3rd International Conference on Digital Disease Detection

Michael Paul
Johns Hopkins University
Influenza in Twitter

Tweets can estimate influenza prevalence
Influenza in Twitter
Influenza in Twitter

Look for tweets that indicate infection:

I’ve had the flu and fever all week :( 

Michael Paul @mjp39 · Jan 24
Infection vs Awareness

“think I’m coming down with the flu” vs “tired of hearing about the flu”
Infection vs Awareness

“think I’m coming down with the flu”

VS

“tired of hearing about the flu”

The user probably has the flu.

• These are the tweets we want to count for surveillance!
Infection vs Awareness

This distinction matters!

Google concluded that media attention contributed to their overestimate in 2012-2013

From Lazer et al., Science, 2014
Tweet Classification

Cascade of 3 logistic regression classifiers:

• about health vs not about health
• about flu vs not about flu
• flu infection vs flu awareness
Tweet Classification

Estimated weekly flu rate:

\[
\frac{\text{# tweets about flu infection that week}}{\text{# of all tweets that week}}
\]

This yields estimates of infection
Infection vs Awareness

“think I’m coming down with the flu” vs “tired of hearing about the flu”

The user is aware of the flu.
• New question: what can we learn from tweets like this?
Influenza Awareness

• Public awareness of a disease is a major factor that can influence its spread

• Officials must often manage public perceptions to manage outbreaks
Influenza Awareness

• We currently lack systems for up-to-date monitoring of influenza awareness
Awareness in Twitter

We can estimate levels of awareness using our tweet classifiers:

• about health vs not about health
• about flu vs not about flu
• flu infection vs flu awareness
Comparing Trends

• Twitter trends for infection and awareness – 9/30/2012 – 5/31/2013

• 10 HHS regions in United States
2012-2013 Flu Season

Weekly awareness:

![Graph showing weekly flu awareness across different regions.](image-url)
2012-2013 Flu Season

Weekly awareness:

![Graph showing weekly awareness for different regions.](image-url)
2012-2013 Flu Season

Weekly infection:
2012-2013 Flu Season

Weekly infection:
2012-2013 Flu Season

Infection:

Awareness:
Conclusion

• Public awareness of disease is important
• Tweet volume can measure awareness
• Awareness, infection have different trends