Influence Maximization in Social Networks – Introductory Remarks
Part I: Outline

• Social Networks and Social Influence
• Real-world stories
• Example applications
• The Flip Side
Social Networks and Social Influence
Online Social Networking Sites

- Flixster
- Last.fm
- Facebook
- Wikipedia
- Flickr
- YouTube
- Twitter
- Orkut
- MySpace
- Tumblr
Social Networks & Media

SarcasticRover
@SarcasticRover

Not the real @marscuriosity... like I care.
4th Rock From the Sun  http://mars.jpl.nasa.gov/msl/

Follow
291 TWEETS
257 FOLLOWING
63,197 FOLLOWERS

Oh sure, I can't think of anything I'd rather be doing than driving around a wasteland looking at dirt for the rest of my life.

3 days ago

I'm really glad all you fricken hipsters took a vague interest in science for 8 hours. Thanks for that.

3 days ago
People are **connected** and perform **actions**

- friends, fans, followers, etc.
- comment, link, rate, like, retweet, post a message, photo, or video, etc.
Basic Data Model

**Graph:** users, links/ties

<table>
<thead>
<tr>
<th>User</th>
<th>Action</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>John</td>
<td>Rates with 5 stars &quot;The Artist&quot;</td>
<td>June 3rd</td>
</tr>
<tr>
<td>Peter</td>
<td>Watches &quot;The Artist&quot;</td>
<td>June 5th</td>
</tr>
<tr>
<td>Jen</td>
<td>…</td>
<td>…</td>
</tr>
</tbody>
</table>
Real World Stories
Social Influence: Real-world Story I

12K people, 50K links, medical records from 1971 to 2003

Alter Type

- Ego-perceived friend
- Mutual friend
- Alter-perceived friend
- Same-sex friend
- Opposite-sex friend
- Spouse
- Sibling
- Same-sex sibling
- Opposite-sex sibling
- Immediate neighbor

Increase in Risk of Obesity in Ego (%)

Obese Friend → 57% increase in chances of obesity
Obese Sibling → 40% increase in chances of obesity
Obese Spouse → 37% increase in chances of obesity

[Christakis and Fowler, New England Journal of Medicine, 2007]
Key to understanding people is understanding ties between them.

Your friend’s friends’ actions and feelings affect your thoughts, feelings and actions!

- **Back pain**: spread from West to East in Germany after fall of Berlin Wall
- **Suicide**: well known to spread throughout communities on occasion
- **Sex practices**: e.g., growing prevalence of oral sex among teenagers
- **Politics**: the denser your connections, the more intense your convictions

[Christakis and Fowler 2011]
Social Media “Friends”

I would delete you off of my facebook friends list, but then you wouldn't be able to see all the fun things I do without you.
Hotmail’s viral climb to the top spot (90s): 8 million users in 18 months!

Boosted brand awareness

Far more effective than conventional advertising by rivals
  - ... and far cheaper, too!

Join the world's largest e-mail service with MSN Hotmail. http://www.hotmail.com

Simple message added to footer of every e-mail message sent out
From rags to riches – Ted Williams

- Voice over artist
- Homeless and many a brush with the law.
- Found at a street corner in Columbus, OH in Jan 2011
- Interview posted in YouTube; 13 million views
- Attracted numerous offers, including jobs!
Social Influence: Real-world Story V

- Gold award from YouTube for most hits; featured in Time, BBC News, News1130 ...
- > 58 x $10^6$ hits on YouTube as of June 2012
Social Influence: Real-world Story V

- Indian song from the sound track of the upcoming Tamil movie Why this kolaveri di? (Why this kolaveri di?)
  - Released on Nov. 16, 2011
  - Top trend on Twitter on Nov. 21 2011

- Within 1 week of release:
  - > 1.3 x 10⁶ views on YouTube
  - > 10⁶ “shares” on Facebook

- Reaches many non-Tamil speakers.
2008 Mumbai Terror Attacks

- \( \approx 16 \text{ tweets/second} \) sent to Twitter via SMS
  - eyewitness accounts, pleas for blood donors...

- Wikipedia page up within minutes, with staggering amount of detail and extremely fast “live” updates

- Metroblog as a newswire service; 112 Flickr photos by a journalist giving a firsthand account of aftermath

- Google map with main buildings involved in the attacks, with links to background and new stories!
Info. Diffusion: Real-world Story VII

2011 Stanley Cup Riots Vancouver

Young rioters bragging in social media: e.g., posing with (looted) Gucci bags in front of burning cars.

- Triggered widespread reactions of disgust
  - Turned into a way to mobilize clean-ups

- Over time, catch the rioters and publicly shame them on SM

- 100 hours VHS footage from 1994 riots vs. 5000 hours of 100 types of digital video
  - Need for sophisticated and efficient analytics
Example Applications
Applications

Viral Marketing
Social media analytics
Spread of falsehood and rumors
Interest, trust, referrals
Adoption of innovations
Human and animal epidemics
Expert finding
Behavioral targeting
Feed ranking
“Friends” recommendation
Social search
Application: viral marketing

Purchase decisions are increasingly influenced by opinions of friends in Social Media

- I like to shop with friends
  - Millennials (20-33): 74%
  - Gen X (34-46): 49%
  - Boomers (47-66): 44%

- When I see a product I am excited about, I frequently post a status update about it on Facebook
  - Millennials (20-33): 50%
  - Gen X (34-46): 33%
  - Boomers (47-66): 19%

- I am more likely to purchase something if I see that a friend has recommended it on Facebook or other places online
  - Millennials (20-33): 55%
  - Gen X (34-46): 39%
  - Boomers (47-66): 28%

- I have asked the opinions of my friends on Facebook about a particular purchase
  - Millennials (20-33): 53%
  - Gen X (34-46): 31%
  - Boomers (47-66): 17%

How frequently do you share recommendations online?

- Every few weeks: 19%
- Every few days: 8%
- Daily: 2%
- Every few months: 42%
- Never: 29%
Viral/Word-of-Mouth Marketing

- **Idea**: exploit social influence for *marketing*

- **Basic assumption**: *word-of-mouth effect*
  - Actions, opinions, buying behaviors, innovations, etc. propagate in a social network

- **Target** users who are likely to produce *word-of-mouth diffusion*
  - Additional reach, clicks, conversions, brand awareness
  - Target the influencers
SOCIAL MEDIA MARKETING MADNESS

I'M A MARKETER.

I BLOG ABOUT MARKETING.

I HAVE A PODCAST ABOUT MARKETING BLOGGERS.

I TWEET ABOUT PODCASTERS THAT TALK ABOUT MARKETING BLOGGERS.

I HAVE A FACEBOOK GROUP FOR TWITTER USERS THAT TWEET ABOUT PODCASTERS THAT TALK ABOUT MARKETING BLOGGERS.

HubSpot
Identifying influencers

- Influencers increase brand awareness, product conversions through WoMM
  - Influencers advocate a brand
  - Influencers influence purchasing actions
Identifying influencers: start-ups

- **Klout**
  - Measure of overall influence online (mostly Twitter, now FB and LinkedIn)
  - Score = function of true reach, amplification probability and network influence
  - Claims score to be highly correlated to clicks, comments and retweets

- **Peer Index**
  - Identifies/Scores authorities on the social web by topic

- **SocialMatica**
  - Ranks 32M people by vertical/topic, claims to take into account quality of authored content

- **Influencer50**
  - Clients: IBM, Microsoft, SAP, Oracle and a long list of tech companies
  + Svnetwork, Bluecalypso, CrowdBooster, Sproutsocial, TwentyFeet, EmpireAvenue, Twitaholic, and many others ...
“He’s not a ‘Super Influencer’, he’s a very naughty boy!”
Viral marketing & The Influence Maximization Problem

- Problem statement:
  - find a seed-set of influential people such that by targeting them we maximize the spread of viral propagations

- Will be the focus of next lectures.
The Flip Side
Criticisms / caveats

1. Are we observing correlation or causation? Homophily or influence?

2. Can social influence actually drive viral cascades?

3. Is viral marketing useful in practice?
Homophily or Influence?

**Homophily:** tendency to stay together with people similar to you

“Birds of a feather flock together”

E.g. I’m overweight → I date overweight girls

**Influence:** force that a person A exerts on a person B that changes the behavior/opinion of B

Influence is a causal process

E.g. my girlfriend gains weight → I gain weight too
Can social influence really drive viral cascades?

- Watts et al. challenge the traditional notions and intuitions about SI causing viral spread

- Social epidemics are not always responsible for dramatic, possibly sudden social change

- Influence is hard to prove

- Do not dismiss influence altogether

How useful is viral marketing?

- Criticism: Hard to predict which campaign will succeed virally.
  - Lack of predictability makes VM hard to implement;
  - The magic might not be in a small number of influentials
  - "Big seed" marketing is a predictable, practical alternative

Evidence of Real Influence

- People rate an item higher if a friend has recommended it
- Even after carefully removing homophily effects, influence can be clearly observed

[Huang et al. WSDM 2012, Aral et al. PNAS 2009]
What Did We Learn So Far?
Key takeaways

- General idea of Social networks and information propagation and how they are modeled

- Several real-life stories of influence and information propagation

- Other applications

- The flip side: it is easy to get overexcited – both about existence of influence and about its absence!