What Stops Social Epidemics?

Greg Ver Steeg
Rumi Ghosh & Kristina Lerman
USC Information Sciences Institute
Information, viruses, etc. spread from node to node on a network

Transmissibility, $\lambda = \text{Probability to infect your neighbor}$
• What is an epidemic? We observe many cascades that:
  – Grow quickly initially
  – But remain too small for standard (viral) epidemic models

• Information cascades differ:
  – Response to repeated exposure is important on Digg (and Twitter)
  – Drastically alters predictions about size of epidemics
What is an epidemic?

On an infinite graph, an epidemic is any process that spreads to a fraction of all the nodes.
Distribution of cascade size on Digg

Most cascades less than 1% of total network size!

A small fraction is still a fraction, though, right?

#nodes 300k
Why are these cascades so small?

Transmissibility of almost all Digg stories fall within width of this line?!

Most cascades fall in this range

(Heterogenous mean field theory, SIR model, same degree distribution as Digg)

Standard model of epidemic growth

\( \lambda^* \), Transmissibility
Maybe graph structure is responsible?

→ clustering reduces epidemic threshold and cascade size, but not enough!
What about the spreading mechanism?

Independent Cascade Model implicit in many epidemic models
How important are repeat exposures?

More than half exposed to a story more than once!
How do people respond to repeated exposure?

Not much.

We have similar results for Twitter.

Also noted by Romero, et al, WWW 2011.
Big consequences for epidemic growth

• Most people are exposed to a story more than once
• Repeated exposures have little effect
• Growth of epidemics is severely curtailed (especially compared to Ind. Cascade Model)
Weak response to repeated exposure

Take effect of repeat exposure into account:

Actual Digg cascades

Result of simulations

Epidemic threshold unchanged

\[ \lambda^* \text{, Transmissibility} \]
Also explains dynamics

Number of new people exposed to a story (who don’t vote on it)

Number of new people exposed to a story (who do vote)
Transmissibility: the percentage of **new** people exposed who end up infected/voting
Summary

• Information epidemic ≠ Disease epidemic
• Repeat exposures are important on Digg and Twitter
• On Digg, people don’t respond to repeat exposure
  – Epidemic threshold unchanged
  – Drastically reduces size of epidemics