Work in Progress

Visualizing Twitter Data Using Time-Varying Graphs

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Why Twitter?

- Twitter can tell us how information is being spread
  - Travel patterns
  - Flu outbreaks
  - Emergency response to disasters
  - Marketing
  - Current events
  - Public opinion

Our project

Approach has been 2-fold:

1. Word co-occurrence graph

   Goal: identify topics of conversation

2. User-follower graph

   Goal: identify influential/well-connected users

Twitter Datasets

- Hurricane Sandy and Irene
  - Irene: 3 million tweets over 2 weeks
  - Sandy: 7 million tweets over 2.5 weeks
- 15k user network
- live Twitter stream

Word Co-occurrence Graph

Tweet text:

"Shocking news: George Zimmerman is acquitted in Trayvon Martin killing"

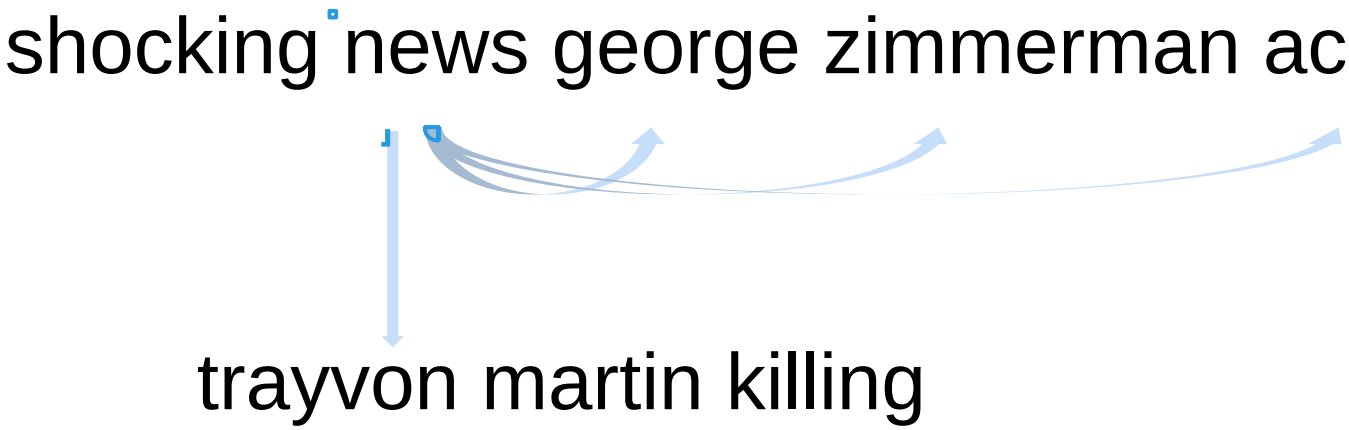
"shocking news george zimmerman acquitted trayvon martin killing"

Word Co-occurrence Graph

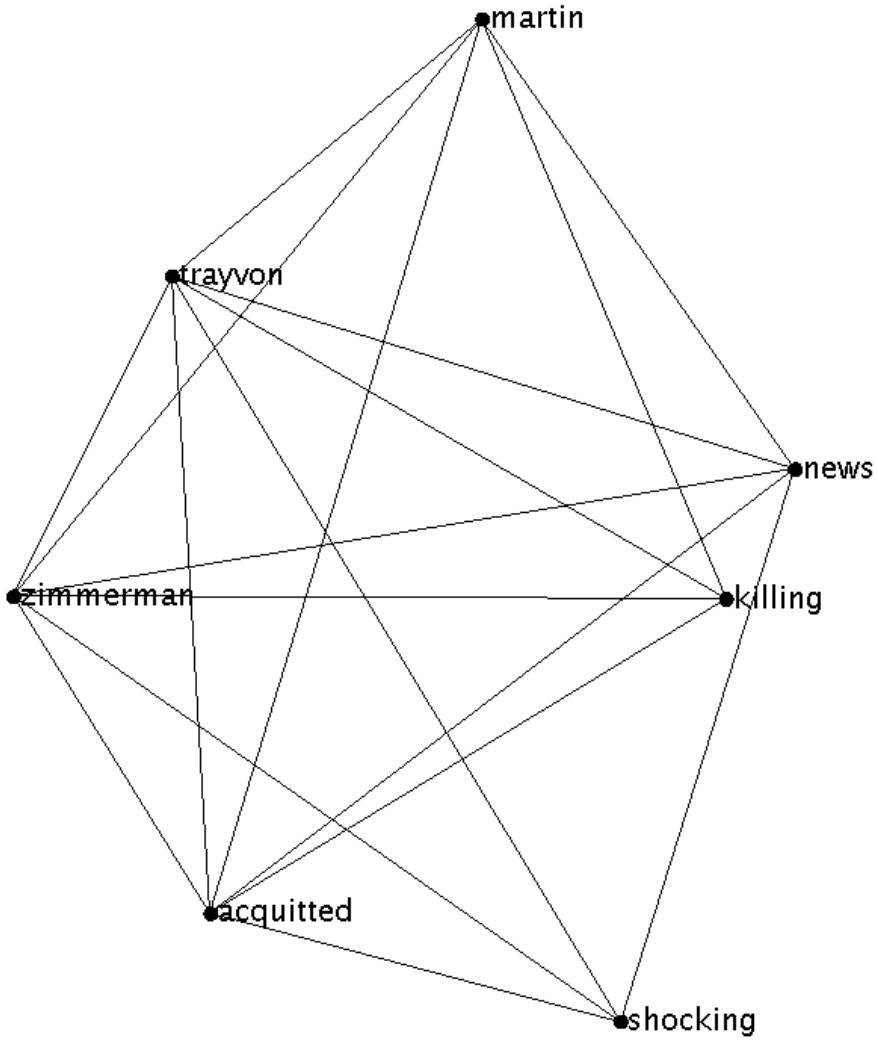
- shocking news george zimmerman acquitted

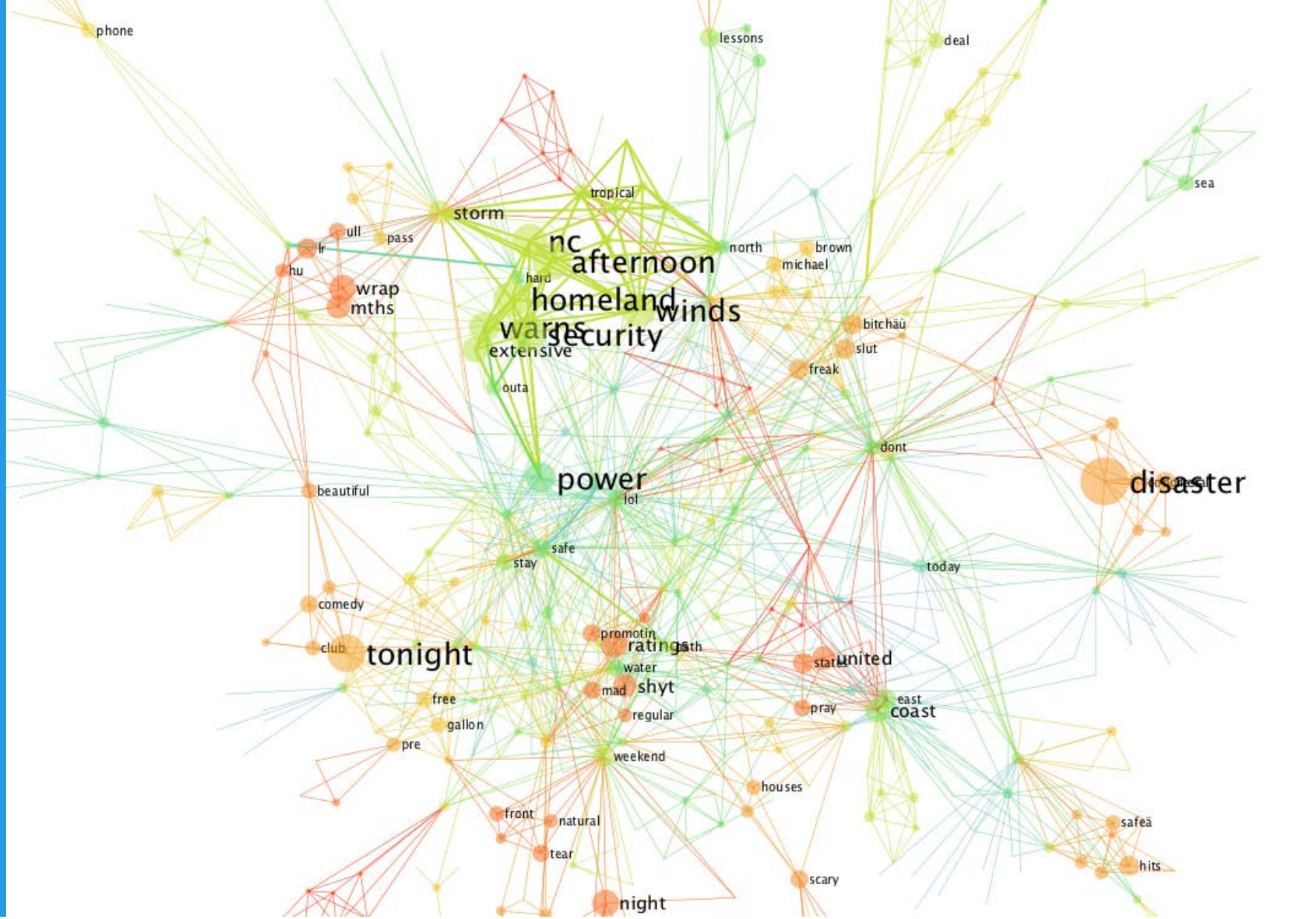
trayvon martin killing

Word Co-occurrence Graph



Word Co-occurrence Graph





colors : recency sizes : rate

Word Co-occurrence Graph

- Screen has capacity (say 2,000 nodes)
- Assign a screen time to each word
  - If the word does not occur in a tweet within that time frame, we remove it from the screen
  - otherwise, update the word's screen time
- How do we determine the amount of screen time to give a word?
  - use the rate of the system = $\frac{\text{total \# of edges seen}}{\text{time}}$

Persistence Diagram

- a second visualization

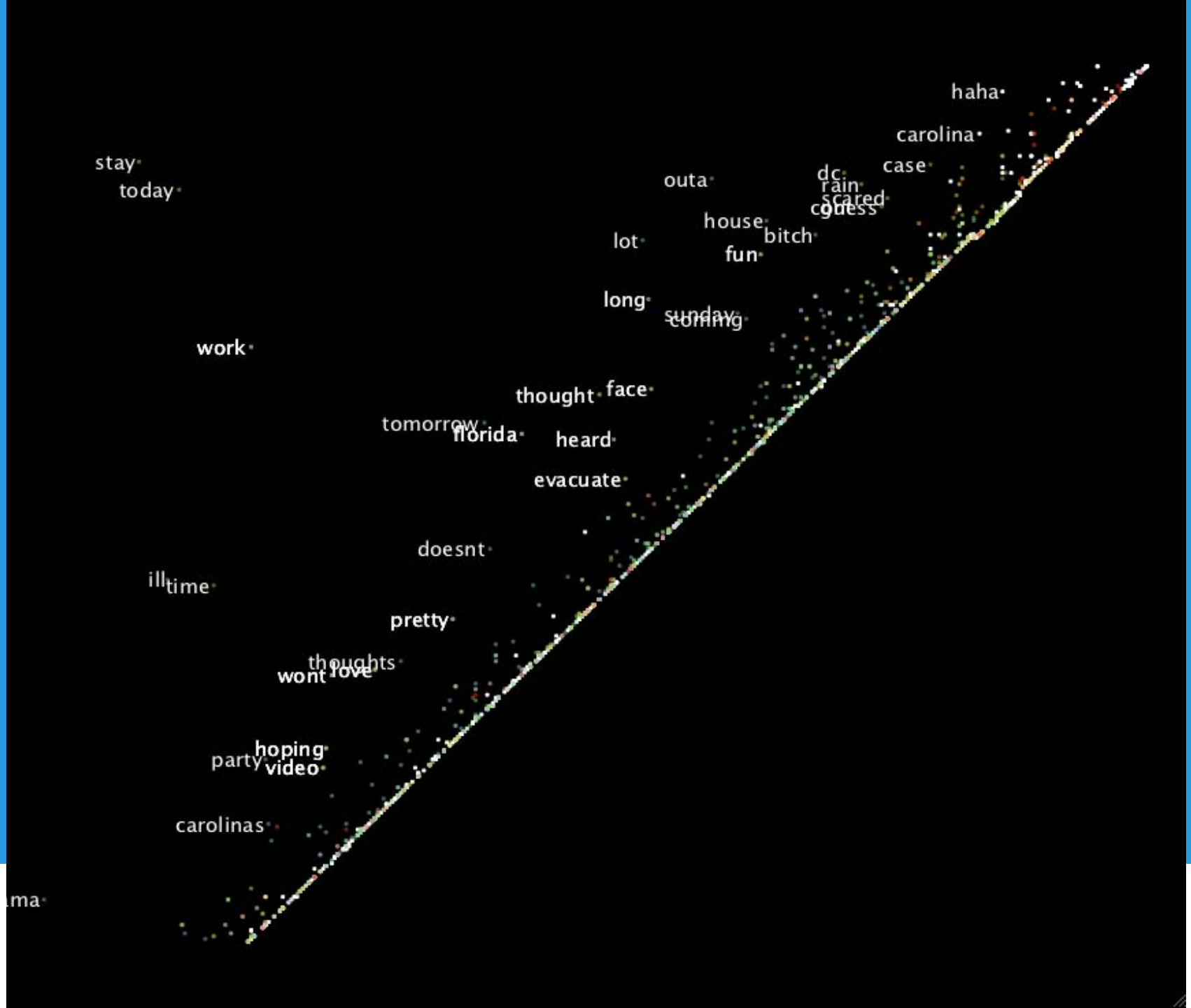
  GOAL: identify persistent nodes

- each node that passes through the co-occurrence graph has

  x = time it appeared

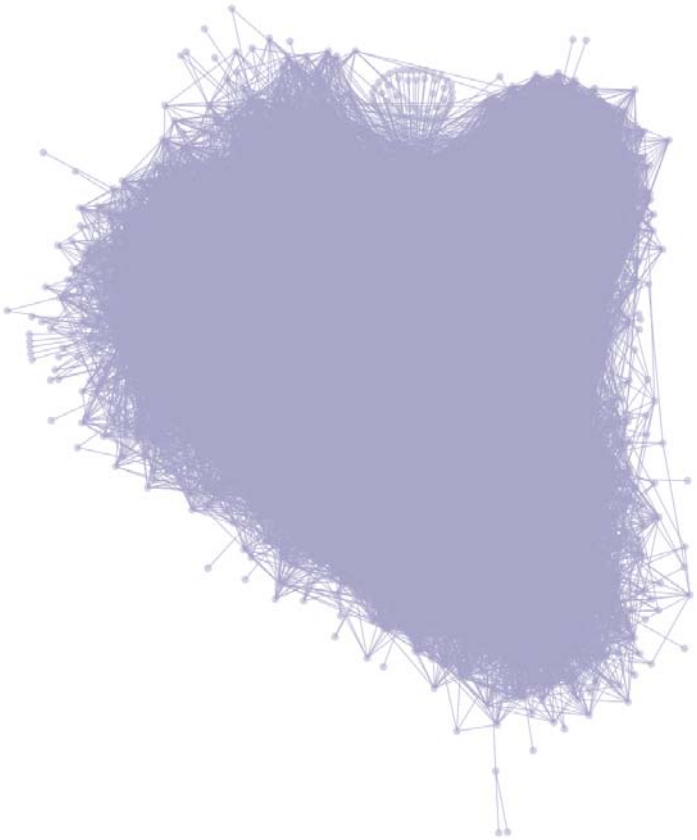
  y = time it disappeared

plot the nodes in the persistence diagram at position (x, y)


haha
carolina
case
stay
today
outa
dc
rain
scared
house
bitch
lot
fun
long
sunday
coming
work
thought
face
tomorrow
florida
heard
evacuate
doesnt
ill
time
pretty
thoughts
wont
love
hoping
party
video
carolinas

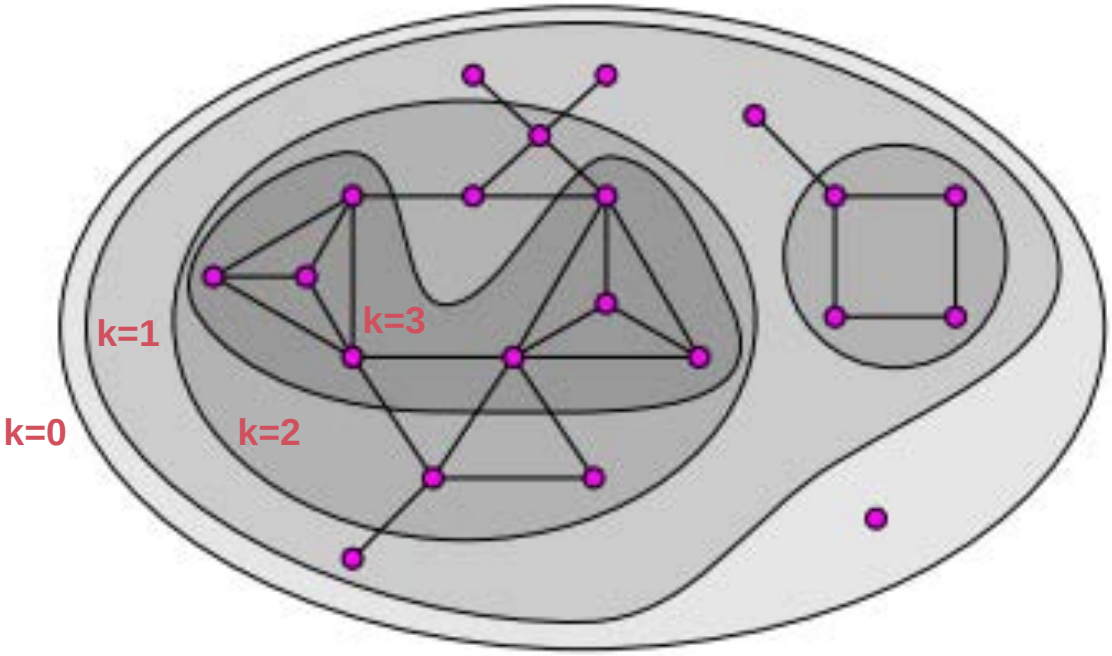
Followers Graph

- Also considered user/follower network



k-Cores of a Graph

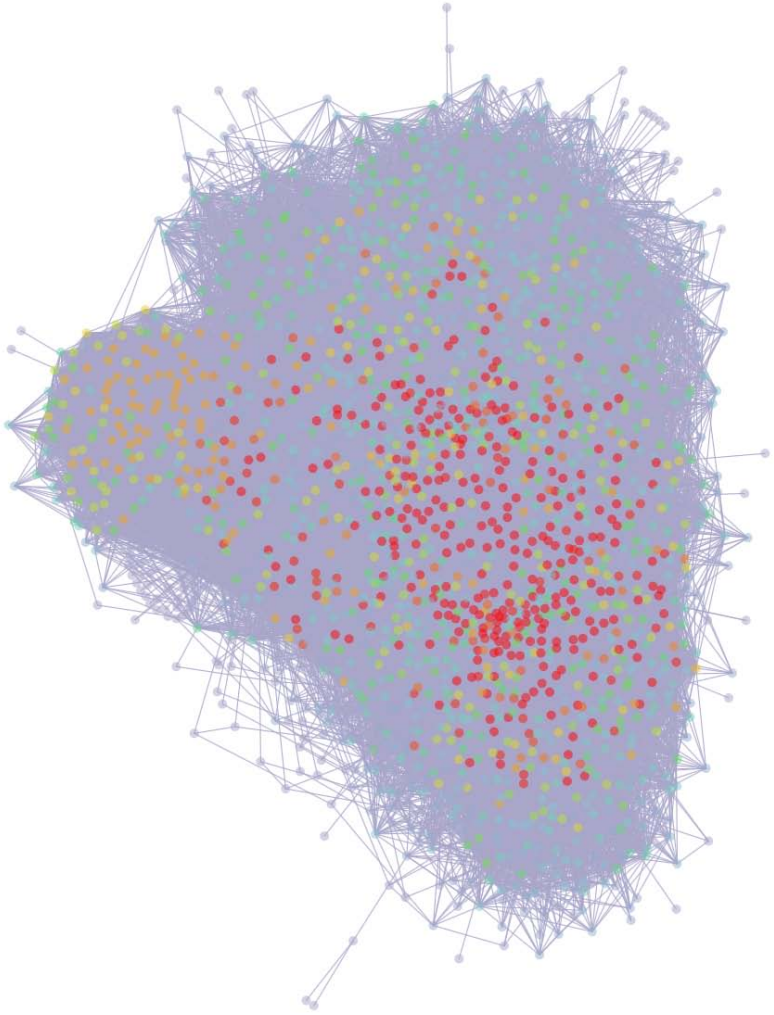
G = (V,E). A subgraph H=(W,E|W) is a *k*-core iff $\forall v \in W : \deg_H(v) \geq k$



Peeling Algorithm

Can assign each vertex the value of the highest core it belongs to in linear time (Bagatelj & Zaversnik 2003) by repeatedly removing vertices of smallest degree

Peeling Algorithm

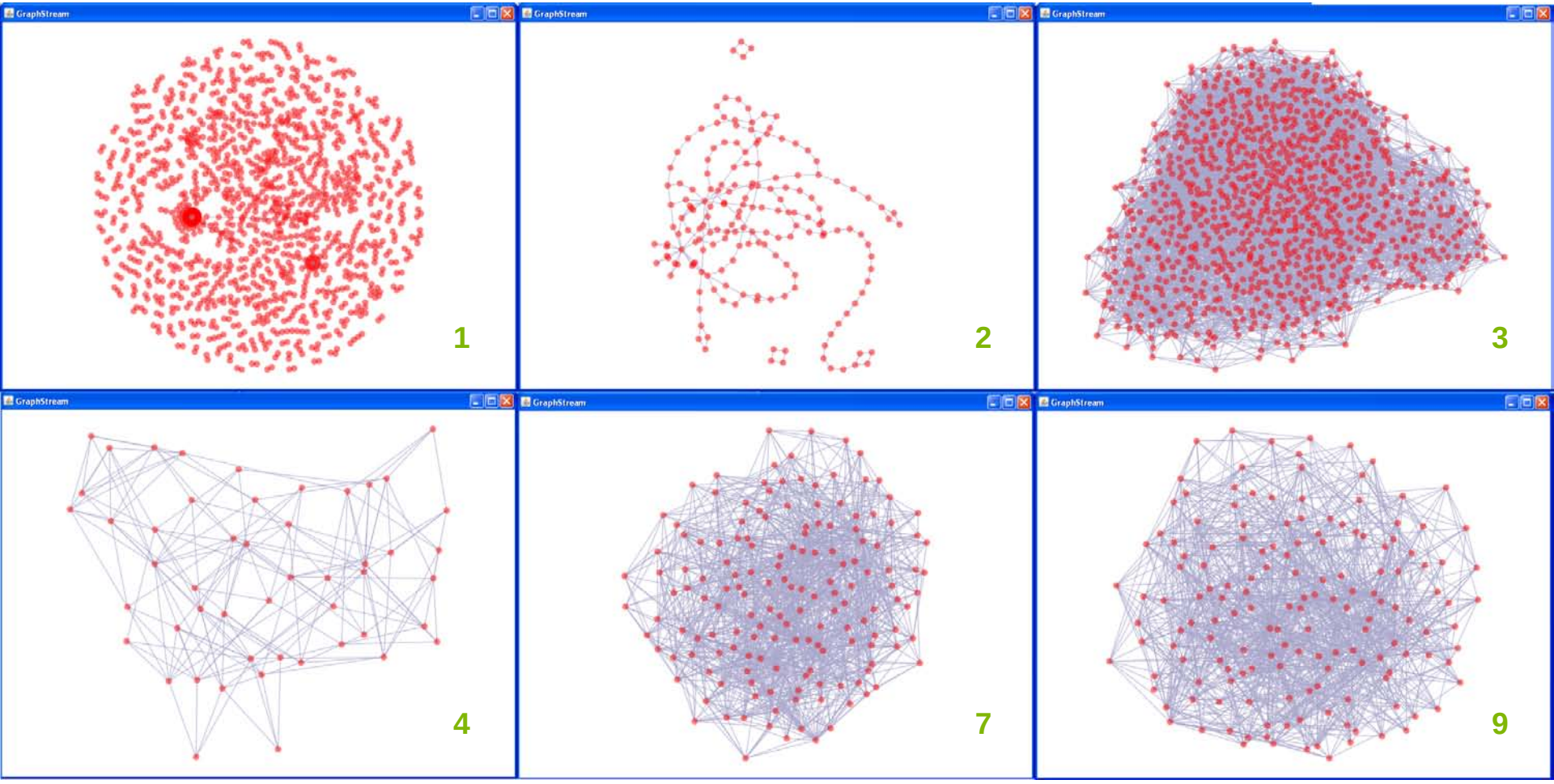


k-Core Values for Edges

- Find vertices with highest core value, *N*
- Assign all edges between these vertices a value of *N*
- Remove these edges, recalculate vertex core values
- Repeat until no edges remain

Result is a partition of edges in original graph

Edge Partitions



Future Work

Integrate the two approaches

- use peeling on tweet text data to find most central topics

References

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- Abello J, and Queyroi F, "Fixed Points of Graph Peeling." 2013 IEEE/ACM International Conference of Advances in Social Networks Analysis and Mining (2013).
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- Gansner E, Hu Y, and North S, "Visualizing Streaming Text Data with Dynamic Maps, to appear in Proceedings of the 20th International Symposium on Graph Drawing" (best paper award), (2012), TwitterScope website.
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