

CS 8803 Data Analytics for Well-being: Background

Munmun De Choudhury

munmund@gatech.edu

Week 1 | January 13, 2016

Resources

- Office hours: 1-2pm Wednesday, or by appointment
- Location: TSRB 341
- Teaching Assistant: Ming Liu (lmffd@gatech.edu)
- TA office hours: by appointment (check with Ming)

- Class website (including readings):
<http://www.munmund.net/CS8803.html>

- Email announcements will be made over the course page on T-Square

Piazza

- Signup link:
piazza.com/gatech/spring2016/cs8803
- Piazza class page:
<https://piazza.com/class/ijd4hi7tg7u4q2>
- Submitting reading reflections
“reflections” folder – put the date in the subject line/title
- Off-class discussion
“discussion” folder
- Class presentation sign-up
A google spreadsheet will be made available during the weekend

What do you understand by “well-being”?

Given the above definition of well-being, what data would you use to make sense of it?

Well-being: the state of being comfortable,
healthy, or happy

- personal
- communal
- societal

From Smartphones to Cognitive Phones

Main idea

- Smartphones as a way to understand our life patterns, reason about our health and well-being, help us navigate through our day, and intervene on our behalf

[News](#) | [Releases](#) |



Nokia Research Center puts Mobile Millennium in gear to help reduce traffic congestion

10 November, 2008

Large scale public pilot to gather and analyze traffic information using GPS-enabled mobile devices

Palo Alto and Berkeley, CA - Nokia today launched Mobile Millennium, a public pilot that will collect and study traffic data received from GPS-enabled mobile devices, such as the Nokia N96, Nokia N95 and Nokia E71. As part of its open innovation model, Nokia Research Center is collaborating with UC Berkeley's California Center for Innovative Transportation (CCIT), the California Department of Transportation (Caltrans) and NAVTEQ to design, execute and analyze the traffic system.

Based in part on the results of an earlier experiment, Nokia believes that a community of users with GPS-equipped mobile devices can help reduce traffic and the amount of time spent on the road. Providing real-time information about traffic congestion helps drivers make more informed decisions - such as whether to take alternative routes, public transport or reschedule their journey.

"The global proliferation of GPS-enabled mobile devices has driven tremendous growth in location-based experiences" said Henry Tirri, Vice President and Head of Nokia Research Center. "Mobile Millennium, with its unique collaboration of private and public stakeholders, is designed to demonstrate that everyone can help address problems such as traffic congestion. Nokia is proud to be part of this research."

A first example...

- CenceMe was a Nokia phone capability that implemented classifiers directly on the phone to infer the user's physical activity (sitting, walking, or running) and social interaction (whether or not the user is having a conversation) in real time.
- Then it shared this sensing presence with the user's social network friends on Facebook.



Figure 1. The BeWell mobile health app: (a) the ambient display on the smartphone's wallpaper screen and (b) the sleep, social, and activity scores.

- In BeWell classification algorithms run directly on the phone to automatically infer the user's sleep duration, physical activity, and social interaction
- Changes in social isolation were detected based on the total duration of ambient speech during a day
- The social interaction dimension also considered the use of social applications on the phone (such as Facebook, voice calls, and email) when computing a composite sociability score for the user

- The BeWell+ cloud service let users not only view his or her scores but also compare them with other BeWell users as a social network.
- The phone system sends targeted messages to users to encourage them to get back on track should the system note a low score

WalkSafe: Pedestrian Safety App

- WalkSafe uses the smartphone's back camera to detect vehicles approaching the user, alerting the user of any potentially unsafe situations.
- WalkSafe uses machine-learning algorithms implemented on the phone to detect moving vehicles.

Cognitive Phones

- Not just track a user's physical, cognitive, and mental health but also use data analytics and prediction to model trends in data.
- Thus, application-specific evidence—such as progressive social isolation, inactivity, and sporadic sleep patterns—could help predict the manic and depressive phases of someone suffering from a serious mental illness, such as a bipolar disorder.
- If the phone could accurately predict this change in health, could it also intervene to help the patient?
- New frontiers: sensor data fusion

How social media will
change public health

Why Social Media

- A range of applications have benefited from Twitter data, ranging from political polling to earthquake monitoring
- These have demonstrated Twitter's ability to deliver fast, cheap, and reliable tools for monitoring real-world events
- Current public health efforts require expensive, time-consuming monitoring mechanisms, primarily surveys and data collection from clinical encounters/traditional biosurveillance
- The article examines the types of health topics discussed on Twitter, and how tweets can both augment existing public health capabilities and enable new ones

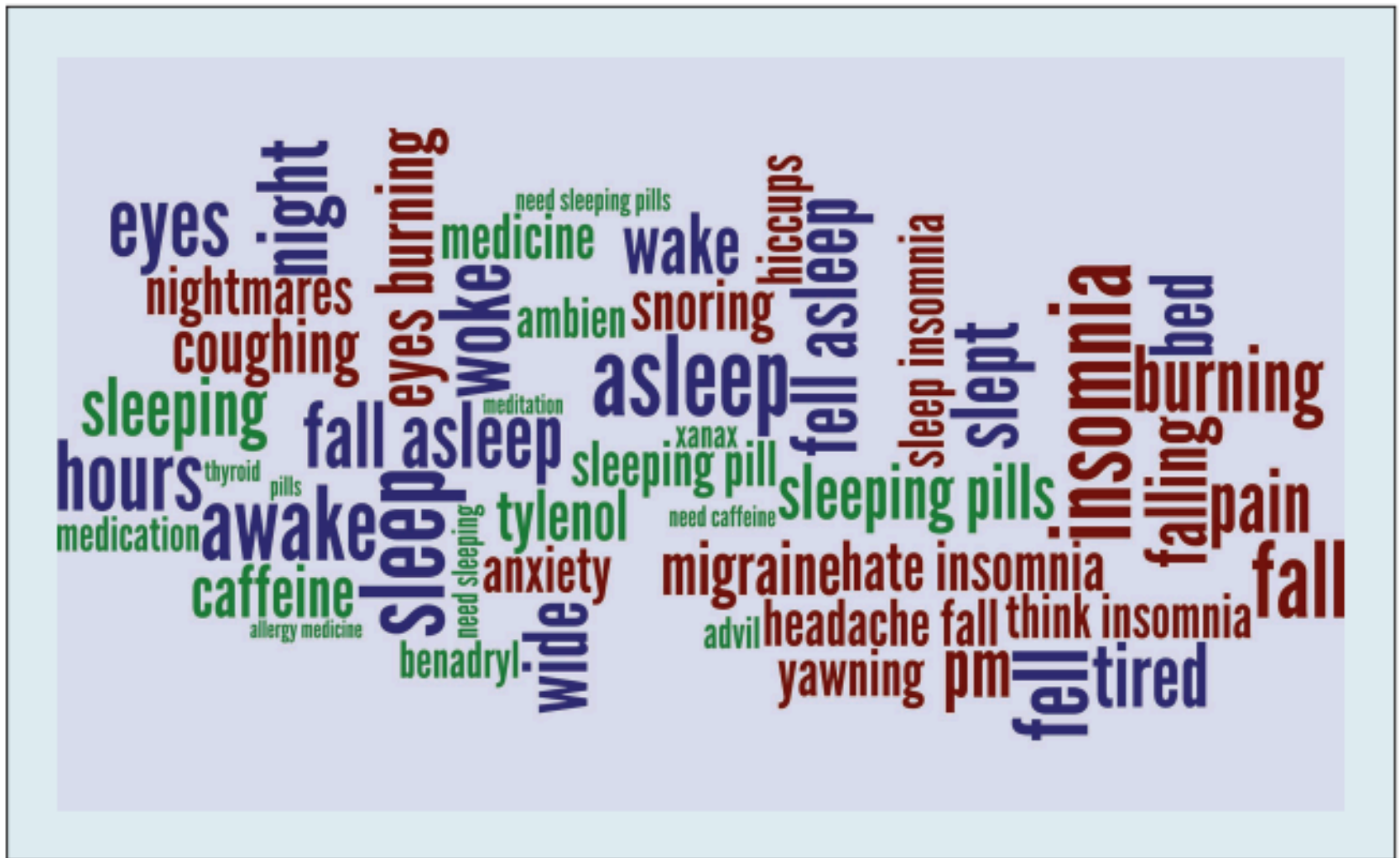


Figure 2. A word cloud visualization showing the words most associated with the ailment “insomnia” as discovered by a machine-learning model that examined 1.6 million tweets related to health. Larger fonts indicate more related terms, blue indicates general terms, red highlights symptoms, and green represents treatments. General words such as “hours,” “awake,” and “tired” characterize insomnia messages, with symptoms such as “nightmares” and “yawning” and treatments of “Benadryl” and “sleeping pills.”

- Ailment Topic Aspect Model (ATAM)

“fever + headache = flu, home sick with Tylenol” discusses influenza, where “fever” and “headache” are symptoms, “Tylenol” a treatment, and “flu” a general word associated with the ailment

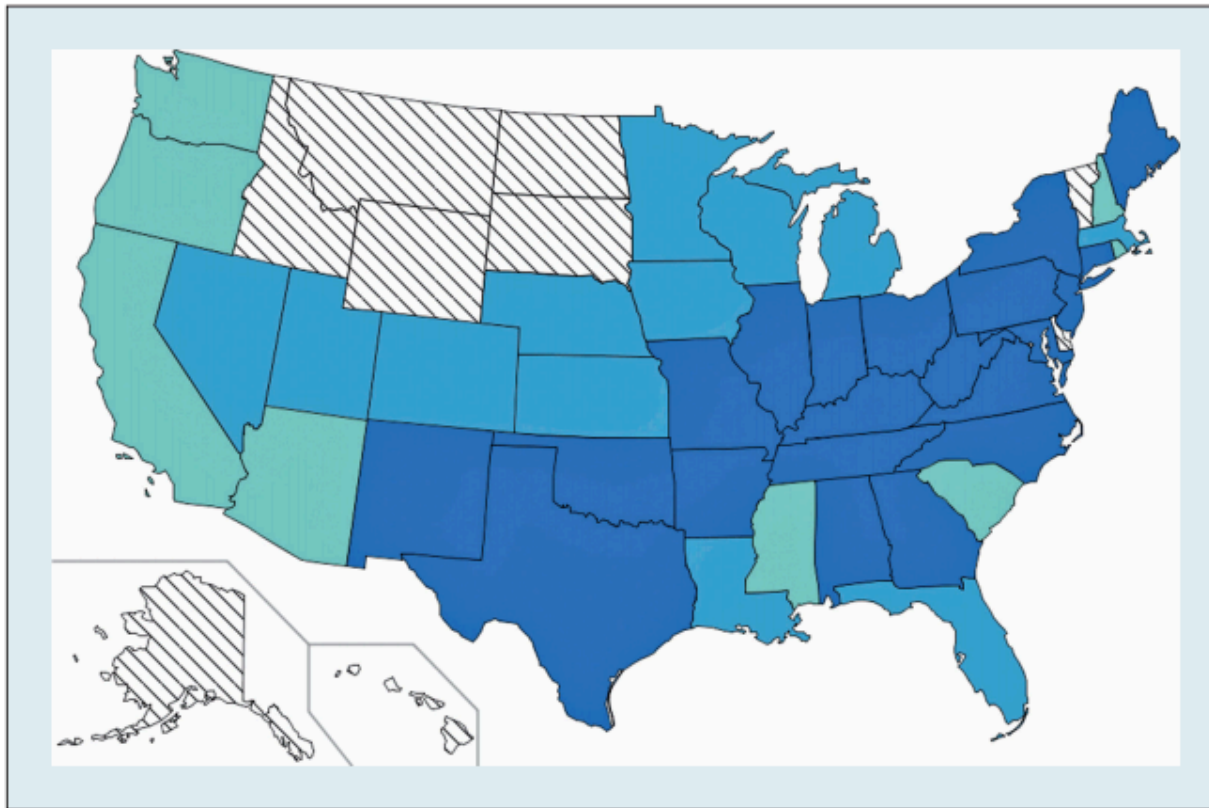


Figure 1. The rate of Twitter messages about seasonal allergies for June 2010. Messages were automatically coded using a machine-learning method and geo-located based on user-provided location. Overall shading indicates significant allergy messages, showing the heart of allergy season. States in the Northeast and Midwest are particularly active. Dashed states had insufficient data.

Well-being inference

- Problems with quantified self or social media data
- Data representativeness issues
- The challenge of ground truth
 - Social media can be relatively easier, due to unpromoted sharing of self-reported data
- Crowdsourcing is promising, but difficult to scale

Social Media and Well-being

- 18 to 24 year olds are more than 2x as likely than 45 to 54 year olds to use social media for health-related discussions
- 90% of respondents from 18 to 24 years of age said they would trust medical information shared by others on their social media networks
- From a recent study, 54% of patients said they are very comfortable with their providers seeking advice from online communities to better treat their conditions
- 28% of health-related conversations on Facebook are supporting health-related causes, followed by 27% of people commenting about health experiences or updates
- 40% of people polled said information found on social media affects how someone coped with a chronic condition, their view of diet and exercise and their selection of a physician

Social media and well-being

- Helps candid disclosure of health conditions
- People may not be comfortable sharing stigmatized conditions with health officials directly
- Behavioral cues may reveal risks, people may be unaware of
- Wellness – goal setting, gamification and peer support
- Discover unknown links between ailments and symptoms, and even drug interaction

Unreported Side Effects of Drugs Are Found Using Internet Search Data, Study Finds

By JOHN MARKOFF MARCH 6, 2013

184 COMMENTS

✉ Email

f Share

t Tweet

📁 Save

↗ More

Using data drawn from queries entered into Google, Microsoft and Yahoo search engines, scientists at Microsoft, Stanford and Columbia University have for the first time been able to detect evidence of unreported prescription drug side effects before they were found by the [Food and Drug Administration](#)'s warning system.

Using automated software tools to examine queries by six million Internet users taken from Web search logs in 2010, the researchers looked for searches relating to an antidepressant, paroxetine, and a cholesterol lowering drug, pravastatin. They were able to find evidence that the combination of the two drugs caused high blood sugar.

[The study](#), which was reported in the Journal of the American Medical Informatics Association on Wednesday, is based on data-mining techniques similar to those employed by services like Google Flu Trends, which has been used to give early warning of the prevalence of the sickness to the public.

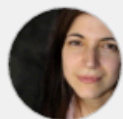
The F.D.A. asks physicians to report side effects through a system known as the [Adverse Event Reporting System](#). But its scope is limited by the fact that data is generated only when a physician notices something and reports it.



Many health challenges have a social dimension

APR 8, 2015 @ 03:52 PM 93,667 VIEWS

New Study Links Facebook To Depression: But Now We Actually Understand Why.



Alice G. Walton, CONTRIBUTOR

I cover health, medicine, psychology and neuroscience.

[FOLLOW ON FORBES \(665\)](#)



Opinions expressed by Forbes Contributors are their own.

FULL BIO ▾

The irony of Facebook is by now known to most. The “social” network has been linked to a surprising number of undesirable mental health consequences: Depression, low self-esteem, and bitter jealousy among them. Now, a new study in the *Journal of Social and Clinical Psychology* finds that not only do Facebook and depressive symptoms go hand-in-hand, but the mediating factor seems to be a well-established psychological phenomenon: “Social comparison.” That is, making comparisons, often between our most humdrum moments and our friends “highlight reels” – the vacation montages and cute baby pics – is what links Facebook time and depressive symptoms together. So is it time to cut down on Facebook? Maybe. Or maybe we should just adjust our attitude toward it.

