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?

Prove Value for Social Sciences

- 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, $\Omega(\frac{|V|^2}{\log |V|})$
  - betweenness centrality, $\Omega(|V|^2)$
- Need near-linear time algorithms
  - $O(|V| \operatorname{polylog}(|V|))$ 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!