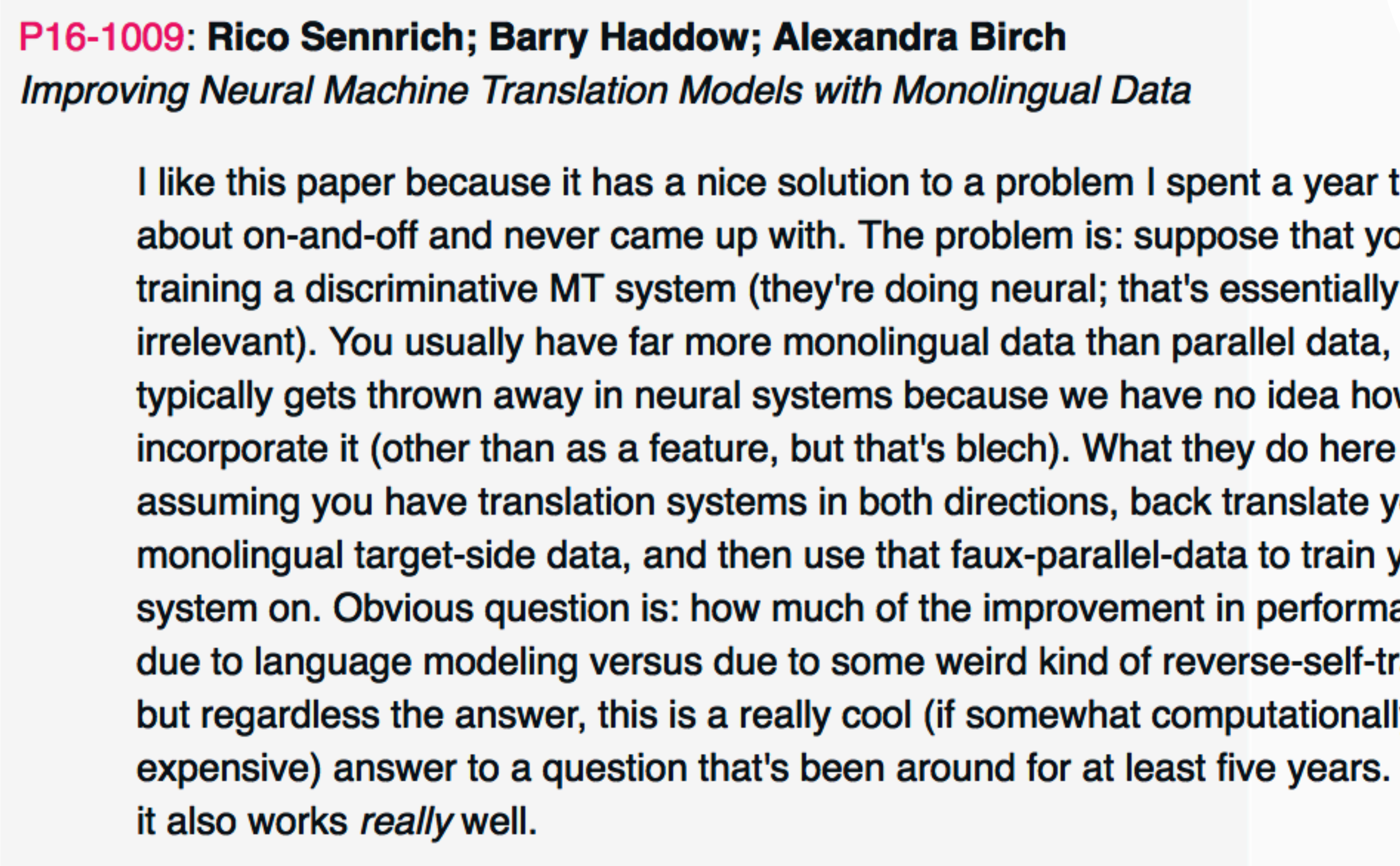
- several simple take-home quizzes (about 5 or 6)
- hard-copy on paper
- will not be graded; but count10 points
- We have **Quiz #1 today** on pre-requirements!

Paper Summaries

- roughly one paper assigned for reading per week
- about 10 papers in total
- allowed to skip two papers throughout the semester
- write a short summary between 100-200 words:
    - discuss positive aspects and limitations
    - suggest potential improvement or extensions

Paper Summaries

- Hal Daumé III's infamous NLP blog



P16-1009: **Rico Sennrich; Barry Haddow; Alexandra Birch**
Improving Neural Machine Translation Models with Monolingual Data

I like this paper because it has a nice solution to a problem I spent a year thinking about on-and-off and never came up with. The problem is: suppose that you're training a discriminative MT system (they're doing neural; that's essentially irrelevant). You usually have far more monolingual data than parallel data, which typically gets thrown away in neural systems because we have no idea how to incorporate it (other than as a feature, but that's blech). What they do here is, assuming you have translation systems in both directions, back translate your monolingual target-side data, and then use that faux-parallel-data to train your MT system on. Obvious question is: how much of the improvement in performance is due to language modeling versus due to some weird kind of reverse-self-training, but regardless the answer, this is a really cool (if somewhat computationally expensive) answer to a question that's been around for at least five years. Oh and it also works *really* well.

Research Project

- **Optional**
- Build a machine translation system and **web demo** that can transfer contemporary English text into Shakespearean style!

Stylistic Language Generation

Palpatine:
If you will not be turned, you will be destroyed!

↓

If you will not be turn’d, you will be undone!

Luke:
Father, please! Help me!

↓

Father, I pray you! Help me!

Wei Xu, Alan Ritter, Bill Dolan, Ralph Grishman, Colin Cherry. “Paraphrasing for Style” In COLING (2012)

Stylistic Language Generation

- I and my collaborators released the data and code:

https://github.com/cocoxu/Shakespeare/

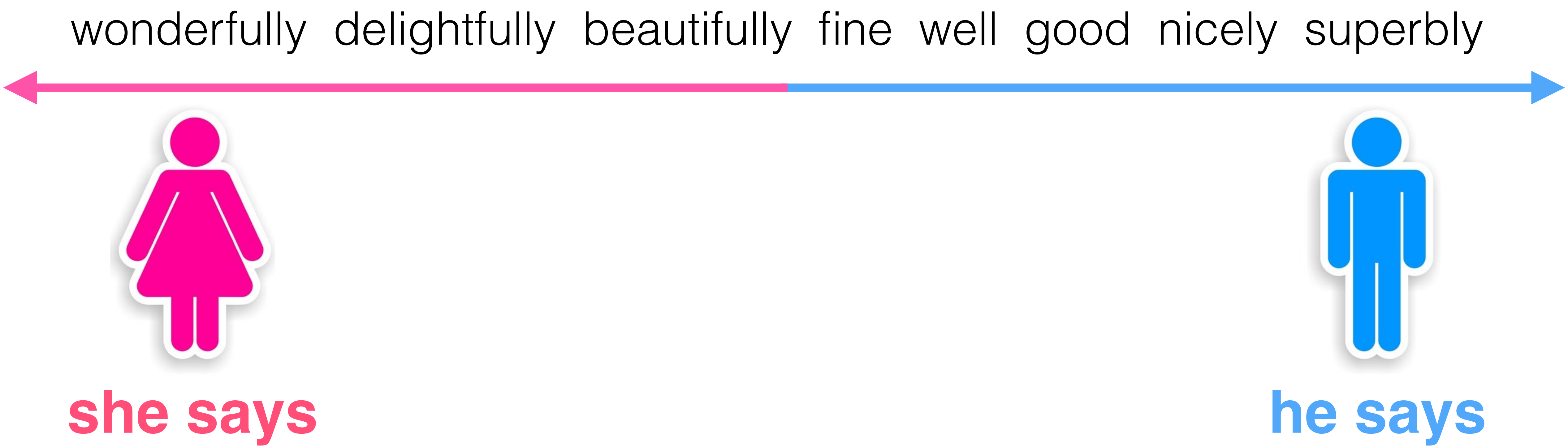
Wei Xu, Alan Ritter, Bill Dolan, Ralph Grishman, Colin Cherry. “Paraphrasing for Style” In COLING (2012)

Stylistic Language Generation

- It has yet become a popular student research project:
  - Stanford students: https://web.stanford.edu/class/cs224n/reports/2757511.pdf
  - University of Maryland students: http://xingniu.org/pub/styvar_emnlp17.pdf
  - CMU students: https://arxiv.org/abs/1707.01161

Wei Xu, Alan Ritter, Bill Dolan, Ralph Grishman, Colin Cherry. "Paraphrasing for Style" In COLING (2012)

Language Styles



wonderfully delightfully beautifully fine well good nicely superbly

she says

he says

Source: Daniel Preot¸iuc-Pietro, **Wei Xu** and Lyle Ungar
"Discovering User Attribute Stylistic Differences via Paraphrasing" AAAI 2016

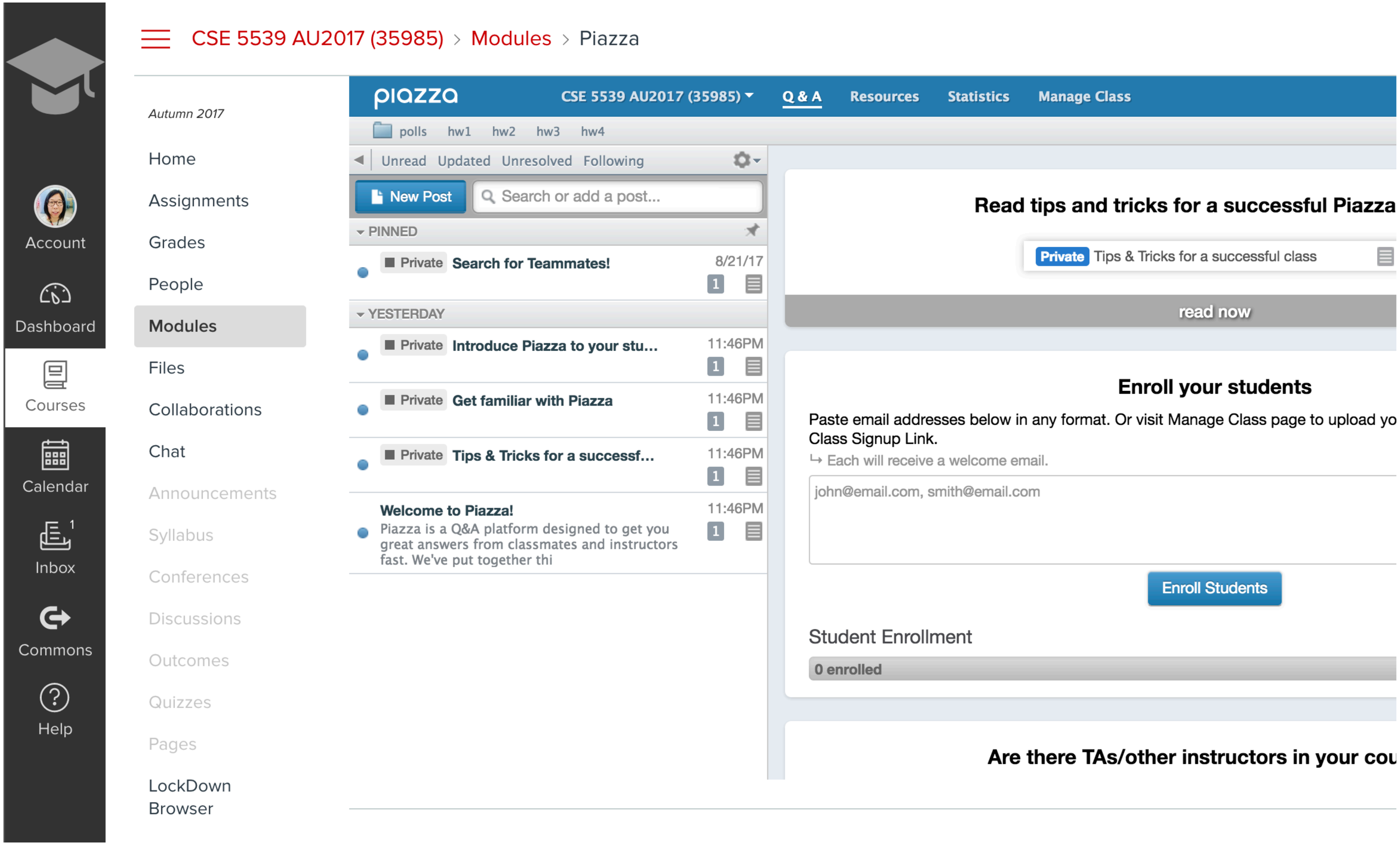
What will you get out of this class?

- Understanding of an emerging field of CS
- Programming and machine learning skills useful in industry companies and academic research
- Getting a taste of research and being prepared
- Summer internships?

Office Hour

- Have a question? Ask at/after each class
- Or ask on Piazza discussion broad
- Office hour — Tuesday 4:15-5:15pm (Dreese 495)

Piazza Discussion Broad



Private Search for Teammates! 8/21/17

Private Introduce Piazza to your stu... 11:46PM

Private Get familiar with Piazza 11:46PM

Private Tips & Tricks for a successf... 11:46PM

Welcome to Piazza! 11:46PM
Piazza is a Q&A platform designed to get you great answers from classmates and instructors fast. We've put together thi

Read tips and tricks for a successful Piazza

Private Tips & Tricks for a successful class

Enroll your students

Paste email addresses below in any format. Or visit Manage Class page to upload yo Class Signup Link.

↳ Each will receive a welcome email.

john@email.com, smith@email.com

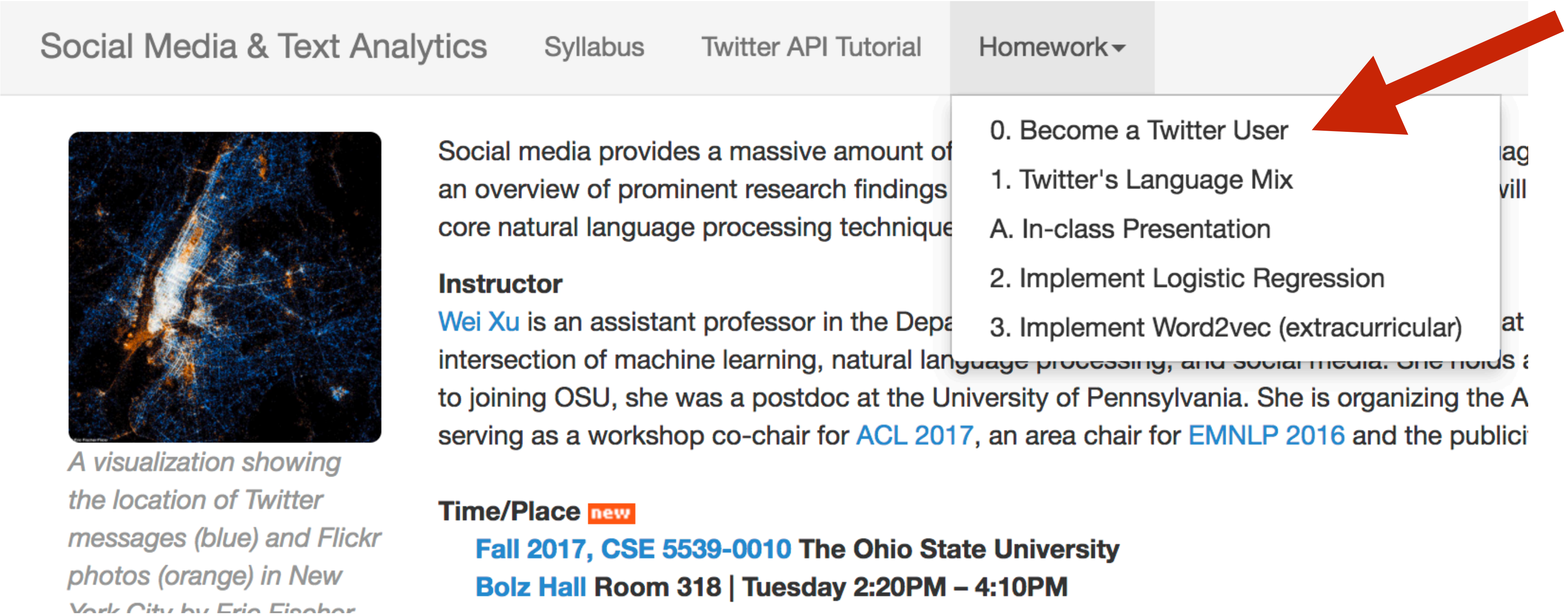
Student Enrollment

0 enrolled

Are there TAs/other instructors in your cou

By Next Class:

- Hand in Quiz #1
- HW#0 Become a Twitter User


Social Media & Text Analytics
Syllabus
Twitter API Tutorial
Homework
0. Become a Twitter User
1. Twitter's Language Mix
A. In-class Presentation
2. Implement Logistic Regression
3. Implement Word2vec (extracurricular)

A visualization showing the location of Twitter messages (blue) and Flickr photos (orange) in New York City by Eric Fischer

Social media provides a massive amount of ag
an overview of prominent research findings vill
core natural language processing technique

Instructor
Wei Xu is an assistant professor in the Depa at
intersection of machine learning, natural language processing, and social media. She holds a
to joining OSU, she was a postdoc at the University of Pennsylvania. She is organizing the A
serving as a workshop co-chair for ACL 2017, an area chair for EMNLP 2016 and the publici

Time/Place new
Fall 2017, CSE 5539-0010 The Ohio State University
Bolz Hall Room 318 | Tuesday 2:20PM – 4:10PM

socialmedia-class.org