



TEXAS TECH UNIVERSITY SYSTEM™

# HealthTvizer: Exploring Health Awareness in Twitter Data through Coordinated Multiple Views



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# Outline



1. Introduction
2. Background and related work
3. Visualization architecture
4. Use cases
5. Future work

# Project Overview



- Analyzing public user posts and shared information on social media can assist us in measuring various population characteristics, patterns, movements, and as well as the public health conditions.
- In this paper, we present a social media analytics tool, called HealthTvizer, for exploring health awareness using Twitter data through interactive and interconnected multiple views.
- We demonstrate HealthTvizer on more than 130k disease-related tweets (extracted from over 57 million tweets) in January 2017.

# Project Overview



When dealing with public health information, domain experts concern on the following issues:

- Q1: What public health information can be learned from Twitter?
- Q2: Are there any geographical areas where people are prone to specific diseases?
- Q3: Is there any relation of diseases with exercise or general daily behavior which we can infer from tweets?
- Q4: Which diseases are more discussed in social media and if there is a gap with respect to an actual scenario?

# Project Overview



We adopt three step metaphor for information visualization:  
overview first, zoom and filter, and then details-on-demand:

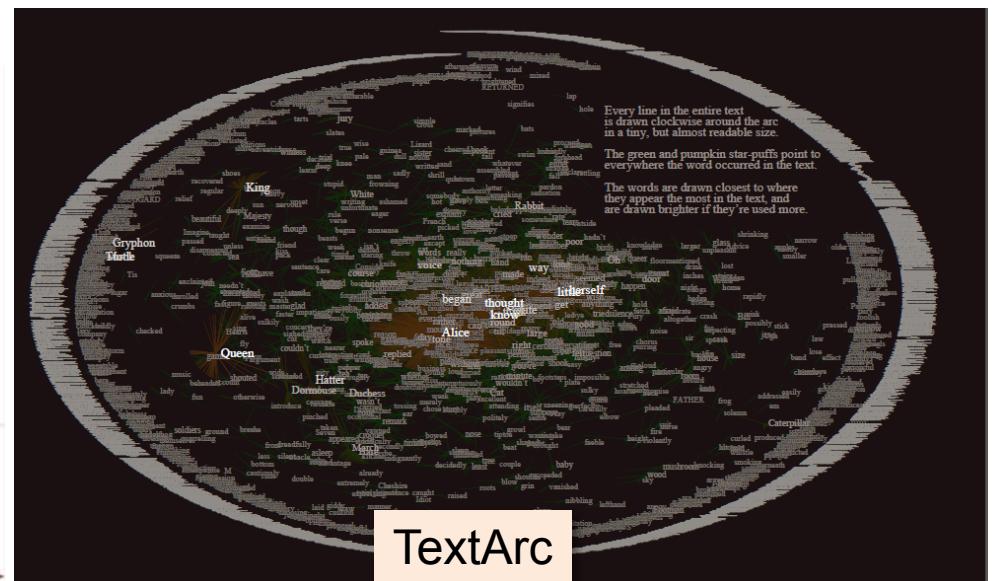
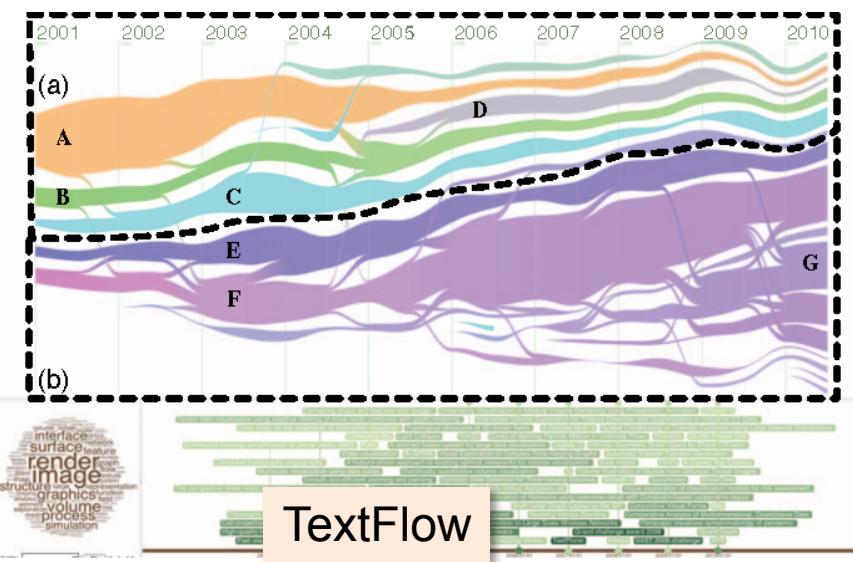
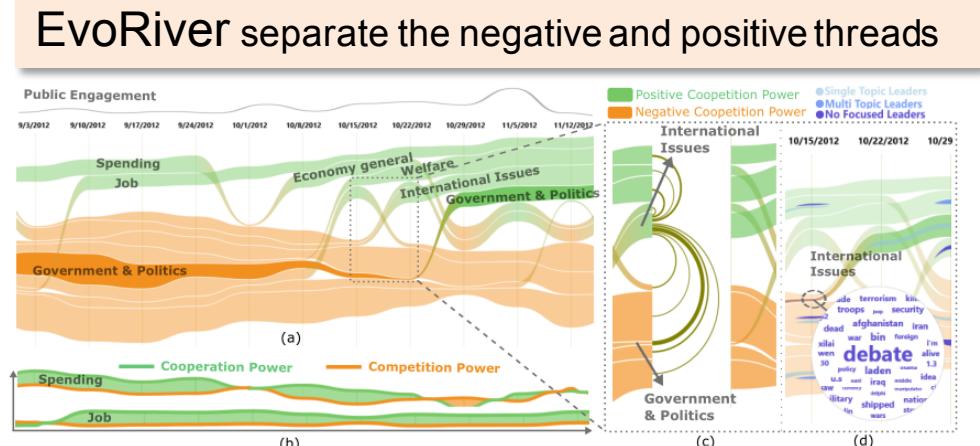
- T1: Provide a summary view of popular diseases and keywords over time.
- T2: Details on demand
- T3: Data filtering
- T4: Order terms in the streamgraphs as well as the word clouds
- T5: Our HealthTvizer represents the **relationships** among the hot keywords and diseases in a force directed layout.

# Related work



## Text visualization

- + focus on topic evolution
- not their correlations



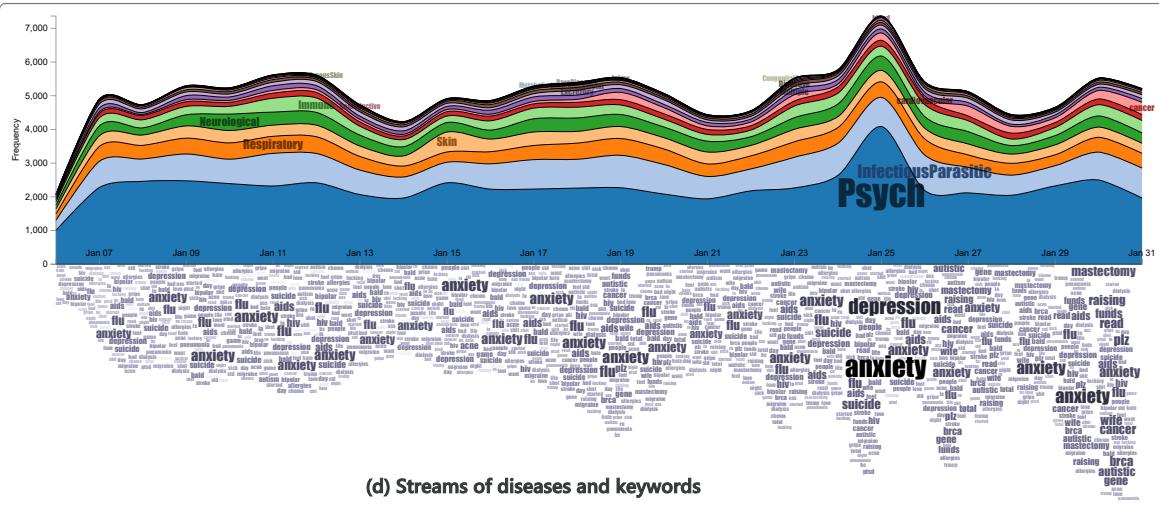
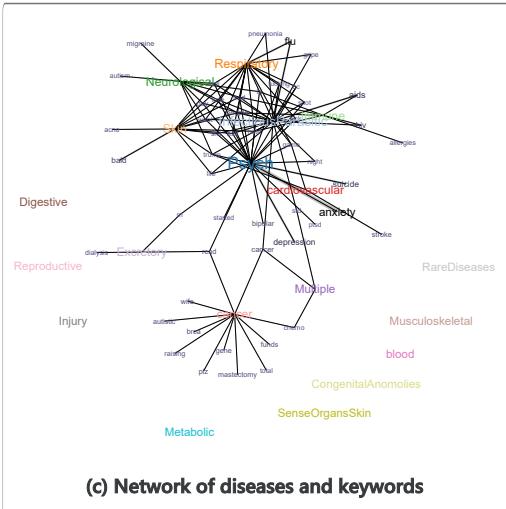
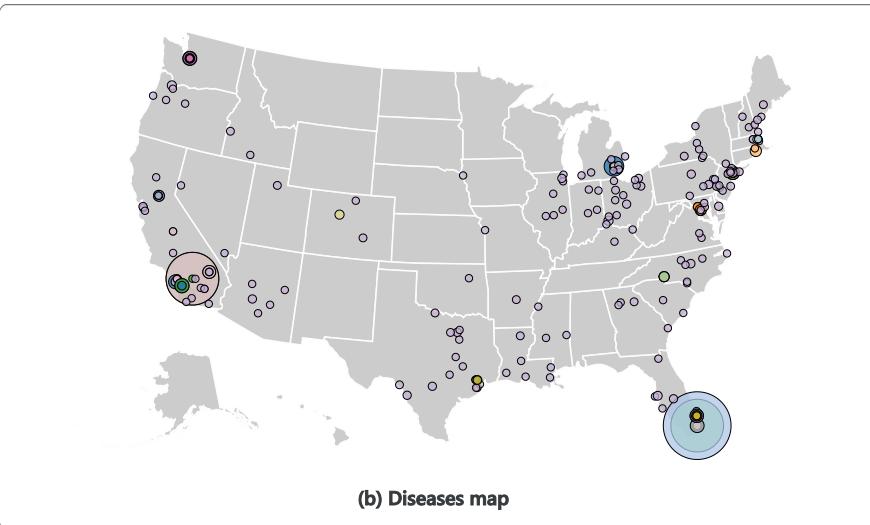
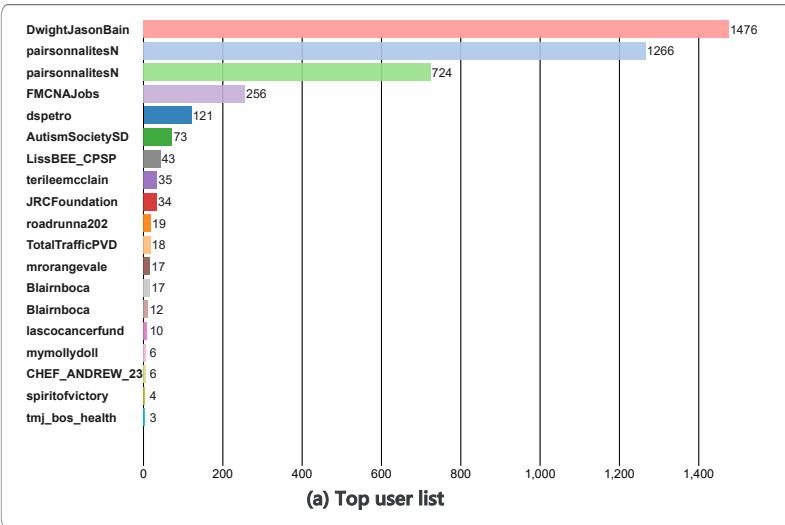
# Processing Twitter data



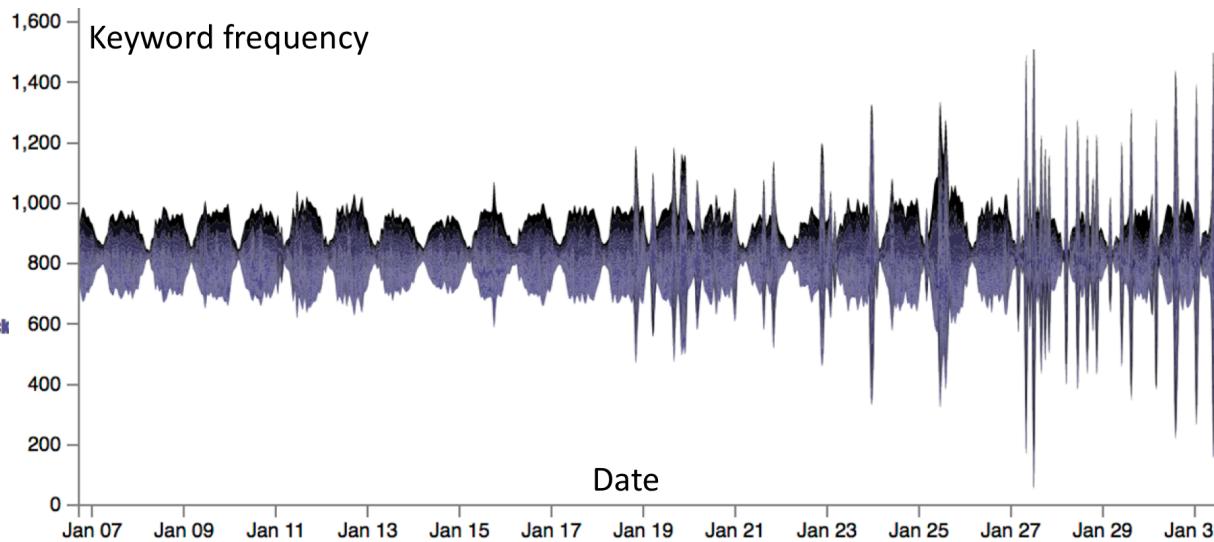
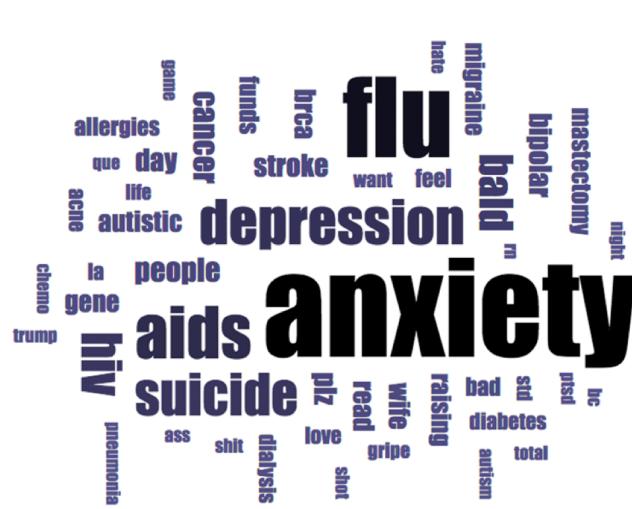
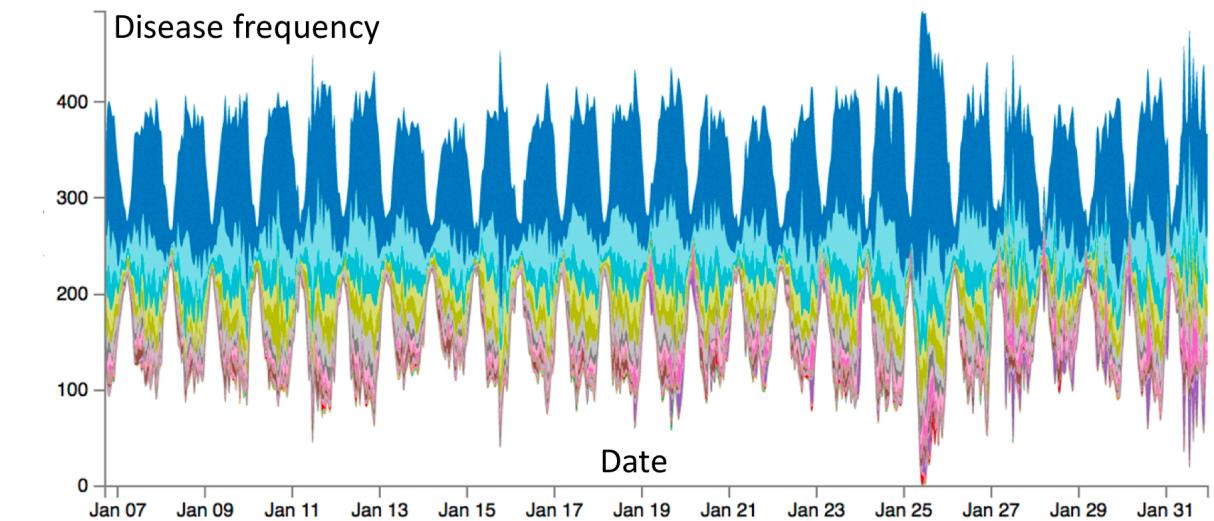
- We collect tweets geolocated in the US from Jan 6 to Jan 31, 2017, which includes 57,934,000 tweets.
- We query Datasift's streaming API to collect tweets that also have meta-information including geographical coordinates...
- Tweets filtering: We are interested in the disease-related tweets. According to Healthcare Hashtag Project, there are 21 main disease categories such as Cancer, Psych
- Each category contains a list of keywords which can be referred to the disease. By filtering this set of keywords, we are able to get each disease's tweets.
- The total number of disease-related tweets is 12,6915, accounting for 0.22% of the total number of tweets from Jan 6 to Jan 31, 2017



# Visual components

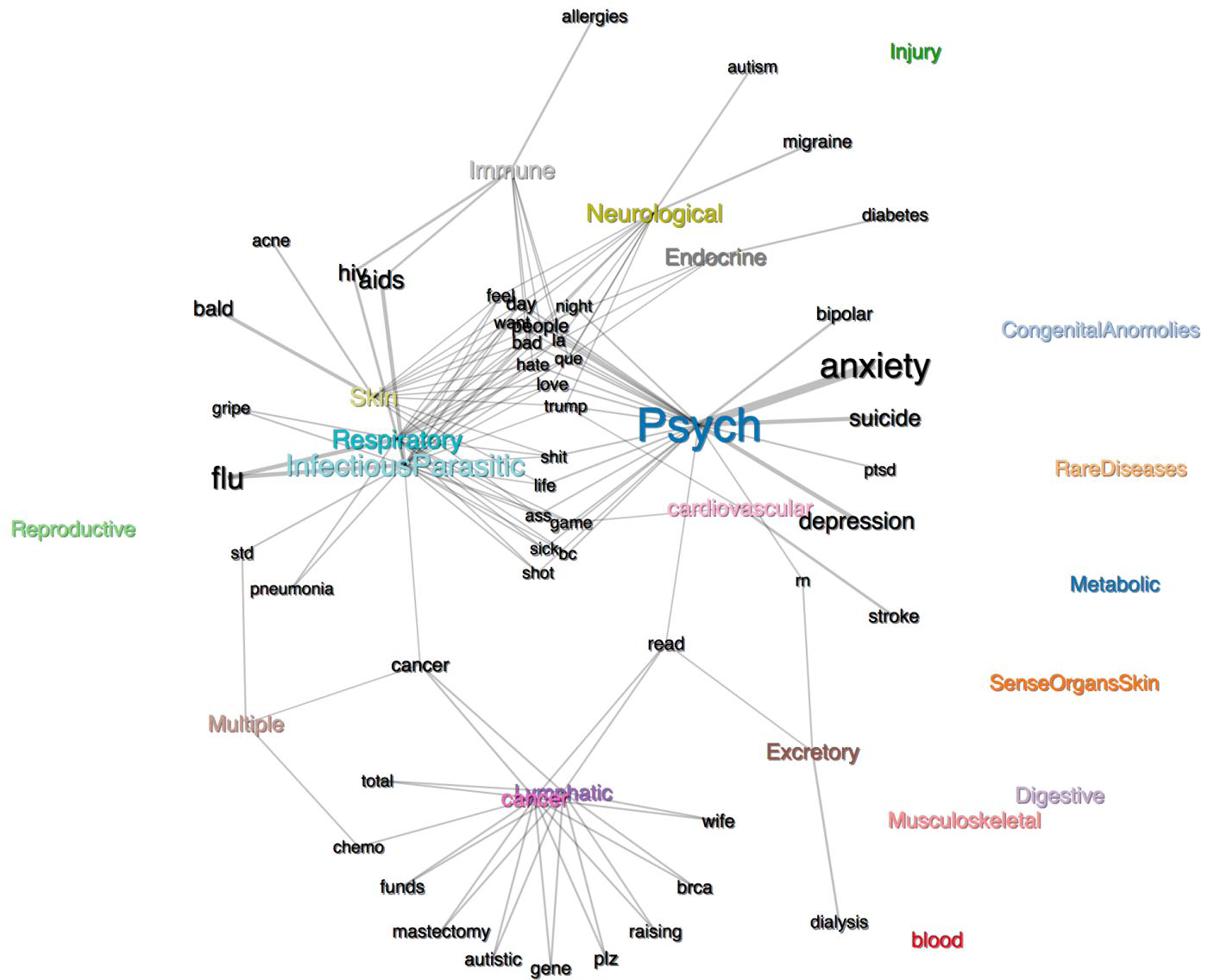


## Visual components



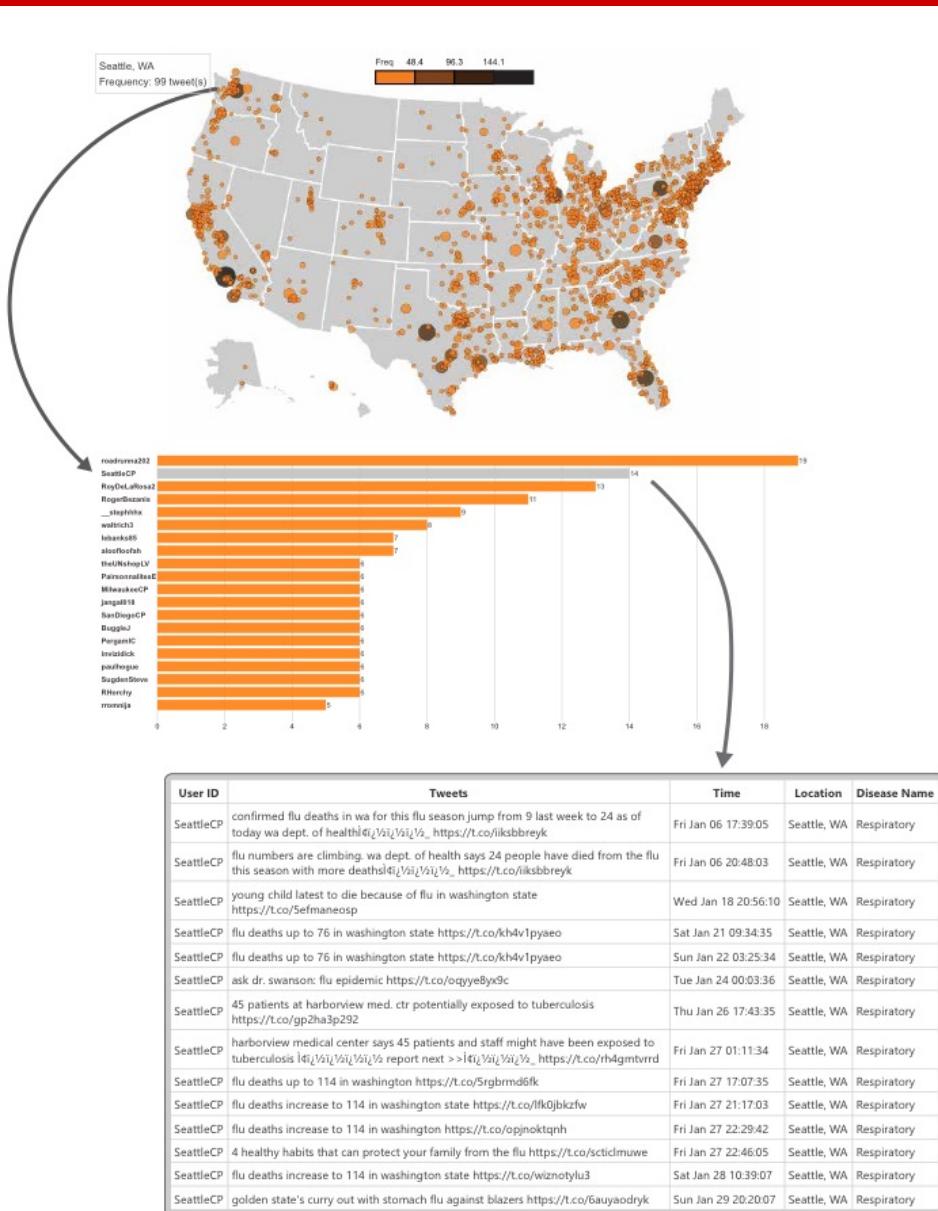


# Visual components



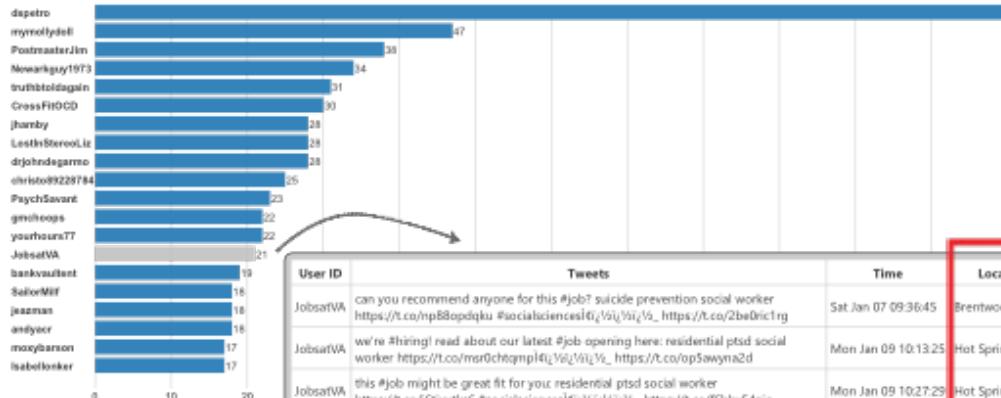


# Visual components





# Visual components

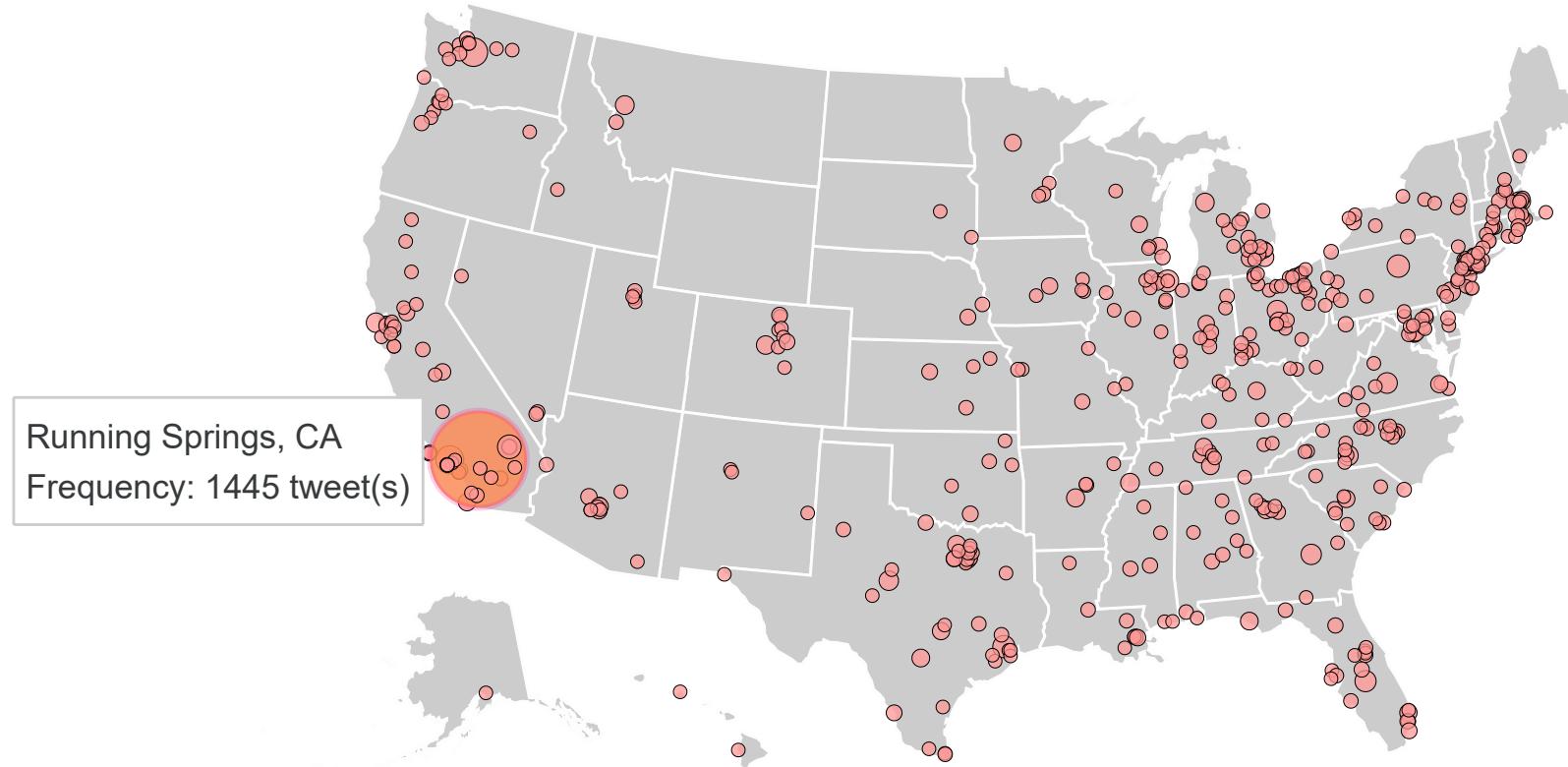


A curved arrow points from the top of the bar chart down to the first row of the table below.

User ID	Tweets	Time	Location	Disease Name
JobsatWA	can you recommend anyone for this #job? suicide prevention social worker <a href="https://t.co/nP88opdqu">@socialsciences412/16/19/16_"&gt;https://t.co/nP88opdqu</a> #socialsciences412/16/19/16_	Sat Jan 07 09:36:45	Brentwood, MO	Psych
JobsatWA	we're hiring! read about our latest #job opening here: residential ptsd social worker <a href="https://t.co/mr0chsqmpl4/16/19/16_">https://t.co/mr0chsqmpl4/16/19/16_</a>	Mon Jan 09 10:13:25	Hot Springs, SD	Psych
JobsatWA	this #job might be great fit for you: residential ptsd social worker <a href="https://t.co/6iyutk6/16/19/16_">https://t.co/6iyutk6/16/19/16_</a>	Mon Jan 09 10:27:29	Hot Springs, SD	Psych
JobsatWA	this #job might be great fit for you: ptsd licensed professional counselor <a href="https://t.co/7eqgkwsed4/16/19/16_">https://t.co/7eqgkwsed4/16/19/16_</a>	Mon Jan 09 10:51:26	Hot Springs, SD	Psych
JobsatWA	can you recommend anyone for this #job? psychologist (tmh ptsd specialist) external <a href="https://t.co/luz2akobf4/16/19/16_">https://t.co/luz2akobf4/16/19/16_</a>	Tue Jan 10 11:54:45	Harlingen, TX	Psych
JobsatWA	latest Harlingen tx #job and click to apply: psychologist (tmh ptsd specialist) internal - <a href="https://t.co/gbjo6sahtq">https://t.co/gbjo6sahtq</a>	Tue Jan 10 13:40:13	Harlingen, TX	Psych
JobsatWA	can you recommend anyone for this #job? staff psychologist ptsd sud specialist <a href="https://t.co/dmjjyccmaek4/16/19/16_">https://t.co/dmjjyccmaek4/16/19/16_</a>	Fri Jan 13 06:11:11	Canandaigua, NY	Psych
JobsatWA	we're hiring! click to apply: licensed professional mental health counselor ptsd sud specialist - <a href="https://t.co/m0rzgpw7">https://t.co/m0rzgpw7</a>	Fri Jan 13 06:16:40	Canandaigua, NY	Psych
JobsatWA	we're hiring! click to apply: psychologist ptsd intake assessment <a href="https://t.co/w5glhypwc/16/19/16_">https://t.co/w5glhypwc/16/19/16_</a>	Fri Jan 13 16:41:22	Richmond, VA	Psych
JobsatWA	we're hiring! read about our latest #job opening here: suicide prevention social worker <a href="https://t.co/nP88opdqu4/16/19/16_">https://t.co/nP88opdqu4/16/19/16_</a>	Sat Jan 14 15:51:21	Brentwood, MO	Psych
JobsatWA	see our latest #hotsprings sd #job and click to apply: ptsd licensed professional counselor - <a href="https://t.co/ynebfqyq6g">https://t.co/ynebfqyq6g</a>	Mon Jan 16 09:00:50	Hot Springs, SD	Psych
JobsatWA	we're hiring! read about our latest #job opening here: ptsd licensed professional counselor - <a href="https://t.co/cnhctd14mo">https://t.co/cnhctd14mo</a>	Mon Jan 16 09:41:10	Hot Springs, SD	Psych
JobsatWA	this #job might be great fit for you: advance practice nurse or nurse practitioner ptsd - <a href="https://t.co/damgkuig5">https://t.co/damgkuig5</a>	Mon Jan 16 12:23:32	Basking Ridge, NJ	Psych
JobsatWA	see our latest #harlingen tx #job and click to apply: psychologist (tmh ptsd specialist) external - <a href="https://t.co/gakrfv7eek">https://t.co/gakrfv7eek</a>	Tue Jan 17 08:21:48	Harlingen, TX	Psych
JobsatWA	can you recommend anyone for this #job? suicide prevention social worker <a href="https://t.co/q1ppj1mzs/16/19/16_">https://t.co/q1ppj1mzs/16/19/16_</a>	Sun Jan 22 07:14:14	Brentwood, MO	Psych
JobsatWA	we're hiring! click to apply: ptsd licensed professional counselor <a href="https://t.co/sgauvce/16/19/16_">https://t.co/sgauvce/16/19/16_</a>	Mon Jan 23 12:38:57	Hot Springs, SD	Psych
JobsatWA	can you recommend anyone for this #job? suicide prevention senior social worker waco (external) - <a href="https://t.co/zpczu692a8">https://t.co/zpczu692a8</a>	Mon Jan 23 18:27:13	Waco, TX	Psych
JobsatWA	can you recommend anyone for this #job? psychologist (tmh ptsd specialist) external <a href="https://t.co/luz2akobf4/16/19/16_">https://t.co/luz2akobf4/16/19/16_</a>	Tue Jan 24 14:50:40	Harlingen, TX	Psych
JobsatWA	this #job might be great fit for you: psychologist (tmh ptsd specialist) internal <a href="https://t.co/dmukskoopd4/16/19/16_">https://t.co/dmukskoopd4/16/19/16_</a>	Tue Jan 24 15:34:02	Harlingen, TX	Psych
JobsatWA	can you recommend anyone for this #job? senior social worker ptsd clinical team (ptcl) <a href="https://t.co/bhrtsap61/16/19/16_">https://t.co/bhrtsap61/16/19/16_</a>	Sat Jan 28 10:39:29	Portland, OR	Psych
JobsatWA	can you recommend anyone for this #job? psychologist (tmh ptsd specialist) internal <a href="https://t.co/dmukskoopd4/16/19/16_">https://t.co/dmukskoopd4/16/19/16_</a>	Mon Jan 30 13:01:04	Harlingen, TX	Psych



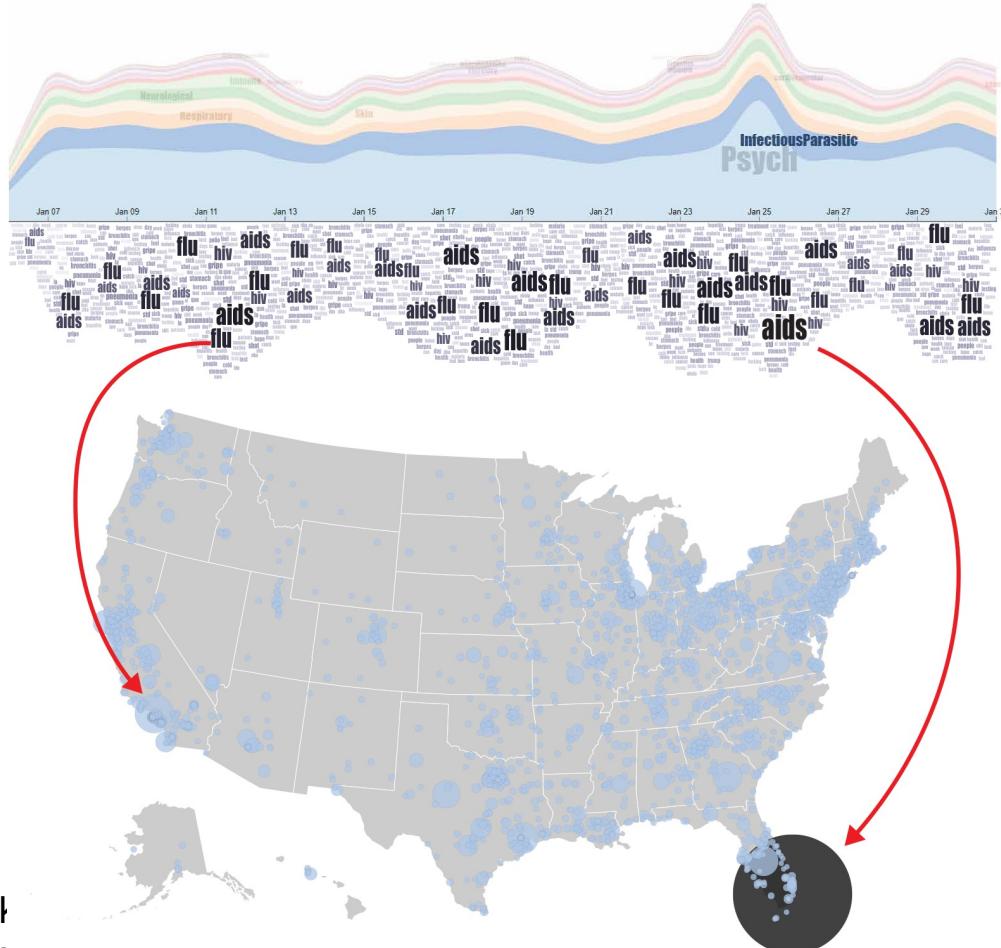
# Use case 1: Cancer



- During January of 2017 the user ID: DwightJasonBain started a fundraising organization for his wife (who is suffering from breast cancer)
- As this person lives in Running Springs, CA and people in that area retweets the appeal for raising fund, the tweets became spread out, causing a huge number of tweets in that area.



# Use case 2: InfectiousParasitic



- Stigmabase work about the work c...cker
- On January 27th in Seattle, WA, a news published on several websites (e.g. Washington Times) stating that the number of death because of Flu increases to 114 in Washington state. There was plenty of tweets related to this issue => these types of reports create awareness and fear among the people



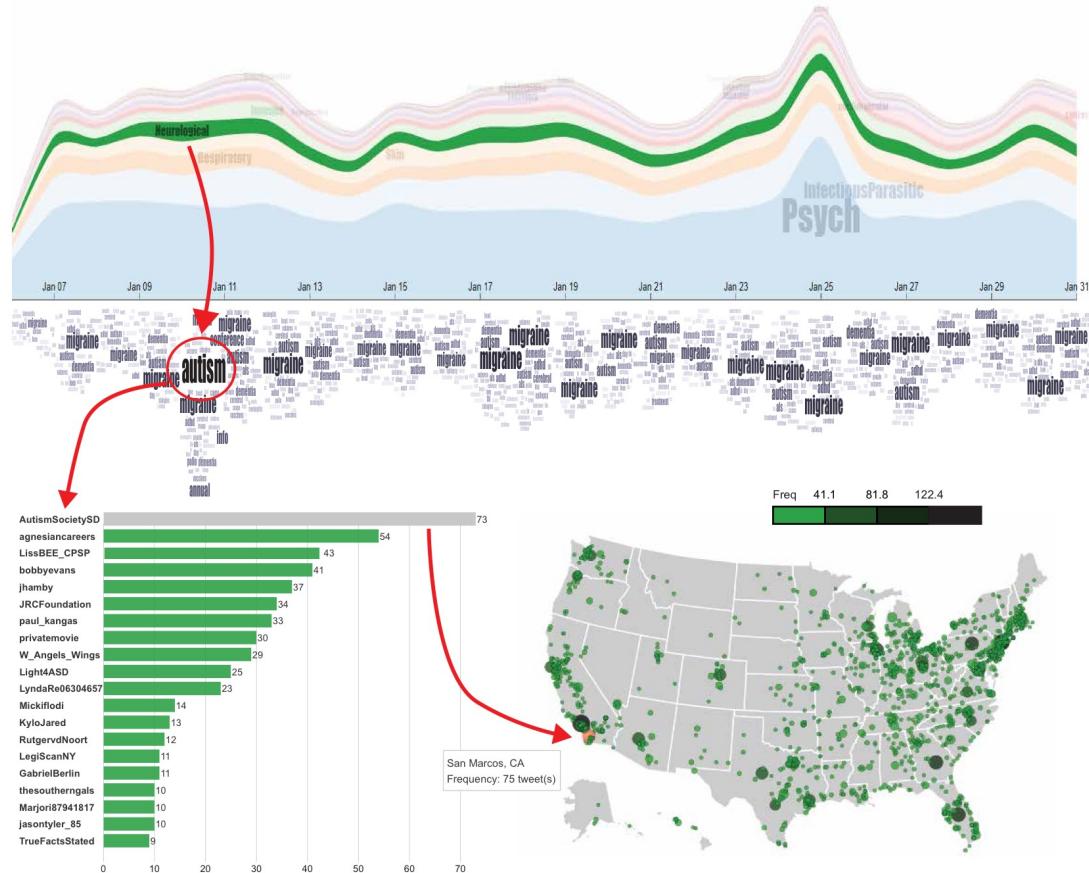
# Use case 3: Injury



Our exploring shows us that on January 17<sup>th</sup> the Fox News Insider [53] published a news related to the list of Democrat who won't attend Trumps Inauguration. One the Twitter user with the ID *LyndaRe06304657* started to tweet about the reason. The user referred that John Lewis, the Democrat congressman, had a brain injury, so those Democrats need to take care of it



# Use case 5: Neurological diseases



In the keyword stream, “Autism” stands out on January 10. Examining the user’s tweets from the user list, we found that the user AutismSocietySD share lots of tweets about the “7th annual swimming with autism conference” in San Marcos, CA. That explains a high frequency of “Autism” on January 10, 2017.

# Informal User study



We solicited qualitative responses about *HealthTvizer* from medical students and associate professor at Health Science Center at a public university.

- They concluded that there is a huge need for these interactive and real-time visualizations for mental health providers in this country. He also mentioned that we could make the argument if more people are talking about something in a certain area then the **government** needs to devote more resources and attention to that disease or condition in that area
- Domain experts agree that *HealthTvizer* could be useful for **doctors who are just starting to decide where to start their careers**. Specifically, when people in a specific city discuss lots a disease, they are probably in need of health care services for that condition/disease

# Demo



<https://healthvizer.github.io/index.html>



Questions?

Email: Tommy.Dang@ttu.edu

