Challenges
Prove Value for Businesses

• "Design of Viral Marketing Campaigns" as a business proposition has yet to be proven beyond doubt

• Measuring marketing effectiveness is not easy in general
  ◦ How do we compare viral vs traditional marketing?

• Lab experiments?
Online data may be huge but it is often neither representative nor complete
(Ask a political scientist what she thinks about your election predictions with Twitter!)

- Offline data is difficult to obtain
  - External influence, e.g., mass media

- The main concern is the input data, how do we address it?
Learn to Design for Virality

- What makes a product/idea/technology viral?
  - Role of content?
  - Role of seeds?
  - Other factors?

- For every video (post) that goes viral on YouTube (Twitter), hundreds fizzle out!

- How can we design a product or meme so that it is intrinsically “sticky”?

- Beyond anecdotes, what do we know about the factors behind successful viral campaigns?
Algorithmic Challenges

- $O(|V|^2)$ algorithms considered not feasible for large graphs (e.g. $|V| > 1M$)
  - greedy IM algorithm, $\Omega(|V|^2)$
  - all-pair shortest paths or graph diameter, $\Omega\left(\frac{|V|^2}{\log |V|}\right)$
  - betweenness centrality, $\Omega(|V|^2)$

- Need near-linear time algorithms
  - $O(|V| \text{ polylog}(|V|))$ algorithms
  - may need new algorithm paradigm (e.g. Laplacian paradigm [Chrstiano et al. STOC 2011, Spielman & Teng, SIAM JC 2011])
  - may need new complexity research on graph problems
More technical challenges

- Competitive diffusion
  - need more realistic model of competitive diffusion
    - validation by real-world traces
  - need incorporation of individual rationality
    - rationality of individuals in social networks
    - rationality of competing companies

- Adaptive viral marketing
  - use the effect of past diffusion or current partial diffusion to guide further seeding choice

- Handling dynamic changes in social networks
  - network structure, influence strength may change over time
Push Technology out to Applications Beyond Viral Marketing

- Case studies of successful deployment of Influence/Information Propagation/Maximization Technology in:

  - Rumor/Innovation spreading modeling, detection, containment
  - Trend detection and prediction
  - Infection propagation detection and containment.
And to Conclude

- Great advances in theory, analysis, algorithms related to viral phenomena.
- But **engineering** of viral phenomena (in the context of any of the apps we have mentioned) has yet to be taken out of the lab!
- Thanks!